

Guide for

Characteristics and performance of mechanical shock testing machines

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the General Mechanical Engineering Standards Policy Committee (GME/-) to Technical Committee GME/21, upon which the following bodies were represented:

- British Coal
- Department of Trade and Industry (National Engineering Laboratory)
- Electricity Supply Industry in England and Wales
- Engineering Equipment and Materials Users Association
- Engineering Integrity
- Institute of Sound and Vibration Research
- Institution of Electronic and Radio Engineers
- Institution of Mechanical Engineers
- Lloyds Register of Shipping
- Ministry of Defence
- Motor Industry Research Association
- Power Generation Contractors Association (BEAMA Ltd.)
- Society of British Aerospace Companies Ltd.
- Society of Environmental Engineers
- Society of Motor Manufacturers and Traders Limited

This British Standard, having been prepared under the direction of the General Mechanical Engineering Standards Policy Committee, was published under the authority of the Board of BSI and comes into effect on 31 July 1990

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National foreword

This British Standard has been prepared under the direction of the General Mechanical Engineering Standards Policy Committee. It is identical with ISO 8568:1989 “*Mechanical shock — Testing machines — Characteristics and performance*”, which was prepared by Technical Committee ISO/TC 108, Mechanical vibration and shock, of the International Organization for Standardization (ISO) and in the development of which the United Kingdom played an active part.

Cross-references

International Standard	Corresponding British Standard
ISO 5344:1980	BS 6140 <i>Test equipment for generating vibration</i> Part 1:1981 <i>Methods of describing characteristics of electrodynamic test equipment for generating vibration</i> (Identical)
ISO 6070:1981	Part 2:1982 <i>Methods of describing characteristics of auxiliary tables for test equipment for generating vibration</i> (Identical)
ISO 8626:1989	BS 7285:1990 <i>Method for describing characteristics of servo-hydraulic test equipment for generating vibration</i> (Identical)
IEC 68-1:1982 ^a	BS 2011 <i>Basic environmental testing procedures</i> Part 1.1:1983 <i>General and guidance</i> (Identical)
IEC 68-2-27:1987	Part 2.1 Ea:1988 <i>Shock</i> (Identical)

^a A 1988 edition of this standard has now been published.

The Technical Committee has reviewed the provisions of ISO 2041, to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This International Standard provides guidance covering the characteristics and performance parameters of shock-testing machines. It is intended to ensure that the potential user of a particular shock machine is provided with an adequate description of the characteristics of the machine and to give guidance for the selection of such machines.

The shock-testing machines considered in this International Standard are only those used for diagnostic testing and for demonstrating or evaluating the effect of shock conditions representative of the service environment. Machines used for metal working, forming, etc., are excluded. Several techniques for generating the desired shock motion are discussed.

Machines and methods used to provide empirical service shock conditions are not covered in this International Standard.

Environmental shock test requirements frequently occur in conjunction with vibration test requirements. Vibration generators can be used when frequency, velocity change and displacement requirements for the specified shock are within the capabilities of the machine. Both simple-pulse and complex transients may be produced. The simulation of transients can be achieved by control of the test with a specified shock spectrum. Making use of test equipment and fixtures already on hand or justified for vibration testing alone has obvious economic advantages for environmental test laboratories. Characteristics of vibration-generating units are covered in ISO 5344, ISO 6070 and ISO 8626.

NOTE Annex A gives information on pulse-shaping devices. Annex B defines the shock response spectra and pulse shape of the initial sawtooth pulse.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards. ISO 2041:1975, *Mechanical vibration and shock — Vocabulary*.

IEC 68-1:1982, *Basic environmental testing procedures — Part 1: General and guidance*.

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 2041 apply.

NOTE For the purposes of this International Standard, the term “machine” is intended to include the physical assembly that generates the shock and applies it to the test specimen, as well as all auxiliary power, cooling, control, pulse shaping, and monitoring equipment necessary to form a complete system.

4 Shock-testing machines

Shock-testing machines are usually described according to the way in which the test is activated or the principle used, for example free-fall (gravity-activated), or accelerated shock-testing machines or gas gun, explosive gun, hydraulic and pneumatically driven shock-testing machines. Electrodynamic and servo-hydraulic test equipment for generating vibration is also used for shock testing. These machines have limited velocity and displacement capability. Since the techniques used to stay within these velocity and displacement limits are not yet standardized, these machines are treated only briefly in this International Standard.

Two types of shock test are common:

- a) **Shock pulse reproduction:** The classic shock pulse shapes 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 are limited to a small fraction of the primary pulse amplitude.
- b) **Shock response spectra reproduction:** A brief oscillatory transient impulse is 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. The desired shock spectrum may be either one of the shock spectra of Annex B or the shock spectrum of a field environment. Typically the input transient impulse is generated as the sum of a large number of impulse shapes, each with a zero net displacement and velocity change, but with different frequency spectra.

4.1 General

The energy needed to create a shock may be achieved by gravity (free-fall) or, if the shock has to be in a direction other than downwards 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.