INTERNATIONAL STANDARD 946

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Grey cast iron — Beam unnotched impact test

Fonte grise — Essai de choc sur éprouvette non entaillée

First edition — 1975-11-01

UDC 669.131.6 : 620.178.742

Ref. No. ISO 946-1975 (E)

Descriptors : cast iron, grey iron, tests, impact tests.

Price based on 3 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 25 has reviewed ISO Recommendation R 946 and found it technically suitable for transformation. International Standard ISO 946 therefore replaces ISO Recommendation R 946-1969 to which it is technically identical.

ISO Recommendation R 946 was approved by the Member Bodies of the following countries :

Belgium	India	Romania
Brazil	Ireland	South Africa, Rep. of
Canada	Israel	Sweden
Chile	Italy	Switzerland
Egypt, Arab Rep. of	Korea, Rep. of	Thailand
Finland	Netherlands	Turkey
France	Norway	United Kingdom
Germany	Poland	Yugoslavia
Greece	Portugal	

The Member Body of the following country expressed disapproval of the Recommendation on technical grounds :

Czechoslovakia

The Member Bodies of the following countries disapproved the transformation of ISO/R 946 into an International Standard :

Czechoslovakia
Switzerland

Printed in Switzerland

Grey cast iron — Beam unnotched impact test

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies requirements for the determination of the impact strength of grey cast iron containing graphite in flake form.

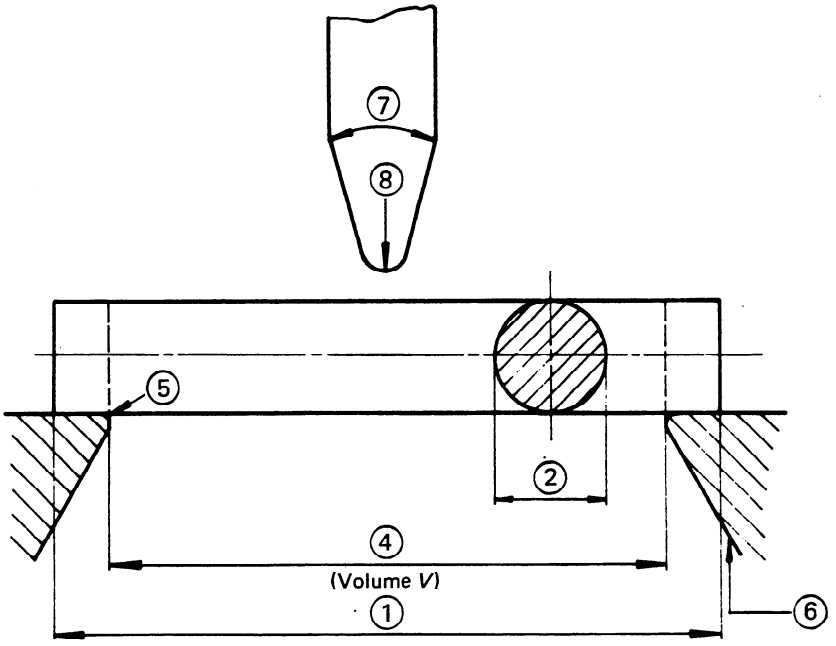
2 PRINCIPLE

2.1 The test consists in breaking, by a single blow from a swinging hammer, a series of unnotched machined cylindrical test pieces resting freely between supports, and measuring the difference between the kinetic energy of the hammer immediately before fracture and its residual energy after the fracture of the test piece.

2.2 The impact strength of the grey cast iron is the apparent energy absorbed in fracture denoted by the symbol *KG*, and is expressed in joules (see also annex A).

3 SYMBOLS AND DESIGNATIONS

Number	Symbol	Designation
1	l	Length of test piece
2	d	Diameter of test piece
3	E_p	Initial potential energy of testing machine
4	L	Distance between supports
5	—	Radius of curvature of supports
6	—	Taper of supports
7	—	Angle at tip of hammer
8	—	Radius of curvature of hammer
9	v	Speed of hammer at instant of striking
10	KG	Apparent energy absorbed in fracture



4 MACHINED STANDARD TEST PIECES

4.1 The test bars shall be cast as cylindrical bars having a diameter of

$$30\ ^{+2}_{0}\ \text{mm}$$

and a *minimum* length of 150 mm.

4.2 The machined standard test piece shall have the dimensions shown in table 1. The test piece shall be well machined with a good surface finish.

TABLE 1 — **Dimensions of test pieces**

Designation	Nominal dimension mm	Machining tolerance mm
Length of test piece, *l*	120	± 2
Diameter of test piece, *d*	20	± 0,2

5 METHOD OF CASTING TEST BARS

5.1 The test bars shall be cast separately in sand moulds and the structure shall be entirely grey.

5.2 Each bar shall be separated from its neighbour or any other casting in the same mould by not less than 50 mm.

5.3 The test bars shall be cast from the same metal as that used for the castings they represent. Precautions shall be taken to ensure sound test bars.

5.4 The test bars shall not be removed from the mould as long as the temperature is above 500 °C.

5.5 If any test piece shows defective machining or obvious lack of continuity in the metal, it shall be discarded and replaced by another test piece.

5.6 If the castings represented are heat-treated, the test bars shall be heat-treated at the same time and under the same conditions as the castings.

6 TESTING MACHINE

6.1 The testing machine shall be constructed and installed steady and rigid.

6.2 The conditions shown in table 2 shall be satisfied.

6.3 The plane of swing of the hammer shall be vertical. The machine shall be constructed so that the loss of energy (such as from translation, rotation or vibration) in the machine framework during a test is negligible.

6.4 The height of the centre of percussion above the point of impact of the hammer shall be 3 ± 3 mm.

TABLE 2 — **Characteristics of testing machine**

Designation	Nominal values and tolerances
Initial potential energy of testing machine, E_p	50 ± 2 J
Distance between supports, *L*	$100\ ^{+0,5}_{0}$ mm
Radius of curvature of supports	1 to 1,5 mm
Taper of supports	1 : 5
Angle at tip of hammer	30 ± 1°
Radius of curvature of hammer	2 to 2,5 mm
Speed of hammer at instant of striking, *v*	3,6 to 4,2 m/s

6.5 The accuracy of the graduation of the scale of the machine shall be ± 0,5 % of the maximum striking energy of the machine.

7 TEST REQUIREMENTS

7.1 The test piece shall lie squarely against the supports with the plane of symmetry of the hammer midway between them (see the figure).

7.2 The test shall be carried out at a temperature between 10 and 30 °C.

8 METHOD OF TESTING

8.1 An impact test shall consist of the fracture of at least four test pieces (see annex B).

8.2 After the four test pieces have been broken under the conditions described above, the arithmetical average $\overline{KG}$ of the values obtained and the difference ΔKG between the greatest and the least shall be calculated.

8.3 If ΔKG is not more than 0,4 $\overline{KG}$, the impact strength shall be expressed as $\overline{KG}$.

8.4 If ΔKG is greater than 0,4 $\overline{KG}$, the test shall be repeated with a fifth test piece which has been held in reserve. The arithmetical average $\overline{KG}'$ of the values obtained and the difference $\Delta KG'$ between the greatest and the least shall be calculated.

8.5 If $\Delta KG'$ is not more than 0,5 $\overline{KG}'$, the impact strength shall be expressed as KG'.

8.6 If $\Delta KG'$ is greater than 0,5 $\overline{KG}'$, the test shall not be considered significant enough to give an acceptable estimate of KG.

8.7 The test shall also be discarded if obvious flaws on the surface or on the broken face of certain test pieces have made it impossible to obtain the required number of values.

ANNEX A

CALCULATION OF IMPACT MODULUS FOR NON-STANDARD TEST PIECES

If it is found necessary to carry out the impact test on test pieces not of the standard size specified in clause 4, it may be useful to calculate the "impact modulus" *MC*, i.e. the ratio $\frac{KG}{V}$, where *KG* is the apparent energy absorbed in fracture, expressed in this case in joules, and *V* is the volume of test piece between the supports, expressed in cubic centimetres.

It has been found that, within acceptable practical limits, for the same grade of iron (same material), the impact modulus is independent of the diameter of the machined test piece, if the following conditions are observed :

a) the test pieces are of proportional dimensions, $l = 6\,d$;

b) the distance between supports is proportional to the dimensions of the test piece, $L = 5\,d$;

c) the value of $\frac{KG}{E_p}$ remains above 0,4;

d) the diameter *d* is between 12 and 29 mm;

e) all the other conditions of test and particularly the velocity of impact *v* and the diameter of the original bar or the mass of the test piece remain unchanged.

In this case the impact modulus of the standard test piece ($d = 20$ mm) shall be calculated according to the formula

$$MC\ [\mathrm{J/cm^3}] = \frac{1}{10\,\pi}\,KG\ [\mathrm{J}]$$

ANNEX B

NOTE ON COEFFICIENTS FOR CALCULATION OF IMPACT STRENGTH

The terms of clause 8 were drawn up so that the coefficient of dispersion of the impact strength thus defined would be comparable with that for tensile strength determined on the rupture of a single test piece, under the conditions of ISO/R 185, *Classification of grey cast iron.*

The numerical coefficients introduced in the same clause were determined from the results of numerous tests carried out in various countries, using standard methods of statistical quality control.

This page intentionally left blank

This page intentionally left blank

This page intentionally left blank