



SURFACE VEHICLE RECOMMENDED PRACTICE

J3105™/2

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Superseding J3105/2 JAN2020

Electric Vehicle Power Transfer System Using Conductive Automated Connection Devices Vehicle-Mounted Pantograph (Bus-Up)

RATIONALE

The vehicle height requirements were modified in the parent document (SAE J3105), causing an addition for the minimum functional articulation span to be added to this document.

INTRODUCTION

Conductive automated connection device (ACD) solutions are attractive to heavy-duty applications in which downtime resulting from charge operations needs to be minimized and the operator prefers to make the connection without leaving the operator's seat. The vehicle-mounted pantograph is suitable for power transfer up to 600 kW with Level 1 and up to 1.2 MW for Level 2. It is hands-free, vertically engaged, and positioned on the roof of the vehicle.

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1. SCOPE

This document details one of the connections of the SAE J3105 document. The connections are referenced in the scope of the main document SAE J3105. SAE J3105/2 details the vehicle-mounted pantograph, or the bus-up connection. All the common requirements are defined in the main document; the current document provides the details of the connection.

This document covers the connection interface relevant requirements for an electric vehicle power transfer system using a conductive automated charging device based on a conventional rail vehicle pantograph design. To allow interoperability for on-road vehicles (in particular, buses and coaches), one configuration is described in this document. Other configurations may be used for non-standard applications (for example, mining trucks or port vehicles).

2. REFERENCES

Refer to the main SAE J3105 recommended practice.

3. DEFINITIONS

Refer to the main SAE J3105 recommended practice.

4. ABBREVIATIONS AND SYMBOLS (ALL)

Refer to the main SAE J3105 recommended practice.

5. GENERAL SYSTEM REQUIREMENTS AND INTERFACE

5.1 General Automated Connection Device (ACD) Charging System Requirements

According to SAE J3105, the vehicle-mounted pantograph is one type of ACD charging system that transfers power between the infrastructure and the vehicle. This power transfer occurs when the correct alignment is complete and the ACD moves into place to electrically connect the infrastructure and the vehicle through conductive connection.

To accommodate all the needs of the fleet, two power levels are required for the vehicle-mounted pantograph (bus-up) system:

- Level 1: The current capability up to 600 A.
- Level 2: The capability will be up to 1200 A.

Both levels will be compatible with one another.

Level 2 is not documented SAE J3105. It is reserved for a future revision.

The vehicle-side connection (VSC) will have the moving connection. The infrastructure-side connection (ISC) will be stationary.

The system is designed to cover gaps between VSC and ISC of up to 1840 mm, depending on the chosen vertical mounting offset on the EV and EVSE top.

Analog signals to indicate the “idle/home” and “working/contact” positions are provided.

NOTE: When the ACD is not in the “home” position, the EV shall be immobilized.

5.2 Functional/Physical Requirements of the VSC

5.2.1 Mechanical Arrangement

The pantograph mounted on the roof of the vehicle is one type of automatic connection that transfers power between the infrastructure and the vehicle.

The active/moving part shall be mounted on the EV.

The active/moving part shall be equipped with a collector with four contacts (DC+, DC-, PE, and CP), as indicated in Figure 1.

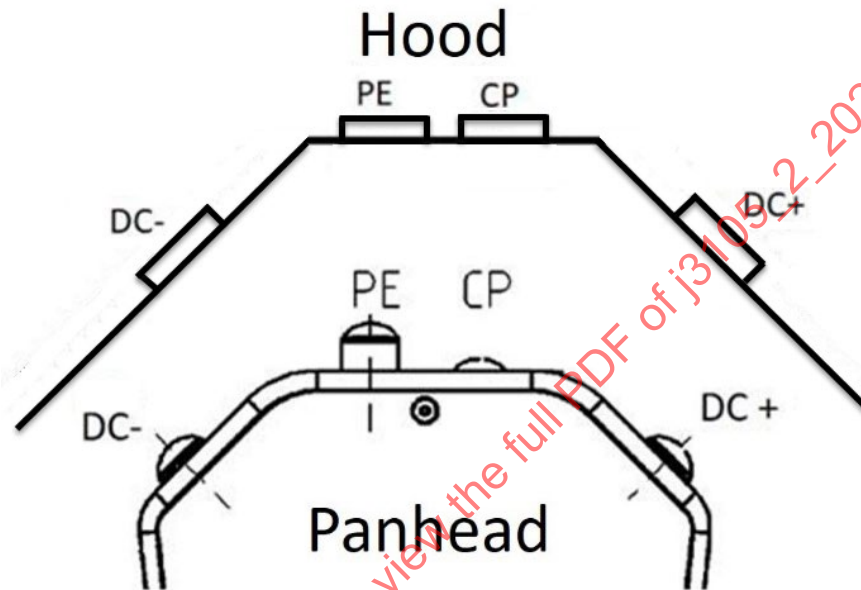


Figure 1 - Example of hood and panhead (front view)

5.2.2 Contact Pin Configuration

The surface of the contacts shall be rounded.

The DC+ and DC- contacts shall be made of copper, which could be coated against corrosion.

5.2.3 Contact Force

The total contact force applied on the contact hood shall be maximum 275 N.

The minimum contact force per DC+ and DC- contact shall be 60 N.

The minimum contact force per PE or CP contact shall be 40 N.

5.3 Functional/Physical Requirements of the ISC

5.3.1 ISC Dimensioning

The passive part shall be mounted on the ISC.

The passive part shall have four contact rails in an insulated hood.

The four contacts are DC+, DC-, PE, and CP.

The DC+ and DC- contacts shall be arranged in the side surface of the hood (see Figure 2).

The PE contact shall be arranged in the horizontal surface of the hood (see Figure 2).

The CP contact shall be arranged in the horizontal surface of the hood (see Figure 2).

Dimensions for the hood shall be as follows (see Figure 2):

- Length of the hood is shown in Figure 3.
- Length of the contact rails (DC+, DC-, PE, CP) in the X direction shall be $1204 \text{ mm} \pm 3 \text{ mm}$.
- Width of DC contact rails shall be $40 \text{ mm} \pm 1 \text{ mm}$.
- Width of the PE contact rail shall be $50 \text{ mm} \pm 1 \text{ mm}$.
- Width of the CP contact rail shall be $40 \text{ mm} \pm 1 \text{ mm}$.
- Creepage distance between live parts and any other surface shall be a minimum of 67 mm.
- Air distance between live parts and any other surface shall be a minimum of 63 mm.

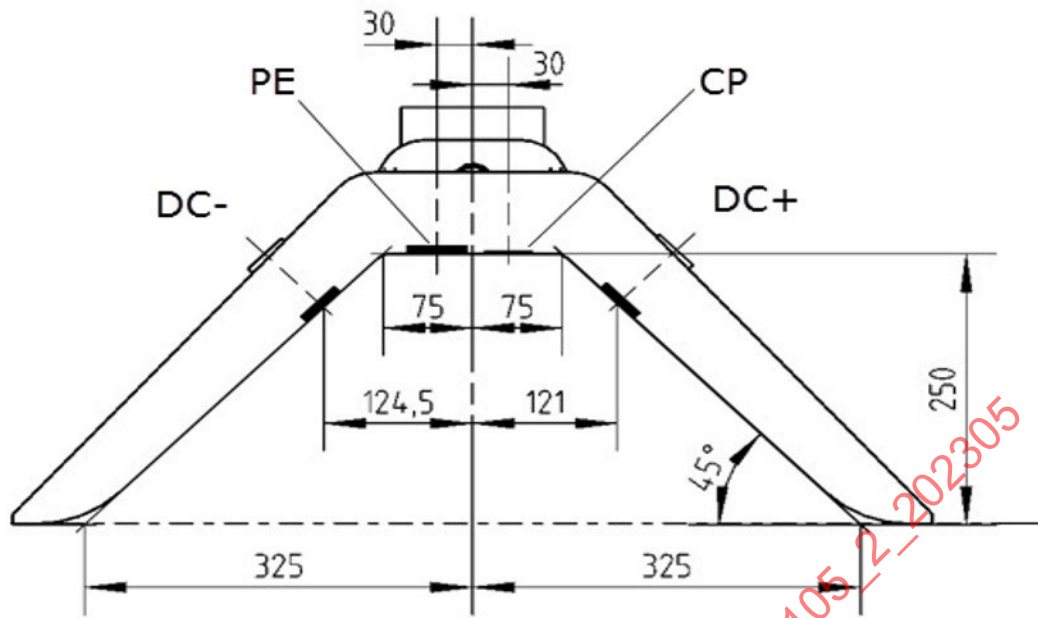
The lower side of the hood and of the contact rails CP and PE shall be parallel to the plane of the roadway surface.

The contact surface of the contact rails shall be planar.

The DC+ and DC- contacts shall be made of copper, which could be coated against corrosion.

The cross-section of the pantograph rails shall be able to transmit rated current of the EVSE.

The location of the hood when the vehicle is stopped shall be as shown in Figures 4 and 5.



Dimensions in mm

Figure 2 - Frontal view of hood dimensions

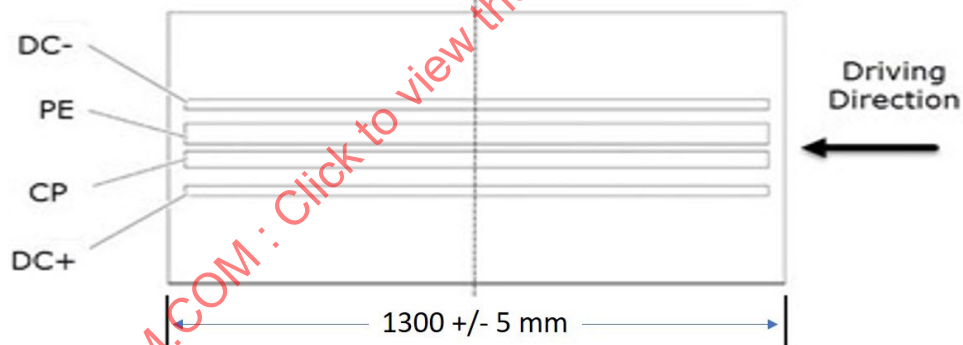


Figure 3 - Top view of hood dimensions

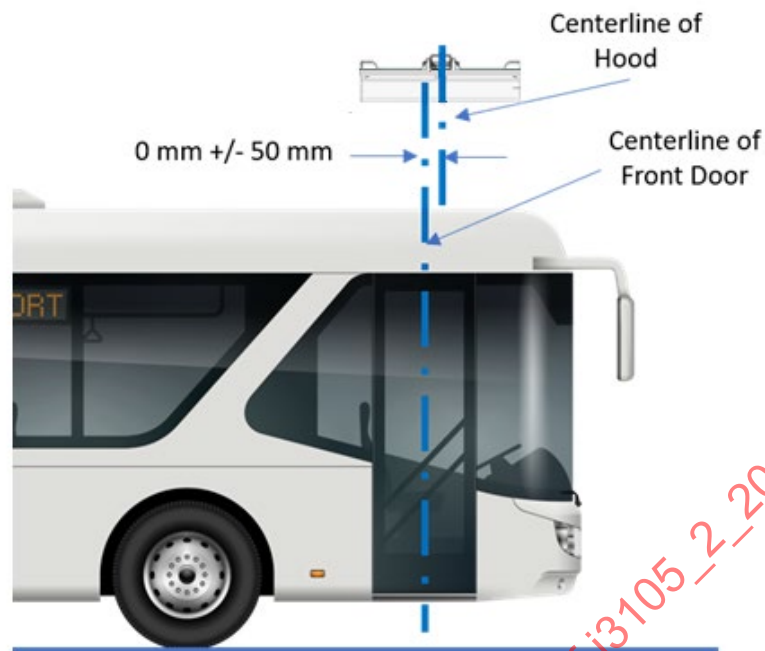


Figure 4 - Lateral hood location

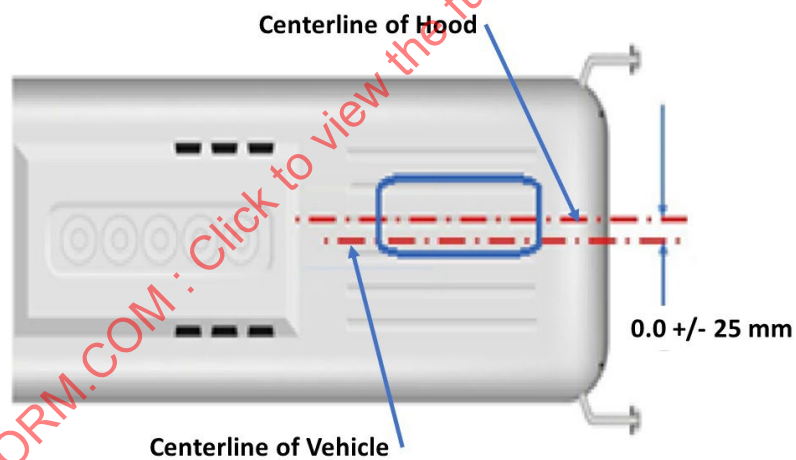


Figure 5 - Hood location above the vehicle

5.3.2 ISC Keep-Out Zone

The keep-out zone is the working range of the hood inside the infrastructure at different positionings of the vehicle and is shown in Figures 6 and 7.

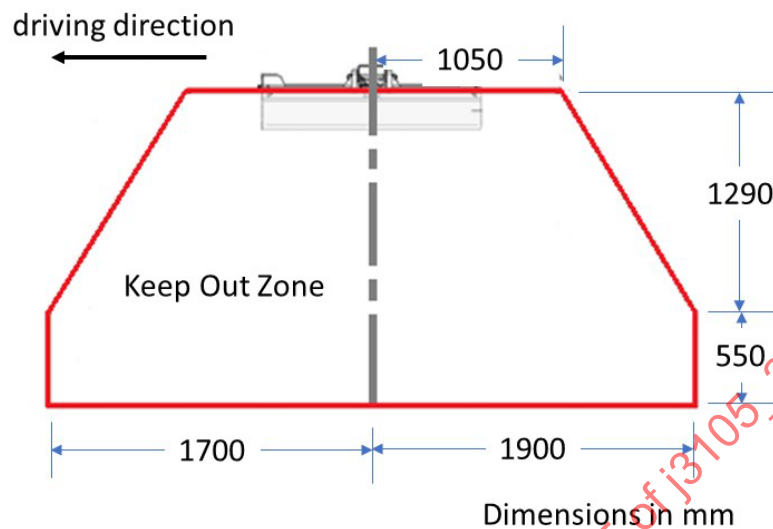


Figure 6 - Lateral keep-out zone dimensions under hood

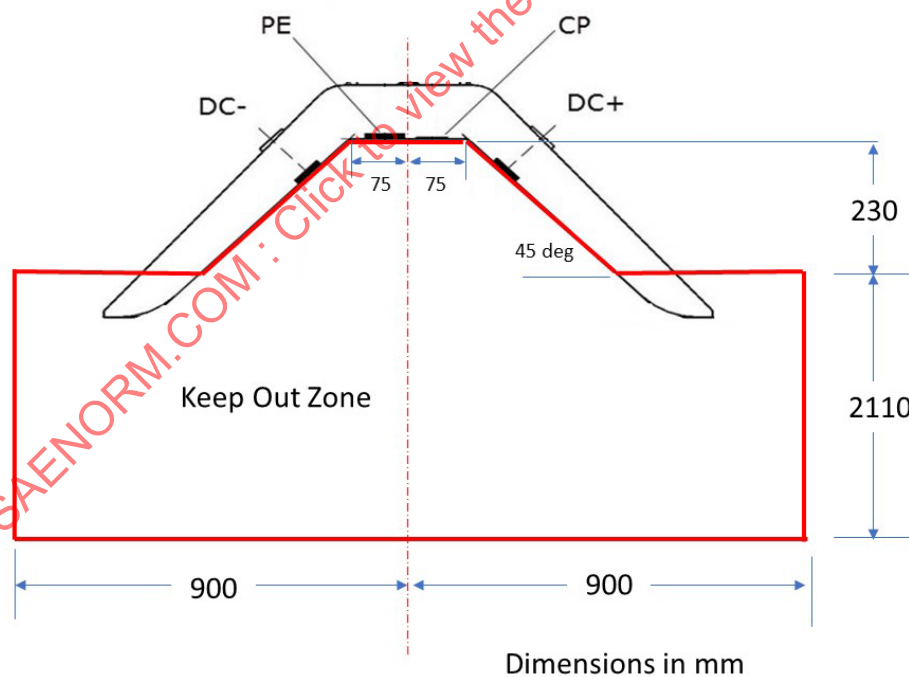


Figure 7 - Fore and aft keep-out zone dimensions (front view)