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Zaptec Pro - Safety architecture

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Contents

1 Introduction

The Zaptec Pro is an electric vehicle supply equipment specially designed for obtaining a scalable charging system, with a quick installation process and low infrastructure cost. Zaptec Pro is fully tested at TÜV SÜD to the relevant safety standards, with no remarks. Zaptec Pro is therefore fully compliant with Article 3.1a of the EU Radio Equipment Directive 2014/53/EU (RED). However, since there have been many questions from installers/authorities about how Zaptec Pro fulfills certain requirements from the relevant standards, this document has been made. The document is split into two parts:

1. **Safety architecture overview**
2. **Frequently asked questions about safety standards**
    - This section answers frequently asked questions about how Zaptec Pro fulfills certain requirements in the relevant standards.

2 Safety Architecture Overview

2.1 Standard overview

- Zaptec Pro is tested against the following safety standards:
  - *EN IEC 61851-1:2019*: To show compliance to EVSE mode 3, case B requirements.
  - *EN 62423:2012+A11:2021*: To show compliance to residual current circuit breaker (RCCB), type B requirements.
  - *EN IEC 61439-7:2020* and *EN 61439-1*: To show compliance with switchgear requirements.

2.2 Safety Requirements Standard overview

The following sections outline how overvoltage, overcurrent and protection against electric shock requirements are fulfilled in a Zaptec Pro installation.

2.2.1 Overvoltage protection

An EVSE installation shall be protected against transient overvoltages.

- Normative standard references: *HD 60364-7-722.443*
- In a Zaptec Pro installation, this requirement is fulfilled by upstream overvoltage protection. There are no overvoltage protection devices inside the Zaptec Pro. The Zaptec Pro is designed and tested against overvoltage category III.

2.2.2 Overcurrent protection

In an EVSE installation, the following requirements must be fulfilled to ensure protection against overcurrent:

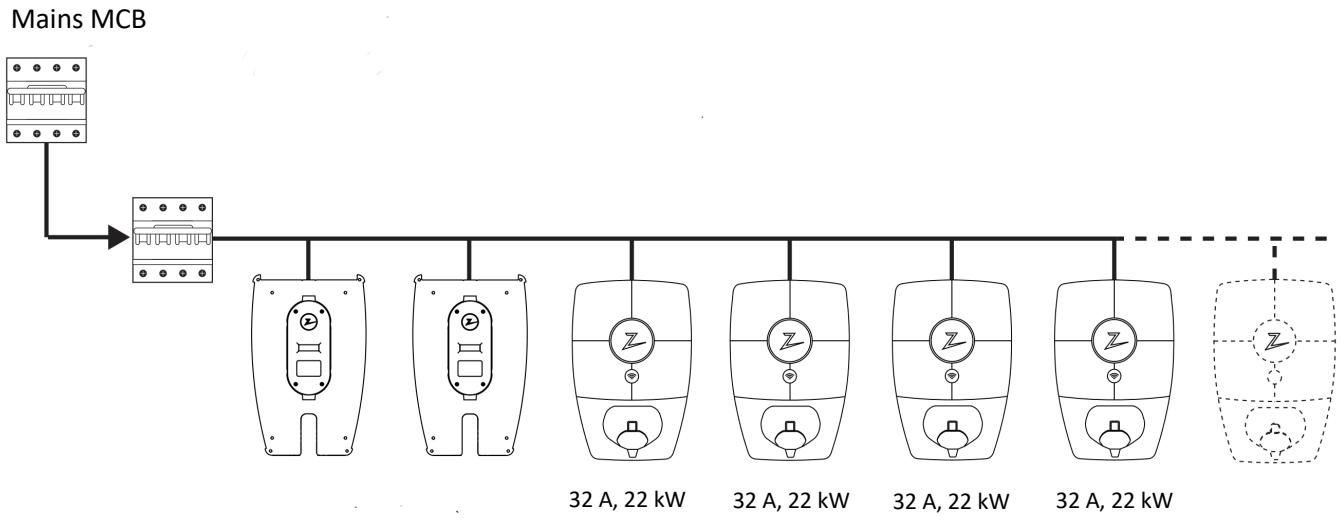
1. **Each charging point (type-2 outlet) must be protected by an overcurrent protective device.**
   - Normative standard references: *HD 60364-7-722.533* and *EN IEC 61851-1:2019, 13*
   - In Zaptec Pro this requirement is fulfilled with the built-in *Lovato P1 MB 3P C40*, MCB. The MCB is fully tested against *EN 60947-2*. Note that overcurrent protection implies each charging point protected against both overload and short-circuit faults.
2. **The installation must be protected against overcurrent.**
   - Normative standard references: *HD 60364-4-43*
   - In a Zaptec Pro installation this requirement is fulfilled by the upstream circuit breaker. Any circuit breaker rating can be chosen if the maximum short-circuit capabilities (Icn=Inc=10 kA) of Zaptec Pro are not exceeded.

2.2.3 Protection against electric shock

In an EVSE installation, the following requirements must be fulfilled to ensure protection against electric shock:

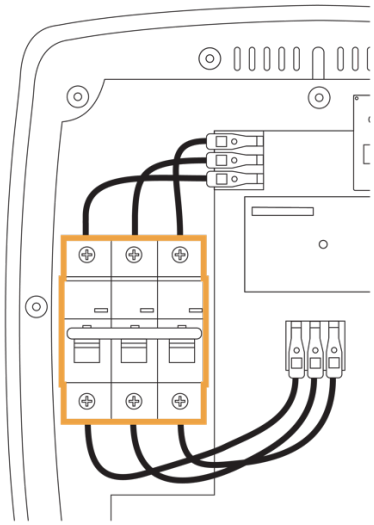
1. **Each charging point (type-2 outlet) must be protected by a dedicated type B RCCB, or equivalent.**
   - Normative standard references: *HD 60364-7-722.531.2* and *EN IEC 61851-1:2019, 8.5*
   - In Zaptec Pro this requirement is fulfilled by the built-in type B RCCB. Note that the RCCB is fully tested against EN 62423:2012+*A11:2021* with no remarks.
2. **The installation must consist of one or more of the following protective measures.**
   - Automatic disconnection of supply;
   - Double or reinforced insulation;
   - Electrical separation if limited to the supply of one item of current-using equipment;
   - Extra low-voltage (SELV and PELV).
   - Normative standard references: *EN IEC 61851-1:2019, 8.3* and *HD 60364-4-41*.
   - In Zaptec Pro this requirement is fulfilled by having reinforced insulation between the phases and PE. This is documented in the *EN IEC 61851-1:2019* test report. Note that Zaptec Pro can't be classified as class II equipment since PE is supplied to the EV through the EVSE (*IEC 61140, 7.3.2*), even though it fulfills all the safety requirements of class II equipment.

2.3 Typical Zaptec Pro installation

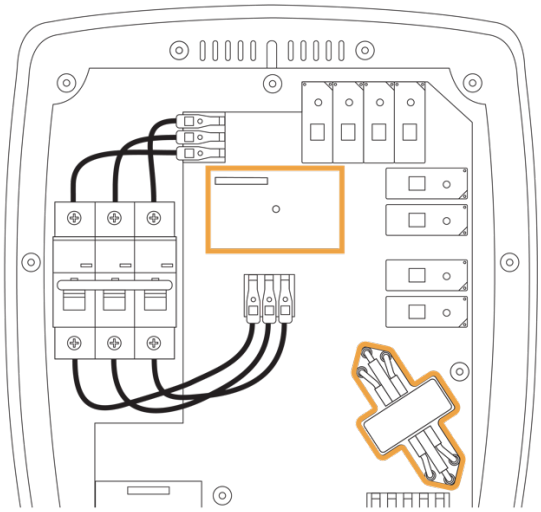


2.4 Block diagram of safeguards in Zaptec Pro

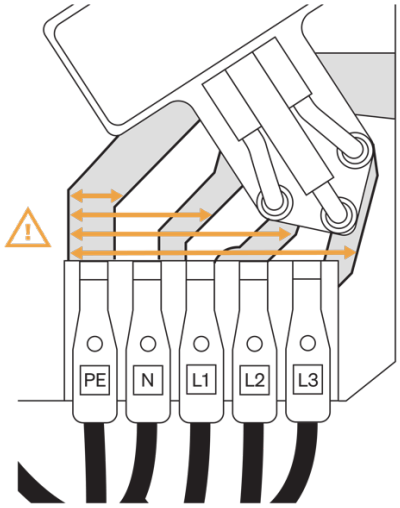
2.4.1 Built-in MCB



2.4.2 Built-in Type B RCCB



2.4.3 Reinforced insulation between phases and PE



3 Frequently asked questions

3.1 RCCB

- **A conventional DIN-mounted, type-B RCCB is not to be found inside Zaptec Pro.**
  - Correct. The RCCB electronics are implemented directly on the circuit board. This is similar to what you would find if you opened a DIN-mounted RCCB.

- **Is the type-B RCCB inside Zaptec Pro electromechanical?**
  - Yes. Zaptec Pro uses a relay to break an isolate if a residual current is detected.

- **Are the poles in the RCCB mechanically coupled?**
  - Yes, all four poles in the relay are mechanically coupled according to *EN 61008-1:2012, 8.1.2*.

- **Does the RCCB meet the make and break requirement of EN 61008-1?**
  - Yes. The relay is able make and break 500 A according to *EN 61008-1:2012, 9.11.2.2*.

- **Does the RCCB meet the short-circuit requirements of EN 61008-1?**
  - Yes. The RCCB has a prospective short-circuit current rating of Inc=10 kA according to *EN 61008-1:2012, 9.11.2.4*.

- **What are the operating times and trip currents of the internal type-B RCCB?**
  - The RCCB is tested against maximum operating times outlined in *EN 62423:2012*. The table below shows selected parameters from the *EN 62423:2012* test report.

Parameter	Zaptec Pro	Requirement according to *EN 62423:2012*
AC (sine) trip level	28 mA	15 mA < I∆n < 30 mA
DC trip level	25 mA	15 mA < I∆n < 60 mA
Trip time at 30 mA AC (sine)	~270 ms	<300 ms
Trip time at 60 mA AC (sine)	~120 ms	<150 ms
Trip time at 150 mA AC (sine)	~23 ms	< 40 ms
Trip time at 500 A AC (sine)	~15 ms	< 40 ms
Trip time at 60 mA DC	~115 ms	< 300 ms

- **Does the RCCB have a test device according to EN 61008-1, 8.11?**
  - Yes. The RCCB is tested before every charging cycle by inducing a 40 mA DC current in the RCD sensor.

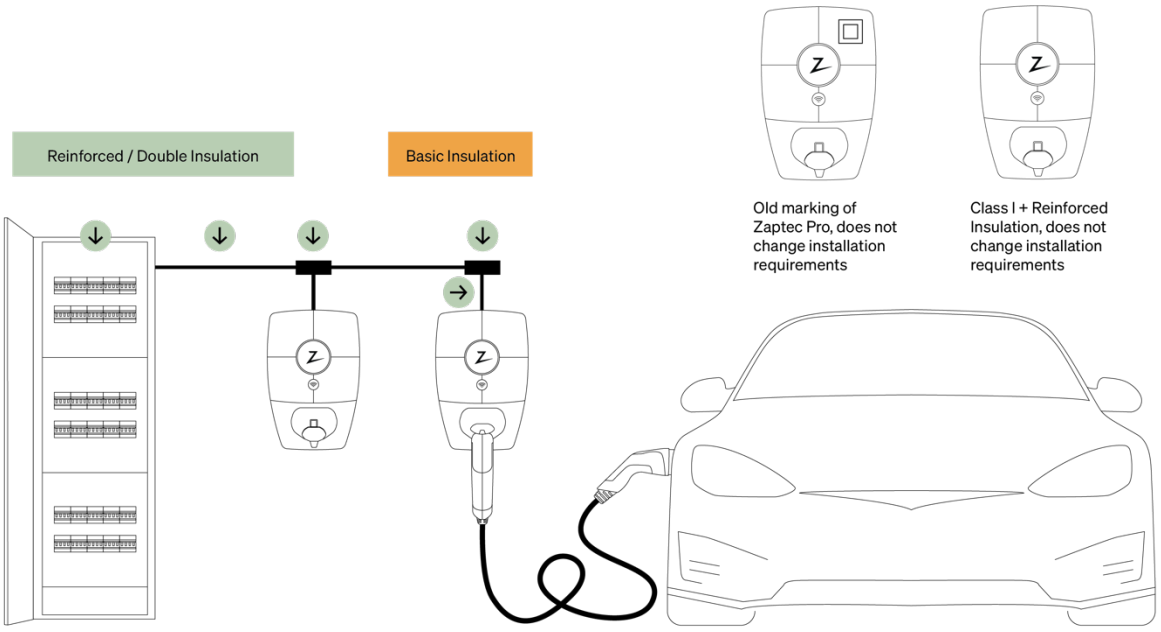
- **Is it possible to test the RCCB manually?**
  - Yes. The test device can be enabled using the *Zaptec App*. Please be aware that enabling the test device will cause the RCCB to open and thus stop the charging session.

3.2 Installation

- Is it required to install an RCCB upstream of every Zaptec Pro?
  - No. Zaptec Pro has a built-in type B RCCB. Furthermore, reinforced insulation is used as a safeguard, to enable installing the EVSE without an upstream RCCB. See chapter 2.2.3 in this document for more information. See illustration 3.2.1, 3.2.2, 3.2.3 and 3.2.4 for examples.
- Is it required to install an MCB upstream of every Zaptec Pro?
  - No. Zaptec Pro has a built-in 40 A MCB. See chapter 2.2.2 in this document for more information.

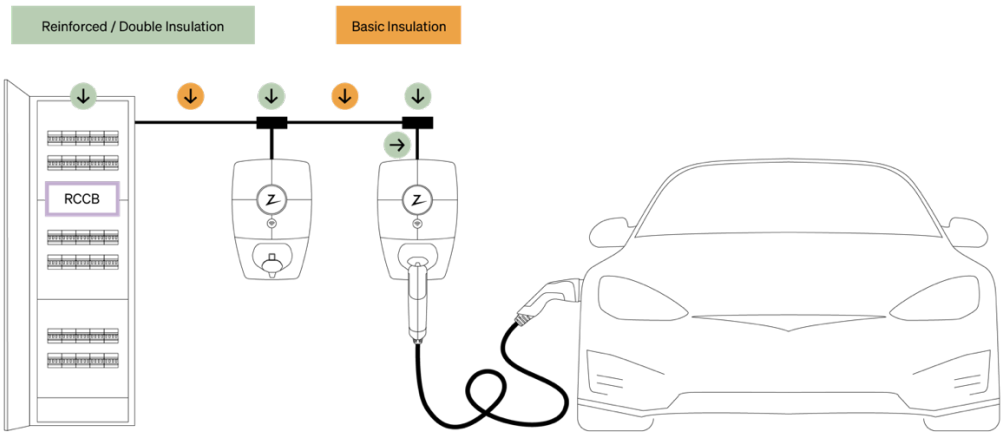
3.2.1 In this example installation, reinforced insulation/double insulation is used as fault protection. (without RCCB up-stream)

Normative standard references: *EN IEC 61851-1:2019, 8.3* and *HD 60364-4-41*



3.2.2 In this example installation, reinforced insulation/double insulation is breached and cannot be used as fault protection. RCCB up-stream needed OR fix breach in reinforced insulation/double insulation

Normative standard references: *EN IEC 61851-1:2019, 8.3* and *HD 60364-4-41*



3.2.3 In this example installation, reinforced insulation/double insulation is breached and cannot be used as fault protection. RCCB up-stream needed OR fix breach in reinforced insulation/double insulation

Normative standard references: *EN IEC 61851-1:2019, 8.3* and *HD 60364-4-41*