

IEC Contactor Utilization Categories

Contactors designed for international applications are tested and rated per IEC 947-4. The IEC rating system is broken down into different utilization categories that define the value of the current that the contactor must make, maintain, and break. The following category definitions are the most commonly used for IEC Contactors.

Ratings for Siemens contactors per these categories can be found in Section 4 on IEC Control.

AC Categories

AC-1

This applies to all AC loads where the power factor is at least 0.95. These are primarily non-inductive or slightly inductive loads. Breaking remains easy.

AC-3

This category applies to squirrel cage motors where the breaking of the power contacts would occur while the motor is running. On closing, the con-

tactor experiences an inrush which is 5 to 8 times the nominal motor current, and at this instant, the voltage at the terminals is approximately 20% of the line voltage. Breaking remains easy.

AC-4

This applies to the starting and breaking of a squirrel cage motor during an inch or plug reverse. On energization, the contactor closes on an inrush current approximately 5 to 8 times the nominal current. On de-energization, the contactor breaks the same magnitude of nominal current at a voltage that can be equal to the supply voltage. Breaking is severe.

DC Categories

DC-1

This applies to all DC loads where the time constant (L/R) is less than or equal to one msec. These are primarily noninductive or slightly inductive loads.

DC-3

This applies to the starting and breaking of a shunt motor during inching or plugging. The time constant shall be less than or equal to 2 msec. On energization, the contactor sees current similar to that in Category DC-2. On de-energization, the contactor will break around 2.5 times the starting current at a voltage that may be higher than the line voltage. This would occur when the speed of the motor is low because the back e.m.f. is low. Breaking is severe.

DC-5

This applies to the starting and breaking of a series motor during inching or plugging. The time constant being less than or equal to 7.5 msec. On energization, the contactor sees about 2.5 times the nominal full load current. On de-energization, the contactor breaks the same amount of current at a voltage which can be equal to the line voltage. Breaking is severe.

Special Contactor Utilization Categories

Some contactors also have ratings for the following specialty utilization categories. For specific applications, please contact your local Siemens sales office.

Kind of Current	Utilization Categories	Typical Applications
AC	AC-2 AC-5a AC-5b AC-6a AC-6b AC-7a AC-7b AC-8a AC-8b	Slip-ring motors: starting, switching off Switching of electric discharge lamp controls Switching of incandescent lamps Switching of transformers Switching of capacitor banks Slightly inductive loads in household appliances and similar applications Motor-loads for household applications Hermetic refrigerant compressor motor [Ⓞ] control with manual resetting of overload releases Hermetic refrigerant compressor motor [Ⓞ] control with automatic resetting of overload releases
DC	DC-6	Switching of incandescent lamps

Electrical Quantities Symbols According to DIN, VDE and IEC

Symbol	Characteristic Electrical Quantity	Symbol	Characteristic Electrical Quantity
U _i	Rated insulation voltage to DIN VDE 0110/DIN VDE 0660	I _{cw}	Rated short-time current withstand capacity to IEC 947-1
U _e	Rated operational voltage	I _p	Test current (general) to DIN VDE 0660, prospective current to DIN VDE 0636
U _c	Rated control voltage (IEC 947-1) at which an operating mechanism or release is rated, e.g. coil voltage to DIN VDE 0660 Part 102	I _n	Breaking current (r.m.s. value) to DIN VDE 0102
U _s	Rated control supply voltage (Control voltage) to DIN VDE 0660 Part 102, IEC 947-1	i _p	Peak short-circuit current (maximum instantaneous value) to DIN VDE 0102
U	No-load voltage to IEC 947-2, -3, -5	i _k	Sustained (symmetrical) short-circuit current (r.m.s. value), DIN VDE 0102.
U _r	Power-frequency recovery voltage (IEC 947-.)		Rated short-time withstand current to DIN VDE 0660
U _o	Transformer no-load voltage to DIN VDE 0532	i _p	Let-through current of fuses and rapidly operating switching devices (maximum instantaneous value during the break time) to DIN VDE 0102
U _k	Short-circuit impedance voltage to DIN VDE 0532	I _o	No-load current at the input side of a transformer (unloaded output side) to DIN VDE 0532
U _{kr}	Rated value of the impedance voltage in % to DIN VDE 0102, 01.90	I _x	Current carrying capacity (ampacity)
I _n	Rated current to IEC 947-.	I _{sr}	Rated rotor operational current (DIN VDE 0660, IEC 947-1)
I _{th}	Eight-hour-current to DIN VDE 0660, conventional free-air thermal current to IEC 947- (defined as eight-hour-current) thermally equivalent short-time current (r.m.s. value) to DIN VDE 0103	I _f	Setting current ("current setting") to DIN VDE 0660
I _{the}	Conventional enclosed thermal current	I _B	Take-over current
I _u	Rated uninterrupted current to IEC 947-1	R	Ohmic resistance
I _e	Rated operational current	S'' _k	Initial symmetrical AC short-circuit power (simplified: apparent short-circuit power)
I _s	Selectivity (discrimination) limit current (DIN VDE 0660, IEC 947-1)	X	Reactance, reactive impedance
I _{cm}	Rated short-circuit making capacity to IEC 947-1	Z	Impedance (apparent resistance)
I _{cn}	Rated short-circuit breaking capacity to IEC 947-1	x	Factor to determine the peak short-circuit current i _p
I _{cm}	Rated ultimate short-circuit breaking capacity to IEC 947-1		

[Ⓞ]Hermetic refrigerant compressor motor is a combination consisting of a compressor and a motor, both of which are enclosed in the same housing, with no external shaft or shaft seals, the motor operating in the refrigerant.