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**Earth-moving machinery - Energy consumption for battery
electric wheel loaders - Test methods**

土方机械 纯电动轮胎式装载机能量消耗量 试验方法

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Foreword

SAC/TC 334 is in charge of this English translation. In case of any doubt about the contents of the English translation, the Chinese original shall be considered authoritative.

The document is drafted in accordance with the rules given in GB/T 1.1-2020 Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents. It was proposed by China Machinery Industry Federation and prepared by SAC/TC 334, the National Technical Committee on Earth-moving Machinery of the Standardization Administration of China.

It was issued on 24 July 2024 by the State Administration for Market Regulation and the National Standardization Administration, and took effect the same day.

1 Scope

China's national test method for the energy consumption of battery electric wheel loaders. Wheel loaders were among the first pieces of construction plant to go battery electric in

China, and the moment they did, the industry lost its yardstick: a diesel loader is compared on litres per hour, but there was no agreed way to state how many kilowatt-hours an electric one uses, or how long a shift it can actually work on a charge. Without a common procedure every manufacturer measured on its own site, with its own load, its own cycle and its own instruments, and the published figures could not be compared. This document supplies the missing procedure. It sets the test conditions - ambient temperature from 5 degrees C to 35 degrees C, relative humidity below 95 per cent, wind speed not more than 5 m/s, a flat and firm site, a warmed-up machine in standard configuration with air conditioning and auxiliary loads switched off - and fixes the measurement parameters, units and accuracies in a table. It then describes how the energy drawn from the power battery is measured, the test cycles to be run (charging, loading, transportation and standby), how the resulting energy consumption is assessed, and how the all electric working time, the longest working time from a full charge, is evaluated. It applies to battery electric wheel loaders whose on-board power battery is the sole power source during work and whose rated operating load does not exceed 8 000 kg; larger machines may use it as a reference. Manufacturers, fleet buyers and testing bodies use it to produce numbers that can be set side by side.

The document specifies the test conditions of energy consumption for battery electric wheel loaders, describes the measurement method and test methods of energy consumption, and gives the evaluation method of energy consumption as well as the evaluation methods of battery endurance.

It is applicable to the tests of energy consumption for battery electric wheel loaders with the on-board power battery, whose maximum working voltage is Class B voltage, used as the sole power source during the working process, and with a rated operating load not exceeding 8 000 kg. For battery electric wheel loaders with a rated operating load exceeding 8 000 kg, the document can be used as a reference.

2 Normative references

The contents of the following documents constitute essential clauses of the document through normative references in the text. For dated references only the edition cited applies; for undated references the latest edition, including any amendments, applies.

GB/T 21153 Earth-moving machinery - Units for dimensions, performance and capacities, and their measurement accuracies.

GB/T 25604 Earth-moving machinery - Loaders - Terminology and commercial specifications.

GB/T 44254 Electric earth-moving machinery - Terminology.

3 Terms and definitions

For the purposes of the document, the terms and definitions given in GB/T 25604 and GB/T 44254 apply, together with the one defined below.

3.1 All electric working time

The longest working time of the electric loader, calculated according to the specified test conditions and methods, when the power battery is fully charged. A note records that the unit is the hour (h).

4.1 Test environment

The test environment shall meet three conditions: an ambient temperature between 5 degrees C and 35 degrees C; a relative humidity of less than 95 per cent; and a wind speed of not more than 5 m/s.

4.2 Test site

The test site shall be flat and firm. Within the operating range of the battery electric wheel loader, referred to throughout as the electric loader, the directional slope of the test site shall not be more than 0.5 per cent and the flatness shall not be more than 3 mm/m².

4.3 Measurement parameters, units and accuracy

Measurement parameters, units and accuracy shall comply with Table 1. The accuracy of any other measured value not covered by Table 1 shall comply with GB/T 21153.

Table 1 fixes, for each quantity, the unit, the accuracy and the resolution. Time is measured in seconds to an accuracy of 0.1 s with a resolution of 0.01; distance in metres to 0.1 per cent with a resolution of 0.01; temperature in degrees Celsius to 1 degree with a resolution of 0.1; rotational speed in revolutions per minute to 0.5 per cent with a resolution of 1; mass in kilograms to 2 per cent with a resolution of 10; and electrical energy in watt-hours to 1 per cent with a resolution of 1. Voltage in volts and current in amperes are each measured to the greater of 0.3 per cent of full scale deflection or 1 per cent of the reading, with a resolution of 0.1, and the electricity integration frequency is to be 20 Hz or higher.

4.4.1 Configuration

The test machine shall be the standard configuration as specified by the manufacturer.

It shall have completed its break-in period. The power battery shall go through at least one process from the full charge state to the lowest state of charge, and the charging capacity shall be controlled within the setting value specified by the manufacturer. The state of health of the battery before the new machine is warehoused shall not be less than 97 per cent.

4.4.2 Warm-up

Before the tests, adequate machine warm-up shall be conducted. The hydraulic oil temperature shall not be lower than 50 degrees C, and the torque converter oil temperature shall not be lower than 80 degrees C if the machine is so equipped. The battery temperature shall reach the heating shutdown threshold specified by the battery manufacturer.

4.4.3 Air conditioner and auxiliary electrical appliances

If an air conditioner is installed it shall be turned off during the test. The battery thermal management system shall work in the defined state specified by the manufacturer during the test. Lights, radio, audio and other auxiliary electrical appliances shall be turned off during the test.