INTERNATIONAL STANDARD

ISO 8442-5

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Materials and articles in contact with foodstuffs — Cutlery and table holloware —

Part 5: Specification for sharpness and edge retention test of cutlery

Matériaux et objets en contact avec les denrées alimentaires — Coutellerie et orfèvrerie de table —

Partie 5: Spécification du tranchant et essai de conservation du tranchant

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Foreword

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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 8442-5 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 186, *Cutlery and table and decorative metal hollow-ware*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

ISO 8442 consists of the following parts, under the general title *Materials and articles in contact with foodstuffs — Cutlery and table holloware*:

— *Part 1: Requirements for cutlery for the preparation of food*

— *Part 2: Requirements for stainless steel and silver-plated cutlery*

— *Part 3: Requirements for silver-plated table and decorative holloware*

— *Part 4: Requirements for gold plated cutlery*

— *Part 5: Specification for sharpness and edge retention test of cutlery*

— *Part 6: Lightly silver-plated table holloware protected by lacquer*

— *Part 7: Requirements for table cutlery made of silver, other precious metals and their alloys*

— *Part 8: Requirements for silver table and decorative holloware*

Contents

Foreword

This document (EN ISO 8442-5:2004) has been prepared by Technical Committee CEN /TC 194, "Utensils in contact with food", the secretariat of which is held by BSI, in collaboration with Technical Committee ISO/TC 186 "Cutlery and table and decorative metal hollow-ware".

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2005, and conflicting national standards shall be withdrawn at the latest by June 2005.

Annex A is normative.

EN ISO 8442 consists of the following parts:

Part 1: *Requirements for cutlery for the preparation of food*

Part 2: *Requirements for stainless steel and silver-plated cutlery*

Part 3: *Requirements for silver-plated table and decorative holloware*

Part 4: *Requirements for gold-plated cutlery*

Part 5: *Specification for sharpness and edge retention test of cutlery*

Part 6: *Lightly silver-plated table holloware protected by laquer*

Part 7: *Requirements for table cutlery made of silver, other precious metals and their alloys*

Part 8: *Requirements for silver table and decorative holloware*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies the sharpness and edge retention of knives which are produced for professional and domestic use in the preparation of food of all kinds, specifically those knives intended for hand use.

Powered blade instruments of any kind are excluded.

Generally these types of knives are manufactured with blades of either plain edge design or with edges incorporating particular features to enhance or optimize aspects of cutting ability.

The following two types of knife blade are suitable for the cutting test:

Type A edges: Cutting edges which can be resharpened by the user and edges with a pitch greater than 1 mm;

Type B edges: Cutting edges which are not intended to be resharpened on a steel.

Whilst these knives are predominantly manufactured with blades made from various grades of heat treated steels, the testing of knives of any construction or blade material is not precluded providing that the test criteria are met.

The principle of the testing is to reproduce a cutting action, by forward and reverse strokes, against a pack of synthetic test medium under controlled parameters.

2 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

2.1
cutlery
utensils for the preparation and serving of food having a blade with a cutting edge

2.2
centre line
line which generally bisects the cross-section of the blade passing through the cutting edge and the back of the blade (see Figure 1)

EXAMPLE

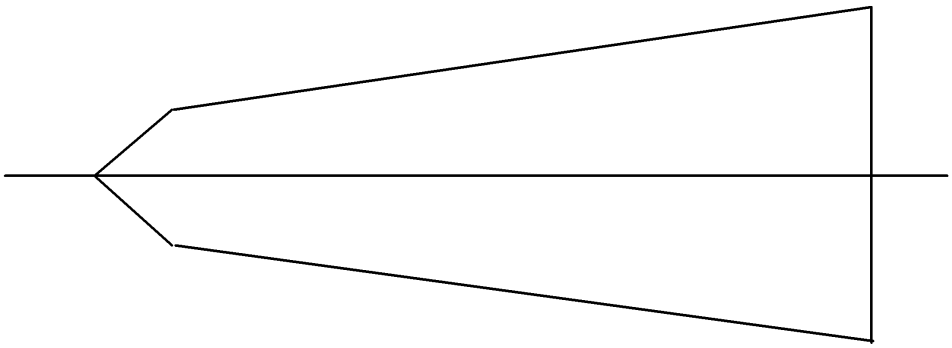


Figure 1 — Centreline

2.3
initial cutting performance (ICP)
cutting ability to be expected by the user from a knife when supplied “as new” from the factory or point of sale

2.4
cutting edge retention (CER)
ability of the knife blade’s edge to resist wear throughout its useful life

2.5
total card cut (TCC)
cumulative amount of card cut (measured in millimetres) by the test knife over the duration of a full test

2.6
cutting cycle
one forward plus one reverse stroke of the designated length of the blade against the medium

3 Testing

3.1 General

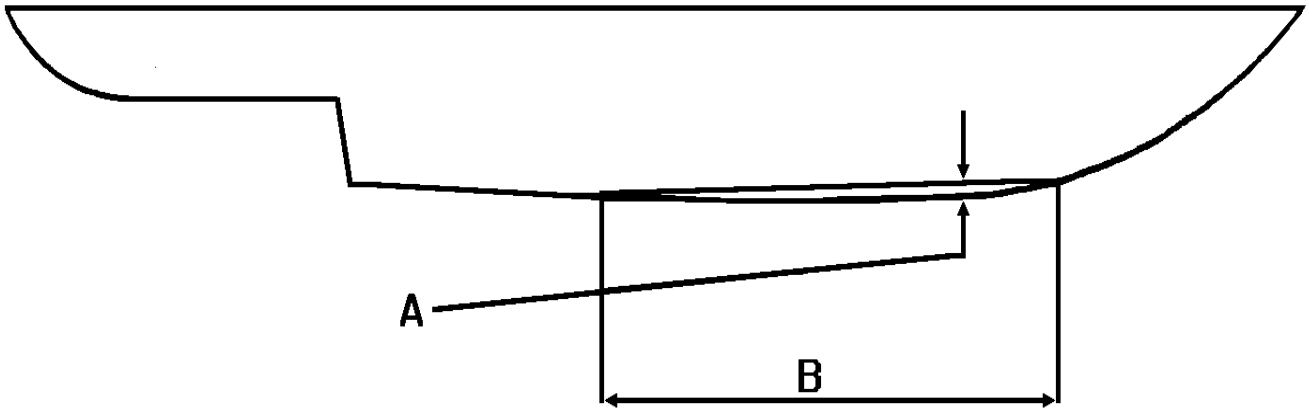
When tested in accordance with the test method of clause 7 each type of knife shall conform to 3.2 to 3.4.

This test shall be carried out before any other physical or mechanical test so that edge performances are assessed in the “as received” condition.

3.2 Test length

The portion of the cutting edge of the blade to be tested (see 3.3) shall be straight except for a maximum deviation (positive or negative, not both) of 1 mm.

In the case of type “ B “ edges the shape of the blade is considered to be the underlying profile on which the detail is superimposed (see Figure 2).



Key

A Max. deviation from straight (shown positive)

B Stroke length

Figure 2 — Blade to be tested

3.3 Test conditions

The same test is applied to both types of knives but the duration for the purpose of establishing cutting edge retention is determined by the type of edge. Test parameters are given in Table 1.

Table 1 — Cutting test parameters

Blade edge Type	Test load N	Stroke Length (mm)	Nominal cutting speed (mm/s)	Total no. Cutting cycles (F)
A	50	40	50	60
B	50	40	50	200

3.4 Cutting performance

When tested in accordance with clause 7 the minimum initial cutting performance (ICP) and cutting edge retention (CER) shall conform to the performance levels specified in Table 2.

Table 2 — Performance levels

Blade edge type	Minimum ICP mm	Minimum CER (TCC) mm
A	50	150
B	50	1 500

4 Principle

Performance of the blade in terms of distance cut through the medium on each cycle is measured throughout the duration of the test, which is designed to accelerate wear of the knife blade over a short period.

Blades shall cut an adequate amount of medium to complete the test and the two cutting performance indicators ICP and CER are calculated in accordance with clause 8 from the accumulated data.

5 Test medium

A specially developed chemical pulp is produced in the form of sheets of card containing a controlled amount of abrasive material i.e. quartz. This card shall be pure chemical soda pulp without any other chemical additive except for the addition of silica in the proportion of (5 ± 0,5) % by weight.

The properties of the quartz shall conform to Tables 3 to 5.

The quartz shall have the percentage composition of chemical elements specified in Table 3.

Table 3 — Composition of silica abrasive

Compound	Composition %
SiO_2	99
Fe	0,013
Al_2O_3	0,22
MgO	Nil
Alkalines	Nil

The grain size distribution of quartz shall be as specified in Table 4.

Table 4 — Grain size distribution of silica - C 400

Grain size µm	Composition *(in weight)* %
> 50	0,2
> 30	4,7
> 20	15
> 16	2
> 12	11
> 10	10
> 8	7
> 6	9
> 4	12
> 2	29

To satisfy the test arrangement the card is cut into 10 mm wide strips (with the fibres of the card grain flowing across the strip) and compiled into a pack maximum 50 mm deep when clamped under pressure (130 ± 2,5) N in a holder as shown in Figure 3.

The physical properties of each strip shall be as specified in Table 5.

Table 5 — Physical properties

Thickness mm	Weight g/m²	Strip (pack) width mm
0,31 ± 0,02	200 ± 10	10,0 ± 0,1

Before use, the test medium shall be conditioned in a controlled atmosphere of (55 ± 5) % relative humidity at (20 ± 2) °C for a period of 24 h. The card shall be open to this atmosphere and used within 4 h of removal from it.

6 Apparatus

NOTE A suitable apparatus for performing the cutting test is shown in Figure 3 and comprises the elements of 6.1 to 6.6.

6.1 Card strip holder

A rigid holder with a 10 mm wide aperture to hold the strips of card (max. 50 mm deep). The holder shall provide sideways restraint against the cutting force of the knife and also a support bar above the card, which protrudes, from the holder to provide the reaction against the 50 N test load throughout the test. The card pack shall be clamped by a force of (130 ± 2,5) N on the inboard side of the cutting line and any cut card shall be allowed to fall away freely (see also Figure 4).

6.2 Counterbalance arrangement

An arrangement of add-on or counterbalance weights, which in conjunction with the card and holder, vertical slide element and all its fittings shall result in a total vertical static load at the interface between card and blade of 50^{+2}_{0} N (average over the working range) at the start of each new test.

6.3 Blade fixture

A fixture, which holds the blade and presents the cutting edge uppermost and provides support against the test load and also a means of easy levelling of the test lengths. The centre line through the section of the blade shall be vertical.

When held in the fixture, the blade edge shall be capable of cutting through the 50 mm of card cleanly without any undue frictional influences excepting that from the blade's sharpened bevel against the face of the uncut card. The blade edge shall be prevented from coming into contact with the metal support bar by means of an independent depth stop.

6.4 Transverse blade slide unit

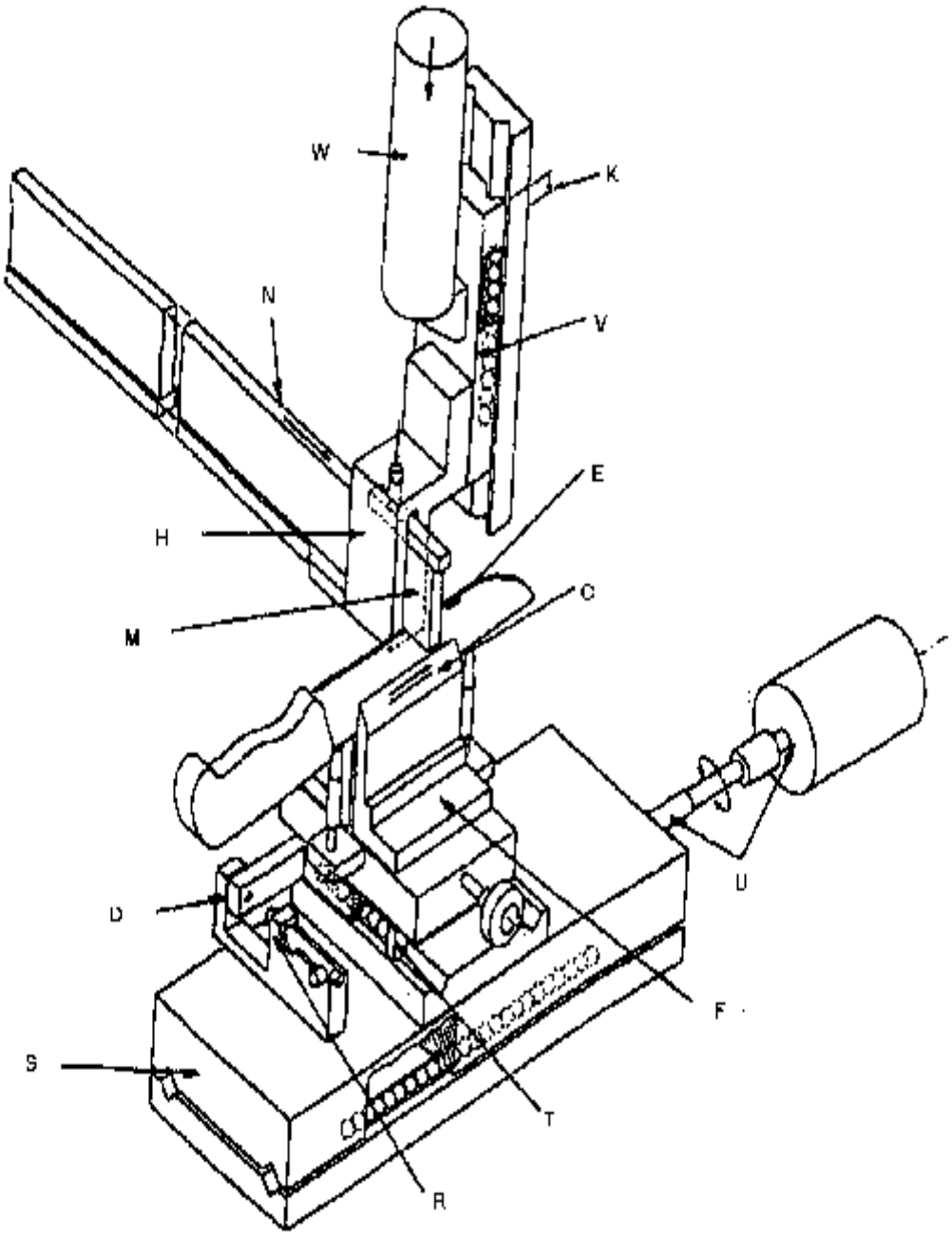
A transverse frictionless slide unit, on which the blade fixture shall be mounted to reduce the influence of friction forces between the blade's sharpened bevel and face of the uncut card. This will allow movement of the blade away from the card holder during the cutting strokes, normal to the direction of the cutting strokes. At the beginning of the first stroke through each 50 mm block of card the point at which the blade starts its cut shall be (3 ± 0,2) mm away from the edge of the card holder/clamp. The end of the card pack should be straight and aligned to an approximate angle of 20° to the vertical to allow an approximately equal length of card beyond the cutting point.

6.5 Longitudinal blade slide unit

A longitudinal frictionless slide table, which provides the motion to the blade in the direction of the cutting strokes. This shall have a drive system which is capable of producing a nominal 50 mm/s cutting speed, which is achieved by maintaining a more or less constant speed of 50 mm/s over at least 90 % of the specified stroke, with rapid acceleration and deceleration at the ends. This parameter will be verified over several non-cutting cycles and the result shall be (45 ± 0,5) mm/s average speed. The stroke shall also be repeatable within (45 ± 0,5) mm/s average and verified over several non-cutting cycles of the table.

6.6 Card cut amount transducer

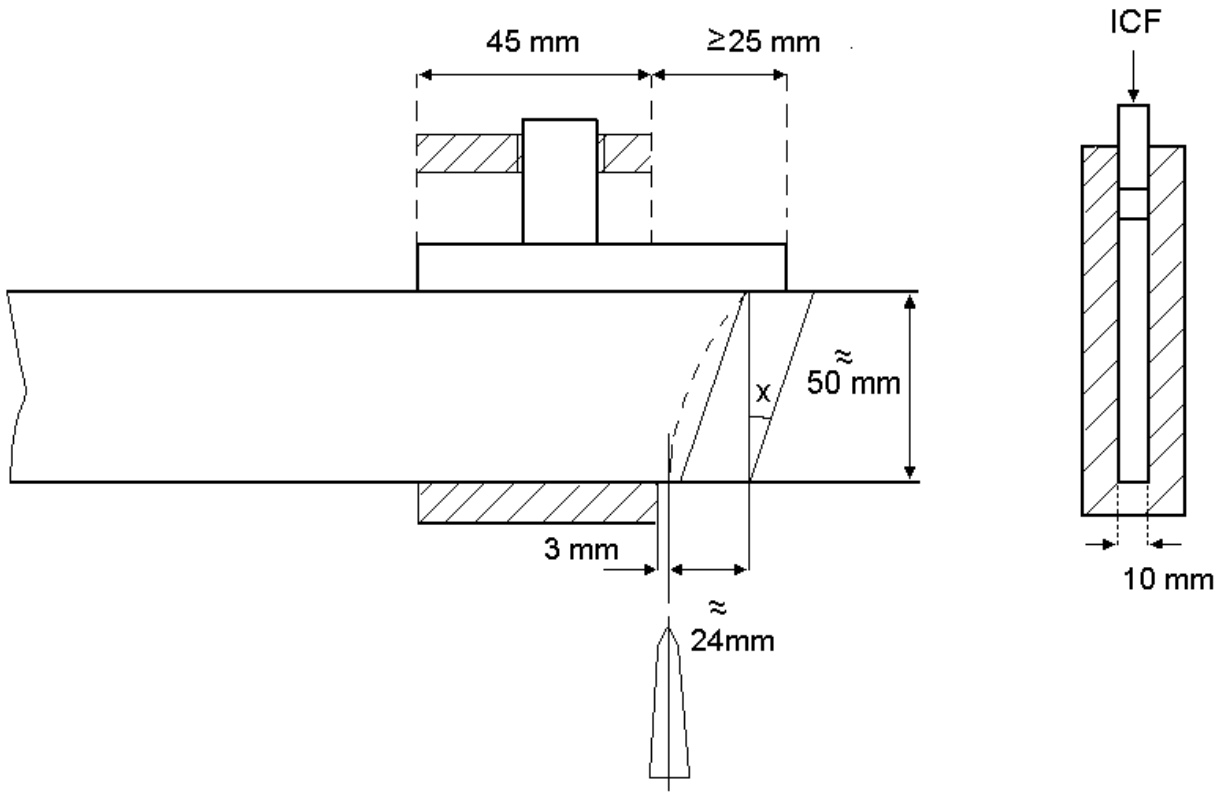
A displacement transducer, capable of measuring the depth of cut through the pack of card on each cutting cycle, with a minimum resolution of 0,1 mm (i.e. 1/3 card thickness).



Key

C	Cutting strokes	N	Medium feed forwards
D	1st cut datum	R	Retaining clamp
E	Test blade	S	Longitudinal slide
F	Component fixture	T	Transverse slide
H	Medium holder	U	Motor & ballscrew drive mechanism
K	Depth of cut measured by slide travel	V	Vertical slide
M	Medium	W	Additional test weight

Figure 3 — Schematic arrangement of suitable test apparatus



No test shall be performed within 25 mm of the start of the new pack.

Key

x ≈ 20°

ICF Independent clamping force (130 ± 2,5) N

Figure 4 — Arrangement of test medium clamp and blade presentation

7 Test procedure

Determine the portion of the blade (50 mm = 40 mm stroke + 10 mm test card width) which meets the straightness criterion (± 1 mm deviation over the stroke length of 40 mm) and mark with a suitable marker. Mount the blade (edge uppermost) in the fixture and set the length to be tested level to within 0,5 mm at either end.

Load the apparatus with the test card and weights which combine to give the required 50 N test load (in the static condition) at the start of a new test.

Clamp the card in the holder with approximately 24 mm protruding and lower the assembly until the protruding medium rests on the edge of the blade and the position of contact is 3 mm from the clamped edge.

Release any retaining clamp on the transverse slide and move the blade in forwards and backwards cutting strokes of 40 mm with the test card contacting the cutting edge of the blade throughout the whole cycle. Measure the depth of cut through the card pack at the end of each cutting cycle. Do not allow the blade cutting edge to contact the metal support bar. When more card is required, lift the card pack off the blade and feed forwards the whole pack by approximately 3 mm. Return the transverse slide back to the starting position with respect to the card clamped edge and carry out more cutting strokes.

Record the depth of cut on each cutting cycle, repeating until the predetermined number of cycles is completed for that type of blade. Tabulate the results showing cumulative card cut as per the example in Table 6.

Table 6 — Method of recording results (example)

Cycle no. (x)	**Depth of card cut** (mm)	
	Per cycle $y_{(x)}$	**Cumulative $z_{(x)}$**
1	34,8	34,8
2	26,5	61,3
3	23,6	84,9
4	21,1	106,0
5	18,2	124,2
6	17,7	141,9
7	16,2	158,1
8	14,6	172,7
9	13,9	186,6
10	11,1	197,7
f	$y_{(f)}$	$z_{(f)}$

$$z_{(x)} = z_{(x-1)} + y_{(x)}$$

where f Final cycle number

Type A blades: 60 cycles

Type B blades: 200 cycles

$z_{(f)}$ TCC - Total card cut over completed test

8 Expression of results

Whilst the plotting of the results graphically is not essential to the calculation of the performance indicators, a typical performance curve would be as shown in Figure 5 with the axes as follows:

X axis: Cutting cycles (up to the limiting number of cycles - 60 type A, 200 type B);

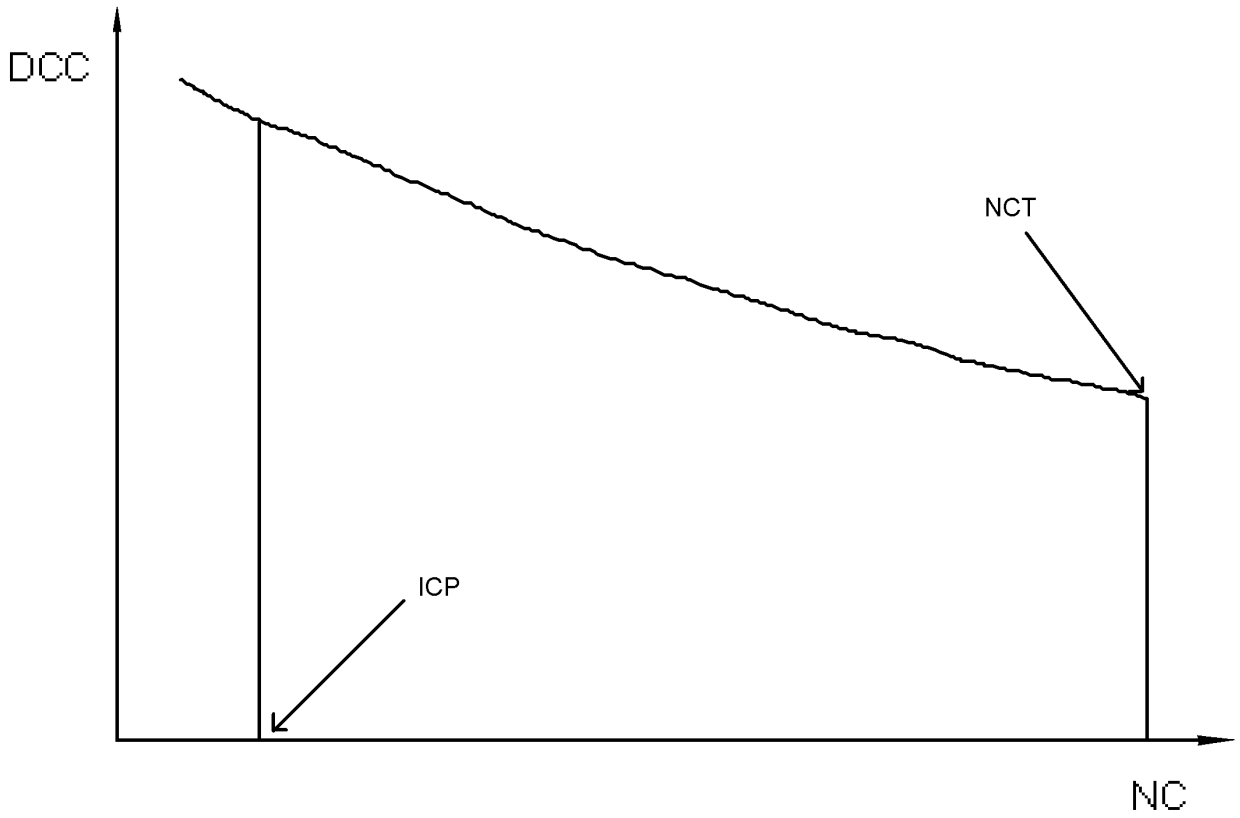
Y axis: Depth of card cut per cycle (mm).

The initial cutting performance ICP is determined by adding together the card cut (in mm) during the initial 3 cycles.

$ICP = z_{(3)}$

The cutting edge retention is determined by the total card cut during the complete test.

$CER = TCC = z_{(f)}$



Key

DCC Depth of card cut per cycle (mm)

ICP Initial cutting performance – Cumulative depth of card cut after 3 cycles

NC Number of cycles

NCT Limiting number of cycles for test

Figure 5 — Typical performance of a knife on test

Annex A
(normative)

Calibration of cutting test apparatus

A.1 Principle

In order to ensure the apparatus performs with accuracy and consistency two forms of calibration are required. Initially the physical parameters of force, distance and speed are calibrated. Once this has been completed the final adjustment of the machine is achieved by carrying out a cutting test with a standard blade. Any discrepancies with the known performance of this blade are then adjusted for.

A.2 Physical calibration

A.2.1 General data

The following parameters shall be calibrated to the given values:

a) cutting load (static) $50\,^{+2}_{0}$ N

(the load with which the test card rests on the knife blade);

b) medium clamping force $(130 \pm 2{,}5)$ N

(the force with which the card is compressed in its holding device);

c) blade traverse speed

1) nominal 50 mm/s;

2) measured average $(45 \pm 0{,}5)$ mm/s over 10 strokes;

d) starting position of test blade in relation to card clamping device $(3 \pm 0{,}15)$ mm.

Card cut measurement transducer accuracy ± 0,2 mm over 50 mm.

These parameters shall be calibrated in accordance with A.2.2 to A.2.7.

A.2.2 Cutting load

This is calibrated in a static condition at four positions of the vertical slide carrying the test medium. Measurement of the static load shall be carried out by placing a certified load cell in the area of the blade fixture and recording the static readings of the force applied. By the use of spacers it is possible to measure the load at intervals along the slide travel.

A.2.3 Medium clamping force

By fitting a suitably sized calibrated load cell into the test medium carriage unit the card clamping device shall be adjusted/calibrated to the force specified in A.2.1.

A.2.4 Blade traverse speed

The speed of the blade traverse system is measured whilst not under the influence of a blade and test medium. Dependent on the type of drive mechanism in use the time and distance characteristics will vary. However, it shall be possible to adjust the maximum traverse speed to around 50 mm/s, such that the average speed over 10 cycles including acceleration and deceleration is (45 ± 0,5) mm/s.

This shall be determined by use of calibrated measurement blocks (see calibration of traverse distance A.2.5) and a microswitch controlled calibrated stop clock. The time to travel 10 cycles of 40 mm is measured and the speed calculated.

A.2.5 Blade traverse distance

This is also carried out without the influence of blade or test medium, by comparing the movement of the blade carrier against a calibrated reference gauge, with the use of a dial indicator.

A.2.6 Cut start position

This parameter is best set by the use of a calibrated distance piece set in the jaws of the blade clamping device.

A.2.7 Card cut measurement transducer

The accuracy of this output device is evaluated by using calibrated distance blocks to move the vertical slide by a pre-set amount and recording the transducer output.

A.3 Cutting performance calibration

A.3.1 Principle

A.3.1.1 General

NOTE The final calibration of the cutting performance is adjusted by the use of a standard cutting blade (see A.3.2). This is achieved by changing the cutting stroke length to give a sharpness level measured by the system equal to that certified for the standard blade.

Standard blades are specified into two quality groups (see A.3.1.2 and A.3.1.3):

A.3.1.2 Masterblades I

Masterblades I will be used to calibrate masterblades II. Masterblades I will be housed at each national test body that has relevant experience and test equipment.

A.3.1.3 Masterblades II

These are second level calibration blades which will be used by each test equipment user and calibrated by a national body to the individual country's masterblades I.

A.3.2 General requirements of standardblades

A masterblade (I or II) may be of any construction, provided that it can perform to the following specification when tested on a machine previously calibrated by a masterblade I:

a) the blade shall have a stabilized cutting value for a single cutting cycle of between 15 mm and 25 mm;

b) a new blade shall be initially cut tested until such point as its stability is determined as not having a variation of cut of more than ± 0,25 mm in a period of 20 cycles;

c) the blade shall not be used more than 200 cycles after its initial calibration until it has been recalibrated.

The calibration of equipment shall follow the procedure of A.3.3.

A.3.3 Defined calibration cutting procedure

A.3.3.1 Preparation

Before commencing, load a full pack of card into the machine and make a full test using a spare blade to enable the machine to stabilize.

A.3.3.2 Test parameters

— 40 mm stroke length (initially);

— 50 N test load;

— 50 mm/s test speed.

It is important that the blades are held in a manner (see 6.3) which prevents contact of the side of the blade with the test card.

Only one cut per 50 mm thickness of card is carried out.

A.3.3.3 Procedure

Load a reference blade into the machine and make a test of only one cut.

If the amount of card cut does not equal the blade's calibrated value ± 0,25 mm carry out a second test but adjust the test stroke to either increase or decrease the amount cut as appropriate.

If the result of the second cut is not equal to the blade's calibrated value ± 0,25 mm make a further adjustment and carry out a third test. Repeat the procedure until the blade's calibrated value ± 0,25 mm is achieved for at least 3 cuts.

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