APPLICATION NOTE

Installation contactors for EV Charging

Safe switching of charging currents in EV Charging applications

Installation contactors for EV Charging

With more and more countries agreeing to reduce carbon dioxide emissions and the importance of this issue growing among the population and society, the share of electric vehicles on the roads will increase significantly in the next few years.

A transition from gasoline- and diesel-fueled cars to electric vehicles will therefore happen, and a charging network will need to be implemented for this. The infrastructure to charge all the vehicles remains a bottleneck. From the provision of energy and distribution to the charging station, there are challenges to be addressed that will ensure a high level of acceptance among users. Local laws and guidelines must be complied with to ensure the necessary safety.

ABB is a long-standing advocate for the use of reliable and safe components and advancing the electrification of transportation.

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Foreword

ABB is a pioneering technology leader in electrification products, robotics and motion, and industrial automation, serving customers in utilities, industry, and transportation and infrastructure globally. Continuing a history of innovation spanning more than 130 years, ABB today is writing the future of industrial digitalization with two clear value propositions: bringing electricity from any power plant to any plug; and automating industries from natural resources to finished products.

This application note is written as a general guide for people working with low-voltage switchgear and controlgear applications for EV Charging or similar charging applications. The following document describes several factors that should be considered when selecting the right products and engineering the right solution for a charging application.

ABB is constantly monitoring changes in the market for EV Charging and similar applications to ensure timely adaptation of relevant products to meet the requirements of the latest developments in this segment.

All the information provided in this application note is only general, and each application must be handled as a specific case. Be sure to always follow all national and local installation regulations/codes for your specific application. Notwithstanding any clause to the contrary, ABB shall not be liable for any damages, claims or losses, etc., directly, or indirectly related to this application note.

1. Introduction

Electromobility opens new opportunities to combine the advantages of environmentally friendly mobility with the optimized use of sustainably generated electrical energy. This results in different requirements, particulary for the components and interfaces between the electric vehicle and the user.

From a technical perspective, ensuring a high level of safety for both vehicles and individuals is paramount. Additionally, the vehicle's communications protocols must adhere to specific standards and requirements. On the environmental side, external factors like heat and humidity pose challenges that charging stations need to withstand.

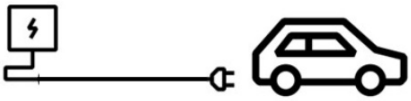
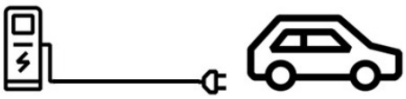
As the galvanic isolation of the contacts is prescribed, the switching device for the safe disconnection of the charging station from the grid plays an important role here. This can be realized with different solutions. One possibility is the use of contactors e.g., on DIN rails. There are many different standards that specify requirements in the areas of safety, charging topology, communications and charging connectors. This document primarily applies to the IEC 61851-1 standard, which outlines the general requirements for electric vehicle conductive charging systems. The standard describes various aspects e.g., the characteristics and operating conditions of the charging station, the definition of the connection between the charging station and the electric vehicle, or the requirements for electrical safety for the charging station, such as contact with live parts.

In this document, we introduce requirements and challenges for contactors and offer a high performance solution for charging stations to further accelerate the electrification of transportation.

2. The application

The Electric Vehicle Charging Infrastructure (EVCI) segment covers all areas concerned with the distribution of charging energy for electric vehicles. A vehicle is usually charged via direct contact, in some cases, inductively. The inductive charging method is used almost exclusively in the commercial vehicle sector for short intermediate charges (opportunity charging). Direct contact with the vehicle can be established via a pantograph or charging plug, which is typically used for E-buses or trucks.

The general requirements for EV charging equipment for road vehicles with a supply voltage up to 1 kV AC and 1.5 kV DC are regulated in the IEC 61851-1 standard. This standard specifies general requirements and forms the basis for all other standards in this series. The first part covers the requirements for AC charging stations and also describes the four charging modes into which EV charging equipment or EVSE (Electric Vehicle Supply Equipment) can be categorized:

	**Mode 1:** AC Charging, up to 16 A 250 V AC single-phase/ 480 VAC three-phase
	**Mode 2:** AC Charging, up to 32 A 250 V AC single-phase/ 480 VAC three-phase
	**Mode 3:** AC Charging, up to 32 A single-phase or three-phase
	**Mode 4:** DC Charging, up to 400 A and up to 950 V DC

Charging stations with charging modes 3 and 4 must comply with the requirements of the IEC 61851-1 standard. These charging modes relate to power, safety and communications between the charging station and the vehicle. Since mode 1 is not widely used and is not permitted in some countries, this charging mode will be not considered in the following.

Mode 2 chargers are mobile devices that can be plugged into a standard household socket or a 3-phase connection. They must include a control and protection device in the charging station in accordance with IEC 61851-1. (NOTE: This charging mode is subject to regional restrictions). Mode 3 refers to permanently installed charging station and is the most common charging mode for home use (e.g., Wallbox). This also needs advanced control and protection, which means that the charging station must be equipped with a pilot conductor and a protective earthing conductor. Mode 4 describes the highest level for DC charging stations. These are permanently installed public charging stations that can also perform fast charging. The requirements for DC charging stations are separately described in IEC 61851-23.

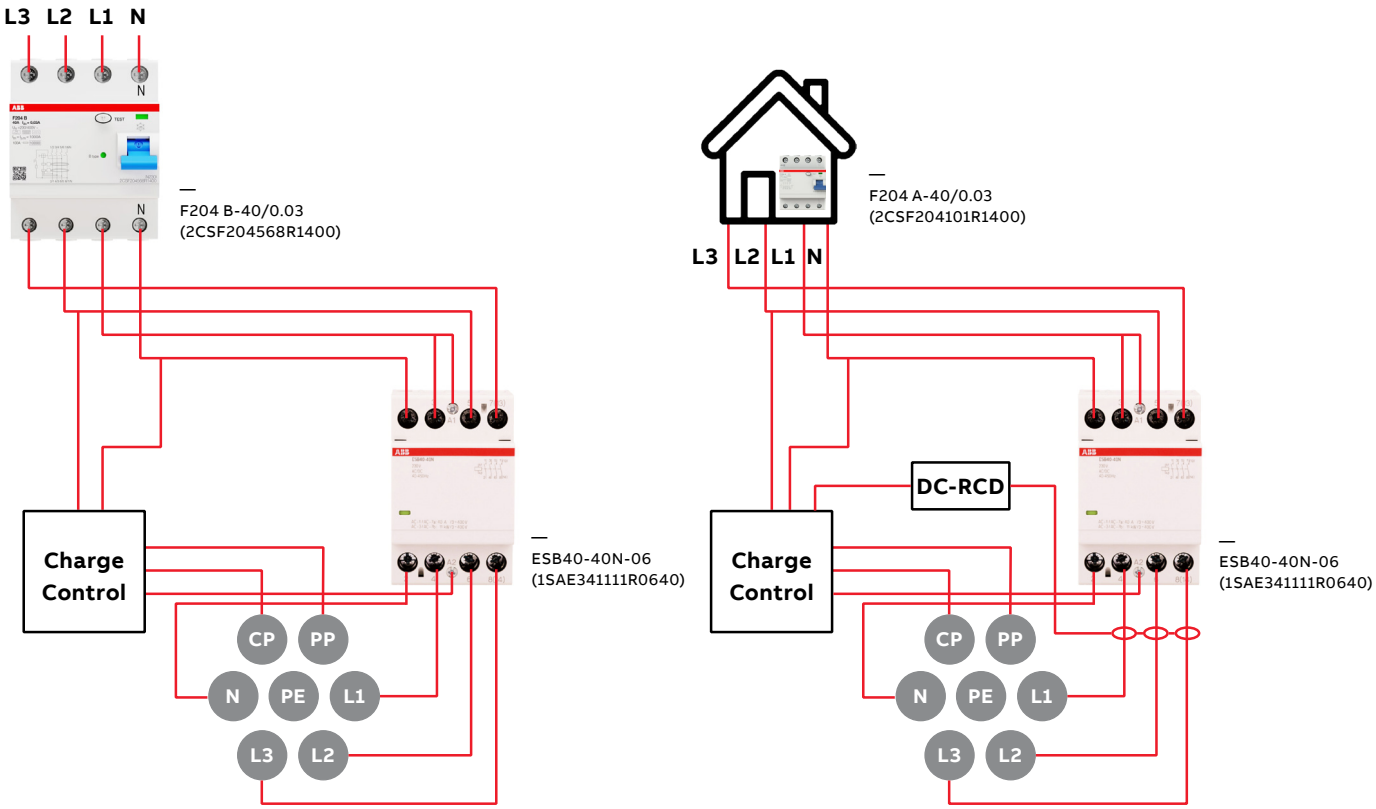
Charging stations for electric cars are available for a single-phase or three-phase connection. With single-phase AC-1 loads the maximum current of 32 A corresponds to a charging power of 7.2 kW (in some countries, single-phase charging is only allowed or possible with a lower charging power). Three-phase versions offer power options ranging from 11 kW (3x16 A) to 22 kW (3x32 A).

Depending on the car and the installed onboard charger, vehicles are charged in 1-phase or 3-phase mode. With installation contactors, a 1-phase/3-phase switchover can be realized. With an additional 2-pole contactor, the charging stations can switch between 1-phase and 3-phase charging by switching one contactor on and off (e.g., 1 contactor N + L1 and the second contactor for L2 + L3). It is thus also possible to expand and upgrade existing 1-phase chargers with an additional contactor.

AC charging stations typically consist of:

- A contactor
- Charge Control
- RCD against residual operating current > 30mA
- Protection against DC residual current > 6mA
- An electricity meter (optional)
- A housing and connecting cable

In the following, two options are shown how to set up an AC charging station, as often used for home use. The difference between the two diagrams concerns the protection against residual current. Figure 1 shows a charging station with an integrated RCD Type B or A-EV; Figure 2 shows a charging station with integrated DC residual current monitoring but without RCD. For this solution, an RCD Type A must be installed in the junction box. If only an RCD Type A but no DC residual current device is installed in the charging station, an additional RCD Type B or A-EV must be installed.



3. The challenge

The contactor is one of the key components in an AC charging station and is critical for safety and function. It must carry the operating current and switch reliably, even under the influence of environmental conditions. This includes outdoor use and sunlight, which can raise the temperature inside the charging station. When using the charging station in outdoor areas, at least IP44 is required as the degree of protection according to IEC 61851-1, and the charging stations must be tested and manufactured according to IEC 61439-7. The charging stations must be operable up to an altitude of 2000 m at an average ambient temperature of -25 °C to +35 °C. However, practical experience shows that a degree of protection for the use in outdoor areas of IP54 and a temperature range of -30 °C to +50 °C are common.

In general, the contactor closes before the onboard charger in the vehicle starts the charging process and therefore does not have to switch under load. In certain cases, the contactor may open under load if the charging process is suddenly interrupted, for example:

- Interruption of the control pilot (CP) in the event of fault
- Interruption of charging by the grid operator in the case of grid-served charging stations.

The contactor must be resistant to this to prevent possible welding of the contacts when opening under load.
Charging stations are oftenly used where people live and park their vehicles e.g., in the garage or in front of the house.
For this purpose, the contactor must be as quiet as possible and avoid noise. For the EVSE to meet the IEC 61851-1 standard for electric vehicle conductive charging systems, it is necessary to use a contactor that complies with IEC 60947-4-1, the standard for low-voltage switchgear and controlgear.

AC-Charging station characteristics to be considered:

- Number of charging points
- Maximum charging current level
- Control voltage output of the charging controller
- Environmental conditions

4. What ABB can offer

ABB installation contactors are ideal for use in AC charging stations and a comprehensive solution from 16 A to 100 A. The ESB..N range is perfectly suited for use in AC charging applications, as they can switch the charging current with a control current from the charging controller and provide reliable galvanic isolation with double-breaking contacts. A contactor is the most sustainable solution when it comes to switching the load, as it can handle a significantly higher number of switching cycles and, in the event of a fault, allows quick and easy replacement without having to replace additional components.

For easy and quick installation, the devices can be mounted and wired on a DIN rail inside the station. This eliminates the need for a circuit board (PCB) and ensures high component availability. This also allows modular expansion from 1-phase to 3-phase charging by adding an additional contactor.

With 4-pole installation contactors, 3 phases (L1, L2, L3) and the neutral conductor (N) can be switched quickly and safely in one device at the same time and offer the possibility to monitor the status of the contacts via additionally mountable auxiliary contacts.

Advantages of ESB..N installation contactors

- The ESB..N range fulfills IEC 60947-4-1 standard for low-voltage switchgear and controlgear
- Hum-free operation due to the innovative AC/DC hum-free coils
- Applicable in ambient temperatures up to 70 °C*
- Designed to fit for DIN rails
- Various accessories are available e.g., auxiliary contacts or sealing covers
- Extensive product support

Installation contactors designed for EV Charging applications

With the ESB63-40N-DC-B, ABB has a special variant of the ESB series, with extended properties ideally suited for use in charging stations or assembly in small cabinets such as wall mounted charges.

For this device, the operational holding voltage can be reduced by 50% after making and has therefore a lower power consumption for holding which reduces heat dissipation significantly, by about 75 %. This allows operation in higher ambient temperature ranges and and harsh conditions (from -40 °C to +85 °C when holding with 0.5x Uc).

In addition, this device offers increased safety due to a faster drop-out time of ≤ 7 ms and therefore has the fastest breaking time on the market.

Type		ESB16..N	ESB20..N	ESB25..N	ESB40..N	ESB63..N	ESB63-40N-DC-B	ESB100..N
AC-1/AC-7a (A)		16	20	25	40	63	63	100
Modular Width		1	1	2	3	3	3	3/6
Auxiliary contact	2 NO	EH04-20N	EH04-20N	EH04-20N	EH04-20N	EH04-20N	EH04-20N	EH04-20N
	1NO + 1NC	EH04-11N	EH04-11N	EH04-11N	EH04-11N	EH04-11N	EH04-11N	EH04-11N

* with derating

5. Technical data installation contactor

For other characteristics, please consult your ABB sales representative

Main circuit – Utilization characteristics according to IEC/EN

Contactor type		**ESB16..N**	**ESB20..N/ EN20..N**	**ESB25..N/ EN25..N**	**ESB40..N/ EN40..N**	**ESB63..N**	**ESB100..N**
Standards		IEC/EN 60947-1, IEC/EN 60947-4-1, IEC/EN 61095					
Rated operational voltage U_e		220 V DC 250 V AC	220 V DC 250 V AC	220 V DC 400 V AC	220 V DC 400 V AC	220 V DC 400 V AC	220 V DC 400 V AC
Rated frequency		DC, 50/60 Hz	DC, 50/60 Hz	DC, 50/60 Hz	DC, 50/60 Hz	DC, 50/60 Hz	DC, 50/60 Hz
AC-1/AC-7a utilization category for air temperature near the contactor ≤ 55 °C							
Rated operational current I_e AC-1/AC-7a	NO	16 A	20 A	25 A	40 A	63 A	100 A
	NC	16 A	20 A	25 A	30 A	30 A	-
Rated operational power AC-1	230 V 1 phase	3.7 kW	4.6 kW	5.8 kW	9.2 kW	14.5 kW	23 kW
	400 V 3 phases	–	–	17.3 kW	27.7 kW	43.6 kW	69.3 kW
AC-3/AC-7b utilization category for air temperature close to contactor ≤ 55 °C							
Rated operational current I_e AC-3/AC-7b	230 V 1 phase	6 A	9 A	9 A	22 A	30 A	–
	400 V 3 phases	–	–	9 A	22 A	30 A	–
Rated operational power AC-3	230 V 1 phase	0.9 kW	1.3 kW	1.3 kW	3.7 kW	5 kW	–
	400 V 3 phases	–	–	4 kW	11 kW	15 kW	–
Rated making capacity AC-3 acc. to IEC 60947-4-1		10 x I_e /AC-3 13 x I_e /AC-3e	10 x I_e /AC-3 13 x I_e /AC-3e	10 x I_e /AC-3 13 x I_e /AC-3e	10 x I_e /AC-3 13 x I_e /AC-3e	10 x I_e /AC-3 13 x I_e /AC-3e	–
Rated breaking capacity AC-3 acc. to IEC 60947-4-1		8 x I_e /AC-3 8.5 x I_e /AC-3e	8 x I_e /AC-3 8.5 x I_e /AC-3e	8 x I_e /AC-3 8.5 x I_e /AC-3e	8 x I_e /AC-3 8.5 x I_e /AC-3e	8 x I_e /AC-3 8.5 x I_e /AC-3e	–
Short-circuit protective devices - gG type fuses, Type 1 coordinated		20 A	20 A	35 A	63 A	80 A	125 A
Rated short-time withstand current I_{CW} at 40 °C ambient temp. in free air, from a cold state	10 s	48 A	72 A	72 A	176 A	240 A	–
Power loss per pole		0.9 W	1.4 W	2 W	3 W	4.5 W	6 W
Maximum electrical switching frequency	AC-1/AC-7a	300 cycles/h	300 cycles/h	300 cycles/h	300 cycles/h	300 cycles/h	150 cycles/h
	AC-3/AC-7b	600 cycles/h	600 cycles/h	600 cycles/h	600 cycles/h	600 cycles/h	–
Electrical durability	AC-1/AC-7a	150,000 cycles	150,000 cycles	130,000 cycles	150,000 cycles	100,000 cycles	70,000 cycles
	AC-3/AC-7b	150,000 cycles	150,000 cycles	500,000 cycles	150,000 cycles	240,000 cycles	–
Mechanical durability		1,000,000 cycles					

General technical data

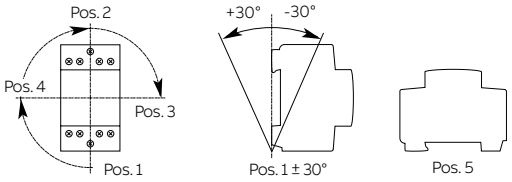
Contactor type		ESB16..N	ESB20..N/ EN20..N	ESB25..N/ EN25..N	ESB40..N/ EN40..N	ESB63..N	ESB100..N
Rated insulation voltage U_i acc. to IEC 60947-4-1 and VDE 0110 (Gr. C)		400 V	400 V	500 V	500 V	500 V	500 V
Rated impulse withstand voltage U_{imp}		6 kV	ESB: 6 kV EN: 6 kV	ESB: 6 kV EN: 4 kV/6 kV with protection cover		6 kV	6 kV
Ambient air temperature range [1]	operation	-25 ... +55 °C	-25 ... +55 °C	-25 ... +55 °C	-25 ... +55 °C	-25 ... +55 °C	-25 ... +55 °C
	storage	-40 ... +80 °C	-40 ... +80 °C	-40 ... +80 °C	-40 ... +80 °C	-40 ... +80 °C	-40 ... +80 °C
Maximum operating altitude permissible		2000 m	2000 m	2000 m	2000 m	2000 m	2000 m
Vibration (sinusoidal) according to IEC/EN 60068-2-6 (Fc)		1 g/3-150 Hz	1 g/3-150 Hz	1 g/3-150 Hz	1 g/3-150 Hz	1 g/3-150 Hz	
Shock (half-sine) according to IEC/EN 60947-1 Annex. Q		Category E	Category E	Category E	Category E	Category E	Category E
Shock (half-sine) according to IEC/EN 60068-2-27 (Ea)		15 g/11 ms	15 g/11 ms	15 g/11 ms	15 g/11 ms	15 g/11 ms	15g/11 ms

1) If several contactors are mounted adjacently, and the duty time is longer than one hour, every second contactor needs a distance piece, Type ESB-DIS (1/2 module). This is unecessary at an ambient temperature of ≤ 40 °C or on Type ESB16..N, ESB/EN20..N and ESB100..N

Magnet system characteristics

Contactor type			ESB16..N	ESB20..N/ EN20..N	ESB25..N/ EN25..N	ESB40..N/ EN40..N	ESB63..N	ESB100..N
Coil operating limits acc. to IEC/EN60947-4-1			0.85 ... 1.1 x U_c (at $\theta \leq 55$ °C)					
Rated frequency			DC, 50/60/400 Hz					
Frequency range			DC, 40 ... 450 Hz					
Coil consumption	pull-in	50 Hz	2.5 VA	2.5 VA	4 VA	4.5 VA	60 VA	90 VA
		60 Hz	2.5 VA	2.5 VA	4 VA	4.5 VA	60 VA	90 VA
		DC	2.5 W	2.5 W	4 W	5 W	70 W	100 W
	holding	50 Hz	2.5 VA	2.5 VA	4 VA	4.5 VA	4.5 VA	7.5 VA
		60 Hz	2.5 VA	2.5 VA	4 VA	4.5 VA	4.5 VA	7.5 VA
		DC	2.5 W	2.5 W	4 W	5 W	5 W	8.5 W

Mounting characteristics and conditions for use

Contactor type	ESB16..N	ESB20..N/ EN20..N	ESB25..N/ EN25..N	ESB40..N/ EN40..N	ESB63..N	ESB100..N
Mounting position	Position 1 to 5 					
Mounting on DIN rail	TH35-15 (35 x 15 mm Mounting Rail) acc. to IEC 60715 TH35-7.5 (35 x 7.5 mm Mounting Rail) acc. to IEC 60715					

Main circuit - Connecting characteristics

Contactor type	ESB16..N	ESB20..N/ EN20..N	ESB25..N/ EN25..N	ESB40..N/ EN40..N	ESB63..N	ESB100..N
Connecting capacity						
Rigid	1x 1 ... 10 mm² 2x 1 ... 4 mm²	1x 1 ... 10 mm² 2x 1 ... 4 mm²	1x 1.5 ... 10 mm² 2x 1.5 ... 4 mm²	1x 1.5 ... 25 mm² 2x 1.5 ... 10 mm²	1x 1.5 ... 25 mm² 2x 1.5 ... 10 mm²	1x 10 ... 50 mm²
Flexible with ferrule	1x 1 ... 6 mm² 2x 1 ... 2.5 mm²	1x 1 ... 6 mm² 2x 1 ... 2.5 mm²	1 x 1.5 ... 10 mm² 2x 1.5 ... 2.5 mm²	1x 1.5 ... 16 mm² 2x 1.5 ... 10 mm²	1x 1.5 ... 16 mm² 2x 1.5 ... 10 mm²	1x 10 ... 35 mm²
Flexible with insulated ferrule	1x 1 ... 6 mm² 2x 1 ...1.5 mm²	1x 1 ... 6 mm² 2x 1 ...1.5 mm²	1 x 1 .5 ... 10 mm² 2x 1 .5 mm²	1x 1.5 ... 16 mm² 2x 1.5 ... 10 mm²	1x 1.5 ... 16 mm² 2x 1.5 ... 10 mm²	1x 10 ... 35 mm²
Flexible	1x 1 ... 6 mm² 2x 1... 4 mm²	1x 1 ... 6 mm² 2x 1... 4 mm²	1 x 1.5 ... 10 mm² 2x 1.5 ... 4 mm²	1x 1.5 ... 16 mm² 2x 1.5 ... 10 mm²	1x 1.5 ... 16 mm² 2x 1.5 ... 10 mm²	1x 10 ... 35 mm²
Stranded acc. to UL/CSA	14-8 AWG	14-8 AWG	16-8 AWG	16-4 AWG	16-4 AWG	8-0 AWG
Degree of protection	IP20	IP20	IP20	IP20	IP20	IP20
Wire stripping length	10 mm	10 mm	10 mm	13 mm	13 mm	15 mm
Tightening torque	1.2 N·m/ 11 lb.in	1.2 N·m/ 11 lb.in	1 N·m/ 9 lb.in	2.5 N·m/ 20 lb.in	2.5 N·m/ 20 lb.in	3 N·m/ 27 lb.in
Recommended screw driver	Pozidriv 1	Pozidriv 1	Pozidriv 1	Pozidriv 2	Pozidriv 2	Pozidriv 2

Control circuit - Connecting characteristics

Contactor type	ESB16..N	ESB20..N/ EN20..N	ESB25..N/ EN25..N	ESB40..N/ EN40..N	ESB63..N	ESB100..N
Connecting capacity						
Rigid	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²
Flexible with ferrule	1x 0.75 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 0.75 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 0.75 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 0.75 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 0.75 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 0.75 ... 2.5mm² 2x 0.75 ... 1 mm²
Flexible with insulated ferrule	1x 1 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 1 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 1 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 1 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 1 ... 2.5 mm² 2x 0.75 ... 1 mm²	1x 1 ... 2.5 mm² 2x 0.75 ... 1 mm²
Flexible	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²	1x 1 ... 4 mm² 2x 1 ... 2.5 mm²
Stranded acc. to UL/CSA	16-10 AWG	16-10 AWG	16-10 AWG	16-10 AWG	16-10 AWG	16-10 AWG
Degree of protection	IP20	IP20	IP20	IP20	IP20	IP20
Wire stripping length	7 mm	7 mm	7 mm	7 mm	7 mm	7 mm
Tightening torque	0.9 N·m/8 lb.in	0.9 N·m/8 lb.in	0.9 N·m/8 lb.in	0.9 N·m/8 lb.in	0.9 N·m/8 lb.in	0.9 N·m/8 lb.in
Recommended screw driver	Pozidriv 1	Pozidriv 1	Pozidriv 1	Pozidriv 1	Pozidriv 1	Pozidriv 1

General technical data

Contactor type			EH04-xxN
Duty time			100%
Rated impulse withstand voltage U_{imp} acc. to IEC/EN 60947-1			4 kV
Rated insulation voltage U_i acc. to IEC/EN 60947-1			500 V
Pollution category acc. to IEC/EN 60664			2
Overvoltage category acc. to IEC/EN 60664			Up to III
Maximum operating altitude permissible			2000 m
Ambient air temperature range	Operation	Open	-25 °C ... +55 °C
	Storage		-40 °C ... +80 °C
Vibration (sinusoidal) acc. to IEC/EN 60068-2-6 (Fc)			5 g/3-150 Hz
Shock (half-sine) acc. to IEC/EN 60947-1 Annex. Q			Category E
Shock (half-sine) acc. to IEC/EN 60068-2-27 (Ea)			15 g/11 ms

6. Definitions

- **EVCI**
  Electric Vehicle Charging Infrastructure

- **EVSE**
  Electric vehicle supply equipment

- **RCD**
  Residual Current Device

- **PCB**
  Printed Circuit Board

- **Rated impulse withstand voltage (Uimp)**
  The peak value of an impulse voltage of prescribed form and polarity which the equipment is capable of withstanding without failure under specified test conditions and to which the values of the clearances refer.

- **Rated insulation voltage (Ui)**
  The rated insulation voltage of an equipment is the value of voltage to which dielectric tests and creepage distances refer.

- **Rated operational current (Ie)**
  The rated operational current of a piece of equipment is stated by the manufacturer and takes into account the rated operational
  voltage, the rated frequency and the utilization category.

- **Rated operational voltage (Ue)**
  The rated operational voltage of a piece of equipment is a value of voltage which, combined with a rated operational cur rent, determines the application of the equipment.

7. Bibliography

The following standards and documents are referred to for use in this application note:

Standards	Document
IEC 60947-1 (edition 5.1)	Low-voltage switchgear and controlgear – Part 1: General rules
IEC 61851-1 (edition 3.0)	Electric vehicle conductive charging system – Part 1: General requirements
IEC 61851-23 (edition 1.0)	Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station
IEC 60947-4-1 (edition 4.0)	Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters
IEC 61439-7 (edition 2.0)	Low-voltage switchgear and controlgear assemblies – Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations
ISO 17409 (edition 1.0)	Electrically propelled road vehicles – Connection to an external electric power supply - Safety requirements

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You can find the address of your local sales organization on the ABB homepage

abb.com/lowvoltage

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