QC

AUTOMOBILE INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 43.040

T 35

QC/T 1132-2020

Measurement methods of the noise of electric power train system for electric vehicles

电动汽车用电动动力系噪声测量方法

Issued on: August 31, 2020 **Implemented on: January 01, 2021**

Issued by: Ministry of Industry and Information Technology of PRC

Table of Contents

Measurement methods of the noise of electric power train system for electric vehicles

1 Scope

This document specifies the measurement method of sound power level and surface sound pressure level of electric power train system for electric vehicles.

This document applies to electric power train system and its subsystems for electric vehicles. Other similar structures and components may refer to this document.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, for dated reference documents, only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to this document.

GB/T 3241-2010 Electroacoustics - Octave-band and fractional-octave-band filters

GB/T 3767-2016 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for an essentially free field over a reflecting plane

GB/T 3785.1-2010 Electroacoustics - Sound level meters - Part 1: Specifications

GB/T 6882-2016 Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for anechoic rooms and hemi-anechoic rooms

GB/T 15173-2010 Electroacoustics - Sound calibrators

GB/T 18488.1 Drive motor system for electric vehicles - Part 1: Specification

GB/T 19596-2017 Terminology of electric vehicles

4.3.2 The test environment is weighted to A. The environmental correction factor K_{2A} ≤ 4 dB. For the j^{th} frequency band in the test frequency range, the environmental correction factor K_{2j} ≤ 4 dB, the test environment is valid.

4.4 Measuring instrument

4.4.1 Acoustic instrument systems, including microphones and cables, shall meet the requirements of Level 1 in GB/T 3785.1-2010.

4.4.2 The filter shall meet the requirements of Level 1 in GB/T 3241-2010.

4.4.3 Before and after each series of measurements, it shall use an acoustic calibrator, that meets the requirements of level 1 in GB/T 15173-2010, to verify the entire measurement system, at one or more frequencies within the measurement frequency range. For the difference between the readings, which are obtained by calibration before and after each series of measurement, it shall not be more than 0.5 dB.

5 Test objects and installation conditions

5.1 Test object

Refer to Appendix A for the typical structure of the electric power train system, which is applicable to this document.

5.2 Installation conditions

5.2.1 Electric power train system

5.2.1.1 It is recommended to use the original vehicle suspension system and drive shaft. The installation posture shall meet the design requirements.

5.2.1.2 For the connection between the drive shaft and the load dynamometer, it shall have at least one set of elastic coupling, which has vibration isolation function.

5.2.1.3 For the installation of the motor controller, it is described as follows:

a) For the drive motor system, where the motor controller and the motor are integrated, the motor controller is regarded as a part of the motor; the motor controller and the motor are installed, according to actual matching conditions;

b) For a drive motor system, where the motor controller and the motor can be separated, the motor controller shall be kept away from the motor, AND acoustic treatment shall be performed on it, so that it does not affect the noise test results of the motor itself. If it needs to include the motor

6.2.1.2 The DC bus voltage of the drive motor system is set to the rated voltage. It runs under the peak torque, peak power, continuous torque, continuous power conditions, of the electric and power generation states. The test power supply shall meet the design requirements of the device under test.

6.2.1.3 The boundary conditions shall be kept consistent during the test.

6.2.1.4 Measure the sound power level of each speed, under the working conditions of 6.2.1.2. The working conditions shall be recorded in the test report.

6.2.1.5 If necessary, other working conditions can be determined, through negotiation between the manufacturer and the user.

6.2.1.6 If the drive train has multiple gears, it shall be measured in accordance with the requirements of 6.2.1.1 ~ 6.2.1.5, in all gears.

6.2.2 Drive motor system and motor controller

6.2.2.1 The cooling shall meet the design requirements.

6.2.2.2 The operating conditions shall be implemented in accordance with the requirements of 6.2.1.2 ~ 6.2.1.5.

6.3 Determination of measurement environment and measurement surface

6.3.1 Electric power train system

The measurement environment and measurement surface of the sound power level of the electric power train system shall meet the requirements of Table 1.

Note: The descriptions of a) and b) in 5.2.1.3 apply to Table 1.

6.3.2 Drive motor system

The measurement environment and measurement surface of the sound power level of the drive motor system shall meet the requirements of Table 2.

Note: The descriptions of a) and b) in 5.2.1.3 apply to Table 2.

6.3.3 Motor controller

The sound power level of the motor controller shall be measured using the method in Table 3.

Where:

L_{pi} - The sound pressure level of the i^{th} microphone position.

n - The number of microphone positions.

7.3.4 The measurement results of steady-state conditions shall be corrected with reference to the requirements of Chapter 8. The measurement results of unsteady-state conditions do not need to be corrected.

8 Measurement correction

8.1 Background noise correction

According to requirements of Chapter 6 and Chapter 7, measure the background noise, when the sound source is not working. The average sound pressure level of the background noise is L''. The average sound pressure level，which is measured when the sound source is running, is L'. Background noise correction value K_1 (A weighting or frequency band) is calculated by formula (2), in the unit of dB:

$$K_1 = -10\lg(1-10^{-0.1\Delta L}) \qquad \cdots\cdots (2)$$

Where:

ΔL = L' - L''

When ΔL ≥ 15 dB, no correction is needed.

When 6 dB ≤ ΔL< 15 dB, it shall be corrected according to formula (2). When the measurement is invalid on a single frequency band, if ΔL > 6 dB, the A weighting value is valid, where $\Delta L = L'_A - L''_A$.

When ΔL < 6 dB, it does not meet the requirements of this standard. The accuracy of the measurement result is reduced. However, it can still be corrected according to formula (2). The result is regarded as the upper limit of the noise source of the measured sound source. It is explained in the text of the report and the result icon.

8.2 Correction of environmental noise

Environmental correction K_2 (A weighting or frequency band) is measured, according to one of the methods, which are given in Appendix A of GB/T 3767-2016.

If K_2 ≤ 4 dB, the environment meets the requirements.

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------