

THE SAFETY BENEFITS OF HIGH-SPEED CHARGING STATIONS ON TRADITIONAL GASOLINE REFUELING

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Since the beginning of the new millennium energy systems of countries have been being developed at an ever-increasing pace, while at the same time energy sources such as oil, gas and fuel were quickly becoming a thing from the past. The demands for electricity and new safety operate large volumes of electricity are increasing [1].

Since recently electric cars have been becoming more and more popular in our world that is why object-matter of article is consideration the basic rules for the installation and use of an integral part of an electric car.

The main advantages of using high-speed electric charging systems over gas refueling systems are their environmental friendliness and reduced risk possibilities to human life during their operation. Therefore, to further highlight these advantages of the high-speed charging stations we will consider the dangers of the gas refueling systems.

One of the biggest dangers of petrol stations is the toxic influence of petroleum products on the environment [2]. According to conducted research, depending on the ambient temperature and time that a person spends in a zone where toxic fumes of petroleum products are present, the level of danger can vary from the permissible to very high. Such danger is completely absent with the high-speed charging stations.

When using charging stations, we exclude the possibility of presence of a flammable substance (petroleum), which, at the onset of a spark, spontaneously ignites instantly. This is incredibly dangerous for all petrol stations.

The last danger we will consider is transportation. Petroleum products are transported in gasoline vehicles, which create additional danger on roads, carrying flammable fuel. However, high-speed electric charging systems can use electricity supplied to them by power lines or at the expense of their own production (decoupled generation).

So, knowing all these factors, we see that high-speed electric charging stations are on the safe side, but they also need to comply with the rules of safe operation. Hereafter we will consider the main types of high-speed electric charging stations and rules for their operation.

There are three main types of fast chargers: CHAdeMO, SAE Combo, and Tesla Superchargers.

CHAdeMO is an abbreviation for "charge for moving". CHAdeMO is collaboration between such well-known manufacturers of electric cars as Toyota, Nissan, Mitsubishi, Fuji Heavy Industries and Tokyo Electric Power Company, which was created in March of 2010. CHAdeMO charging stations can provide a charging power of 40 to 60 kW (decreases as battery is being charged) and have a maximum power of 100 kW.

Combined Charging Systems arose as a result of the association between American and German automotive engineers working in various committees of Society of Automotive Engineers (SAE). The main reason for this was the fact that the connector and CHAdeMO protocol is thought to be insufficient. In 2012, SAE published so-called "standard" for the J1772 connector option (already used for Charging Level 2), specifying additional contacts for quick charging with DC and power up to 90 kW. The presence of a plug for charging at several speeds – Level 1, Level 2, and quick charge with DC, caused the name – “Combined charging system”, which is often referred to as “Combo Cord”. As a result of this association, electric cars of General Motors and BMW are the first ones compatible with the SAE Combo cord.

Tesla Supercharger uses a specially designed two-pin connector that supports charging modes from Level 1 (up to 120 V AC) to quick charging with 120 kW DC. Tesla provides a simple adapter for J1772 connector with charging Level 2 and a travel cord with fasteners for 120-volt charging Level 1 and 240-volt Level 2. The Tesla connector has the ability to charge with DC and AC.

Tesla uses this connector for its quick charging, called Supercharger, through which it is possible to charge with power up to 120 kW. Tesla is currently developing a Supercharger network in the United States (and other countries), but you must have a properly equipped Model S to use the stations. Tesla also sells CHAdeMO adapters that can charge Model S at any CHAdeMO station.

The International Electrotechnical Commission (IEC) is currently standardizing charging systems of direct and alternating current electric cars. The relevant documents are part of a series of IEC 61851 standards. They describe general characteristics and operating conditions of the equipment, principles for organizing its connection to the car, as well as digital interfaces between charging stations and cars.

The latest standard in this series is IEC 61851-1 Ed.3.0 b: 2017 [3]. The document covers specifications and operating conditions for charging equipment, describes specification for equipment-to-vehicle connections, and includes electrical safety recommendations for equipment suppliers. This standard is used as a basis for all subsequent standards in the IEC 61851 series. It sets requirements for charging equipment for electric cars with a nominal voltage of up to 1000 volts AC, or 1500 volts DC and nominal output voltage up to 1000 volts AC, or up to 1500 volts DC.

IEC 61851 series standards also include digital communication between charging stations for electric vehicles and electric vehicles, requirements for electromagnetic compatibility (EMC) for wired connection to AC / DC, requirements for voltage conversion units and battery system.

We can conclude that as of 2018, the use of electricity is increasing, both in the industrial sector and in household. Use of charging stations for electric cars is an example of an increase in the use of electric energy by motor vehicles and, accordingly, in increasing of the capacity of the charging devices that they use. This fact indicates a higher risk of the use and production of such devices by consumers and manufacturers respectively. However, simultaneous creation of safety rules for

the development and use of these devices indicates the controllability of the danger and damage that these devices can cause and decreases many risks associated with the use of petrol stations by reducing the demand for them.

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Reference

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