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**Energy efficiency level and test methods for drive motor
system and electric drive assembly used on electric vehicles
(English Translation)**

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1 Scope

This specification stipulates the energy efficiency classification method, test conditions and test methods of the drive motor system and electric drive assembly for electric vehicles.

This specification applies to drive motor systems for electric vehicles, and electric drive assemblies in various forms including motors and speed changers.

For vehicle motors and their controllers that only have power generation functions, they can be implemented with reference to this specification.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this article. For undated reference documents, the latest version (including all amendments) is applicable to this document.

GB 755-2008 Rotating electric machine rating and performance GB/T 18488.1-2015 Drive motor system for electric vehicles Part 1: Technical conditions GB/T 18488.2-2015 Drive

motor system for electric vehicles Part 2: Test method

3 Terms and definitions

The following terms and definitions defined in GB/T 19596 and GB/T 18488.1-2015 apply to this document.

Electric drive assembly Electric vehicle power drive assembly unit, including but not limited to the following parts. drive motor, speed change device, motor controller, etc.

Energy efficiency level A classification method used to indicate the energy efficiency of a drive motor system or an electric drive assembly. According to the drive motor system or electric drive assembly the percentage value of the high-efficiency work area (efficiency not less than 85%) measured under the specified test conditions and test methods in the total work area is determined.

4.1 Basic requirements

The general requirements, input and output characteristics, environmental adaptability, reliability, etc. of the drive motor system and electric drive assembly shall meet the relevant requirements respectively.

standard.

4.2 Requirements for test instruments

Unless otherwise specified, the selection and accuracy of the instruments and meters used in the test shall meet the requirements of 4.2 in GB/T 18488.2-2015.

Set and request.

4.3 Energy efficiency classification

The energy efficiency rating of the drive motor system or the electric drive assembly is divided into 4 levels, as shown in Table 1 and Table 2, of which level 1 has the highest energy efficiency level.

Among them, η -under the specified test conditions and test methods, the measured high-efficiency working area of the drive motor system or electric drive assembly (effective Rate not less than 85%) the percentage value (%) of the total work area.

5.1 Basic requirements

The energy efficiency test method of the drive motor system or the electric drive assembly refers to the method specified in 7.2.5.7 of GB/T 18488.2-2015.

The product cooling inlet temperature is $50\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, and the temperature tolerance can be

increased if necessary; the flow rate is in accordance with the technical requirements of the product; the blowing of the air-cooled machine the temperature of points, heat sinks, etc. are in accordance with the manufacturer's regulations; the motor winding temperature is between 60°C and the maximum allowable temperature.

It will be explained in the report. Selection of test voltage. It is recommended to set the DC bus voltage to the highest operating voltage, rated voltage, and lowest operating voltage.

Test under voltage.

5.2 Selection of speed test points

The speed test points should be selected as densely as possible. Generally, no less than 10 speed points are selected within the working speed range, and the lowest speed point should not be greater than the highest working speed.

10% of the speed, the interval between adjacent speed points should not be greater than 10% of the maximum operating speed, and 2%, 2%, and 2% should be included below 10% of the maximum input speed.

4% and 6% speed points, but include the following characteristic points.

- a) Rated operating speed point;
- b) The highest operating speed point;
- c) The lowest operating speed point corresponding to the continuous power;
- d) The lowest operating speed point corresponding to the peak power;
- e) Other specially defined work points, etc.

5.3 Selection of torque points

The torque test points should be selected as densely as possible. At each speed point, the torque interval should not be greater than 10% of the corresponding maximum torque at that speed, and should Including the following characteristic points.

- a) The point at the continuous torque value;
- b) The point at the value of the peak torque (or maximum torque);
- c) Point on the continuous power curve;
- d) The point on the peak power (or maximum power) curve;
- e) Other specially defined work points, etc.

Note: The test point under 10% of the maximum torque should include at least 2 points.

5.4 Selection and calculation of efficiency

At each speed point, record the test results from low torque to high torque, and from high torque to low torque, and use the same torque the average value of the next two test efficiencies is used as the efficiency value corresponding to the torque.

According to the test data, draw the system efficiency distribution map, obtain the efficiency 85% contour line according to the linear interpolation method, and calculate the area the percentage method obtains the energy efficiency value under the corresponding conditions.

Note: The 85% efficiency contour can be calculated using the `contour()` function in the MATLAB software or other software related functions.

5.5 Calculation of Area Proportion

The grid method is recommended for the calculation of area ratio, and the specific implementation method is as follows.

a) In the torque-speed working area, the abscissa is the speed (unit. r/min), and the ordinate is the torque (unit. N·m).

Efficiency MAP and 85% contour;

b) Rotation speed grid. the grid step length of the highest working speed $n_{\max} \leq 10000$ r/min is not more than $1\%n_{\max}$, the highest working speed $n_{\max} > 10000$ r/min grid step size is not more than 100 r/min;

c) Torque grid. the grid step length of peak output torque $T_{\max} \leq 2000$ N·m is not greater than $1\%T_{\max}$, peak output torque $T_{\max} > 2000$ N·m grid step length is not more than 20 N·m;

d) Area ratio calculation. separately count the grids inside and outside the contour; in particular, for the grid on the contour, if the efficiency is greater than 85% (within the contour) area is greater than or equal to 1/2 of the grid area, then the count is 1, otherwise the count is zero;

The number of grids divided by the grid number of all tested efficiency areas is the ratio of the efficient area.

references

[1] GB 755-2008 Rotating electrical machine rating and performance [2] GB/T 18488.1-2015 Drive motor system for electric vehicles Part 1: Technical conditions [3] GB/T 18488.2-2015 Drive motor systems for electric vehicles Part 2: Test methods