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DRAFT EAST AFRICAN STANDARD

Hacksaw blade — Specification

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EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 042*, Production and general engineering.*

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Hacksaw blades — Specification

1 Scope

This draft East African Standard specifies the requirements, sampling and test methods for hand and machine hacksaw blades.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15510, *Stainless steel — Chemical composition*

ISO 6507-1, *Metalic materials — Vickers hardness test — Part 1: Test method*

ISO 6508-1, *Metalic materials — Rockwell hardness test — Part 1: Test method*

3 Terms and definitions

For the purposes of this draft standard the following definitions apply.

3.1 Elements
3.1.1
Centre Line
longitudinal line which passes through the centres of the pin holes.

3.1.2
Pin Hole
hole at each end of the blade by means of which the blade is held and tensioned when in use. The pin holes are normally located on the centre line of the blade.

3.1.3
Teeth
serrations formed across the thickness of the blade to provide cutting edges.

3.1.4 Toothed Edge
longitudinal edge along which the teeth have been formed.

3.1.5 CuttingEdge
edge of the face intended to perform cutting. It is formed by the intersection of the flank and the face.

3.1.6 Face
surface of the tooth over which the chip flows.

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3.1.7
Flank
surface over which the surfaces produced on the work piece pass. It extends to the root radius.

3.1.8
Root Radius
radius connecting the face of the tooth and flank of the preceding tooth.

3.1.9
Gullet
space bounded by the face, root radius and flank of a tooth, which permits chip removal.

3.1.10
Back Edge
longitudinal edge parallel to the toothed edge.

3.1.11
Side
flat surface between the toothed edge and the back edge.

3.1.12
Set
projection of teeth from the side of the blade to provide cutting clearance.

3.1.13
Staggered Set
transverse setting or staggering of groups of teeth.

3.1.14
Wavy Set
transverse setting or staggering of groups of teeth in the wave form.

3.2 Linear Dimensions
3.2.1
Nominal Length
dimension between the centres of the pin holes, measured along the centre line of the blade.

3.2.2
Overall length
dimension between the ends of the blade measured along its centreline.

3.2.3
Width
Width is the overall distance between the toothed edge and the back edge.

3.2.4
Thickness
The distance between the two sides of the blade body, excluding any set.

3.2.5
Pitch
The distance between the adjacent cutting edges.

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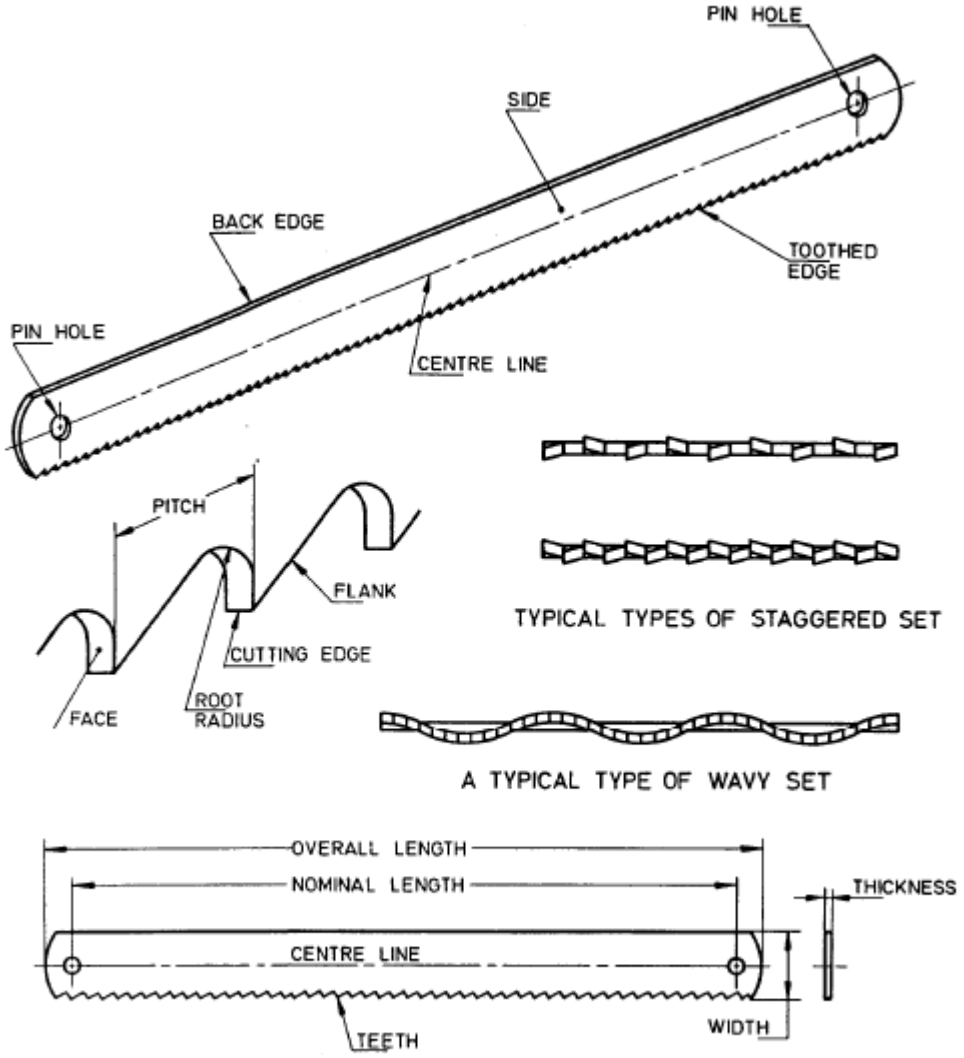

FIG. 1 TERMS RELATING TO HACKSAW BLADES

4 Types

4.1 All Hard Blade (Type A)

A blade hardened uniformly except for the area adjacent to the pin holes.

4.2 Flexible Blade (Type B)

A blade hardened uniformly along the length of toothed edge.

4.3 Flexible Centre Blade (Type C)

A blade uniformly hardened and tempered along the length of toothed edge and the back edge with the centre of the blade in soft condition and the back edge either soft or hard.

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4.4 Spring Back Blade (Type D)

A blade hardened uniformly along the length of toothed edge, the remainder being spring tempered.

4.5 Shatterproof Blade (Type E)

A hand hacksaw blade of any type or quality so manufactured that it will resist breakage but if breakage occur, it will not fragment into more than two pieces.

5 Requirements

5.1 General requirements

5.1.1 The blades shall be manufactured reasonably straight true to shape and size. The pinholes shall be neatly punched. The out of straightness per 100 mm length of the blade in the longitudinal direction shall not exceed 0.6 mm for all types and sizes of hacksaw blades.

5.1.2 The teeth shall be cleaned and uniform along the wavy set or staggered toothed edge. The teeth of the blade shall be having set as follows:

a) For pitch, P = 0.8 – wavy set

b) For pitch, P = 1.0 to 1.8 – wavy or staggered set

c) For pitch, P > 1.8 – staggered set

5.1.3 The formulation of the set, of either type, shall be symmetrical along the length of toothed edge.

5.1.4 The blades shall be heat-treated in such a manner that they fulfil the requirements of hardness as given in 7 and applicable flexibility as given in 13.1 and applicable cutting tests as given in 13.2.

5.1.5 The centre of pin hole shall be located on the centre line of the blade. The centre of offset maybe within ±0.20 mm.

5.2 Dimensions

The dimensions of hand hacksaw blade and machine hacksaw blade shall be as given in table 1 and 2 respectively (see Fig. 2).

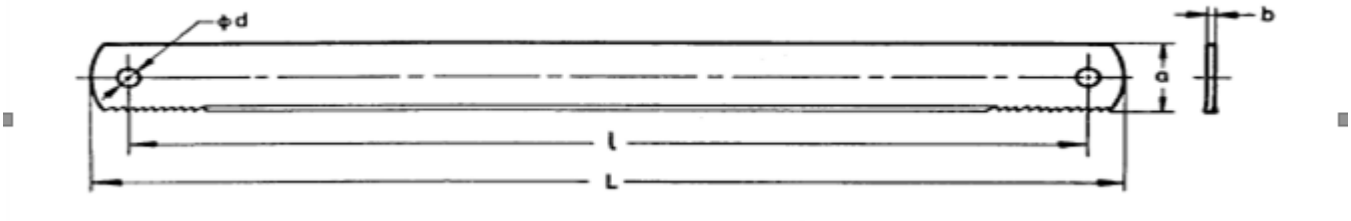

Figure 2 – Dimensions of hacksaw blades

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Table 1 — Hand hacksaw blades

All dimensions in millimetres.

Nominal length l ± 2	Width a ± 1	Thickness b ± 0.1	Teeth Spacing		Overall Length, L Max	Pinhole Diameter, d H14
			Pitch, P ± 6%	No. of Teeth, N[1)]		
250	12.5	0.63	0.8	32	265	4
			1.0	24		
			1.4	18		
300			0.8	32	315	
			1	24		
			1.4	18		
			1.8	14		
1)Number of teeth are per 25 mm length						

Table 2 — Machine hacksaw blades

All dimensions in millimetres

Nominal length l ± 2	Width a ± 1	Thickness b ± 0.1	Teeth Spacing		Overall Length, L Max	Pinhole Diameter, d H14
			Pitch, P ±6 %	No. of Teeth, N[1)]		
300	25	1.25	1.8	14	330	8.4
			2.5	10		
		1.5	1.8	14		
			2.5	10		
			4.0	6		
350	25	1.25	1.8	14	380	8.4
			2.5	10		
		1.50	1.8	14		
			2.5	10		
			4.0	6		
	30	1.50	1.8	14		
			2.5	10		
			4.0	6		
		2.0	1.8	14		
			2.5	10		
			4.0	6		
400	25	1.5	1.8	14	430	8.4
			2.5	10		
			4.0	6		

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	30	1.50	1.8	14		
			2.5	10		
			4.0	6		
		2	2.5	10		
			4	6		
			6.3	4		
	40	2.00	4.0	6	440	10.4
			6.3	4		
450	30	1.5	2.5	10	490	8.4
			4	6		
	40	2.00	2.5	10		8.4/10.4
			4.0	6		
			6.3	4		
500	40	2.00	2.5	10	540	10.4
			4.0	6		
			6.3	4		
575	50	2.5	4	6	615	
			6.3	4		
			8.5	3		
600			4.0	6	640	
			6.3	4		
700			4	6	745	10.4/12.9
			6.3	4		
			8.5	3		
1) Number of teeth are per 25 mm length.						

5.3 Materials

Hand hacksaw blade and machine hacksaw blades shall be made from high speed steel in accordance with 5.5.1 or bi-metal high speed steel in accordance with 5.3.2. Hand hacksaw blade may also be made from low alloy steel in accordance with 5.3.3.

5.3.1 High-speed steel

Unless otherwise specified, the high-speed steel shall be according to Table 3.

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Table 3 — Chemical composition of high-speed steel

C	Cr	Mo	W	V	Si Max	Mn Max	S&P Max
0.95 to 1.03	3.80 to 4.50	2.50 to 2.90	2.70 to 3.00	2.20 to 2.50	0.45	0.40	0.030
0.82 to 0.92	3.75 to 4.50	4.75 to 5.50	5.75 to 6.75	1.75 to 2.05	0.40	0.40	0.03

5.3.2 Bi-metal High-Speed Steel

Bi-metal high-speed steel blades shall be manufactured with a tooth edge formed in high-speed steel and joined to a spring steel-backing strip.

5.3.3 Low Alloy Steel

Low alloy steel flexible blade shall be manufactured from high carbon steel, which contains sufficient-alloy addition to significantly enhance wear resistance properties.

5.4 Hardness

5.4.1 The hardness when measured, as near to the tip of the tooth as possible shall be minimum of 62.5 HRC.

5.4.2 The area around the pin holes shall be suitably heat-treated to reduce the risk of end fracture in use. The hardness around the pin holes shall be 25.6 HRC to 49.1 HRC.

6 Designation

Hacksaw blades shall be designated by the name, type, nominal length, width, thickness, pitch, number of this standard and the symbol for material.

7 Workmanship and finish

The blades shall be coated with corrosion preventive material and shall be free from burrs, rust, scale, other defects and freedom from distortion requirements.

8 Marking and packaging

8.1 Marking

Each blade shall be marked with the following details:

a) Manufacturer’s name initial or trade-mark;

b) Designation; and

c) Country of Origin.

8.2 Packaging

Each wrapped packet shall contain five or ten blades and a suitable number of packets shall be packed in a carton bearing the designation, manufacturer’s name, initial or trade-mark. Each carton shall contain same size of blades.

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9 Tests

9.1 Flexibility test for hand hacksaw blades

9.1.1 All hard blades

The blades shall be bent round the periphery of a test block of 250 mm, diameter until the blade throughout its length is in contact with the block (see Fig. 3). The blade when released shall show no sign of fracture or permanent set.

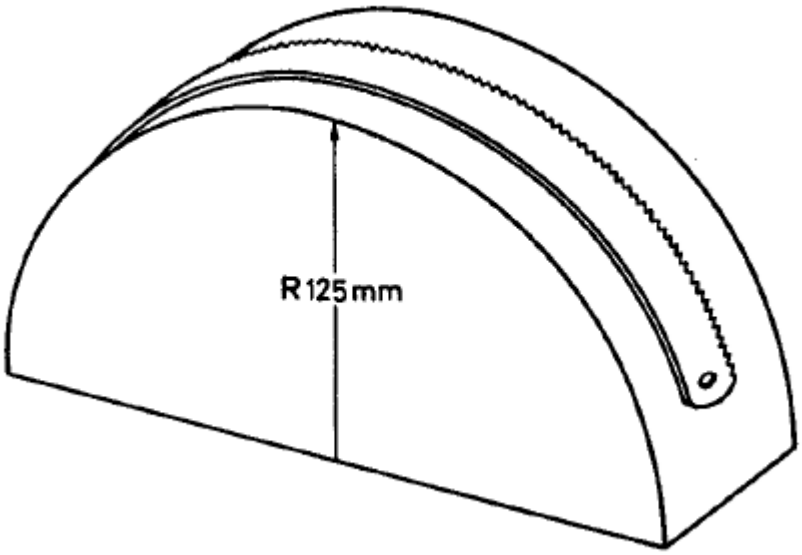

Figure 3 — Flexibility test for all hard blades (Type A)

9.1.2 The blades shall be bent round the whole circumference of a test bar 60 mm in diameter (see Fig. 4). The blade, when released with the exception of hardened portion, shall be capable of being straightened again without fracture.

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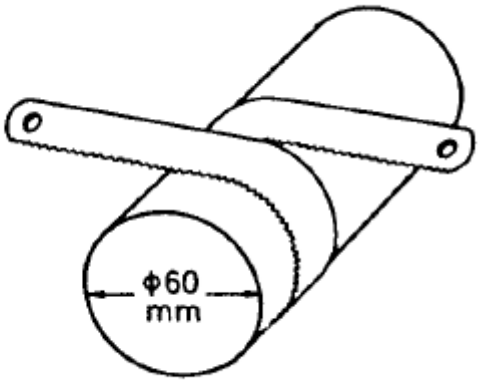

Figure 4 – Flexibility test for flexible blades (Type B)

9.1.3 Flexible centre and spring back blades

The blades shall be bent to lie on half the circumference of a test bar of 100mm diameter (see Fig. 5). The blade, when released, shall not show any sign of fracture or permanent set.

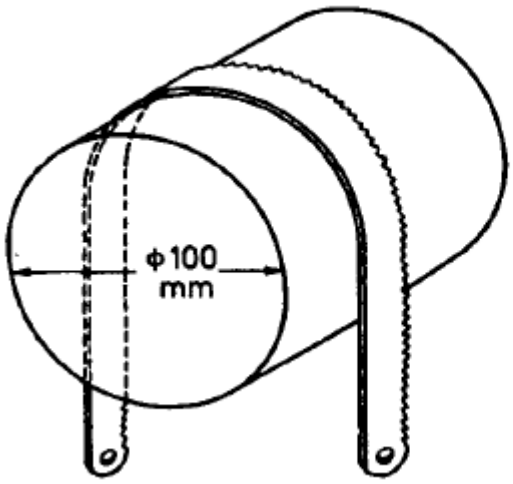

Figure 5 – Flexibility test for flexible centre and spring back blades (Type C and D)

9.1.4 Shatterproof Blades

Test each blade to destruction by twist in the blade until rupture takes place using a suitable jig (see Fig. 6). Check that upon rupture, the blade does not break into more than two pieces.

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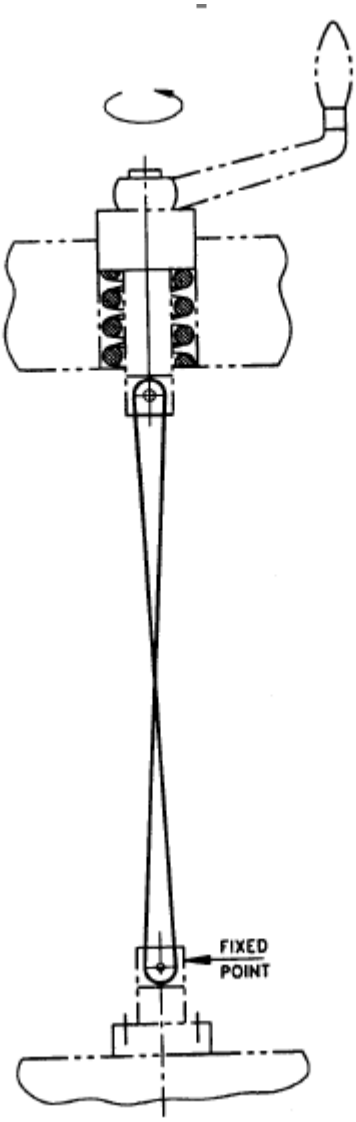

Figure 6 – Destruction test apparatus for shatter proof (Type E) Blades)

9.2 Cutting performance test

When tested in accordance with Annex A, the wear rate of the hand or machine blade and the total time taken to complete the number of cuts shall not exceed the values given in Tables 4 and 5 for the type of blade tested.

The blade shall not produce a cut more than 3 mm out of square. The blade shall not break. A new blade shall be used for each test.

Table 4 — Test Conditions and Acceptance Limits for Hand Blade Cutting Tests

Blade Type	Blade Dimensions			Speed, Strokes/min	No. of cuts	Test Bar		Wear Rate sec/cut	Total Time min
	Thickness mm	Pitch mm	No. of Teeth			No. of Strips	Thickness of Strip mm		
High speed steel: all hard and bi-	0.63	1.8	14	70	10	10	2.6 ± 0.05	33	92
	0.63	1.4	18	70	10	10	2.6 ± 0.05	37	112

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metal	0.63	1.0	24	70	10	9	2.6 ± 0.05	40	124
	0.63	0.8	32	70	10	8	2.6 ± 0.05	40	132
High-speed steel: flexible	0.63	1.8	14	70	8	10	2.6 ± 0.05	73	122
	0.63	1.4	18	70	8	10	2.6 ± 0.05	78	132
	0.63	1.0	24	70	8	9	2.6 ± 0.05	118	146
	0.63	0.8	32	70	8	8	2.6 ± 0.05	120	149
Low alloy steel: flexible	0.63	1.8	14	35	8	5	2.6 ± 0.05	44	134
	0.63	1.4	18	35	8	5	2.6 ± 0.05	40	123
	0.63	1.0	24	35	8	5	2.6 ± 0.05	34	147
	0.63	0.8	32	35	8	4	2.6 ± 0.05	37	127

Table 5 — Test Conditions and Acceptance Limits for Machine Blade Cutting Tests

(High Speed Steel, All Hard and Bi-metal)

Blade Dimensions				**Speed, Strokes/min**	**No. of Cuts**	**Test Bar**		**Wear Rate sec/cut**	**Total Time min**
Length, mm	**Width, mm**	**Thickness, mm**	**Pitch, mm**			**No. of Strips**	**Thickness of Strip, mm**		
300 and 350	25	1.25	1.8	124	10	15	2.6 ± 0.05	66	66
300 and 350	25	1.25	2.5	124	10	20	2.6 ± 0.05	56	61
350 400 450	32	1.60	2.5	124	10	20	2.6 ± 0.05	65	87
350 400 450	32	1.60	4	124	10	25	2.6 ± 0.05	47	60
400 450	40	2.00	4	124	10	25	2.6 ± 0.05	81	80
400 450	40	2.00	6.3	124	10	25	2.6 ± 0.05	69	76

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Annex A
(informative)

Methods for testing the performance of hand and power hacksaw blades

A.1 Principle

A.1.1 The cutting performances of hand and power hacksaw blades is assessed by subjecting sample blades to an accelerated test using calibrated hacksaw machines to control the variables in friction, stroke characteristics and loads.

A.1.2 The standard test bar is chosen to induce sufficient wear to the blade and to provide by its homogeneous structure reproducible machining characteristics.

A.2 Test bar

A.2.1 A test bar consisting of lengths of cold rolled 18/8 stainless steel strip as per ISO 15510 shall be used.

A.2.2 The strip shall be 25.0 mm ± 0.15 mm in width, 2.6 mm ± 0.05 mm in thickness. The hardness shall be 180 ± 12 HV30. The material shall have rolled or prepared edges. Ragged sheared edges are to be avoided.

A.3 Apparatus

A.3.1 Test Machine for Hand Blades

A power hacksaw machine as follows:

a) In good condition, particularly in respect of stroke alignment and freedom from excessive vibration;

b) With main slides sufficiently free from friction to prevent variations in dynamic loads;

c) With the main pivot on the same axis as the crank drive shaft;

d) Which cuts on the forward stroke;

e) Which presents the blade at an inclination of 1º15’ ± 10’ relative to the machine slides in the direction of cut;

f) With a stroke length of 153 mm ± 1mm;

g) With a cutting speed of 70 strokes/min ± 2 strokes/min when blades of high speed steel and bii-metal type are to be tested;

h) With a cutting speed of 35 strokes/min ± 2 when blades of low alloy type are to be tested;

j) With location facilities for the test bar so that when the machine is stroking, the test bar is positioned no closer than 50 mm from the blade pin holes;

k) Which does not lift the reciprocating arm on the return stroke;

m) Which exerts static loads on the test bar at the top of the cut in accordance with Table 3.

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A.3.2 Test Machine for Machine Blades

A power hacksaw machine as follows:

a) In good condition, particularly in respect of stroke alignment and freedom from excessive vibration;

b) Which cuts on the return stroke;

c) Which presents a blade at an inclination of 1º 40' ± 10' relative to the machine slides in the direction of cut;

d) With a machine speed of 124 ± 2 cutting strokes/min;

e) With a stroke length of 133 mm ± 1 mm;

f) With location facilities for the test bar so that when the machine is stroking the test bar is positioned no closer than 50 mm from the blade pin holes;

g) With lift-off on the non-cutting stroke synchronized so that no dynamic load is applied during the non-cutting stroke, and so that no dynamic load relief is applied during the cutting stroke;

h) Which exerts static loads onto the test bar in accordance with Table 6;

i) Which supplies a coolant, consisting of 100 g/l of $Na_2CO_3.10H_2O$ in water, to the blade immediately above the test bar at a rate of 2 l/min minimum.

Table 6 — Static Load on Test Bar at Top Cut

Position of Bow	Static Load, kg	
	For Hand Blades	For Machine Blades
Start of stroke	3.3 ± 0.1	69 ± 0.1
Mid-stroke	5.7 ± 0.1	72 ± 0.1
End of stroke	8.4 ± 0. 1	75 ± 0.1

A.4 Preparation of test blades

There is no preparation required for hand blades. Correct machine blades to a length of 350 mm if necessary.

NOTES

1 Machine blades, because of their variation in length from 300 mm to 450 mm and the capacity limit of hack sawing machines, may need to be corrected to a Made length of 350 mm.

2 Testing in the unaltered length is valid if the bow capacity of the machine allows, and alteration of blade clamping mechanisms in the machhre is also feasible.

A.5 Test procedure

A.5.1 Calibrate the test machine to the loads given in Table 3 for hand blades and for machine blades.

A.5.2 Once the load has been adjusted to give the load specified, ensure that the jaw of the test bar clamp that is nearest the main pivot of the machine remains in a fixed position, irrespective of the number of test bar strips being used in the blade testing.

A.5.3 Position lengths of strip in accordance with Table 1 for hand blades, or Table 2 for machine blades, edge upwards in the machine work piece wise to form a pack approximately 25 mm deep.

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NOTE — The actual width of the pack is determined by the number and thickness of strips given in Table 1 and 2.

A.6 Assessment of results

Calculate the wear rate and total time as given in A.6.1 and A.6.2.

A.6.1 Wear Rate

Wear is represented by the recorded number of strokes plotted sequentially against section numbers. The average increase in wear per section cut is the slope of the plotted curve.

A mathematical value for this is derived by first performing a least squares linear regression which is designed to minimize the sum of the squares of the deviations of the actual recorded data points from the straight line of best fit and then calculating the slope of the line.

This can be done automatically using a scientific calculator with linear regression facilities, or manually using the following formula:

$$\text{Wear rate} = \frac{N\sum n.X_n - \sum n \sum X_n}{N\sum n^2 - (\sum n)^2}$$

Where;

Σ = sum between n = 1 and n = N,

N = number of cuts;

n = cut number; and

X_n = number of strokes per cut.

A.6.2 Total Time

The total time shall be calculated by dividing the cumulative number of strokes for the allotted number of sections to be cut by the number of strokes per minute performed by the machine.

A.7 Test report

Cutting performance test results shall state the nominal dimensions and tooth pitch of the blade, the type of blade, the stroking rate per minute of the machine and the number of strips used in the pack of test bars. The following information shall be included in the test report:

a) Wear rate (to the nearest whole number);

b) Total time (to the nearest minute);

c) Number of cuts completed by the blade; and

d) Amount by which the blade cut out of square (if the amount exceeded 3 mm).

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Annex B
(informative)

Hacksaw blade designation

Example 1

A hand hacksaw blade of Type A having nominal length, l = 300 mm; width, a = 12.5 mm; thickness, b = 0.63 mm; pitch, P = 1.0 mm conforming to this standard and made from low alloy steel (LA) shall be designated as:

Hand Hacksaw Blade, A 300 x 12.5 x 0.63 x 1.0 -LA.

Example 2

A machine hacksaw blade of Type A having nominal length, l= 400 mm; width, a = 32 mm; thickness, b = 1.60 mm; pitch, P = 2.5 mm; conforming to this standard and made from high-speed steel (HS) shall be designated as:

Machine Hacksaw Blade, A 400 x 32 x 1.60 x 2.5 -HS.

Example 3

A machine hacksaw blade of Type A, having nominal length, l = 400 mm; width, a = 32 mm; thickness, b = 1.60 mm; pitch, P = 2.5; mm made from hi-metal HSS conforming to this standard shall be designated as:

Machine Hacksaw Blade, A 400 x 32 x 1.6 x 2.5 -HSS.

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