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GB/T 10068-2020 / IEC 60034-14:2018

Replacing GB/T 10068-2008

Mechanical Vibration of Certain Machines with Shaft Heights 56mm and Higher – Measurement, Evaluation and Limits of Vibration Severity

轴中心高为 56mm 及以上电机的机械振动 振动的测量、评定及限值

(IEC 60034-14:2018, Rotating Electrical Machines – Part 14: Mechanical
Vibration of Certain Machines with Shaft Heights 56mm and Higher –
Measurement, Evaluation and Limits of Vibration Severity, IDT)

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Foreword

This Standard was drafted as per the rules specified in GB/T 1.1-2009.

This Standard replaced GB/T 10068-2008 *Mechanical Vibration of Certain Machines with Shaft Heights 56 mm and Higher—Measurement Evaluation and Limits of Vibration Severity*. Compared with GB/T 10068-2008, this Standard has the major technical changes as follows besides the editorial modifications:

- Delete the measurement of vibration acceleration; the vibration intensity of the motor only needs to measure the vibration displacement and vibration speed (see 4.2 of 2008 Edition);
- Modify the definition of "free suspension" (see 6.2 of this Edition; 6.2 of 2008 Edition);
- Change the maximum vibration speed measured on the foot of the rigid installation not exceeding 25% of the measured vibration speed of the adjacent bearing into 30% (see 6.3.1.2 of this Edition; 6.3.1 of 2008 Edition);
- Add the second rigid installation method (see 6.3.1.3 of this Edition);
- Modify the measurement limits of vibration displacement and vibration speed (see Table 1 of this Edition; Table 1 of 2008 Edition);
- Motors with a shaft center height of 132 and below do not consider rigid installation (see Table 1 of this Edition; Table 1 of 2008 Edition);
- Add the vibration limit diagram (see Figure 7 of this Edition).

This Standard adopts the translation method to equivalently use IEC 60034-14:2018 *Rotating Electrical Machines – Part 14: Mechanical Vibration of Certain Machines with Shaft Heights 56mm and Higher – Measurement, Evaluation and Limits of Vibration Severity*.

The Chinese documents that have consistent correspondence with the international documents quoted in the Normative References of this Standard are as follows:

- GB/T 755-2019 Rotating Electrical Machines - Rating and Performance (IEC 60034-1:2017, IDT);
- GB/T 997-2008 Rotating Electrical Machines—Classification of Types of Construction, Mounting Arrangements and Terminal Box Position (IM Code) (IEC 60034-7:2001, IDT);
- GB/T 9239.32-2017 Mechanical Vibration - Rotor Balancing - Part 32: Shaft and

Mechanical Vibration of Certain Machines with Shaft Heights 56mm and Higher – Measurement, Evaluation and Limits of Vibration Severity

1 Scope

This Standard specifies the factory acceptance vibration test procedures and vibration limits for certain electrical machines under specified conditions, when uncoupled from any load or prime mover.

This Standard is applicable to DC and three-phase AC machines, with shaft heights 56 mm and higher and a rated output up to 50 MW, at operational speeds from 120 r/min–~15000 r/min.

This Standard is not applicable to machines mounted in situ (on site), three-phase commutator motors, single-phase machines, three-phase machines operated on single-phase systems, vertical waterpower generators, turbine generators greater than 20 MW and machines with magnetic bearings or series-wound machines.

NOTE: For machines measured in situ, refer to current editions of ISO 20816, ISO 10816 and ISO 7919.

2 Normative References

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this document.

IEC 60034-1 Rotating Electrical Machines – Part 1: Rating and Performance

IEC 60034-7 Rotating Electrical Machines – Part 7: Classification of Types of Constructions and Mounting Arrangements (IM Code)

ISO 2954 Mechanical Vibration of Rotating and Reciprocating Machinery – Requirements for Instruments for Measuring Vibration Severity

ISO 10817-1 Rotating Shaft Vibration Measuring Systems – Part 1: Relative and

NOTE: Large AC induction machines running at very low slip values at no load may require several minutes to more than 10min for such measurements to be completed at each vibration measuring position.

4.3 Relative shaft vibration

The criterion adopted for the relative shaft vibration shall be the vibratory displacement S_{p-p} in the direction of measurement from ISO 20816-1.

5 Measurement Equipment

The measurement equipment shall be capable of measuring the effective value of vibration with flat response over a frequency range of 10Hz ~ 1000Hz, in accordance with the requirements of ISO 2954. However, for machines with speeds approaching or below 600r/min, the lower limit of the flat response frequency range shall be no greater than 2Hz.

Measurement equipment for relative shaft vibration shall meet the requirements in ISO 10817-1.

Multi-directional vibration sensors shall not be used.

NOTE: Multi-directional sensors do not provide proper vibration measurement in all directions when mounted in only one location.

6 Machine Mounting

6.1 General

The vibration of an electrical machine is closely linked with the mounting of the machine. To permit evaluation as far as balance and vibration of rotating electrical machines are concerned, it is necessary to measure the vibration on the machine alone, under properly determined test conditions, to enable reproducible tests to be carried out and to provide comparable measurements.

6.2 Free suspension

This condition is achieved by suspending the machine on a spring or by mounting on an elastic support (springs, rubber pads, etc.).

The highest natural oscillation frequency (f_{no}) of the free suspension system and machine, shall be less than 1/3 of the frequency (f_1) corresponding to the speed of the machine under test, as defined in 7.3. Based on the mass of the machine being tested, the relationship between elastic displacement and rated speed of the suspension

maximum velocity, which is measured at the adjacent bearing housing in the same measurement direction. The ratio of foot to bearing vibration velocities is valid for the electrical line frequency component or twice electrical line frequency component (if the latter is required to be measured).

NOTE 1: The rigidity of a foundation is a relative quantity. It is compared with the rigidity of the machine bearing system. The ratio of bearing housing vibration to foundation vibration is a characteristic quantity for the evaluation of foundation flexibility.

NOTE 2: If the machine is to be supported in the field by a structure other than a massive foundation, it may be necessary to perform a system dynamic analysis to make the necessary changes to the foundation dynamic stiffness.

6.3.1.3 Rigid mounting on test floor stand

The resonant frequency of the motor installed on a rigid ground must reach the mandatory frequency condition of 6.3.1.1.

NOTE: This mounting is the most used in manufacturers test labs.

6.3.2 Horizontal machines

During the test, the motor shall be installed on the foundation with bolts or clamping devices at all screw holes according to the requirements of 6.3.1.1 or 6.3.1.2.

There are constructions and mountings in which the above fixing conditions cannot be met, such as single-bearing machines. In those cases, there should be an agreement between the supplier and user.

6.3.3 Vertical machines

The vertical machine should be placed on a solid rectangular or round steel plate, which corresponds to the central drilling of the motor shaft extension, with a processed plane that matches the flange of the tested motor, and taps the threaded hole to connect the flange bolt. The steel plate thickness shall be at least three times greater than that of the machine flange, five times is recommended. The edge length respective to the diameter shall be at least equal to the height of the top bearing, L , from the bearing. Figure 5 gives an example for machine installation code of IM V1 (see IEC 60034-7).

The steel base shall be clamped tightly and installed firmly on a solid foundation, so that meet the requirements to 6.3.1.1 or 6.3.1.2. The flange connection shall use the proper number of fasteners or clamps. If the above method of mounting is not reasonable, the agreement shall be made between the supplier and the user.

6.4 Active environment determination

For machines that are bi-directional, the vibration limits apply for both directions of rotation, but need to be measured in only one direction.

7.4 Vibration transducer

The mounting of the transducer used for vibration measurement on the machine surface shall be as specified by the manufacturer of the transducer and shall not disturb the vibratory condition of the machine under test.

For this, it is necessary that the total coupled mass of the transducer assembly shall be less than 1/50 of the mass of the machine.

8 Limits of Bearing Housing Vibration

8.1 Limits of vibration magnitude

The limits apply to the measured effective vibration velocity and displacement in the frequency range specified in Clause 5.

The vibration magnitude for DC and three phase AC machines with shaft heights 56 mm and higher, for one of either of the two mounting conditions according to Clause 6, shall not exceed the limits specified in Table 1. Limits are given for two vibration grades. When no grade is specified, machines complying with this Standard shall be grade A.

For routine tests of standard machines with rotational speeds less than 600r/min, only vibration displacement is only required to be measured. For rotational speeds at 600r/min ~15000r/min, vibration velocity is only required to be measured.

When the routine test is made with a free-suspension mounting condition, the type test should also include testing with rigid mounting. This is valid for the whole speed range of this Standard.

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