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**Wireless power supply in mechanical parking system -
Technical requirement and testing specification**

立体停车库无线供电系统 技术要求及测试规范

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Wireless power supply in mechanical parking system - Technical requirement and testing specification

1 Scope

This document specifies general principles, technical requirements, test preparation, test methods and inspection rules for wireless power supply in mechanical parking system.

This document applies to the design, development and testing of wireless power supply equipment for DC charging and AC charging vehicles in mechanical parking system.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 4208-2017, *Degrees of protection provided by enclosure (IP code)*

GB/T 14048.2-2020, *Low-voltage switchgear and control gear -- Part 2: Circuit-breakers*

GB/T 16916.1-2014, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCB) -- Part 1: General rules*

GB/T 19596-2017, *Terminology of electric vehicles*

GB/T 22794-2017, *Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*

GB/T 26476-2021, *Mechanical parking system -- Vocabulary*

GB/T 38775.1-2020, *Electric vehicle wireless power transfer -- Part 1: General requirements*

GB/T 38775.2-2020, *Electric vehicle wireless power transfer -- Part 2: Communication protocols between on-board charger and wireless power transfer equipment*

GB/T 38775.3-2020, *Electric vehicle wireless power transfer -- Part 3: Specific*

requirements

GB/T 38775.4-2020, *Electric vehicle wireless power transfer -- Part 4: Limits and test methods of electromagnetic environment*

GB/T 38775.5-2021, *Electric vehicle wireless power transfer -- Part 5: Electromagnetic compatibility requirements and test methods*

GB/T 38775.6-2021, *Electric vehicle wireless power transfer -- Part 6: Interoperability requirements and testing -- Ground side*

GB 50057-2010, *Code for design protection of structures against lightning*

3 Terms and definitions

For the purposes of this document, the terms and definitions defined in GB/T 19596-2017, GB/T 38775.1-2020, GB/T 38775.3-2020, GB/T 26476-2021 as well as the followings apply.

3.1 wireless power transfer; WPT

A power supply mode that uses invisible soft media in space (such as electric fields, magnetic fields, microwaves, etc.) to transfer electrical energy from the power source to electrical equipment.

NOTE: Wireless power transfer technology can also be called Contactless Power Transfer technology (CPT).

[Source: GB/T 38775.1-2020, 3.3]

3.2 mechanical parking system

Mechanical equipment used to access and store vehicles.

NOTE: Also known as mechanical parking equipment.

3.3 wireless power supply

The AC or DC power grid (power supply) is transmitted from the grid side to the parking equipment through wireless power transfer technology.

3.4 primary power components

A power conversion unit that converts electrical energy from the grid into electrical energy required by primary equipment.

3.5 secondary power components

A power conversion unit that converts the electric energy picked up by the secondary coil into the electric energy required for vehicle charging.

3.6 mechanical air gap

The shortest distance between the upper surface of the primary equipment and the surface of the secondary equipment.

[Source: GB/T 38775.1-2020, 3.10, modified]

3.7 system efficiency

The efficiency of power transfer from the AC (or DC) power input to the electric vehicle battery or on-board equipment.

[Source: GB/T 38775.3-2020, 3.8]

4 Abbreviations

The following abbreviations apply to this document.

MF-WPS: Wireless Power Supply Through Magnetic Field

PE: Protective Earthing conductor

5 General rules

5.1 System structure

The wireless power supply system includes input-side equipment and output-side equipment. The input-side equipment at least includes primary power components, primary equipment, primary control units, and primary communication units. The output-side equipment at least includes secondary power components, secondary equipment, secondary control units, and secondary communication units. The schematic diagram of the wireless power supply system is shown in Figure 1.

The wireless power supply system can be arranged in any parking space in the mechanical parking system. The output-side equipment of the wireless power supply system is installed on the vehicle carrier board.

6 Technical requirements

6.1 System security requirements

6.1.1 Electric shock protection

The electric shock protection requirements of wireless power supply systems shall meet the requirements of 10.2 in GB/T 38775.1-2020.

6.1.2 Protection level

The protection level of the wireless power supply system shall at least meet IP54.

6.1.3 Dielectric strength requirements

The insulation resistance of the wireless power supply system shall meet the requirements of 10.2.3 in GB/T 38775.1-2020. The dielectric strength of the wireless power supply system shall meet the requirements of 10.2.4.1 in GB/T 38775.1-2020. The impulse withstand voltage of the wireless power supply system shall meet the requirements of 10.2.4.2 in GB/T 38775.1-2020.

6.1.4 Lightning protection

The installation and selection of surge protectors shall be based on the installation location of the power supply equipment and meet the requirements of 6.4 in GB 50057-2010. When the wireless power supply system must take lightning protection measures, a surge protection equipment shall be installed between the conductor and PE.

6.1.5 Switching equipment and breaking capacity

The switching equipment and breaking capacity of the wireless power supply system shall meet the requirements of 11.2 in GB/T 38775.1-2020.

6.1.6 Exception protection

The wireless power supply system shall have exception protection function. The specific requirements are as follows.

- It shall have over-voltage protection, under-voltage alarm, over-current protection, no-load protection, and short-circuit protection functions. The overcurrent protection and short-circuit protection functions shall meet the requirements of 10.3 in GB/T 38775.1-2020.
- It shall have temperature rise and overheating protection functions. The temperature rise and overheating protection functions shall meet the requirements of 10.4 in GB/T 38775.1-2020. When the temperature rise exceeds the limit, the

system shall reduce power or stop running.

- During the charging process, when it is detected that the communication between the input-side equipment and the output-side equipment is interrupted, the system shall stop charging.
- The input-side equipment shall be equipped with a residual current protector. The residual current protector of AC power supply equipment shall be type A or B, complying with the relevant requirements of GB/T 14048.2-2020, GB/T 16916.1-2014 and GB/T 22794-2017.
- The system shall have protection measures to avoid accidental live disconnection between the charging equipment and the electric vehicle.
- The system shall have emergency stop function. When executing the emergency stop function, the system shall be powered off immediately.

6.1.7 Electromagnetic compatibility (EMC)

The electromagnetic compatibility of the wireless power supply system shall meet the requirements of GB/T 38775.5-2021.

6.1.8 Electromagnetic environment limits (EMF)

The electromagnetic environment limits (EMF) of the wireless power supply system shall comply with the requirements of GB/T 38775.4-2020.

6.2 System performance requirements

6.2.1 System efficiency

When the wireless power supply system is in rated working condition, the system efficiency shall be no less than 85%. Under the allowed offset state, the system efficiency shall not be less than 82%.

6.2.2 Working frequency

The rated operating frequency of the wireless power supply system shall be f_0 . The operating frequency range shall be $f_1 \sim f_2$.

The values of f_0 , f_1 and f_2 refer to the "Radio Frequency Allocation Regulations of the People's Republic of China" and the regulations of the International Telecommunication Union (ITU).

6.2.3 Power factor

Under rated input and rated output conditions, the input power factor value of the wireless power supply system shall not be less than 0.98.

8 Test methods

8.1 Test methods for system security

8.1.1 Protection against electric shock

The electric shock protection of the wireless power supply system is tested according to the method specified in 10.2 of GB/T 38775.1-2020.

8.1.2 Protection level

The protection level of the wireless power supply system is tested according to the methods specified in Chapters 13 and 14 of GB/T 4208-2017.

8.1.3 Insulation strength

The insulation strength of the wireless power supply system is tested according to the method specified in 10.2 of GB/T 38775.1-2020.

8.1.4 Overcurrent protection and short circuit protection

The overcurrent protection and short circuit protection of the wireless power supply system are tested according to the methods specified in 8.8 of GB/T 38775.3-2020.

8.1.5 Temperature rise and overheating

The temperature rise and overheating of the wireless power supply system are tested according to the methods specified in 8.8.3 in GB/T 38775.3-2020 and 8.2.1 in GB/T 38775.6-2021.

8.1.6 Electromagnetic compatibility (EMC)

The electromagnetic compatibility of the wireless power supply system is tested according to the method specified in GB/T 38775.5-2021.

8.1.7 Electromagnetic environment limits (EMF)

The electromagnetic environment limit test points cover all areas where people can move.

The following methods can be used to reduce the impact of personnel on electromagnetic environment limits:

- Adopt physical isolation and limit the activities of personnel in areas above the electromagnetic environment limits;
- For parking spaces or facilities that provide wireless power supply services that

allow personnel to enter, adopt feasible detection methods. When a person is detected entering, the power transmission of the wireless power supply system is suspended.

The electromagnetic environment limits of the wireless power supply system are tested according to the methods specified in GB/T 38775.4-2020.

8.2 Test methods for system performance

8.2.1 System efficiency

The efficiency of the wireless power supply system is the ratio between the output power of the secondary power component No. 8 in Figure 2 and the input power of the primary power component No. 2.

During the system efficiency test, the system output can be directly connected to the load through the secondary power component No. 8 in Figure 2.

The system efficiency is tested according to the method specified in 8.3 of GB/T 38775.6-2021. The test points are selected according to the range specified in 6.2.5 and 6.2.6. The step size selection of the test point satisfies:

- The offset range test point step size does not exceed 2.5 mm.
- The step length of the mechanical air gap test point does not exceed 20 mm.

8.2.2 Operating frequency

The system operating frequency is the operating frequency of the high-frequency inverter in the primary power component No. 2 in Figure 2 or the current frequency of the primary coil in the primary equipment No. 3.

During the operating frequency test, the system works at full power output. The test points include at least the following two working conditions:

- No offset range and minimal mechanical air gap;
- Maximum offset and maximum mechanical air gap.

8.2.3 Power factor

The selection of power factor test points of the wireless power supply system is consistent with that specified in 8.2.1. Test the power factor under 50%, 75% and 100% rated output power conditions.

8.2.4 Input harmonic current

The input harmonic current of the wireless power supply system is tested according to

the method specified in 8.4 of GB/T 38775.3-2020.

9 Inspection rules

9.1 Type inspection

Products shall undergo type inspection under the following circumstances:

- Products newly put into production and products produced in transferred factories shall undergo type inspection before production appraisal;
- For continuously produced products, type inspection shall be carried out every 3 years on products that have passed the exit-factory acceptance;
- When design changes, changes in processes or major components affect product performance, type inspection shall be conducted before being put into production;
- Products that have been out of production for more than two years shall undergo type inspection before being put into production again.

The product can pass the type inspection only after it has completed at least the type inspection items specified in 9.4.

9.2 Exit-factory inspection

Each product shall undergo exit-factory inspection. The technical inspection department of the manufacturer shall conduct product inspection in accordance with the exit-factory inspection items specified in 9.4. After passing the inspection, a certificate can be issued to prove that the product is qualified.

9.3 Arrival acceptance

The receiver needs to review each product (or sampled product) received. Carry out arrival acceptance before use. The inspection items for product acceptance shall comply with the provisions of 9.4. All projects can be put into use only after they are qualified.

9.4 Inspection items

The inspection items of the wireless power supply system are shown in Table 6.

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