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GB/T 25123.3-2011 / IEC 60349-3:1995

**Electric traction - Rotating electrical machines for rail and
road vehicles - Part 3: Determination of the total losses of
convertor-fed alternating current motors by summation of
the component losses**

电力牵引轨道机车车辆和公路车辆用旋转电机 第3部分:用损耗总

和法确定变流器供电的交流电动机的总损耗

(IEC 60349-3:1995, IDT)

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Foreword

GB/T 25123 "Electric traction - Rotating electrical machines for rail and road vehicles" consists of the following parts:

- Part 1: Machines others than electronic convertor-fed alternating current motors;
- Part 2: Electronic convertor-fed alternating current motors;
- Part 3: Determination of the total losses of convertor-fed alternating current motors by summation of the component losses.

This Part is Part 3 of GB/T 25123.

This Part was drafted in accordance with the rules given in GB/T 1.1-2009.

This Part uses redrafting method to modify and adopt IEC 60349-3:1995 "Electric traction - Rotating electrical machines for rail and road vehicles - Part 3: Determination of the total losses of convertor-fed alternating current motors by summation of the component losses".

This Part made the following editorial changes:

- According to the requirements of GB/T 1.1-2009, the formula numbers (1)~(8) of IEC 60349-3:1995 are numbered as (A.1)~(A.9) in this Part. Add numbers to the formulas in 3.2.1.2 and Annex B;
- Correct the following errors in Table A.2 of the original text:
 - a) In the formula of item 15, "(1)/(7)" in the original text is changed to "1/(7)";
 - b) In the formula of item 19, "(17)-(18)" in the original text is changed to "(17)+(18)";
 - c) In the formula of item 24, "(23)/(2)" in the original text is changed to "(23)+(2)";
 - d) In the formula of item 27, "(22)²" in the original text is changed to "(22)".

This Part was proposed by Ministry of Railways of the People's Republic of China.

This Part shall be under the jurisdiction of National Technical Committee on Traction Electrical Equipment and Systems of Standardization Administration of China (SAC/TC 278).

Main drafting organizations of this Part: Zhuzhou CSR Times Electric Co., Ltd.

The drafting organizations of this Part: CSR Zhuzhou Electric Co., Ltd. and Yongji Xinshisu Electric Co., Ltd.

Electric traction - Rotating electrical machines for rail and road vehicles - Part 3: Determination of the total losses of convertor-fed alternating current motors by summation of the component losses

1 Scope

This Part of GB/T 25123 applies to machines that comply with GB/T 25123.2.

The total losses of a convertor-fed motor may be determined by summation of the component losses derived from no-load and load tests. The total input power is the sum of the power at the fundamental frequency and at all other frequencies. In all practical cases the latter input includes the losses resulting from the voltage and current harmonics in the convertor supply by using suitable instrumentation it can be derived from measurement of the total and fundamental frequency power inputs when the machine is on load.

The losses supplied at the fundamental frequency cannot be measured directly and so are derived from measurement of the fundamental frequency load current and the fundamental frequency no-load power input.

2 Instrumentation

The extra loss due to operation on a convertor supply is obtained from the difference of the total and fundamental frequency power input on load.

The power inputs shall be measured simultaneously on each phase by a digital sampling instrument. Measurement on all three phases is preferred but the two wattmeter method is permissible as an alternative.

The total power is obtained from the product of voltage and current over a period of time and the fundamental power from a Fourier transform using the same sampling.

It is necessary to consider the accuracy of the whole instrument chain considering both amplification and phase shift errors over the desired frequency range. As the power factor of the harmonics is generally very low (less than 0.1 for voltage imposed asynchronous systems) particular attention is drawn to the need for minimum phase angle errors.

fully established by experience. Additional information may be obtained by carrying out a low power test described in Annex B.

3.2.1.3 Losses supplied at other than the fundamental frequency

The losses arising from the supply harmonics are the difference between the total and fundamental frequency power inputs to the motor when on load with the stator windings at approximately the temperature of reference.

NOTE: If the convertor is a voltage source type and its modulation pattern is independent of load, the difference may be measured on no-load.

3.2.2 Synchronous motors

3.2.2.1 No-load losses supplied at the fundamental frequency

The motor shall be driven on open circuit by a calibrated machine at the speed for which the losses are being determined and shall be excited by an independent source to generate the voltage shown on the specified characteristic at the same speed. The losses are equal to the mechanical power input to the motor shaft.

3.2.2.2 Load dependent losses supplied at the fundamental frequency

The fundamental frequency I^2R losses in the stator shall be calculated from the fundamental frequency current in each winding at the point for which the losses are being determined and from the measured resistance of the winding corrected to the temperature of reference.

Unless otherwise specified, the additional load losses shall be determined by driving the machine with the stator windings short-circuited at the speed of the point on the specified characteristic for which the losses are being determined. The excitation shall be adjusted to give the fundamental frequency stator winding currents for the same point. The losses shall be taken as the power supplied to the machine shaft less the sum of the total stator I^2R losses and the power supplied when the machine is driven unexcited at the same speed.

3.2.2.3 Losses supplied at other than the fundamental frequency

The losses arising from the supply harmonics are the difference between the total and fundamental frequency power inputs to the motor when on load with the windings at approximately the temperature of reference.

3.2.2.4 Loss in the excitation circuit

The loss in the excitation circuit shall be the product of the current in the winding and the total excitation voltage at the point for which the losses are being determined. The voltage shall be the value required to supply the excitation current with the winding at the temperature of reference. Account shall be taken of any ripple in the excitation

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