High-voltage contactor

Gas-filled contactor for high-voltage DC switching

Series/Type: HVC500B-24S
Ordering code: B88269X2350C011
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Version: 07
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Product description
The HVC series has been especially designed to meet the requirements of high-voltage DC switching applications. The optimized hermetically sealed design exhibits excellent reliability performance against harsh environments. HVC series can be used in a wide range of applications.

Features
- Gas-filled and hermetically sealed
- No EMI, low operating power
- No polarity of contact terminals
- RoHS compatible

Applications
- Battery charge/ discharge systems
- Renewable energy storage systems
- DC high-voltage/ high-current applications
- DC fast charging stations

Characteristics

<table>
<thead>
<tr>
<th>Contact arrangement</th>
<th>1A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inner contact material</td>
<td>Cu alloy</td>
</tr>
<tr>
<td>Internal contact gap (full disconnection)</td>
<td>3.2 (2 × 1.6) mm</td>
</tr>
</tbody>
</table>

Recommended connection cable cross section 1
- > 200 mm²

Coil wires
- length
- cross section
- material
  - 300 mm
  - AWG20
  - Cu

Auxiliary contact
- max. voltage
- max. current
- max. switching power
- max. resistance
- wire cross section
  - 36 V_DC
  - 250 mA_DC
  - 3 W
  - 200 mΩ
  - AWG26

Vibration in closed state, xyz-axis
- shock, 11 ms ½ sine, peak
- vibration, sine 100 ... 2000 Hz, peak
- wideband random vibration, 10 ... 1000 Hz 2
  - 196 m/s²
  - 196 m/s²
  - 49 m/s²RMS

Operation and storage 3
- temperature
- humidity
- air pressure
  - −40 ... +85 °C
  - 5 ... 85 %
  - 69 ... 106 kPA

Climatic category (IEC 60068-1)
- 40/085/21

Weight
- ~ 500 g

Certifications
- UL 60947-4-1 (E491412)
- CE

See “Notes” on page 8

1 See “Notes” on page 8
** Specification 4 **

<table>
<thead>
<tr>
<th>Contact</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum operating voltage</td>
<td>1000 V</td>
<td>V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Continuous carry current</td>
<td>I&lt;sub&gt;th&lt;/sub&gt;</td>
<td>500 A&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Temporary overcurrent (10 min)</td>
<td>I&lt;sub&gt;CW1&lt;/sub&gt;</td>
<td>600 A&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Temporary overcurrent (1 min)</td>
<td>I&lt;sub&gt;CW2&lt;/sub&gt;</td>
<td>750 A&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Rated operational voltage</td>
<td>U&lt;sub&gt;e&lt;/sub&gt;</td>
<td>1000 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Rated operational current</td>
<td>I&lt;sub&gt;e&lt;/sub&gt;</td>
<td>100 A&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Mechanical endurance</td>
<td>1 000 000 switchings</td>
<td></td>
</tr>
<tr>
<td>Maximum cut-off current (1 operation)</td>
<td>2000 A&lt;sub&gt;DC&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Contact resistance (&gt; 100 A&lt;sub&gt;DC&lt;/sub&gt;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- typical</td>
<td>0.125 mΩ</td>
<td></td>
</tr>
<tr>
<td>- max.</td>
<td>0.25 mΩ</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance at 1000 V&lt;sub&gt;DC&lt;/sub&gt; (initial)</td>
<td>&gt; 1 GΩ</td>
<td></td>
</tr>
<tr>
<td>- contact to contact / contact to coil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dielectric strength</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- contact to contact / contact to coil</td>
<td>&gt; 4400 V&lt;sub&gt;AC&lt;/sub&gt;</td>
<td></td>
</tr>
<tr>
<td>Operating time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- make</td>
<td>&lt; 35 ms</td>
<td></td>
</tr>
<tr>
<td>- break</td>
<td>&lt; 15 ms</td>
<td></td>
</tr>
</tbody>
</table>

| Coil 10                                      |         |         |
| Rated operation voltage                      | U<sub>c</sub> | 24 V<sub>DC</sub> |
| Operating voltage range                      | U<sub>1</sub> ... U<sub>2</sub> | 18 ... 32 V<sub>DC</sub> |
| Pick-up voltage (max.)                       | U<sub>1</sub> | 18 V<sub>DC</sub> |
| Drop-out voltage (min.)                      | 2 V<sub>DC</sub> |
| Minimum holding current                      | 0.08 A<sub>DC</sub> |
| Power at nominal voltage                     | 6 W |
| Nominal resistance                           | 96 Ω |

** Operating voltage characteristics **

24 V single coil

- Pick-up voltage (max.)
- Drop-out voltage (min.)

See “Notes” on page 8
**Characteristics** \(^{12, 13}\)

![Graph showing Estimated service life for resistive loads](attachment://graph1.png)

- **Switching life (cycles)** vs. **Load current [A]**
- **Estimated service life**

- **Current handling capability** at 85 °C

![Graph showing Current handling capability at 85 °C](attachment://graph2.png)

- **Time [s]** vs. **Carry current [A]**

See "Notes" on page 8
Dimensional drawing in mm

<table>
<thead>
<tr>
<th>Connection name</th>
<th>Type</th>
<th>Marking</th>
<th>Finishing</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Main terminal</td>
<td>A1</td>
<td>copper contact surface</td>
<td>tightening torque 6...8 Nm; 7 Nm recommended</td>
</tr>
<tr>
<td>A2</td>
<td>Main terminal</td>
<td>A2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil (+)</td>
<td>Coil wire</td>
<td>red</td>
<td>stripped and tinned</td>
<td>max. allowable pull force 10 N</td>
</tr>
<tr>
<td>Coil (−)</td>
<td>Coil wire</td>
<td>black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aux COM</td>
<td>Auxiliary wire</td>
<td>white</td>
<td>stripped and tinned</td>
<td></td>
</tr>
<tr>
<td>Aux NO</td>
<td>Auxiliary wire</td>
<td>blue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- Auxiliary contacts “blue” and “white” are normally open.
- When the contacts are short and the coil voltage is “0 V”, the part is stuck.
- Coil (+) and coil (−) are suppressed with a surge protection device, see “Cautions and warnings”.

In case of no tolerance shown in dimensional drawing, general tolerances apply:
- dimension ≤ 10 mm: ± 0.3 mm;
- dimension 10 to 50 mm: ± 0.6 mm;
- dimension > 50 mm: ± 1 mm
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**Auxiliary contact**
Example circuit to realize stuck detection:

![Circuit Diagram]

In case the contactor is stuck, the Aux COM (white) and Aux NO (blue) wires will be short, hence the circuit is closed and the LED will be on.

**Packing unit**

*B88269X…C 11 = 1 pc. in cardboard box*
Accessories

Nuts and washers: (PE-bag enclosed in packing unit)

Cover shield:

To order if required:

B88269X2200C101 = 10 pcs. cover shields in a box
Notes:
1. The diameter must be matched to actual current and operation temperature (see: Cautions and warnings).
2. Referring to IEC 60068-2-64
3. Freezing or condensing must be avoided.
4. Referring to IEC/EN 61810-1
5. Referring to IEC 60947-4-1, 6000 operations make & break
6. Duty cycle 50%, cycle duration 1 s, value represents B10 life time acc. to Weibull analysis.
7. Tested at 450 V for resistive loads with τ ≤ 1 ms
8. No fire and no explosion will occur after this break. Afterwards, the dielectric strength and insulation resistance may not meet initial data sheet specification.
9. Detection limit 10 mA
10. Specified referring to JIS C 5442 (temperature 15 °C to 35 °C, humidity 25% to 85% RH).
11. Tolerance ±10% at thermal equilibrium
12. End of life is reached when insulation resistance is < 50 MΩ at 1000 V.
13. For currents > “make & break border” only break is permitted to avoid tack welding, duty cycle 1%, 600 s cycle duration. For currents < “make & break border” make and break is permitted duty cycle 10%, 6 s cycle duration.

Cautions and warnings
- To guarantee a satisfying performance of this contactor in the application we strongly recommend to implement redundancy, take measures to prevent the spread of fire, take the possibilities of malfunction into account, and perform regular maintenance.
- It is also required to always use a suitable backup fuse for the contactor.
- It is not allowed to use the contactor outside of the parameter range specified in this datasheet. This also includes temperature and humidity. Overloading may destroy the component.
- The lifetime depends on several factors: e.g. load type, driving circuit and ambient conditions. We recommend checking the performance of the part under actual conditions.
- For capacitive loads the inrush current through the contactor should not exceed the specified limit (see make and break border). Otherwise tack welding and permanent failure will occur.
- Break of inductive loads with τ > 1 ms will shorten the lifetime and failure may occur.
- In the event of a break under inductive load, the voltage at the connection terminals of the contactor must not exceed the nominal operating voltage by more than 10 %.
- For continuous high current operation, make sure that temperature at the connection terminals does not exceed 120 °C by selecting an appropriate connection cable cross section or active cooling.
- The leads to the contactor must be securely tightened to the terminals (check torque specification in data sheet), otherwise current stress may generate sparks and heating. Use only suitable screws or bolts and nuts for all mechanical connections to the contactor and verify their functionality in the application. The recommended torque range is suitable for multiple fixations; the maximum torque is suited for one time fixation only.
- After long-term operation, the contactor coil resistance is increased due to the temperature rise. If the contactor is switched on immediately afterwards the coil characteristics may be deteriorated.
- The coil contacts need to be protected from overvoltage when switching off. Therefore, a protection device is installed in parallel. No further protection device shall be used parallel to the coil.
For successful pick-up, the voltage cannot be ramped up slowly. The voltage needs to be applied instantly to at least the maximum pick-up voltage.

Simultaneously applied maximum operation parameters for e.g. coil voltage, over currents, temperature, vibration etc. may lead to reduced lifetime. We recommend applying rated settings to achieve optimum life performance.

For contactors equipped with auxiliary contacts: The auxiliary contact (“stuck detection”) is no real parallel contact and delivers only an indirect source of information about the actual switching status.

For additional safety, the contactor must be mounted in a way that the vertical axis of the part (Z-axis) is not in line with the main shock axis inside the application.

Contactors radiate magnetic and electromagnetic fields. Please ensure that other components mounted in close proximity are not affected.

In case two contactors are mounted in close proximity, a clearance distance of 20 mm has to be kept.

The operating life of the contactor can be affected by strong magnetic fields. Please ensure that there are no magnetic field sources in close proximity and avoid nearby installed heat sources.

The contactor must not be operated without any load. This may increase contact resistance.

Contactors may become hot during extended periods of current overload (burn hazard).

Contactors must be handled with care and must not be dropped. The attached wires are not allowed to be used for lifting and handling the part (max. allowed pull-force is 10 N).

Damaged contactors must not be re-used.

The manufacturer cannot be held liable for failures caused by condensation or icing. The customer has to apply suitable measures to avoid these circumstances.

This contactor is not waterproof.

It is forbidden to use this contactor in atmospheres loaded with organic solvents (alcohol, petroleum, etc.) or strong alkaline substances (ammoniac, acids in general, etc.).

It must be ensured that during installation and operation no kind of foreign matter adheres to the main contact. Especially oils and silicones must be avoided.

It is forbidden to attach any kind of additional construction to or on the contactor.

This contactor is tested and classified according to UL as an open-type device. This means the contactor is intended to be installed in an ultimate enclosure provided by a third party.

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