

Mechanical shock — Testing machines — Characteristics and performance

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National foreword

This British Standard is the UK implementation of ISO 8568:2007. It supersedes BS 7347:1990 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee GME/21, Mechanical vibration, shock and condition monitoring, to Subcommittee GME/21/2, Vibration and shock measuring instruments and testing equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8568 was prepared by Technical Committee ISO/TC 108, *Mechanical vibration, shock and condition monitoring*, Subcommittee SC 6, *Vibration and shock generating systems*.

This second edition cancels and replaces the first edition (ISO 8568:1989), which has been technically revised.

Mechanical shock — Testing machines — Characteristics and performance

1 Scope

This International Standard specifies performance parameters and methods of inspection of mechanical shock-testing machines and gives guidelines for describing their characteristics. It is intended to ensure that the potential user of a particular shock-testing machine is provided with an adequate description of the characteristics of the machine, and also to give guidance on the selection of such machines.

This International Standard is applicable to the shock-testing machines that are used for demonstrating or evaluating the effect of shock conditions representative of the service environment in accordance with the relevant part of IEC 60068 and also for diagnostic testing. The purpose of the shock test is to reveal mechanical weakness and/or degradation in specified performance. It can also be used to determine the structural integrity of a test specimen or as a means of quality control.

Machines used for simulation of earthquakes, sonic booms, explosions and implosions, bursting tests, metalworking, forming, etc. are not covered in this International Standard.

Several techniques for generating the desired shock motion are discussed. Both simple-pulse and complex transients can be produced. The simulation of transients can be achieved by control of the test with a specified shock-response spectrum.

NOTE 1 Annex A gives a description of pulse-shaping devices. Annex B defines methods of application of the shock response spectra. Annex C considers a method of evaluating the possibility of using a vibration generator for producing a shock pulse. Annexes D and E deal with the methods of measurement of some characteristics in inspection methods (or procedures) of shock-testing machines.

NOTE 2 Characteristics of vibration-generating equipment are covered in ISO 5344, ISO 6070 and ISO 8626.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2041:1990, *Vibration and shock — Vocabulary*

ISO 5347 (all parts), *Methods for the calibration of vibration and shock pick-ups*

ISO 5348, *Mechanical vibration and shock — Mechanical mounting of accelerometers*

ISO 15261, *Vibration and shock generating systems — Vocabulary*

ISO 16063 (all parts), *Methods for the calibration of vibration and shock transducers*

IEC 60068-1:1988, *Environmental testing — Part 1: General and guidance*

IEC 60068-2-27:1987, *Environmental testing — Part 2: Tests — Test Ea and guidance: Shock*

IEC 60068-2-81, *Environmental testing — Part 2-81: Tests — Test Ei: Shock — Shock response spectrum synthesis*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041, ISO 15261 and the following apply.

3.1 check point

fixing point nearest to the centre of the table surface of the shock-testing machine, unless there is a fixing point having a more rigid connection to the table, in which case the latter point is used

3.2 nominal load

maximum load used for the testing of a shock-testing machine as specified by the manufacturer

3.3 shock-testing machine

device for subjecting a system to controlled and reproducible mechanical shock

[ISO 2041:1990, 3.23]

NOTE Shock-testing machines can be classified as specially designed shock generators, gravity and powered, and vibration generators of electrodynamic and servo-hydraulic types used in a shock mode.

4 Performance

4.1 General

The performance of a shock-testing machine is based on a relatively slow accumulation of energy used to reproduce a shock, and its consequent discharge in an energy-transducing device for a short period of time.

The energy needed to create a shock may be achieved by the work against gravity (in free-fall machines) or, if the shock is in a direction other than upwards or if the free-fall machine does not provide enough velocity change, the necessary potential energy may be supplied by elastic cords, springs or hydraulic and pneumatic means.

The shock can also be achieved by releasing compressed gas, by explosives or by transfer of momentum from one moving mass to another.

4.2 Operation principles

According to the principle used, shock-testing machines are classified as free-fall or accelerated shock-testing machines, or as gas guns or explosive guns, hydraulic and pneumatic, as well as servo-hydraulic and electrodynamic.

The shock pulse (either a single-pulse or a transient vibration) is produced by a shock pulse-shaping device mounted on the table or carriage, on the reaction mass, or on both. A wide selection of pulse shapes can be produced depending on how the kinetic energy is transferred by pulse-shaping devices. Annex A gives some guidelines on the selection of pulse-shaping devices.

Pulse-shaping devices can be used in a rebounding or non-rebounding mode. Usually the device that attaches the test specimen is initially accelerated and a shock is produced during the rebound of the test specimen. Sometimes (for large masses or when the acceleration of the test specimen during shock pre-history is undesirable) a reaction mass or a hammer can be initially accelerated and the shock is produced as a result of the impact between the reaction mass and the device that attaches the test specimen. This mode is classified as non-rebounding.

As an alternative to the shaping of the shock pulse, for electrodynamic or servo-hydraulic vibration generators, a shock-response spectrum of the impulse to be applied to the specimen may be shaped to be similar to the required shock-response spectrum.

When the test specification requires some tolerance for a test shock-response spectrum (e.g. +3 dB, -1,5 dB), electrodynamic and servo-hydraulic test equipment for generating vibration may also be used for shock testing. These machines can generate classical shock waveforms (half-sine, trapezoidal, saw-tooth, etc.) as well as arbitrary waveforms which have the required shock-response spectra, and are usually produced by means of digital control, but generally have limited velocity and displacement capability. A method for maintaining the above limitations is briefly treated in Annex C. Characteristics of vibration-generating equipment are covered in ISO 5344, ISO 6070 and ISO 8626.

4.3 Test types

4.3.1 Shock pulse generation

Classical shock pulse shapes in accordance with IEC 60068-2-27 are generated with additional pre-pulse and post-pulse shaping to limit velocity and displacement. The amplitude of the pre-pulse and post-pulse shapes is limited to a small fraction of the primary pulse amplitude.

4.3.2 Shock-response spectrum generation

A brief, low-level oscillatory transient impulse is typically applied to the specimen. The shock-response spectrum is measured, compared with the desired shock-response spectrum, and the difference used to modify the shape of the next impulse. Typically, this process is repeated several times until the desired shock spectrum is achieved, and then an input transient impulse of the desired level is applied to the specimen. The desired shock spectrum may be either standardized (i.e. one of the shock spectra of Annex B) or the shock spectrum of a field environment.

4.4 Shock-testing machine components

A shock-testing machine consists of the following:

- a) a rigid table or carriage with means of attaching test specimens and shock pulse-shaping devices;
- b) a set of guides that controls the movement of the carriage;
- c) a means for storing the potential energy necessary for imparting the shock, such as provisions for hoisting or preloading springs and cords attached to the carriage;
- d) a means for securing the carriage at a selected drop height or position, prior to initiation of the shock pulse;
- e) a release mechanism;
- f) a reaction mass or base upon which the carriage impacts;
- g) a pulse-shaping and rebound braking system, or means to generate and control the shock spectra;
- h) control equipment;
- i) shock-measuring system;
- j) auxiliary power, cooling and other equipment, as required.