Bitesize Guide

Electric Vehicle Charging

Are you aware of the installation requirements for charging electric vehicles?

We've got you covered in this bitesize guide.

hager

The requirements for charging electric vehicles were the subject of amendment 1 to BS 7671 which came into effect in July 2020.

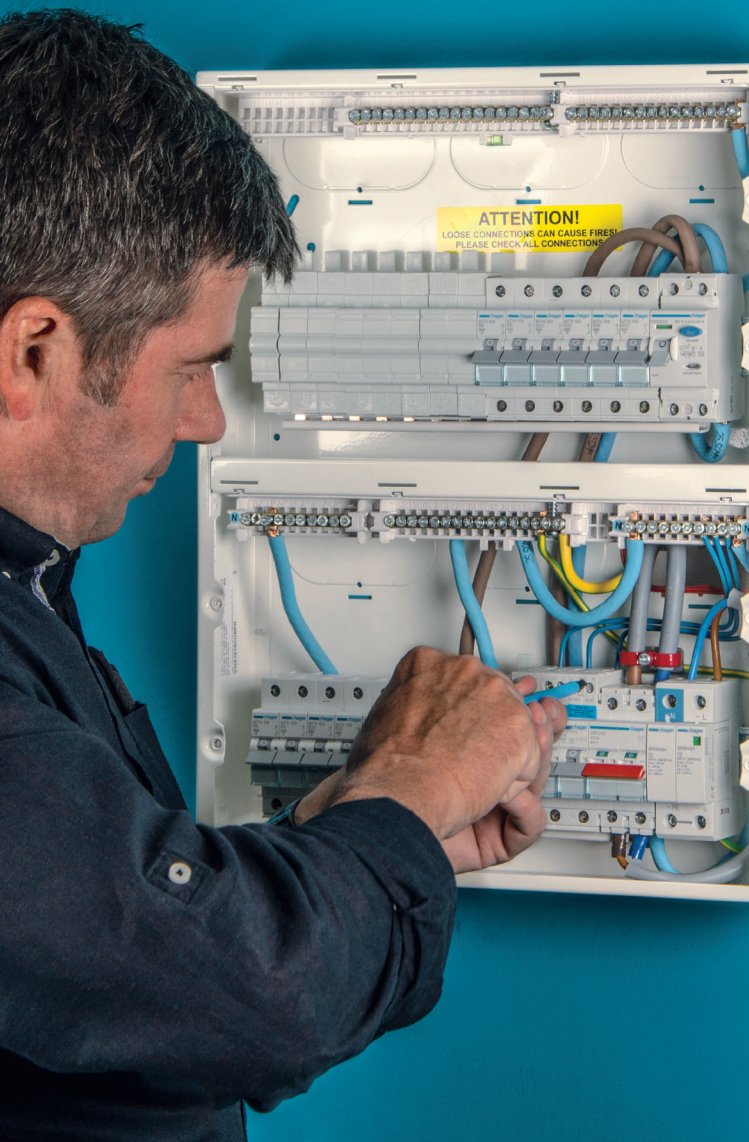
Amendment 1 was subsequently incorporated within Amendment 2 on 28th March 2022 with minor changes.

Although we don't market charging equipment at the moment, we will discuss the electrical supply needed for such products which does fall under our area of expertise.

We will take into account the requirements of BS 7671 and the product standard BS EN 61439-3. In addition, we will consider several product solutions.

There are 4 main topics that will be covered:

1. RCD Requirements
2. Requirements where RCD's are in series
3. Simultaneous loading of circuit supplying car charger with adjacent circuits.
4. Product Solutions


ATTENTION!
LOOSE CONNECTIONS CAN CAUSE FIRES!
PLEASE CHECK ALL CONNECTIONS

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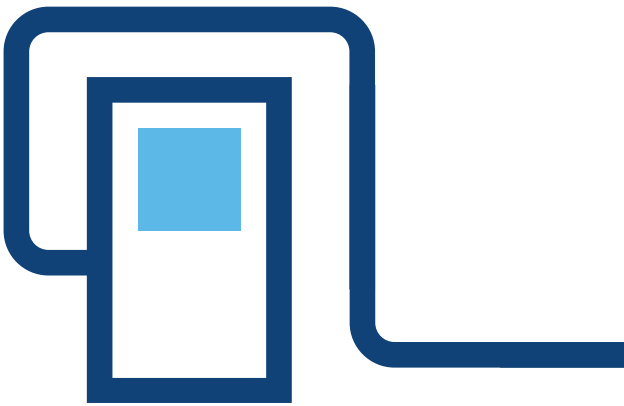
01 RCD Requirements

Regulation 722.531.3.101 requires that each charging point including a socket-outlet shall be protected individually by an RCD not exceeding 30 mA. This RCD shall disconnect all live conductors including the neutral, so a single module, solid neutral RCBO should not be used for this application. This RCD shall be at least a Type A

Note – The MCB (overcurrent device) does not need to disconnect all live conductors.

The car is essentially DC and the RCD is part of the normal electrical installation supplied at AC. This potentially could cause an issue if there was a fault and some of the DC passed through the RCD.

This DC could effectively blind the RCD so it would not work correctly. Some car charger units can detect this and shut the charging system down.



“The MCB (overcurrent device) does not need to disconnect all live conductors”

This detector is called an RDC-DD (Residual Direct Current Detecting Device). It is important that the specification of the car charger in terms of this RDC-DD is matched to the RCD:-

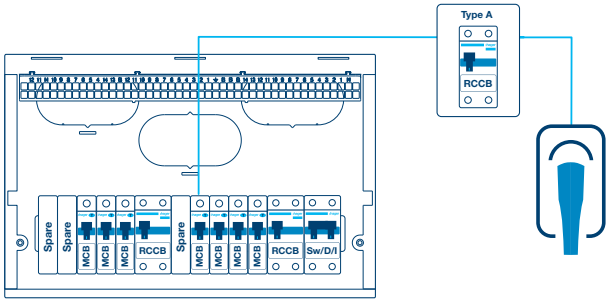
(i) If the car charger does not have an RDC-DD then you will need a Type B RCD supplying the car charger. This is because the Type B can detect this DC, will deliver protection and disconnect if required. Please contact our Technical Helpline for inquiries on a Type B RCD.

(ii) If the car charger has an RDC-DD that will detect and disconnect any DC issues above 6mA then you can choose a Type A RCD. This is because the Type A can still work correctly up to a level of 6mA DC. Over 6mA however this Type A device could be blinded and fail to operate correctly. This is the preferred option as Type A devices are the most commonly used devices within modern consumer units. Therefore, most EV charging units have 6mA RDC DD built-in.

02 Requirements where RCD’s are in series

Where a car charger is supplied from an existing installation, from a spare way in the consumer unit, we may consider installing as shown below.

A dedicated MCB is installed in the consumer unit to feed a Type A RCCB for the car charging supply.

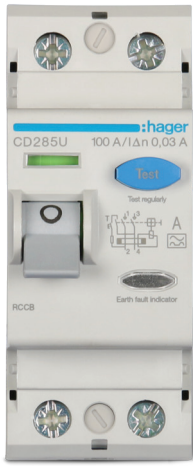


This design does have an individual RCD supplying the car charger.

There is however an RCD upstream within the consumer unit which also supplies other circuits. This therefore would not satisfy the requirements of 722.531.3.101 and as such should not be used.

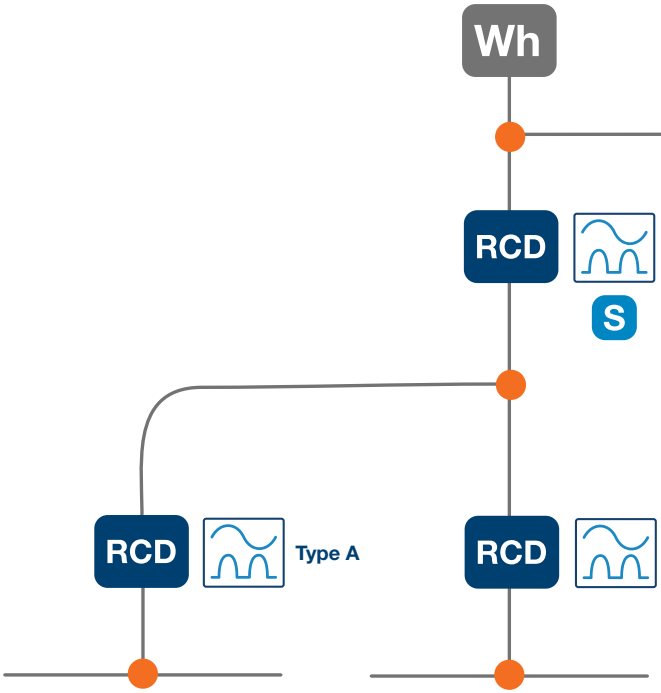
Some car chargers have an integral RCD which meets the requirements of the RCD being individual so an external RCD may not be required. It is then a consideration of whether the cable supplying the car charger requires additional protection by RCD to comply with regulation 522.6 where the cable is installed in a wall.

If the cable itself requires RCD protection then this RCD can also serve as the RCD supplying the car charger but again would need to not supply other circuits. If the chosen car charger has an integral RCD and if an RCD is required within the consumer unit to provide additional protection to the cable, then there will in effect be 2 RCDs in series. It is essential that manufacturers guidance is followed. As a general rule the upstream RCD should be of the same type or better than the downstream RCD. This is because any DC leakage form the car could affect the operation of any upstream RCD. All RCDs in this case would also be required to switch all live conductors including the neutral. This is because they will both likely be 30mA so there would be no selectivity and as such you could not be sure which device may trip first in the event of an earth fault.



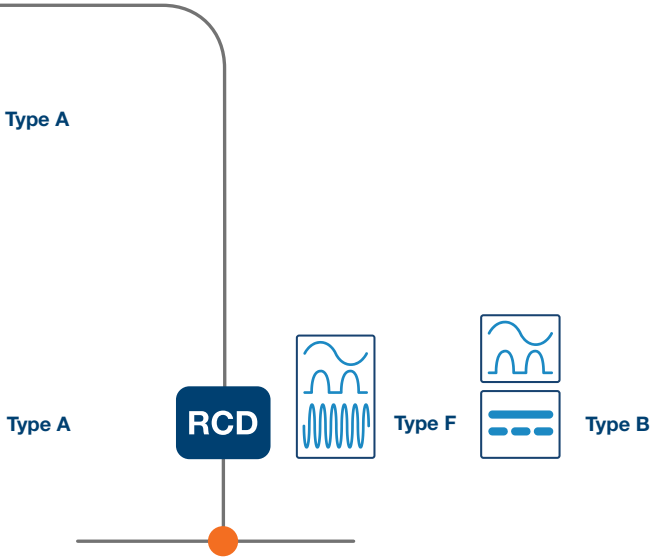
BEAMA has produced a handy guide that includes some basic rules should there be RCDs in series. These rules should be followed unless instructed differently by the manufacturer.

01 **A Type AC RCD should not be fitted upstream of a Type A, F or B RCD as the load characteristics that the Type A, F or B RCD has been selected for could impair operation of the Type AC RCD.**

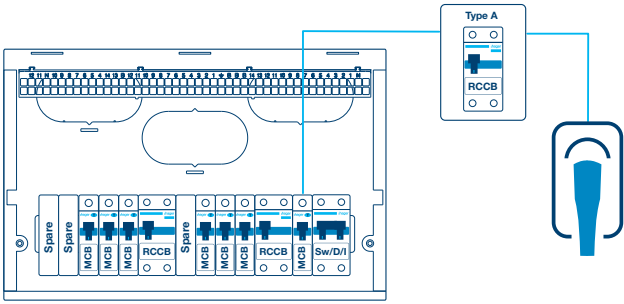


02 A Type F RCD should not be fitted upstream of a Type B RCD as the load characteristics that a Type B RCD has been selected for could impair operation of the Type F RCD.

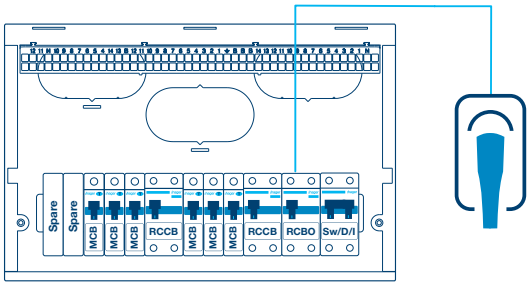
03 A Type A RCD should not be fitted upstream of a Type F or B RCD as the load characteristics that a Type F or B RCD has been selected for could impair operation of the Type A RCD.



In cases where the cable does not require RCD protection (i.e. was surface wired or SWA cable) and if the consumer unit design permits, an unprotected way could be used to supply the car charger as seen in the example below.



If the cable does require RCD protection then a DP RCBO, 30 mA Type A could be selected as the protective device as in this example. An additional RCD closer to the car charger will not be required.




LOOSE CO
L OUT N
IR TEST HERE
IR test can be carried out at load terminals with device in OFF position
:hager
MTN 106 B6
CD285U
100 A/IΔn 0,03 A
Test
Test regularly
RCCB
Earth fault indicator
ADA310G B10
ADA320G B20
ADA310G B10
IΔn 0,03 A
SBR 290
100A
400 V~
L IN

03 Simultaneous loading of a circuit supplying car charger with adjacent circuit

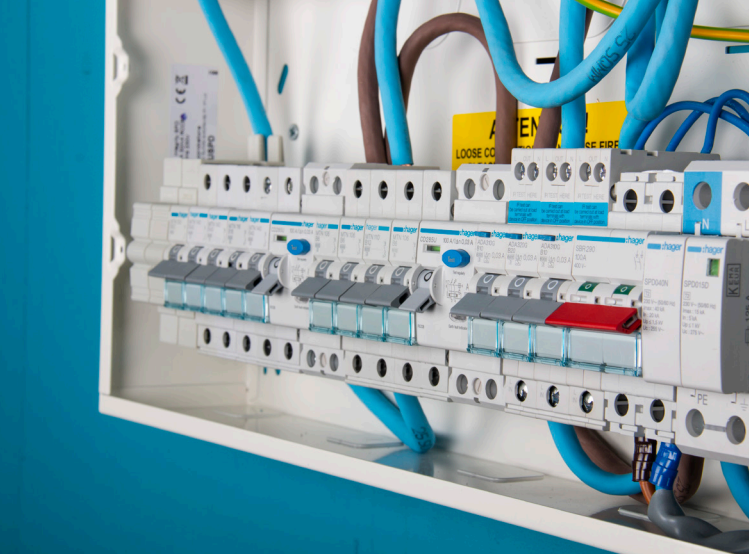
The product standard for the consumer unit is BS EN 61439-3. This standard describes a term called Assumed Loading Factor or Rated Diversity Factor (RDF) and has values given in Table 101.

Table 101- Values of assumed loading

Number of outgoing circuits	Assumed loading factor
2 and 3	0.8
4 and 5	0.7
6 to 9 inclusive	0.6
10 and above	0.5

In basic terms what this means is that in the absence of specific information given by the manufacturer, the values in this table (or others supplied by the manufacturer) need to be applied as a factor to any circuit that was both Continually and Simultaneously loaded with other circuits.

This is because such circuits could heat each other up and lead to the overheating and premature failure of a particular device.



A circuit will be considered to be continually loaded where the ‘on’ time of the circuit exceeds 30 minutes or for cyclic loads where the ‘on’ time exceeds the ‘off’ time. (Lightly loaded circuits i.e. 6A lighting circuit with LED luminaires will likely not count as continually loaded)

The circuit supplying the car charger will clearly be continually loaded. Should this protective device be adjacent to another protective device (this includes the main switch and an RCCB) that is also continually loaded then they are both now simultaneously loaded and will require the factor to be applied.

Example
A 10-way consumer unit having an MCB or RCCB adjacent to the car charging circuit, where deemed to be continually loaded, the 7kW car charger will require a 63A rated protective device (MCB/RCBO).

The protective device (MCB/RCBO) next to it would also need to be increased by a factor of 2 (In/0.5). These rating factors could obviously have implications on associated cable sizing.

04 Product Solutions

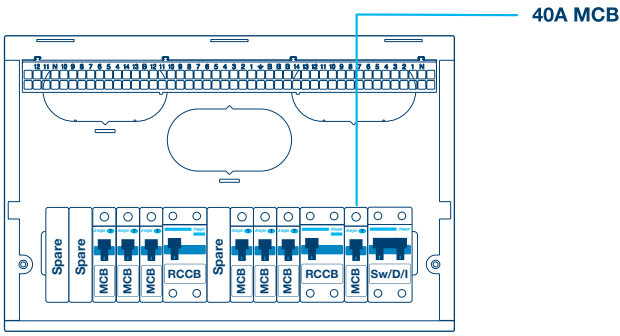
Due to the requirements from BS 7671, we suggest the options shown in this section for car charging circuits.

Within the consumer unit the two options have individual circuit protection which better satisfies BS 7671 section 314, dividing circuits to avoid danger and minimize inconvenience. In addition the requirements of 722.531.3.101 are satisfied with the RCD being individual and not supplying other circuits

Depending on the charging manufacturer and the wiring method, the circuit protection device at the distribution board will either need to be an MCB or a double pole RCD. It is also important guidance from the distribution board manufacturer is sought as a car charger would be a constant load and the Rated Diversity Factor (RDF) of the distribution board may need to be applied

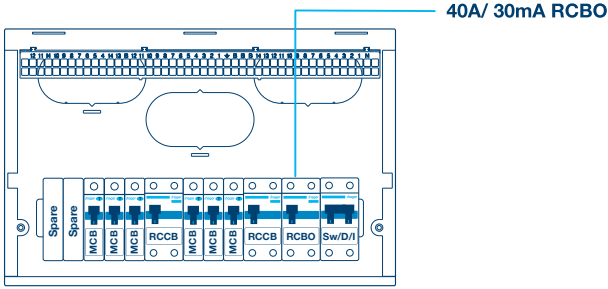
In these solutions RDF is applicable as the circuit is adjacent to other continually loaded devices. Test results from Hager have proved both these solutions suitable using 40A In devices and applying an RDF of 0.8.

i) No requirement for RCD at consumer unit as RCD supplied within or local to the car charger and cable does not require additional protection by RCD (surface wired or SWA)



ii) RCD is required to supply car charger that has RDC-DD of 6mA. Or cable requires additional protection by RCD. Either of these can be satisfied with Double Pole Type A RCBO within consumer unit.

For more information, please contact our Technical Helpline.



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