



High-voltage contactor

Gas-filled contactor for high-voltage DC switching

Series/Type: HVC27
Ordering code: B88269X*
Date: 2022-10-06
Version: 07

High-voltage contactor
B88269X*
Gas-filled contactor for high-voltage DC switching
HVC27

Values in this document are preliminary and may be subject to change.


General

The HVC27 series has been specially designed to meet the requirements of high-voltage DC switching applications. The optimized hermetically sealed design exhibits excellent reliability performance against harsh environments. HVC27 series can be used in a wide range of applications such as automotive traction battery systems, electrical energy storage systems (ESS) and DC fast charging stations.

Features

- Single or dual coil
- Coil termination with varistor or diode
- Main terminals without polarity (bi-directional)
- Auxiliary contact with Hall element (optional)
- RoHS compatible

Characteristics

Type HVC27-...	300A	400A	500A	
Contact arrangement	1A			
Inner contact material	Cu alloy			
Internal contact gap (full disconnection)	3.2 (2 × 1.6)			mm
Recommended connection cable cross section ¹	≥ 100	≥ 200	≥ 200	mm ²
Wires		Isolator Ø max.		
- coil	AWM 3266	AWG20	1.9	mm
- auxiliary contact	AWM 3266	AWG20	1.9	mm
- length	300			mm
- material	Cu (tinned)			
Auxiliary contact (Hall)				
- supply voltage range, Aux V _{CC} ²		5 ... 24		V _{DC}
- indication V _{IND} voltage range		1 ... 24		V _{DC}
- max. carry current		0.8		A _{DC}
- max. switching current, peak (< 100 ms)		1.2		A _{DC}
- max. current consumption		5		mA _{DC}
- ON resistance		≤ 0.5		Ω
- OFF resistance		> 10		MΩ
Vibration in closed state, xyz-axis				
- shock, 6 ms ½ sine, peak ³		490		m/s ²
- vibration, sine 100 ... 2000 Hz, peak ⁴		98		m/s ²
- wideband random vibration, 10 ... 1000 Hz ⁵		49		m/s ² _{RMS}
Operation and storage ⁶				
- temperature		-40 ... +85		°C
- humidity		5 ... 85		%
- air pressure		50 ... 106		kPa
Climatic category (IEC 60068-1)	40/085/21			
Weight ⁷	~ 540			g
Certifications	UKCA CE UL 60947-4-1 (E491412)			pending pending 

See "Notes" on page 14

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Specification ⁸

Type HVC27-...		300A	400A	500A	
Contact					
Maximum operating voltage		1000			V _{DC}
Continuous current	I _{th}	300	400	500	A _{DC}
Temporary overcurrent (10 min)	I _{CW1}	400	520	600	A _{DC}
Temporary overcurrent (1 min)	I _{CW2}	500	650	750	A _{DC}
Rated operational voltage ^{9, 10}	U _e	1000			V _{DC}
Rated operational current ^{9, 10}	I _e	100			A _{DC}
Contact resistance at 100 A _{DC}					
- typical		0.125			mΩ
- max.		0.30			mΩ
Insulation resistance at 1000 V _{DC}					
- contact to contact / contact to coil		≥ 1			GΩ
Dielectric strength					
- contact to contact / contact to coil ¹¹		≥ 4400			V _{AC}
Operating time ¹²					
- make		≤ 35			ms
- break		≤ 20			ms
Electrical endurance ^{10, 13, 14}		Single coil	Dual coil (E2)		
Mechanical (make & break) ¹⁵		500 000	500 000		operations
- max. 1 V _{DC} , 1 A _{DC}					
Capacitive (make)		50 000	80 000		operations
- at 20 V _{DC} , 200 A _{DC} for single coil					
Resistive (break) ¹⁶		1500	2000		operations
- at 450 V _{DC} , 300 A _{DC}		150	1000		operations
- at 750 V _{DC} , 300 A _{DC} for					
Maximum cut-off (break) ^{17, 18}		1	1		operation
- at 450 V _{DC} , 2000 A _{DC}		1	1		operation
- at 1000 V _{DC} , 900 A _{DC}					
Coil type		12 V	24 V	12 V ¹⁹	24 V ¹⁹
Rated control voltage (nominal)	U _c	12	24	12	24
Operating voltage range	U ₁ ... U ₂	9 ... 16	18 ... 32	9 ... 16	18 ... 32
Pick-up voltage (max.)	U ₁	9	18	9	18
Drop-out voltage (min.)		1	2	1	2
Pick-up current (inrush)		---	---	4	2
Power at nominal voltage ²⁰		6	6	4	4
Nominal resistance ¹³		24	96	36	144
					V _{DC}
					V _{DC}
					V _{DC}
					V _{DC}
					A _{DC}
					W
					Ω

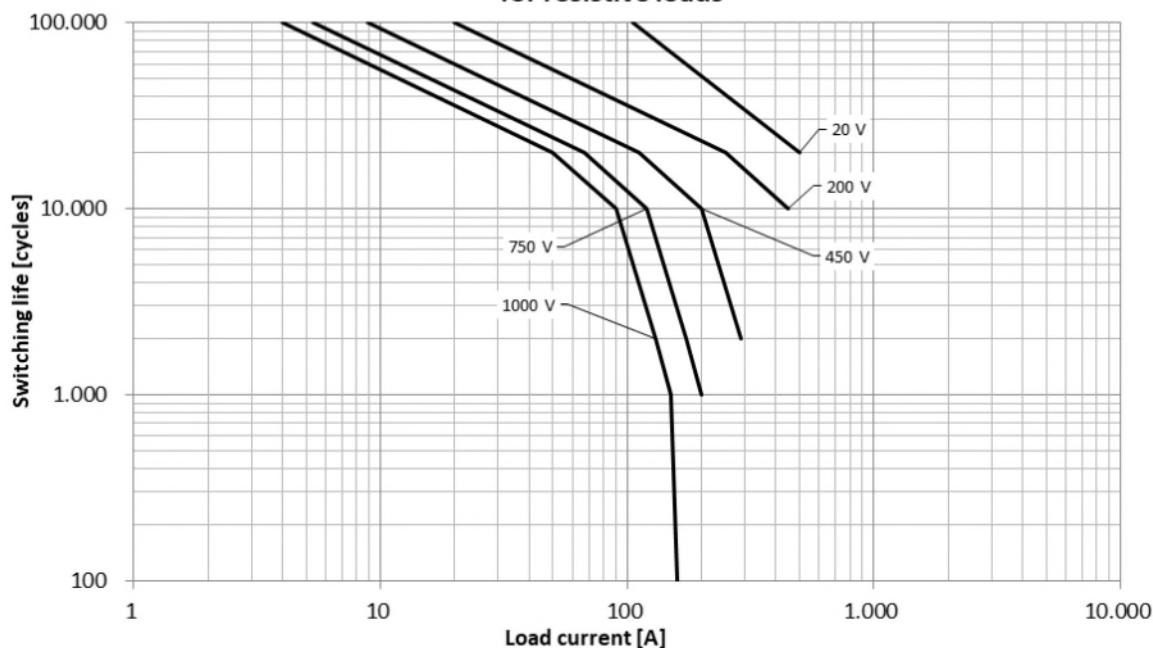
See "Notes" on page 14

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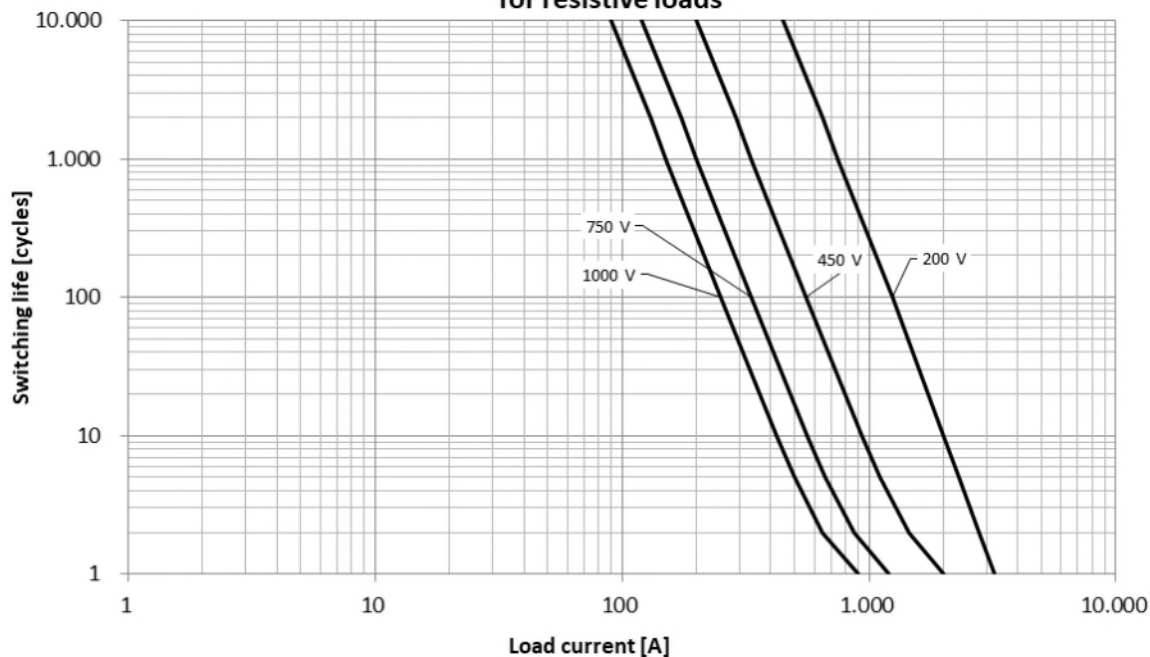
Characteristics 10, 13, 14, 21

Single coil

**Estimated make & break life curve
for resistive loads**



**Estimated break-only life curve
for resistive loads**

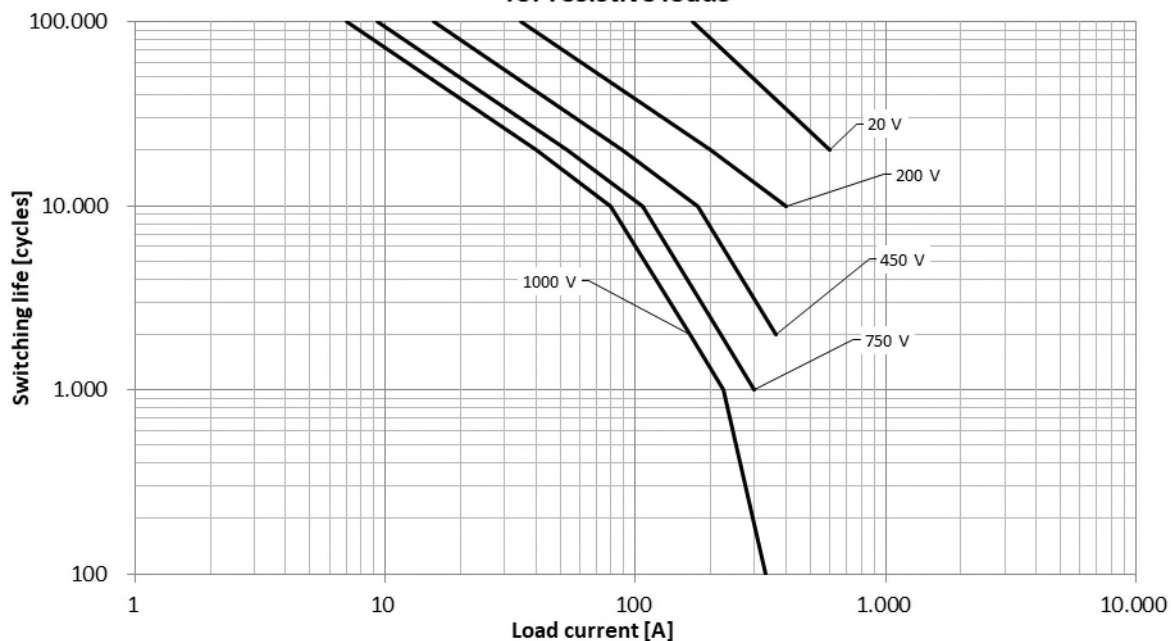


See "Notes" on page 14

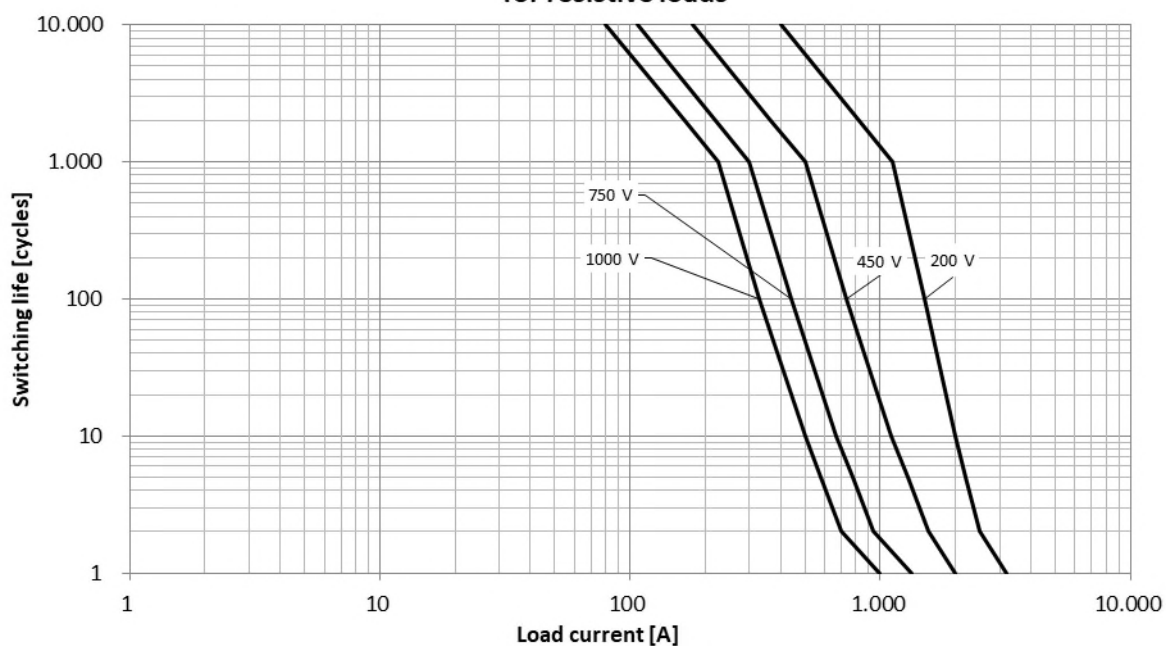
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Dual coil (E2)

**Estimated make & break life curve
for resistive loads**



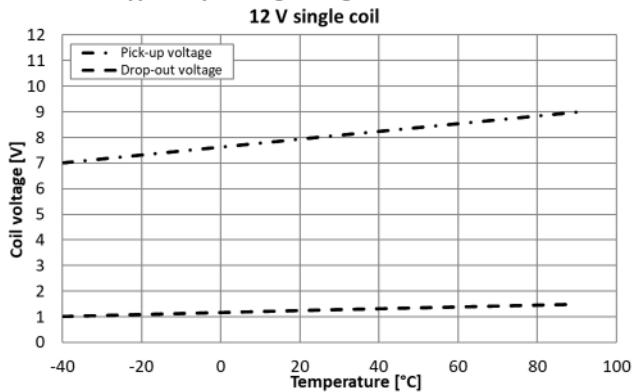
**Estimated break-only life curve
for resistive loads**



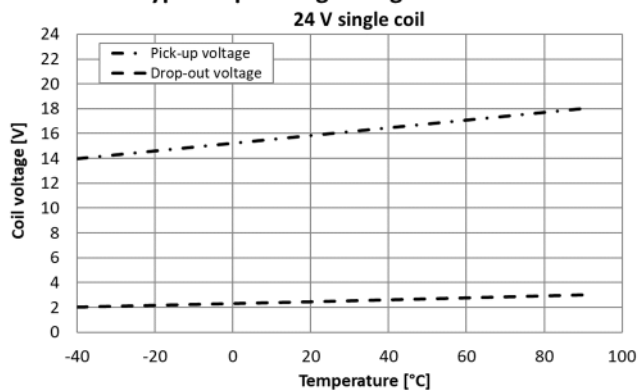
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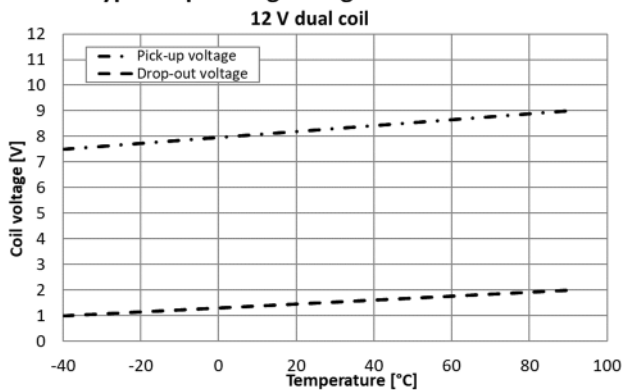
Typical operating voltage characteristics



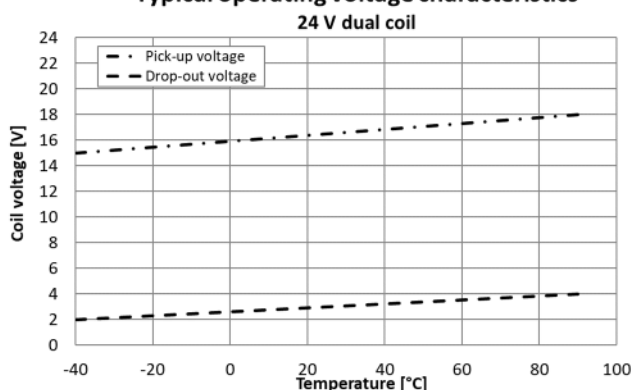
Typical operating voltage characteristics



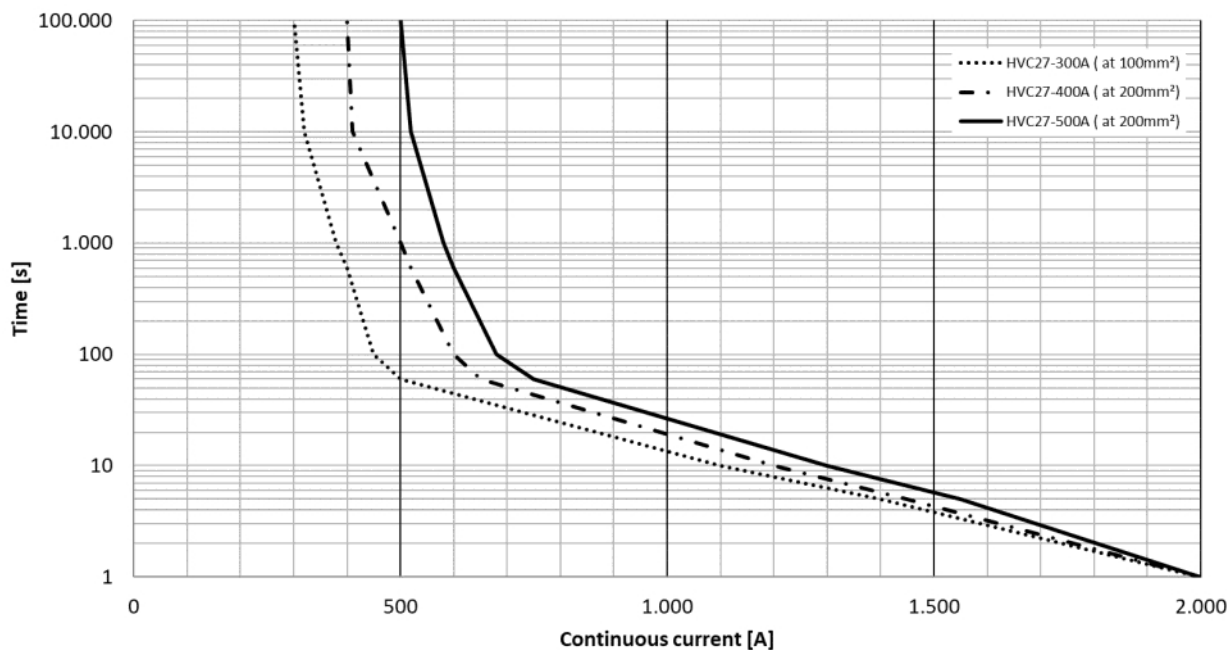
Typical operating voltage characteristics



Typical operating voltage characteristics



Current handling capability for single and dual coil
at 85 °C



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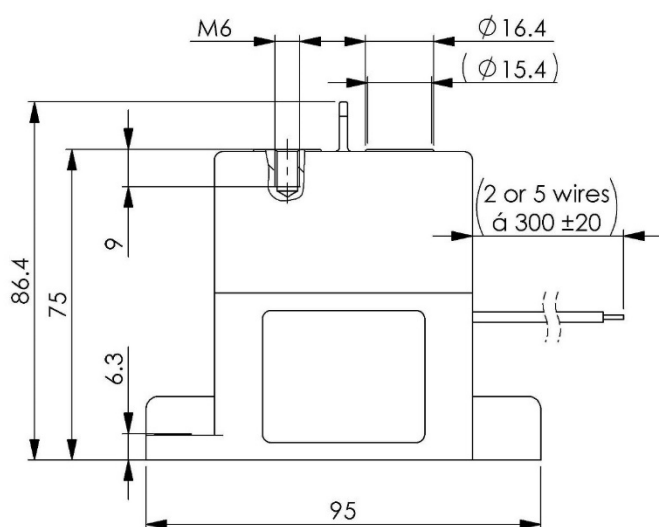
Dimensional drawings

in mm

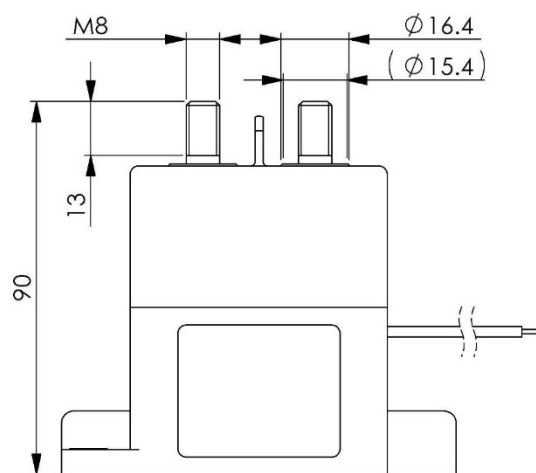
In case of no tolerance shown in dimensional drawing, general tolerances apply:
 dimension ≤ 10 mm: ± 0.3 mm; dimension 10 to 50 mm: ± 0.6 mm; dimension > 50 mm: ± 1 mm

C1-housing (standard)

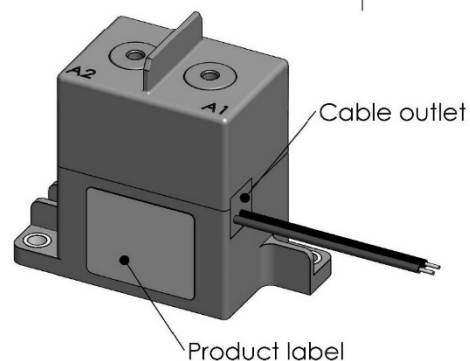
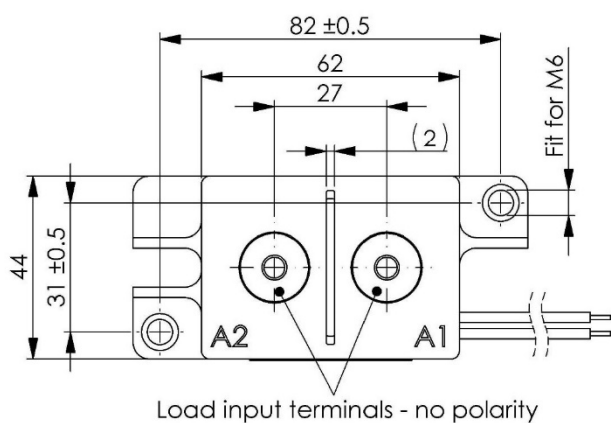
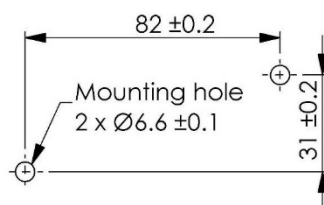
HVC27-___A-___C1



HVC27-___B-___C1F



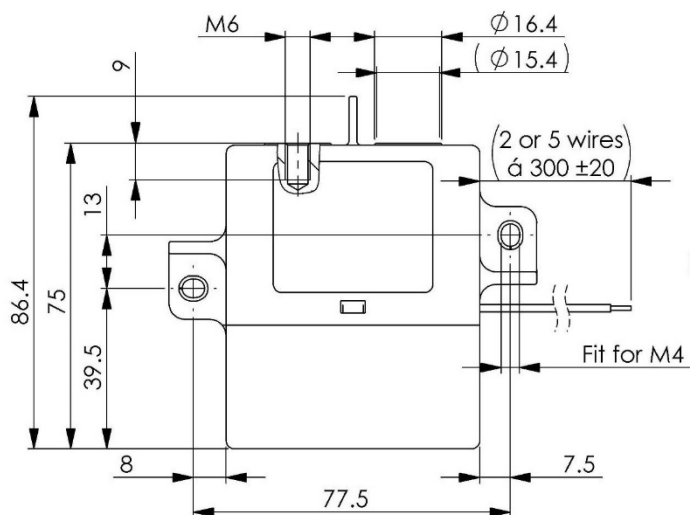
Mounting dimensions:



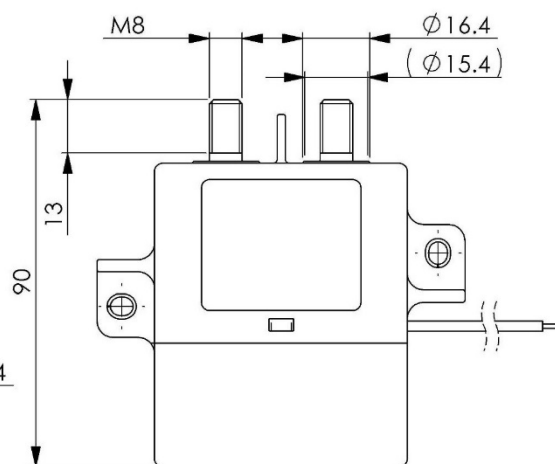
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C5-housing

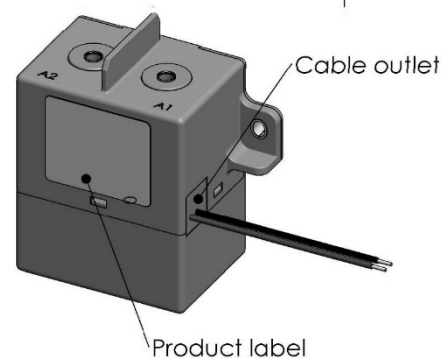
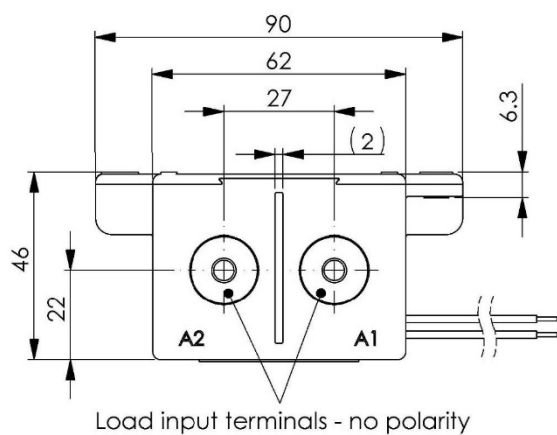
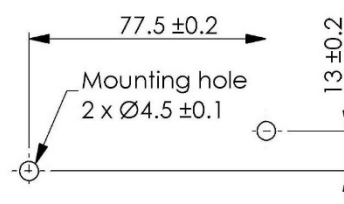
HVC27-___A-___C5



HVC27-___B-___C5F



Mounting dimensions:

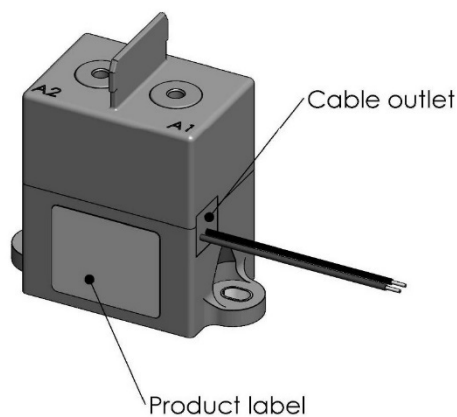
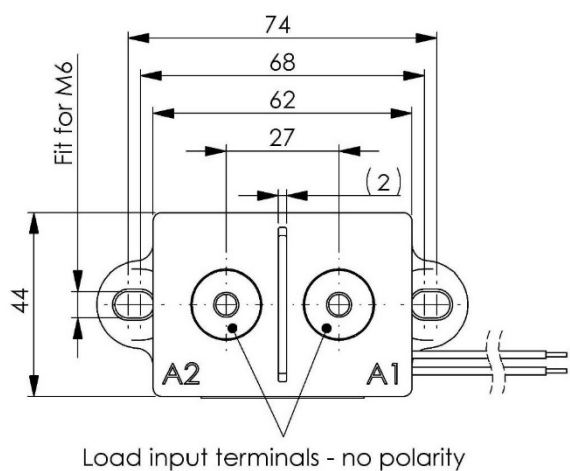
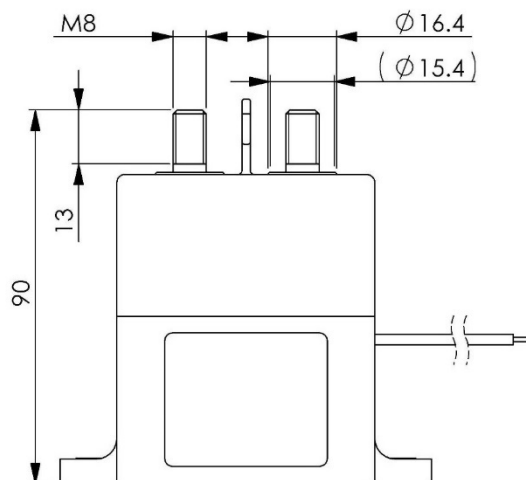
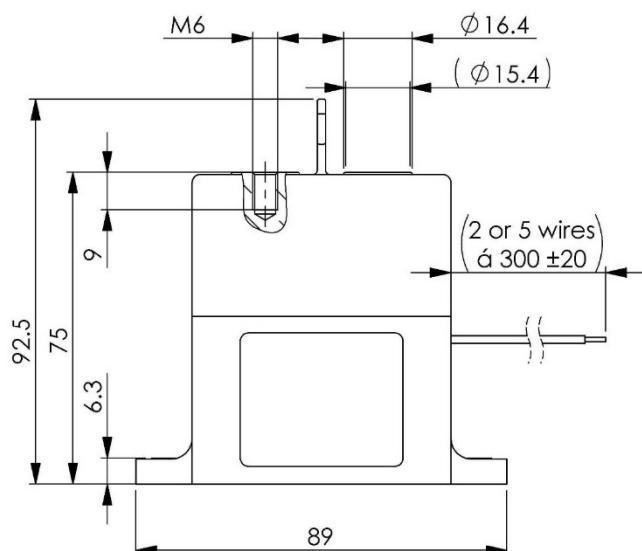


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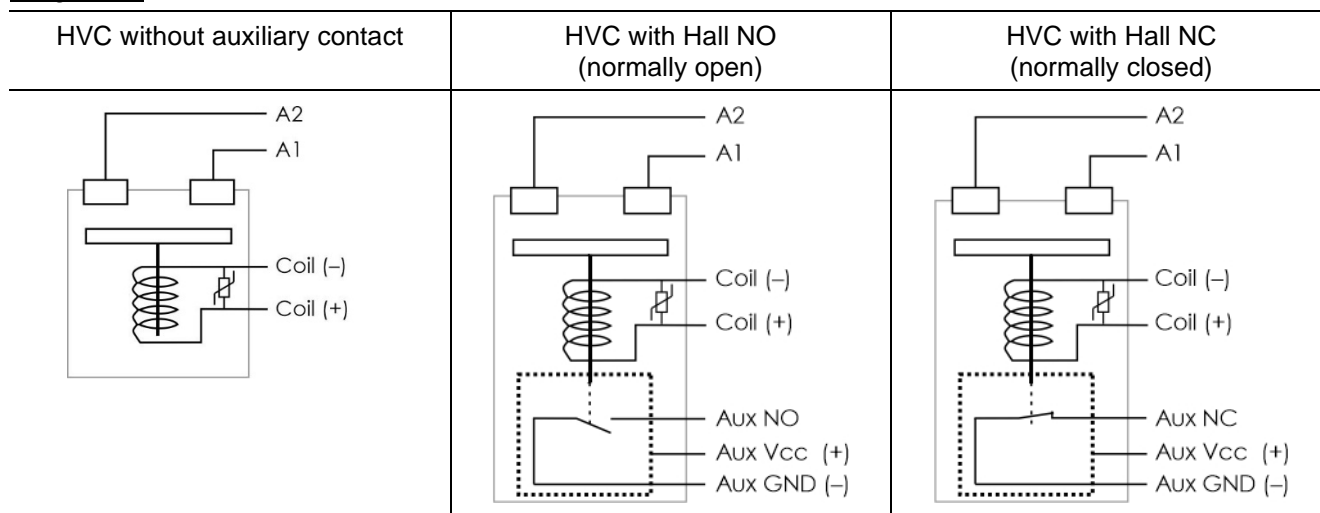
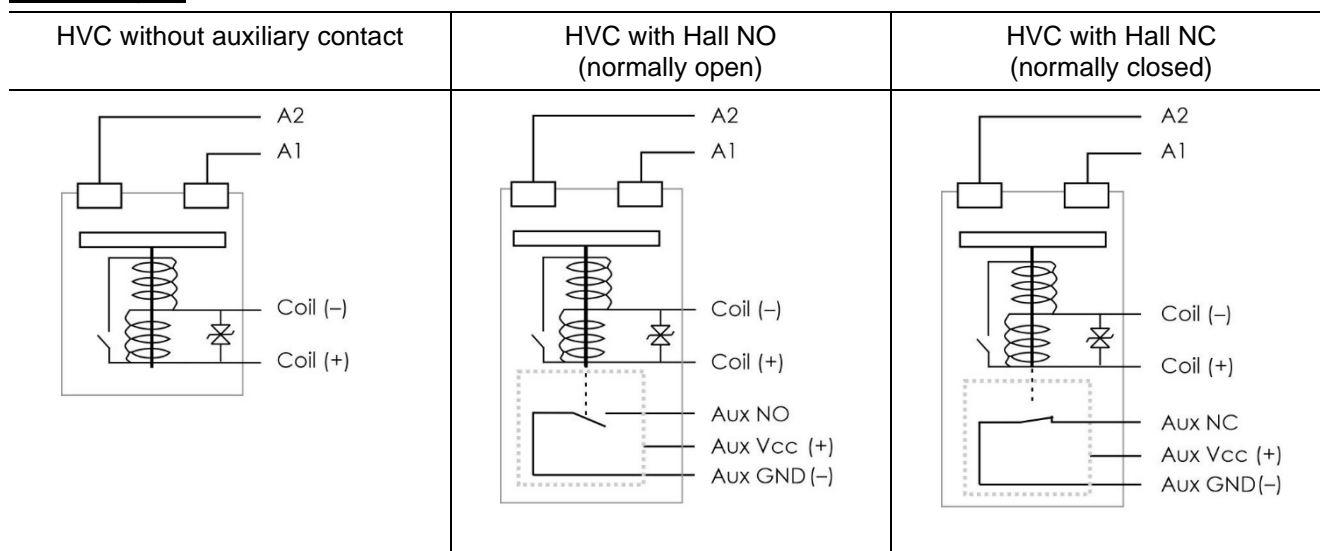
NIL - replacement housing for HVC2.5 series

HVC27-___A-___

HVC27-___B-___F



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Schematics
Single coil

Dual coil (E2)


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Installation information

Connection name	Type	Marking	Finishing	Remarks
A1	Main terminal	A1	copper contact surface	tightening torque 6...8 Nm
A2	Main terminal	A2		
Coil (+)	Coil wire	red	stripped and tinned	max. allowable pull force 10 N
Coil (-)	Coil wire	black		
Aux Vcc (+)	Auxiliary contact wire	brown	stripped and tinned	supply voltage input; max. allowable pull force 10 N
Aux GND (-)	Auxiliary contact wire	white		common GND for supply voltage V_{cc} & external indication voltage; max. allowable pull force 10 N
Aux NO or Aux NC	Auxiliary contact wire	blue or green		indication voltage port max. allowable pull force 10 N
Case mounting	Contactor mounting M6 (C1-) / M4 (C5-housing)	none	stainless steel insert	tightening torque 4...6 Nm

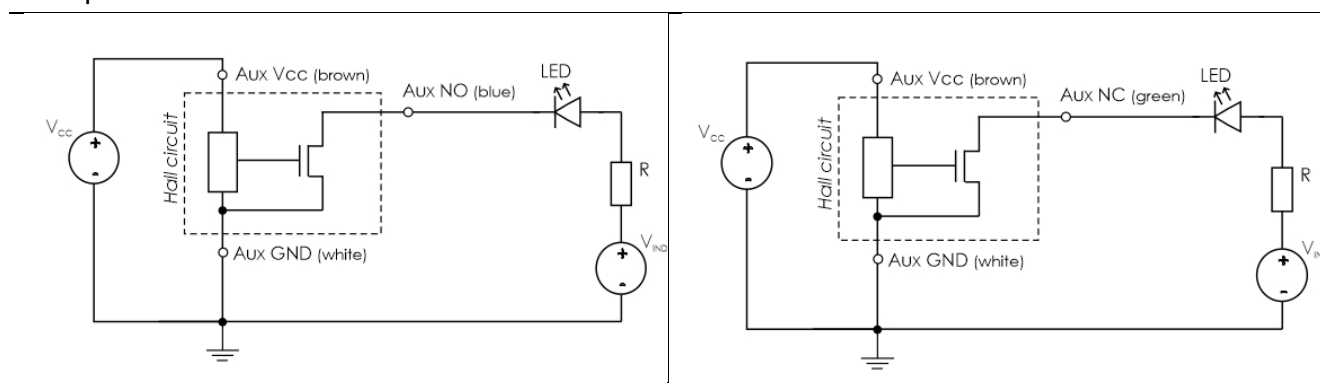
Important:

The auxiliary contact wires are polarization sensitive and have no reverse voltage protection. Please connect only as stated under column "Remarks".

Coil (+) and coil (-) are suppressed with a surge protection device, see "Cautions and warnings".

Auxiliary contact

Example circuits to realize stuck detection:



The contact Aux NO respectively Aux NC is internally implemented as a low-side switch.

To allow a safe operation, V_{IND} and R must be selected in a way that the current through Aux NO respectively Aux NC is limited to 0.8 A.

In case the contactor is stuck, the Aux GND (white) and Aux NO (blue) wires will be short, hence the circuit is closed and the LED will be on or the Aux GND (white) and Aux NC (green) wires will be open, hence the circuit is open and the LED will be off.

Important:

Aux Vcc must always be energized to enable the auxiliary contacts. If V_{cc} is not applied, Aux GND and Aux NO respectively Aux NC will be high-ohmic.

The voltages V_{cc} and V_{IND} must not be supplied by the same single physical voltage source as V_{coil} .

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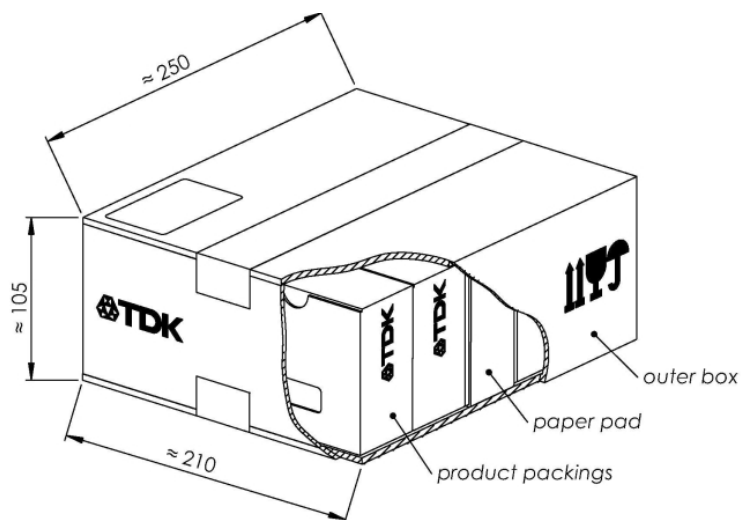
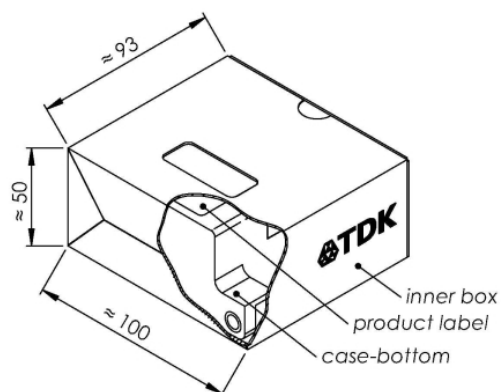
Packing unit

B88269X...C011 = 1 pc. in cardboard box

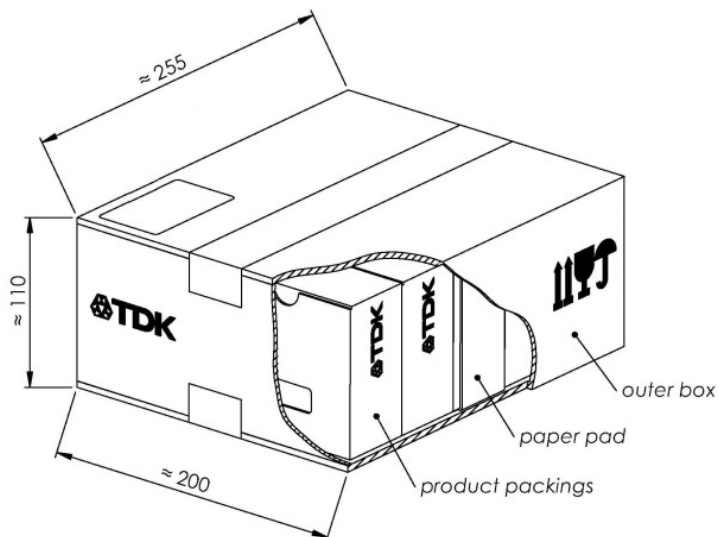
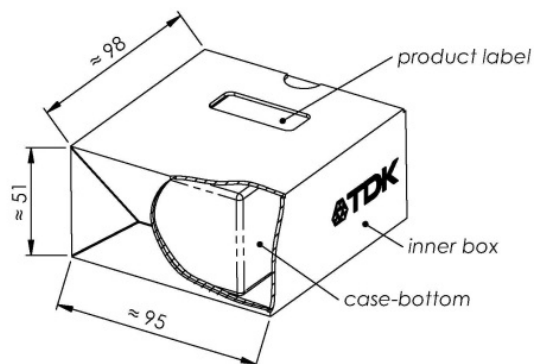
Delivery unit

10 pcs. in cardboard box

Packing for HVC with C1 housing

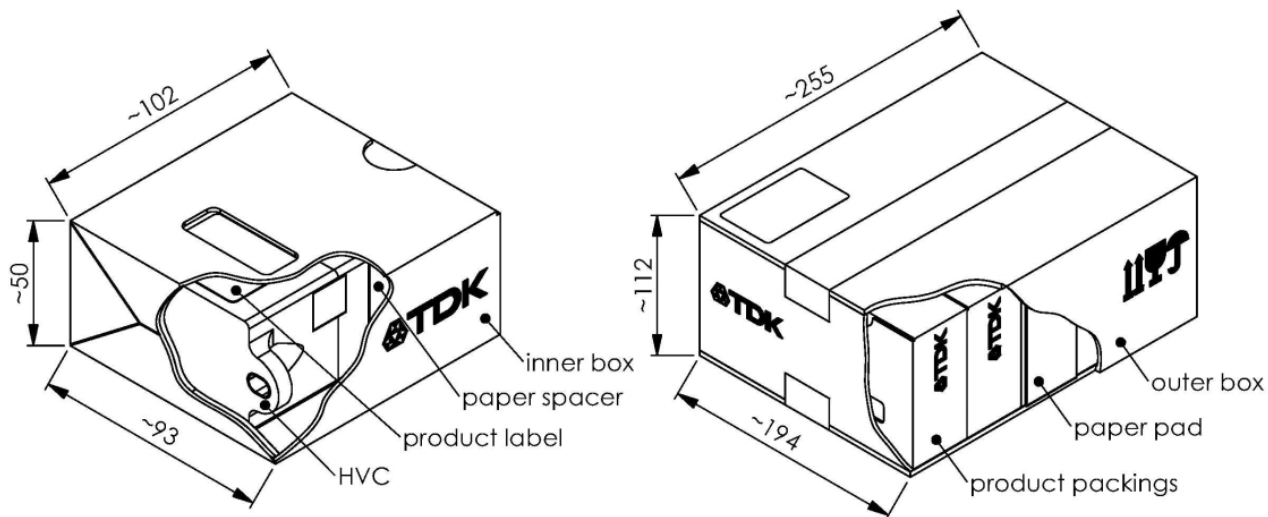


Packing for HVC with C5 housing



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Packing for replacement for HVC2.5 series



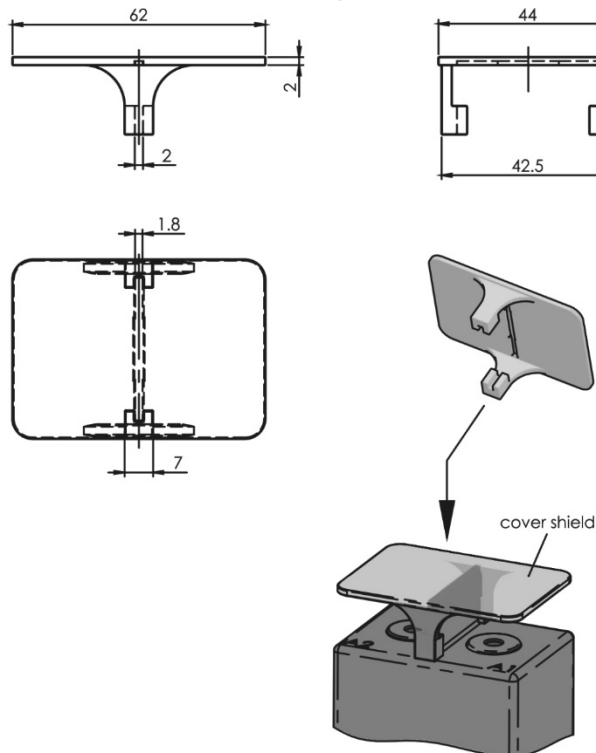
Accessory

(for replacement for HVC2.5 series only)

Cover shield:

To order if required:

B88269X2200C101 = 10 pcs. cover shields in a box



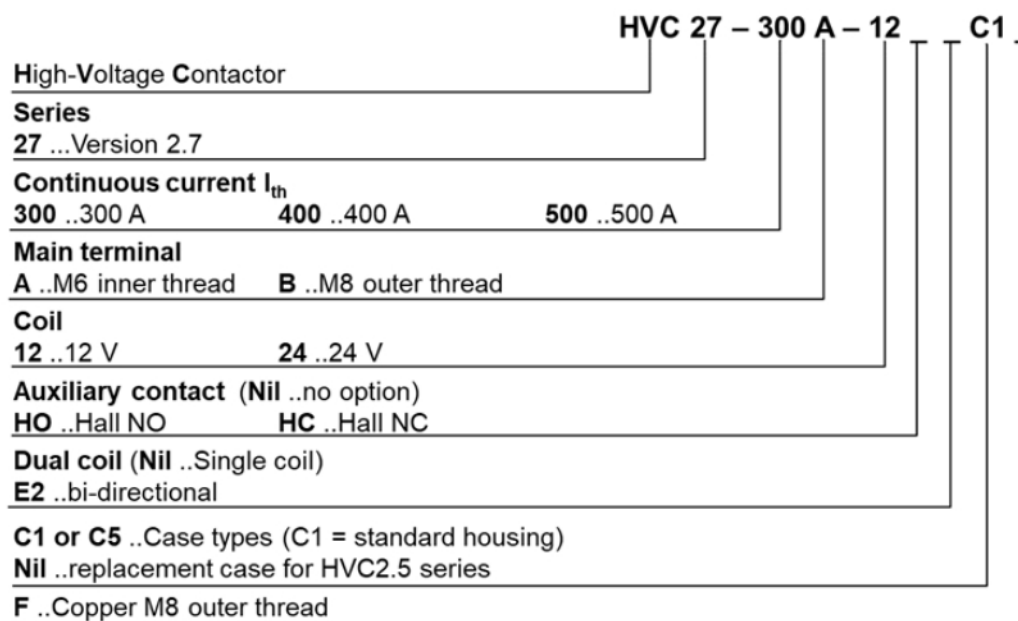
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Notes:

- ¹ The recommended cross section refers to pure copper. In other cases it must be matched to actual current, conductor material properties and operation temperature (see: Cautions and warnings).
- ² Referring to IEC 61810-10: 2019, test T2.5.4, table T3 for $V_{CCmax} = 32 V$
- ³ Referring to IEC 60068-2-27
- ⁴ Referring to IEC 60068-2-6
- ⁵ Referring to IEC 60068-2-64
- ⁶ Freezing or condensing must be avoided.
- ⁷ Valid for base-model with 300 mm wires. Other configurations will lead to deviations.
- ⁸ The specified values apply to unused contactors acc. to IEC 61810-1.
- ⁹ Referring to IEC 60947-4-1, 6000 operations make & break
- ¹⁰ Referring to IEC 60947-4-1, 50% of operations in positive and 50% in negative direction (see: Cautions and warnings)
- ¹¹ Detection limit 10 mA
- ¹² Measured at rated control voltage U_c including contact bouncing time.
- ¹³ Specified referring to JIS C 5442 (temperature 15 °C to 35 °C, humidity 25% to 85% RH).
- ¹⁴ End of life is reached when insulation resistance is < 50 MΩ at 1000 V.
- ¹⁵ Duty cycle 50%, cycle duration 1 s, value represents B10 life time acc. to Weibull analysis.
- ¹⁶ Duty cycle 1%, cycle duration 600 s
- ¹⁷ Tested for resistive loads with $\tau \leq 1 ms$
- ¹⁸ No fire and no explosion will occur after this break
- ¹⁹ At start up two coils are active. After ~100 ms one of the coils is switched off, leaving only a low power holding coil active.
- ²⁰ Tolerance $\pm 10\%$ at thermal equilibrium
- ²¹ For „make & break life curves“ duty cycle is 10% and cycle duration is 6 s. For “break-only life curves” duty cycle is 1% and cycle duration is 600 s.

Nomenclature of type name

Example (other digits may indicate customized version or special option)



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Ordering codes

Single coil

Continuous current A _{DC}	Coil voltage V _{DC}	Type name	Ordering code
300 (without Hall)	12	HVC27-300A-12C1 HVC27-300A-12C5 HVC27-300A-12	B88269X3280C011 B88269X6740C011 B88269X3870C011
	24	HVC27-300A-24C1 HVC27-300A-24C5 HVC27-300A-24	B88269X3880C011 B88269X6720C011 B88269X3890C011
300 (with Hall)	12	HVC27-300A-12HOC1 HVC27-300A-12HCC1 HVC27-300A-12HOC5 HVC27-300A-12HCC5 HVC27-300A-12HO HVC27-300A-12HC	B88269X3900C011 B88269X3910C011 B88269X6180C011 B88269X6800C011 B88269X3920C011 B88269X3930C011
	24	HVC27-300A-24HOC1 HVC27-300A-24HCC1 HVC27-300A-24HOC5 HVC27-300A-24HCC5 HVC27-300A-24HO HVC27-300A-24HC	B88269X3530C011 B88269X3940C011 B88269X6660C011 B88269X6690C011 B88269X3860C011 B88269X3950C011
400 (without Hall)	12	HVC27-400A-12C1 HVC27-400A-12C5 HVC27-400A-12 HVC27-400B-12F	B88269X3520C011 B88269X6750C011 B88269X6200C011 B88269X6210C011
	24	HVC27-400A-24C1 HVC27-400A-24C5 HVC27-400A-24 HVC27-400B-24F	B88269X6220C011 B88269X6730C011 B88269X6230C011 B88269X6240C011
400 (with Hall)	12	HVC27-400A-12HOC1 HVC27-400A-12HCC1 HVC27-400A-12HOC5 HVC27-400A-12HCC5 HVC27-400A-12HO HVC27-400A-12HC HVC27-400B-12HOF HVC27-400B-12HCF	B88269X3820C011 B88269X6250C011 B88269X6810C011 B88269X6790C011 B88269X6540C011 B88269X6640C011 B88269X6170C011 B88269X6580C011
	24	HVC27-400A-24HOC1 HVC27-400A-24HCC1 HVC27-400A-24HOC5 HVC27-400A-24HCC5 HVC27-400A-24HO HVC27-400A-24HC HVC27-400B-24HOC1F HVC27-400B-24HOF HVC27-400B-24HCF	B88269X6260C011 B88269X6270C011 B88269X6670C011 B88269X6700C011 B88269X6610C011 B88269X6760C011 B88269X3830C011 B88269X6160C011 B88269X6560C011

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Continuous current A_{DC}	Coil voltage V_{DC}	Type name	Ordering code
500 (without Hall)	12	HVC27-500A-12C1 HVC27-500A-12C5 HVC27-500A-12 HVC27-500B-12C1F HVC27-500B-12F	B88269X3290C011 B88269X6280C011 B88269X3970C011 B88269X3390C011 B88269X6290C011
	24	HVC27-500A-24C1 HVC27-500A-24C5 HVC27-500A-24 HVC27-500B-24F	B88269X6300C011 B88269X3840C011 B88269C6520C011 B88269X6310C011
500 (with Hall)	12	HVC27-500A-12HOC1 HVC27-500A-12HCC1 HVC27-500A-12HOC5 HVC27-500A-12HCC5 HVC27-500A-12HO HVC27-500A-12HC HVC27-500B-12HOF HVC27-500B-12HCF	B88269X6320C011 B88269X6330C011 B88269X3980C011 B88269X6280C011 B88269X6550C011 B88269X6650C011 B88269X6340C011 B88269X6590C011
	24	HVC27-500A-24HOC1 HVC27-500A-24HCC1 HVC27-500A-24HOC5 HVC27-500A-24HCC5 HVC27-500A-24HO HVC27-500A-24HC HVC27-500B-24HOF HVC27-500B-24HCF	B88269X6350C011 B88269X6360C011 B88269X6680C011 B88269X6710C011 B88269X6620C011 B88269X6770C011 B88269X3580C011 B88269X6570C011

Dual coil (E2)

Continuous current A_{DC}	Coil voltage V_{DC}	Type name	Ordering code
300 (without Hall)	12	HVC27-300A-12E2C1 HVC27-300A-12E2C5 HVC27-300A-12E2	TBD6440 on request on request
	24	HVC27-300A-24E2C1 HVC27-300A-24E2C5 HVC27-300A-24E2	on request on request on request
300 (with Hall)	12	HVC27-300A-12HOE2C1 HVC27-300A-12HCE2C1 HVC27-300A-12HOE2C5 HVC27-300A-12HCE2C5 HVC27-300A-12HOE2 HVC27-300A-12HCE2	on request on request on request on request on request on request
	24	HVC27-300A-24HOE2C1 HVC27-300A-24HCE2C1 HVC27-300A-24HOE2C5 HVC27-300A-24HCE2C5 HVC27-300A-24HOE2 HVC27-300A-24HCE2	on request on request on request on request TBD3780 TBD6630

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Continuous current A _{DC}	Coil voltage V _{DC}	Type name	Ordering code
400 (without Hall)	12	HVC27-400A-12E2C1	on request
		HVC27-400A-12E2C5	on request
	24	HVC27-400A-12E2	on request
		HVC27-400B-12E2C1F	on request
400 (with Hall)	12	HVC27-400B-12E2F	on request
		HVC27-400A-24E2C1	on request
	24	HVC27-400A-24E2C5	on request
		HVC27-400A-24E2	on request
500 (without Hall)	12	HVC27-400B-24E2C1F	on request
		HVC27-400B-24E2F	on request
	24	HVC27-400A-12HOE2C1	on request
		HVC27-400A-12HCE2C1	on request
500 (with Hall)	12	HVC27-400A-12HOE2C5	on request
		HVC27-400A-12HCE2C5	on request
	24	HVC27-400B-12HOE2C1F	on request
		HVC27-400B-12HOE2F	TBD6190
500 (without Hall)	12	HVC27-400A-24HOE2C1	on request
		HVC27-400A-24HCE2C1	on request
	24	HVC27-400A-24HOE2C5	on request
		HVC27-400A-24HCE2C5	on request
500 (with Hall)	12	HVC27-400B-24HOE2C1F	on request
		HVC27-400B-24HOE2F	on request
	24	HVC27-500A-12E2C1	on request
		HVC27-500A-12E2C5	on request
500 (without Hall)	12	HVC27-500A-12E2	on request
		HVC27-500B-12E2F	on request
	24	HVC27-500A-24E2C1	on request
		HVC27-500A-24E2C5	on request
500 (with Hall)	12	HVC27-500A-24E2	on request
		HVC27-500B-24E2F	on request
	24	HVC27-500A-12HOE2C1	TBD3810
		HVC27-500A-12HCE2C1	TBD3690
500 (without Hall)	12	HVC27-500A-12HOE2C5	on request
		HVC27-500A-12HCE2C5	on request
	24	HVC27-500A-12HOE2	on request
		HVC27-500A-12HCE2	on request
500 (with Hall)	12	HVC27-500B-12HOE2F	on request
		HVC27-500B-12HCE2F	on request
	24	HVC27-500A-24HOE2C1	TBD3850
		HVC27-500A-24HCE2C1	on request
500 (without Hall)	12	HVC27-500A-24HOE2C5	on request
		HVC27-500A-24HCE2C5	on request
	24	HVC27-500A-24HOE2	TBD3960
		HVC27-500A-24HCE2	on request
500 (with Hall)	12	HVC27-500B-24HOE2C1F	TBD6400
		HVC27-500B-24HOE2F	on request
	24	HVC27-500B-24HCE2F	on request
		HVC27-500B-24HCE2F	TBD6380

Values in this document are preliminary and may be subject to change.

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 data sheet. 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. Otherwise tack welding and permanent failure will occur.
- Break of inductive loads with $\tau > 1$ 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 130 °C by selecting an appropriate connection cable cross section or active cooling.
- The main connections of the contactor also act as a heat sink. Please ensure that the connection surface area is fully covered with a matched cable lug or busbar and that the connection hole in the busbar is according to DIN ISO 20273 (middle clearance).
- 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.
- For parts with copper outer threads (F-types): When doing multiple fixation a slight elongation of the outer thread is possible. We recommend to use always the same busbar height for multiple fixation.
- 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 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.
- The contactor is not intended to be used with pulse width modulation (PWM) controllers. Please contact TDK for details.
- 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.
- The HVC27 series is bi-directional (e.g. no polarity of main contacts), the service life curves are estimated based on the requirements of IEC60947-4-1; Chapter 8.2.4 where 50% of the required operations are performed in positive direction and 50% in negative direction.
- For contactors equipped with auxiliary contacts: The auxiliary contact (“stuck detection”) is no real parallel contact; delivers only an indirect source of information about the actual switching status.
- For full compatibility with EN61000-4-5, the auxiliary connection wires need to be surge protected. We recommend the usage of TDK S10K30 varistors from each Aux port to another.

Values in this document are preliminary and may be subject to change.

- 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. Still, it must be mounted either upright standing or horizontal lying on either side. Overhead mounting must be avoided and only the original mounting holes are allowed to be used to mount the part.
- 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 10 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).
- If a current occurred that exceeded the maximum breaking current by more than 50% or triggered a series fuse, the contactor is considered damaged and must be replaced.
- 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 must be ensured that during usage, storage, or transportation direct sunlight is avoided. The ambient temperature during usage must not exceed the value specified in this data sheet.
- 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.
- If the contactor is equipped with two coils (dual coil), during pick-up, both coils are active. After approximately 100 ms, one coil will be removed electronically from the circuit.
- Fast and consecutive switching of the contactor is not allowed. The minimum OFF time is 5 s. If switching happens in faster cycles, the coil may become hot and fail.
- For dual coil: Distortions of the DC supply of the contactor may influence the electronics. Superimposed voltages at frequencies > 10 Hz and > 3 V peak to peak must be avoided. Otherwise, the coil may become hot and fail.
- 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. Furthermore, the contactor coil circuit is intended to be powered with a Class 2 source.

Display of ordering codes for TDK Electronics products

The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.** Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.

6. Unless otherwise agreed in individual contracts, **all orders are subject to our General Terms and Conditions of Supply**.
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard**. The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements ("CSR") TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System**. For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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