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Basic environmental testing procedures

Part 2: Tests

Test Ed: Free fall

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 mécanique  
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 (CEI 68-2-32 : 1975 + A1 : 1982 + A2 : 1990)

Grundlegende Umweltprüfverfahren  
 Teil 2: Prüfungen  
 Prüfung Ed: Frei Fallen  
 (IEC 68-2-32 : 1975 + A1 : 1982 + A2 : 1990)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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**CENELEC**

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### Foreword

At the request of CENELEC Reporting Secretariat, HD 323.2.32 S2 : 1991 (IEC 68-2-32 : 1975 + A2 : 1990 – incorporating A1 : 1982) was submitted to the CENELEC voting procedure for conversion into a European Standard.

The text of the International Standard and its amendments was approved by CENELEC as EN 60068-2-32 on 9 March 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-04-01
- date of withdrawal of conflicting national standards (dow) –

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## INTRODUCTION

This test is divided into two procedures. The first simulates falls which a specimen, normally in the unpacked state, could undergo during handling and is normally restricted to two falls from a prescribed attitude onto a specified surface from a specified height.

The second procedure simulates repeated falls which may occur to such devices as connectors or small remote control units which are normally attached to cables during use. Repeated falls onto a specified surface from a specified height are achieved by using a suitable apparatus, e.g. a tumbling (rotating) barrel.

### Procedure 1 — Free fall

#### 1. Object

To assess the effects on a specimen of simple standard tests intended to be representative of the fall likely to be experienced during rough handling, or to demonstrate a minimum degree of robustness, for the purpose of assessing safety requirements.

This test is primarily intended for specimens not in their packing and for items in their transport case when the latter may be considered as part of the specimen itself.

#### 2. Test conditions

##### 2.1 Test surface

The test surface shall be a smooth, hard, rigid surface of concrete or steel. Where necessary, other surfaces may be prescribed in the relevant specification.

##### 2.2 Height of fall

The height shall be measured from the part of the specimen nearest to the test surface, when the specimen is suspended prior to letting it fall.

##### 2.3 Method of release

The method of releasing the specimen shall be such as to allow free fall from the position of suspension, with a minimum of disturbance at the moment of release.

#### 3. Severities

The height of fall shall be taken from the following series:

25 mm, 50 mm, **100 mm**, 250 mm, **500 mm**, **1 000 mm**

The values in bold type are preferred values.

*Note.* — It may not be appropriate for heavy equipment to be subjected to the higher severities.

**BS 2011 : Part 2.1Ed : 1992**

**4. Initial measurements**

The specimen shall be visually examined and electrically and mechanically checked, as required by the relevant specification.

**5. Conditioning**

5.1 The specimen in its normal attitudes in carrying or use, as prescribed in the relevant specification, shall be allowed to fall freely.

5.2 Unless otherwise prescribed in the relevant specification, the specimen shall be subjected to two falls from each prescribed attitude.

**6. Final measurements**

The specimen shall be visually examined and electrically and mechanically checked, as required by the relevant specification.

**7. Information to be included in the relevant specification**

When the test (Procedure 1) is included in the relevant specification, the following details shall be given as far as they are applicable:

	Clause or Sub-clause
a) Test surface if other than concrete or steel	2.1
b) Height of fall	3
c) Initial measurements	4
d) Attitude from which the specimen is dropped	5.1
e) Number of falls, if other than two	5.2
f) Final measurements	6

**Procedure 2 — Free fall — Repeated**

**8. Object**

This procedure is primarily intended for testing cable-connected devices such as connectors and small remote control units where the apparatus may be dropped frequently onto hard surfaces.

**9. Description of the test**

Each specimen is tested individually, and to simulate practical conditions a length of cable is normally attached to the specimen during the test, which consists of subjecting the specimen to a prescribed number of falls from a specified height onto a hard surface. The effect of the test is checked in relation to the changes, if any, in the mechanical and electrical parameters of the specimen.

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## 10. Description of test apparatus

The apparatus shall be such that the prescribed number of falls from the specified height may be applied to individual specimens in accordance with the requirements of the relevant specification. Appendix A describes one suitable form of apparatus employing a rotating barrel.

## 11. Severities

### 11.1 Number of falls

The number of falls selected from the list given below should be related to the intended usage of the item.

The total number of falls shall be as prescribed in the relevant specification and shall be taken from the following series:

50, 100, 200, 500, 1 000

### 11.2 Height of fall

The height of fall shall be 500 mm.

### 11.3 Rate of falls

The rate of falls shall be approximately ten falls per min.

### 11.4 Test surface

The specimen shall fall on a smooth, hard, rigid test surface which, unless otherwise prescribed by the relevant specification, shall be of steel of 3 mm thickness backed by wood of between 10 mm and 19 mm thickness.

## 12. Initial measurements

The specimen shall be visually examined and electrically and mechanically checked as prescribed in the relevant specification.

## 13. Conditioning

The specimen shall be placed in the test apparatus and subjected to the prescribed number of falls. Where the specimen is normally attached to a cable, the relevant specification should state the type of cable to be used. A free length of 100 mm of cable shall remain connected to the specimen during the test, unless otherwise prescribed in the relevant specification.

## 14. Final measurements

The relevant specification shall prescribe the criteria upon which the acceptance or rejection of the specimen is to be based.

The specimen shall be visually examined and electrically and mechanically checked as prescribed in the relevant specification.

15. Information to be included in the relevant specification

When the test (Procedure 2) is included in the relevant specification, the following details must be given as far as they are applicable:

	Clause or Sub-clause
a) Initial measurements	12
b) Number of falls	11.1
c) Final measurements	14
d) Type of cable to be attached	13

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## APPENDIX A

- A1. One suitable form of apparatus for the repeated free fall test of Procedure 2 is based on a barrel which rotates and causes a free fall combined with a tumbling motion of the specimen. Where a large number of specimens has to be tested, the barrel may contain a number of sections, one specimen being placed in each section so that simultaneous testing may be carried out.
- A2. The width of each section,  $W$ , is not specified but should preferably be between 200 mm and 300 mm, depending on the size of the specimen.
- A3. The dimensions of the barrel are given in Figure A1. The smooth rigid steel test surface at each end, 3 mm in thickness, is backed by wood of between 10 mm and 19 mm thickness (see also Sub-clause 11.4).

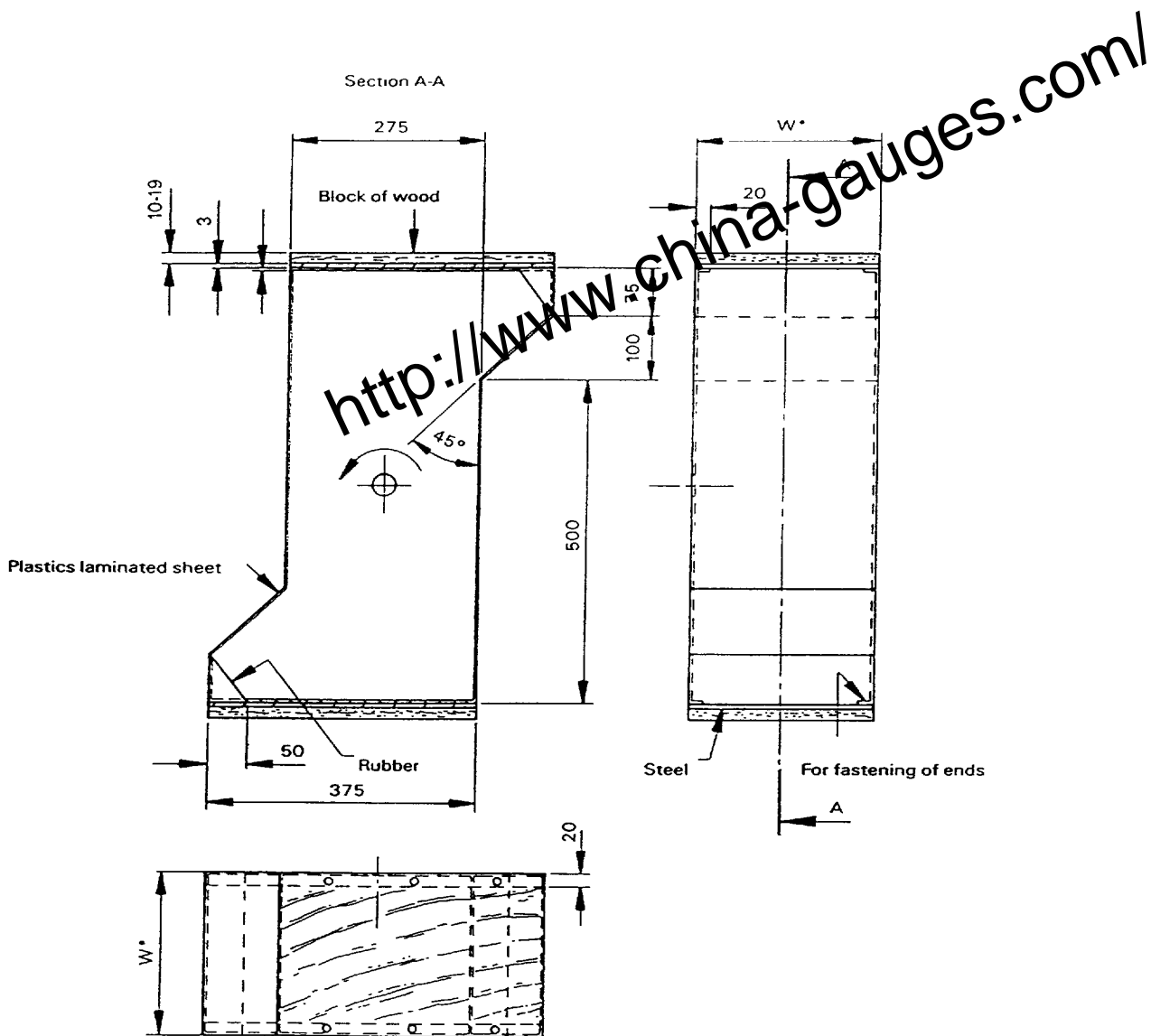
Each compartment in which the specimen rests between falls is backed by a wedge-shaped piece made of chip-resistant rubber with a hardness of  $80 \pm 20$  IRHD, as defined in ISO Standard 48\*, and the sliding surfaces of that same compartment are made of smooth, hard plastics laminated sheet.

The rotating barrel is designed so that the shaft does not protrude into the interior.

The rotating barrel is provided with an aperture with a lid which may be made of transparent acrylic material.

\* ISO Standard 48 (1979): Vulcanized rubbers – Determination of hardness (Hardness between 30 and 85 IRHD)





\* For the value of W, see Clause A2

Nominal dimensions in millimetres

The body of the rotating barrel is of steel sheet of 1,5 mm thickness.

FIG. A1. Rotating (or tumbling) barrel.

APPENDIX B

GUIDANCE

B1. Object

The free fall test is applicable to specimens which during transportation, handling or repair work are liable to be dropped from the means of transport or from a work surface. The test is not applicable to very heavy specimens or those of large dimensions, for example large power transformers.

B2. Related tests

- Test Ea: Shock  
(IEC Publication 68-2-27) – simulates the effects of non-repetitive shocks likely to be encountered by equipment and components during transportation or operation.
- Test Eb: Bump  
(IEC Publication 68-2-29) – simulates the effects of repetitive shocks likely to be experienced by equipment and components during transportation or when installed in various classes of vehicle.
- Test Ec: Drop and topple  
(IEC Publication 68-2-31) – is a simple test intended to assess the effects of knocks or jolts likely to be received primarily by equipment-type specimens during repair work or rough handling on a table or bench.
- Test Ed: Free fall repeated  
(IEC Publication 68-2-32, procedure 2) – also simulates repetitive shocks likely to be received by certain component-type specimens, for example connectors in service.
- Test Ee. Bounce  
(under consideration) – is intended to simulate the random shock conditions experienced by specimens which may be carried as loose cargo in wheeled vehicles travelling over irregular surfaces.

Shock and bump tests are performed on the specimen when fixed to the test machine. Drop and topple, free fall, repeated free fall and bounce tests are performed with the specimen free.

B3. Selection of test severities (IEC Publication 68-2-32, Clauses 3 and 7, Items a), b), d) and e))

The specification writer intending to prescribe this test should refer to Clause 7 of IEC Publication 68-2-32 to ensure that all such information is included in the relevant specification.

Where possible, the test severity applied to the specimen should be related to the expected handling and transport conditions to which the specimen will be subjected. However, it is neither realistic nor economical to expect all specimens to survive the most severe mishandling which can be encountered in service, for example dropping from an aircraft loading platform or from a crane. For tests on specimens where it is required to demonstrate serviceability, the height of fall should be selected taking into account the risk of occurrence, the tolerable level of damage and the conditions of operational use, transportation and storage.

The appropriate severity, selected from Clause 3 and IEC Publication 68-2-32, should be related to the mass of the specimen, the type of handling and transport, and whether the Test is to be applied to unpacked specimens such as sub-assemblies, components, non-portable equipment, or transportable items which are housed in integral transport cases.

In the absence of precise information on these aspects, a suitable severity should be selected by the specification writer from Table I which lists examples of severities appropriate to various transport or handling conditions.

TABLE I

*Examples of test severities typically employed*

This table is not mandatory, but lists severities which are typical. It should be borne in mind that there will be instances where the actual severities experienced in handling differ from those shown in the table.

Height of fall (mm)	Specimen mass		Example of unpacked specimen	Type of handling
	Unpacked (kg)	In integral transport cases (kg)		
25	>100 ≤ 250	> 500	Cubicles	* Fork lift trucks
50	>50 ≤ 100	≤ 500	Cabinets	* Fork lift trucks
100	> 10 ≤ 50	≤ 200	Switchboards	* Cranes
250	> 5 ≤ 10	≤ 100	Portable cases	Storage, stacking
500	> 2 ≤ 5	≤ 50	Small items	Fall from conveyor belts
1000	≤ 2	≤ 20	Components, small assemblies	Fall from work benches or tail board of truck

\* This is intended to simulate the impact when lowered to the loading level by a fork lift truck or crane, not dropping from the platform of the truck or sling of the crane

**Publication(s) referred to**

See national foreword.

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