creos
Energy in motion

Home-charging of an electric vehicle

INFORMATION BULLETIN

Devices for charging electric vehicles at home
Process for implementing a “smart-grid-ready” charging device

All installations or devices for charging electric vehicles with a single-phase power greater than 4.6 kW or a three-phase power greater than or equal to 7 kW must be declared to Creos via a signed application form.

Although it is possible to use a single-phase domestic plug (Schuko) to charge an electric vehicle, it is not recommended. Standard outlets are thermally and mechanically weak and not designed for extended use at a high current.

Therefore, many charging cables have a vehicle-specific device called an In-Cable-Control-Box (ICCB) – (Figure 1) – which is used to control the various safety factors when charging the vehicle. Be careful though, the weight of the ICCB when suspended from the cable can damage both the cable and plug. It is also important to note that charging the electric vehicle through a single-phase household socket will greatly limit the charging power and lengthen the charging time.

Figure 1 – In-Cable-Control-Box

Another option is to use a single-phase or three-phase CEE industrial plug socket and a cable with a suitable ICCB. However, for any load with a power of 7 kW or more, the technical requirements regarding the load-shedding of the CEE outlet by the grid operator via the SMARTY smart meter must be respected. These requirements are explained in detail in the "Installation of a 'smart-grid-ready' charging device" section of this information bulletin.

It is also important to note that using one of the above-mentioned plugs does not exempt the customer from declaring his or her charging device!

Alternatively, there are specially developed solutions to optimize the mechanical, thermal and electrical conditions for charging an electric vehicle at home (Figure 2). These charging stations (i.e. wall-boxes) are recommended by Creos and are available in different versions from several suppliers. The connection to the electric vehicle is generally made with cables 4 to 6 metres long. Longer cables should be avoided as they may overheat.

The maximum charging time of an electric vehicle depends on the capacity of the vehicle's battery and the charging power applied: for example, a battery with a capacity of 50 kWh can be fully charged in about eleven hours with a charging power of 4.6 kW using a suitable single-phase device and in about four and a half hours with a charging power of 11 kW using a suitable three-phase device.

Charging time [h] ≈ Battery capacity to recharge [kWh] / Charging power [kW]

Figure 2 – Charging device

The maximum possible/authorized charging power is determined by several factors:

1. By the power of the household connection
   For a single-family home with a standard 27 kW (40 A) electrical connection, a single-phase charge with a maximum power of 4.6 kW (20 A) or a three-phase charge with a maximum power of 11 kW (16 A) is allowed, regardless of the number of vehicles you want to charge or the number of charging devices you have installed.
2. By the maximum charging power of the charging device
   Several suppliers offer models with different maximum charging powers. This difference is due to the charging method, which can be single-phase or three-phase. Depending on the model and its manufacturer, the charging power can vary between 3.7 kW and 22 kW, with one or more charging points.
3. By the maximum charging power of the electric vehicle
   It is possible that the electric vehicle manufacturer has only allowed for one single-phase charging mode or that the power of the three-phase charging is limited by the system. The possible charging powers of vehicles currently on the market range from 3.7 kW to 22 kW in alternating current, and from 50 kW to 150 kW through the use of special direct-current charging stations.

In summary, in order to comply with the network's capacity limitations and guarantee the security of the electricity supply, the following maximum powers are authorised by Creos and should be used for charging an electric vehicle at home:

4,6 kW - 20 A - single-phase / 11 kW - 16 A - three-phase

Installation of a “smart-grid-ready” charging device

To connect the charging infrastructure to the Creos power grid, it must be "smart-grid-ready", which means that charging devices with a charging power of 7 kW or more must be connected to the SMARTY smart meter to allow for remote load shedding (if the customer’s meter has not yet been changed, the meter replacement process must be initiated). Remote load shedding makes it possible to reduce the network load if necessary, thereby avoiding overloads and the shutdown of sensitive installations.

It should be noted that all electric vehicle charging devices must be reported to Creos via a signed and completed “Installation of a charging terminal for electric vehicles” application form, which can be downloaded from www.creos.net. Requests for a single-phase charge with a power greater than 4.6 kW or a three-phase charge with a power greater than or equal to 7 kW require permission from Creos before the electrician’s installation work may begin. The installation must be carried out by a licensed electrician and the components of the charging devices must be periodically inspected by a qualified person to ensure their safety. In order to properly connect the charging device to the SMARTY smart electricity meter, the electrician must comply with the current TAB-BT technical connection conditions and their appendices (available on our website www.creos.net) and follow the operating instructions supplied with the product.

The power of the device needs to be limited according to the capacity of the Creos network connection and may thus be lower than its maximum power. For a 40 A connection, a maximum power of 11 kW (16 A) (4.6 kW (20 A) on a single phase) is allowed. This limitation must be set, checked and documented by the electrician or manufacturer. In accordance with VDE 0100-722, each connection point of a charging infrastructure must be protected by a differential (RCD) of type A ≤ 30 mA. If the charging infrastructure is equipped with a connector according to DIN EN 62196 (VDE 0623), the detection of DC direct fault current must be ensured. This can be achieved by using a type A differential in conjunction with an additional detection element that detects direct fault currents ≥ 6 mA. This element must then be integrated into the charging infrastructure. Otherwise, the installation of a type B differential or AEV is necessary. In addition, all the supply phases of the terminal must be protected by circuit breakers. The dimensioning of the circuit breakers is dictated by the maximum permissible charging current. of 20 A, the nominal current of the circuit breaker is 25 A. For three-phase charging, maximum charging currents of 16, 32 or 64 A can be applied depending on the capacity of the power supply connection, requiring circuit breakers with a nominal current of 20, 40 or 80 A respectively.

It is imperative that the electrician distinguishes between the two types of charging devices:

1. Device with a load-shedding function:
   Closing the R2 contact of the SMARTY meter will switch the “smart” charging device from normal mode to load-shedding mode, according to the availability of the Creos network (Figure 3).
2. Device without a load-shedding function:
   Closing the R2 contact of the SMARTY meter should completely disconnect the charging device from the Creos low voltage network via a relay.

Devices with a digital input for direct control (type 1) are more advantageous because they consider load shedding as a normal operating mode, which can allow charging at reduced power and—in the event of a complete suspension of the charging procedure—guarantee that the charge will resume after reactivation.

When the R2 contact is closed, the smart charging infrastructure should reduce the charging power by at least 30% if it has a nominal power greater than or equal to 7 kW, and by at least 50% if the nominal power is equal to or greater than 11 kW. For the non-smart devices (type 2), the load-shedding signal implies a total deactivation.

Charging devices should be connected via a control line to the measuring device (potential-free contact) of the distribution system operator. When connecting an ordinary device, a power relay must be integrated into the terminal supply line to ensure the load-shedding function (Figure 4).

Connection and device control ≥ 7 kW/400 VAC

(Source: Annex 2018.1 version 2016.1 of the TAB-BT)

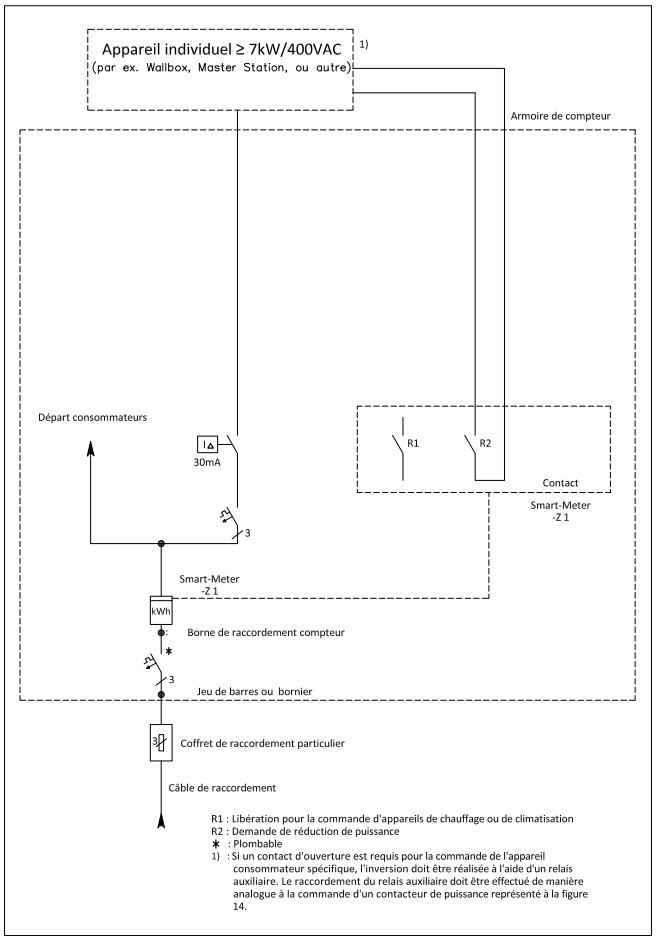

Figure 3 – Connection of a device with load-shedding function

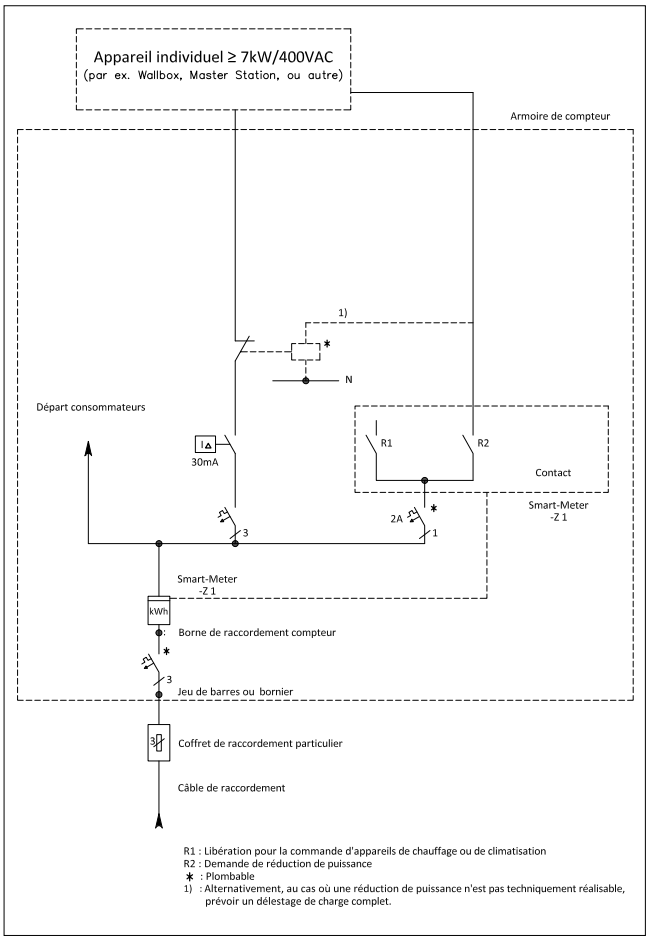

Figure 4 – Connection of a device without load-shedding function

After installing the charging infrastructure, the electrician must perform a first installation test in accordance with DIN VDE 0100-600 and then seal the SMARTY meter cover with a red tag. After this test, the “notification de fin de travaux” form must be returned to Creos and an appointment will be made with one of our agents.

Our agent will check the report of the first test, carry out a visual check of the installation and test the correct operation of the load shedding as well as compliance with the maximum power granted. If the inspection is satisfactory, the agent will place a final blue seal on the SMARTY meter and a sticker with the installation date on the charging device.