Amendment No. 2
published and effective from 15 March 1995
to BS EN 131 : Part 1 : 1993

Ladders
Part 1. Specification for terms, types, functional sizes

Correction

Table 3. Functional sizes

In column three under the heading b_2, delete the existing text and substitute the following.

$b_1 + 0{,}15l_8 + 2t^{*)}$

9503—0.5k— BIR

METHODS FOR
NOTCHED BAR TESTS

Part 1.
The Izod Impact Test on Metals

B.S. 131 : Part 1 : 1961

Incorporating amendments issued September 1962 (PD 4651)
and March 1986 (AMD 5069)

CONFIRMED JANUARY 1982

BRITISH STANDARDS INSTITUTION

Incorporated by Royal Charter

2 PARK STREET, LONDON, W1A 2BS

Telex: 266934

Telephone: 01-629 9000

THIS BRITISH STANDARD, having been approved by the Mechanical Engineering Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 30th May, 1961.

First published August, 1920.
First revision, August, 1933.
Second revision, May, 1961.

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

In order to keep abreast of progress in the industries concerned, British Standards are subject to periodical review. Suggestions for improvements will be recorded and in due course brought to the notice of the committees charged with the revision of the standards to which they refer.

A complete list of British Standards, numbering over 9,000, fully indexed and with a note of the contents of each, will be found in the BSI Catalogue which may be purchased from BSI Sales Department. The Catalogue may be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standard:

B.S. 131 : Part 2. Charpy V-notch impact test on metals.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following B.S.I. references relate to the work on this standard:
Committee reference ISM/NFM/4
Draft for comment A(MEE) 9391.

CONTENTS

CO-OPERATING ORGANIZATIONS

The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

*Admiralty
Air Ministry
Associated Offices' Technical Committee
Association of Consulting Engineers (Incorporated)
British Chemical Plant Manufacturers' Association
British Compressed Air Society
*British Electrical and Allied Manufacturers' Association
British Engineers' Association
British Gear Manufacturers' Association
British Internal Combustion Engine Manufacturers' Association
*British Iron and Steel Federation
British Railways, the British Transport Commission
Crown Agents for Oversea Governments and Administrations
*D.S.I.R.—National Engineering Laboratory
Electricity Council, The Generating Board and the Area Boards in England and Wales
Engineering Equipment Users' Association
Gas Council
High Commission of India
Institute of Marine Engineers
Institute of Petroleum
Institution of Civil Engineers
Institution of Gas Engineers
Institution of Heating and Ventilating Engineers
*Institution of Mechanical Engineers
Institution of Mechanical Engineers (Automobile Division)
*Institution of Production Engineers
Locomotive and Allied Manufacturers' Association of Great Britain
Machine Tool Trades Association
Ministry of Labour (Factory Inspectorate)
Ministry of Power
Ministry of Transport
Ministry of Works
National Coal Board
*National Physical Laboratory (D.S.I.R.)
Radio Industry Council
*War Office

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the Committee entrusted with the preparation of this standard:

Alloy Steels Association
Aluminium Development Association
Aluminium Industry Council
Association of British Chemical Manufacturers
British Cast Iron Research Association
British Constructional Steelwork Association
British Iron and Steel Research Association
British Non-ferrous Metals Research Association
British Welding Research Association
Council of British Manufacturers of Petroleum Equipment
D.S.I.R.—Building Research Station
D.S.I.R.—Forest Products Laboratory
Institute of Welding
Institution of Engineering Inspection
Lloyd's Register of Shipping
Ministry of Aviation
Testing Houses
Testing Machine Manufacturers and Individual Firms

BRITISH STANDARD METHODS FOR

NOTCHED BAR TESTS

Part 1. The Izod Impact Test on Metals

FOREWORD

This British Standard which states the requirements for the Izod Impact Test on metals is published as Part 1 of a revision of B.S. 131. Part 2 previously published gives the requirements for the Charpy V-notch test.

The work of Technical Committee 17, ' Steel ', of the International Organization for Standardization (ISO) has been taken into account in preparing the standard and the square section and circular section straight notch test pieces are in accordance with ISO Recommendation R84. The scope has also been widened to include details of the method of test together with structural and dimensional requirements for testing machines.

Dimensions with appropriate machining tolerances are given for standard 10 mm square section and standard circular section test pieces. The use of the curved notch circular section test piece is not preferred, but at the request of the steel industry the form and dimensions of this test piece are given in an Appendix.

As altered Sept., 1962

After due consideration of the requirements of certain sections of industry for subsidiary test pieces of cross-section smaller than 10 mm × 10 mm, it has been decided to omit the two given in the 1933 revision of the standard, and to introduce in an appendix two new subsidiary test pieces having dimensions of 10 mm × 7·5 mm and 10 mm × 5 mm with the notch cut in a narrow face. These are intended for use only when it is impossible to obtain a standard test piece from the material available. It should be noted that no trustworthy relationship has been found between the energies absorbed in breaking test pieces of different sizes and only results of test pieces of identical dimensions should be compared.

In this standard no reference is made to the number of tests required for particular applications as this is regarded as part of the specification for the material.

It should also be noted that no reliable relationship has been found between different types of impact test, and conversions from Izod impact test results to Charpy-V-notch or Charpy U-notch values are not recommended.

METHOD OF TEST

SCOPE

1. This British Standard specifies the conditions for carrying out the Izod impact test on metals. The test consists of measuring the energy absorbed in breaking a notched test piece by one blow from a striker carried by a pendulum. The test piece is gripped vertically with the root of the notch in the same plane

as the upper face of the grips. The blow is struck on the same face as the notch and at a fixed height above it.

FORM AND DIMENSIONS OF TEST PIECE

2. The standard test pieces shall have dimensions and tolerances in accordance with Table 1 or Table 2 and shall conform to the appropriate figures as follows:

a. Test pieces with square section (10 mm × 10 mm).

Fig. 1. With single notch.
Fig. 2. With two notches.
Fig. 3. With three notches.

b. Test pieces with circular section (0·45 inch diameter).

Fig. 5. With single straight notch.
Fig. 6. With two straight notches.
Fig. 7. With three straight notches.

Where more than one notch is cut in a test piece the notches shall be spaced as shown in Table 1 or Table 2. The notches shall be cut around the test pieces as shown in Figs. 2, 3, 6 and 7 unless otherwise required by the material specification.

The plane of symmetry of the notch shall be perpendicular to the longitudinal axis of the test piece, i.e. the direction of the notch shall be at right angles to the longitudinal axis of the test piece and the plane of symmetry of the notch shall be at right angles to the face in which it is cut.

Dimensions and tolerances for curved notch circular section test pieces are given in Appendix B, and those for rectangular section subsidiary test pieces in Appendix C. *As added Sept., 1962*

PREPARATION OF TEST PIECE

3. The schedule of operations for producing a test piece will in general be a matter for the specification of the material being tested.

Details of the notches are given in Figs. 4 and 8.

Unless a particular method of preparing the notch is specified in the standard for the material, it may be cut by any machining method provided that a smooth contour of the specified form is produced. Attention is drawn to the fact that the impact properties of some materials are affected by the method employed.

As altered March 1986

Table 1. Dimensions and tolerances of ferrous and non-ferrous square section test pieces

Item	Nominal dimensions		Machining tolerances			
			Ferrous test pieces		Non-ferrous test pieces	
	Millimetre	Inch equivalents	Millimetre	Inch equivalents	Millimetre	Inch equivalents
Minimum overall length of test piece:						
1 Notch	70	2.76	—	—	—	—
2 Notch	98	3.86	—	—	—	—
3 Notch	126	4.96	—	—	—	—
Width	10	0.394	±0.10	±0.004	±0.05	±0.002
Thickness	10	0.394	±0.10	±0.004	±0.05	±0.002
Root radius of notch	0.25	0.010	±0.025	±0.001	±0.025	±0.001
Depth below notch measured at both ends	8	0.315	±0.10	±0.004	±0.025	±0.001
Distance of plane of symmetry of notch from free end of test piece and from adjacent notch	28	1.1	±0.41	±0.016	±0.41	±0.016
Angle of notch	45°		±2°		±1°	

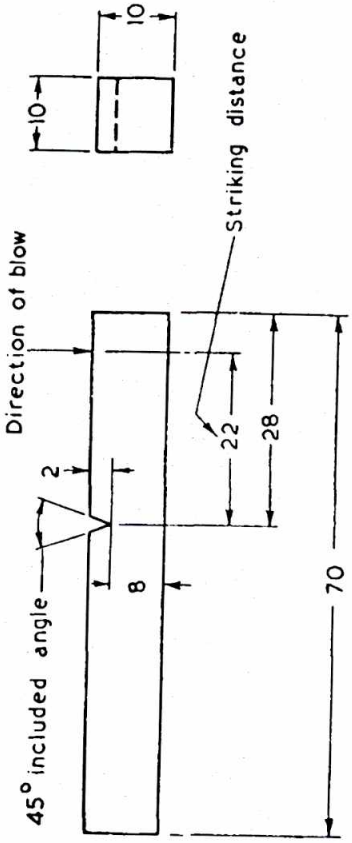

Fig. 1. Single notch square section test piece

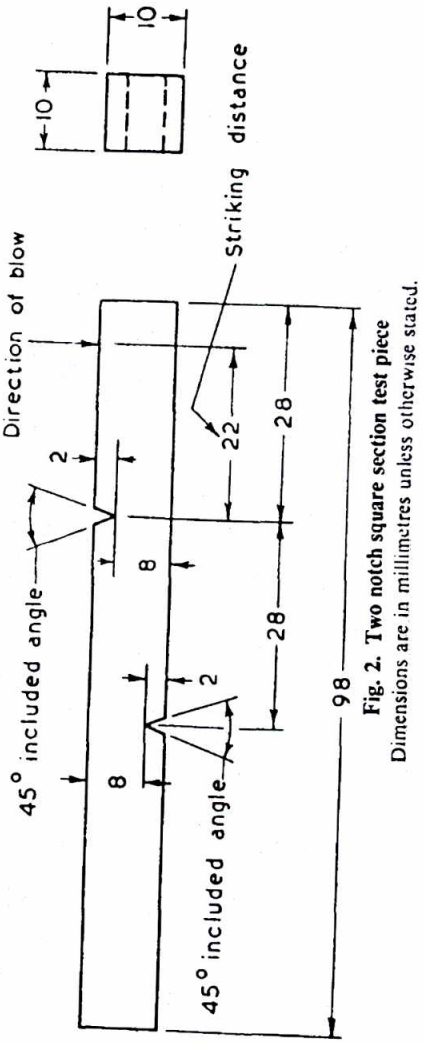

Fig. 2. Two notch square section test piece

Dimensions are in millimetres unless otherwise stated.

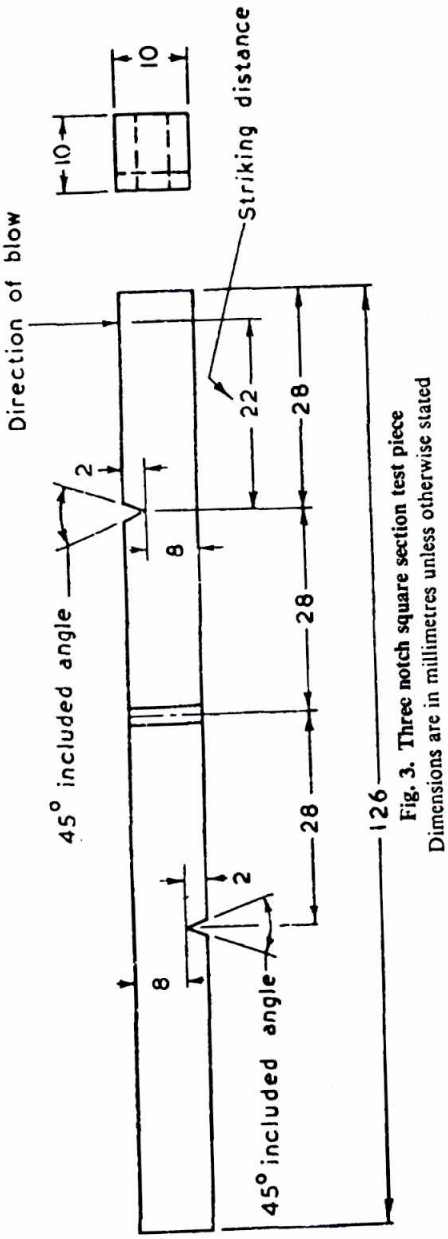

Fig. 3. Three notch square section test piece
Dimensions are in millimetres unless otherwise stated

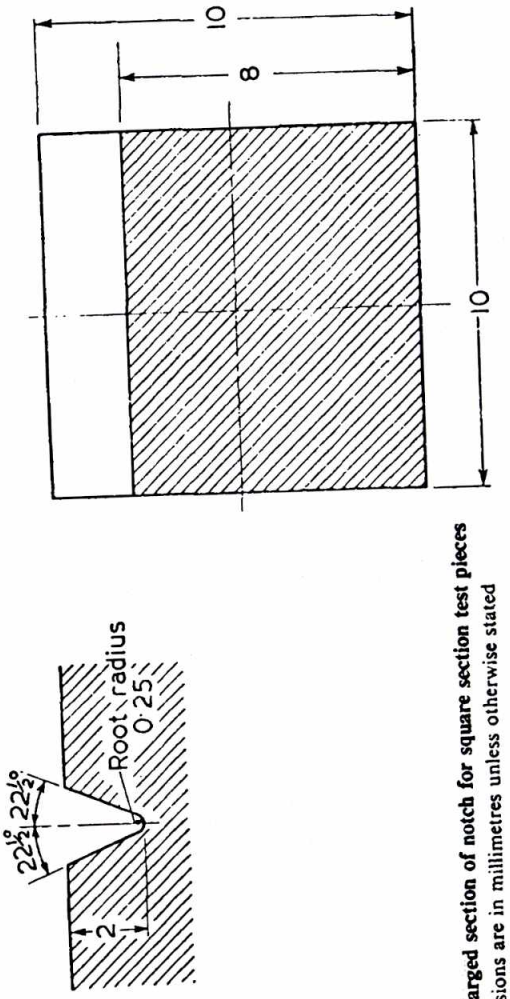

Fig. 4. Enlarged section of notch for square section test pieces
Dimensions are in millimetres unless otherwise stated

Table 2. Dimensions and tolerances of ferrous and non-ferrous circular section test pieces

As altered March 1986

Item	Nominal dimensions		Machining tolerances			
			Ferrous test pieces		Non-ferrous test pieces	
	Inch	Millimetre equivalents	Inch	Millimetre equivalents	Inch	Millimetre equivalents
Minimum overall length of test piece:						
1 Notch	2.8	71	—	—	—	—
2 Notch	3.9	99	—	—	—	—
3 Notch	5.0	127	—	—	—	—
Diameter	0.45	11.43	± 0.001	± 0.025	± 0.001	± 0.025
Root radius of notch	0.010	0.25	± 0.001	± 0.025	± 0.001	± 0.025
Depth below notch	0.32	8.13	± 0.004	± 0.10	± 0.002	± 0.05
Distance of plane of symmetry of notch from free end of test piece and from adjacent notch	1.1	28	± 0.02	± 0.5	± 0.02	± 0.5
Angle of notch	45 °		± 2 °		± 1 °	

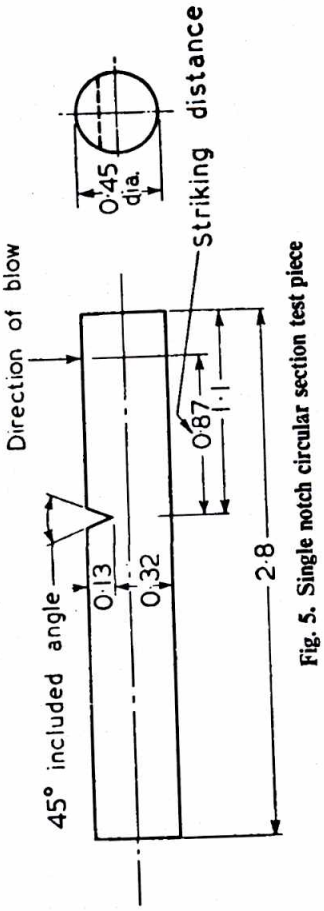

Fig. 5. Single notch circular section test piece

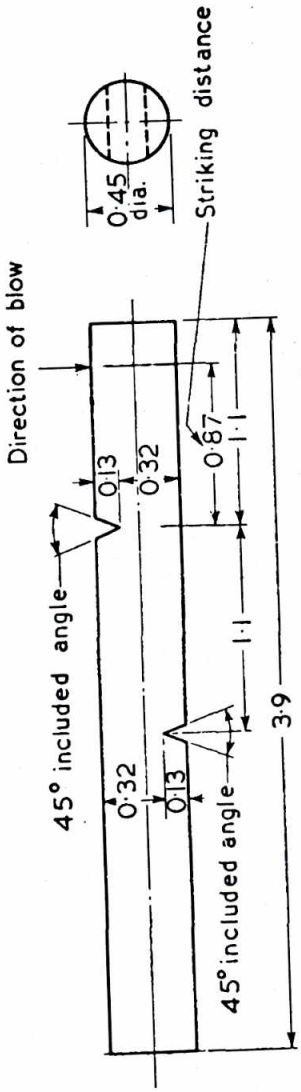

Fig. 6. Two notch circular section test piece
Dimensions are in inches unless otherwise stated.

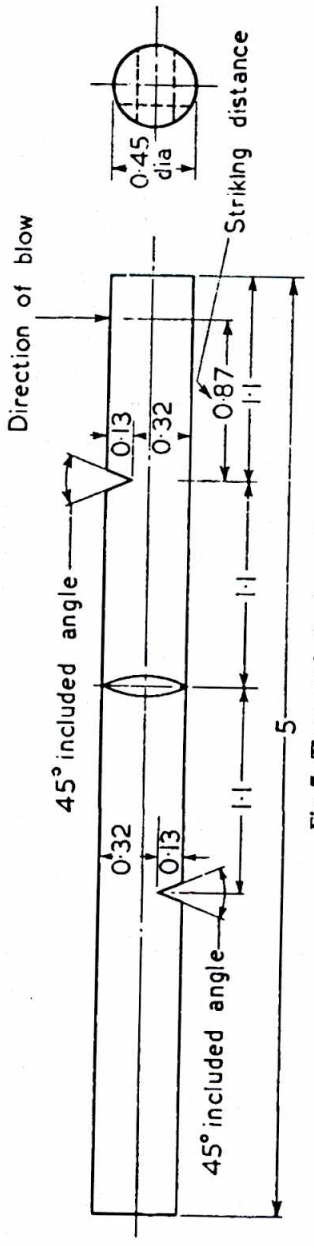

Fig. 7. Three notch circular section test piece
Dimensions are in inches unless otherwise stated

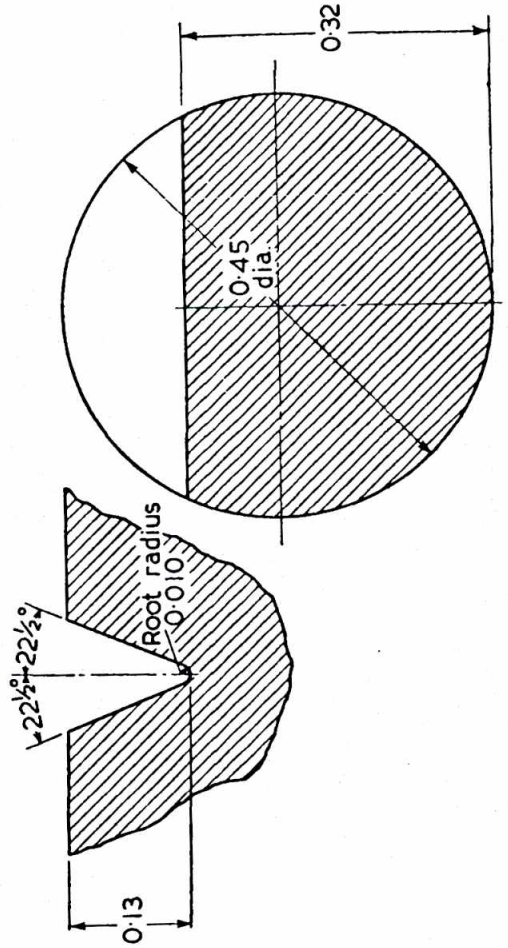

Fig. 8. Enlarged section of notch for circular section test pieces
Dimensions are in inches unless otherwise stated

TESTING MACHINE

4. The testing machine shall be constructed and installed steady and rigid (see Appendix A).

The following conditions shall be satisfied (see Fig. 9)

Distance between plane of symmetry of notch and line of contact between test piece and striker	22±0·5 mm
Angle at tip of striker	75±1°
Radius at tip of striker	0·5–1·0 mm
Angle between face of test piece and underside face of striker	100±1°
Speed of striker at instant of impact	3–4 m/s (9·8–13·1 ft/s)

The plane of swing of the striker shall be vertical. The machine shall be so constructed that the loss of energy (such as from translation, rotation or vibration) in the machine framework during a test is negligible. The radius of the centre of percussion about the axis of rotation shall be equal to the radius of the striker about this axis within a tolerance of ± 1 per cent.

STRIKING ENERGY

5. In general a machine of 120 ft lb (16·6 kg m) capacity will be found adequate for most materials. Smaller machines of 20 ft lb or 60 ft lb (2·76 or 8·3 kg m) will provide better discrimination with materials of very low energy absorption.

When recording the energy absorbed the capacity of the machine shall also be indicated (see Clause 8).

TEST REQUIREMENTS

6. The test piece shall be supported behind the notch by a rigid support block having a vertical groove to locate the test piece in the plane of swing of the pendulum. The groove shall accept test pieces having tolerances specified in Tables 1, 2, 3 or 4. In the case of square specimens the groove shall be increased in width locally to 18·5 mm as shown in Fig. 10 to allow flow of the material to occur in a direction normal to the plane of swing of the pendulum.

The top edge of the support about which bending takes place shall be slightly rounded. The test piece shall be rigidly clamped on the face containing

the notch by a clamp block, and shall be so positioned that the plane of symmetry of the notch coincides with the top surface of the support and clamp blocks (see Fig. 9).

As altered Sept., 1962

When clamped, the face of a square and rectangular subsidiary test piece containing the notch shall lie in a plane which also includes the axis of rotation of the pendulum. The chord joining the extremities of the notch of a circular section test piece shall be parallel to the striking edge of the hammer. A positioning gauge is necessary to ensure that this condition is met.

When testing 2 notch and 3 notch test pieces the material remaining after each test shall be examined to ensure that any deformed metal does not interfere with the performance of the next test.

TESTING TEMPERATURE

7. The test shall be carried out with the test piece at the ambient temperature of the test house.

NOTE. In view of the difficulties of carrying out the Izod test at other than ambient temperatures, it is recommended that the Charpy V-notch test be used for testing at sub-ambient and elevated temperatures.

PRESENTATION OF RESULTS

8. The following information shall be included in respect of each test made:

a. Type of test: Izod Impact.

b. Striking energy of machine in ft lb (see Clause 5).

As altered Sept., 1962

c. Test piece used: standard (square or circular section, straight or curved notch) or subsidiary.

If subsidiary, the width shall be stated.

d. The energy absorbed in foot pounds.

If a standard test piece is used it is permissible to use symbols in giving the result of the test. The result shall then be prefaced by symbols such as ' I 120 S ' or ' I 60 Rc ' as appropriate to indicate respectively the type of test, the striking energy range of the machine used, and the type of section (S—square, Rs—circular, straight notch, or Rc—circular, curved notch):

' I 120 S: *x* ft lb '.

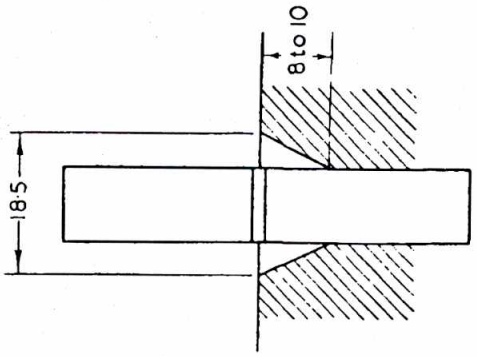

Fig. 10. Sketch showing local increase in width of locating groove for square section test pieces.
Dimensions are in millimetres unless otherwise stated

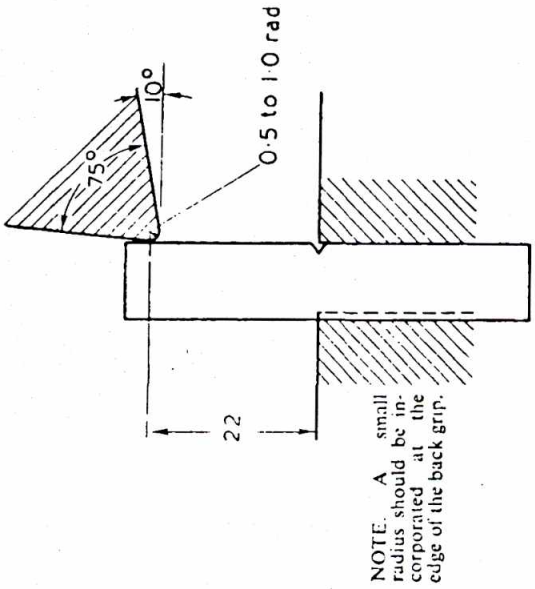

Fig. 9. Sketch showing angle and radius of striker, and inclination of striker to horizontal for cantilever type test piece (elevation).

APPENDIX A

INSTALLATION OF THE TESTING MACHINE

(See Clause 4)

It is recommended that the machine should be securely bolted to a concrete floor not less than 6 inches thick, or where this is not available should be bolted to a concrete or masonry foundation having a mass not less than 40 times that of the pendulum. Any lack of rigidity in the fixing of the machine or the anvil will affect the energy absorbed.

APPENDIX B

CURVED NOTCH CIRCULAR SECTION TEST PIECE

(See Foreword)

The curved notch circular section test piece shall have dimensions and tolerances in accordance with Table 3 and shall conform with the appropriate Figures as follows:

Fig. 11. With single notch.
Fig. 12. With two notches.
Fig. 13. With three notches.

Details of the notch are given in Fig. 14. Where more than one notch is cut in a specimen the notches shall be spaced as shown in Table 3. The notches shall be cut around the specimen as shown in Figs. 12 and 13 unless otherwise required by the material specification. The preparation of the test piece and notch shall conform with Clause 3.

Table 3. Dimensions and tolerances of ferrous and non-ferrous curved notch circular section test pieces

As altered March 1986

Item	Nominal dimensions		Machining tolerances			
			Ferrous test pieces		Non-ferrous test pieces	
	Inch	Millimetre equivalents	Inch	Millimetre equivalents	Inch	Millimetre equivalents
Minimum overall length of test piece:						
1 Notch	2.8	71	—	—	—	—
2 Notch	3.9	99	—	—	—	—
3 Notch	5.0	127	—	—	—	—
Diameter	0.45	11.43	±0.001	±0.025	±0.001	±0.025
Root radius of notch	0.010	0.25	±0.001	±0.025	±0.001	±0.025
Depth below notch	0.33	8.38	±0.004	±0.10	±0.002	±0.05
Distance of plane of symmetry of notch from free end of test piece and from adjacent notch	1.1	28	±0.02	±0.5	±0.02	±0.5
Angle of notch	45°		±2°		±1°	

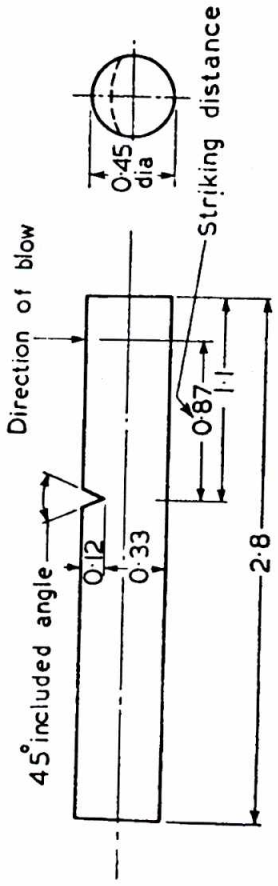

Fig. 11. Single curved notch circular section test piece

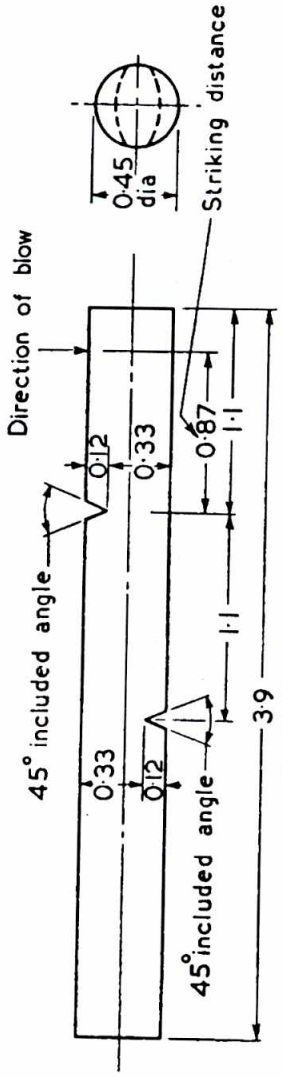

Fig. 12. Two curved notch circular section test piece
Dimensions are in inches unless otherwise stated.

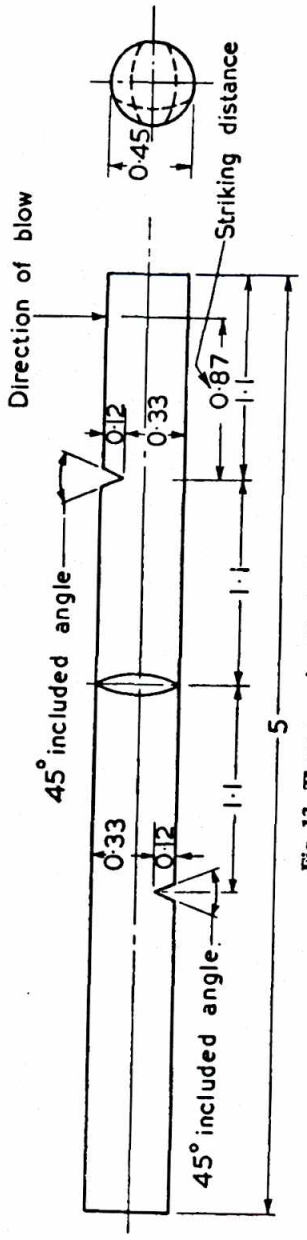

Fig. 13. Three curved notch circular section test piece
Dimensions are in inches unless otherwise stated

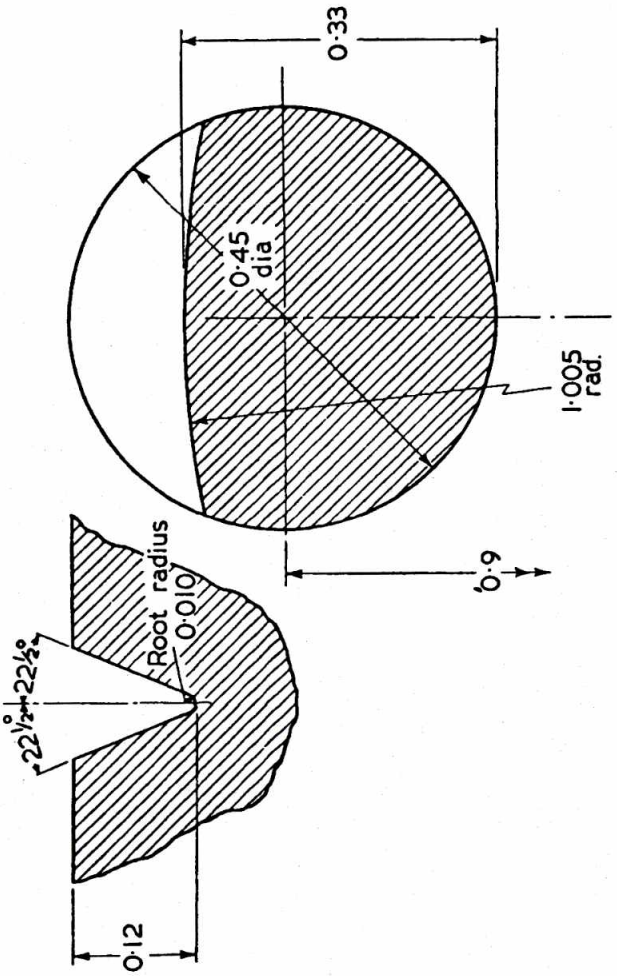

Fig. 14. Enlarged section of curved notch for circular section test piece
Dimensions are in inches unless otherwise stated

APPENDIX C

RECTANGULAR SECTION SUBSIDIARY TEST PIECES

(See Foreword)

Rectangular section subsidiary test pieces shall have dimensions and tolerances in accordance with Table 4. The notch shall be cut in a narrow face of the test piece and its details shall be as indicated in Fig. 4. If two notches are cut in the test piece they shall be spaced as shown in Table 4, and the relative position of the notches shall be as indicated in Fig. 2 unless otherwise stated in the standard for the material. The preparation of the test piece and notch shall conform with Clause 3.

As altered March 1986

Table 4. Dimensions and tolerances of ferrous and non-ferrous rectangular section subsidiary test pieces

Item	Nominal dimensions		Machining tolerances			
			Ferrous test pieces		Non-ferrous test pieces	
	Millimetre	Inch equivalents	Millimetre	Inch equivalents	Millimetre	Inch equivalents
Minimum overall length of test piece:						
1 Notch	70	2.76	—	—	—	—
2 Notch	98	3.86	—	—	—	—
Width	7.5	0.295	± 0.10	± 0.004	± 0.05	± 0.002
	5.0	0.197	± 0.05	± 0.002	± 0.025	± 0.001
Thickness	10	0.394	± 0.10	± 0.004	± 0.05	± 0.002
Root radius of notch	0.25	0.010	± 0.025	± 0.001	± 0.025	± 0.001
Depth below notch measured at both ends	8	0.315	± 0.10	± 0.004	± 0.025	± 0.001
Distance of plane of symmetry of notch from free end of test piece and from adjacent notch	28	1.1	± 0.41	± 0.016	± 0.41	± 0.016
Angle of notch	45°		± 2°		± 1°	