KENYA STANDARD

KS 516: 2008
ICS 79.040

Wood poles for power and telecommunication lines — Specification

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Kenya Bureau of Standards

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In order to keep abreast of progress in industry, Kenya Standards shall be regularly reviewed. Suggestions for improvements to published standards, addressed to the Managing Director, Kenya Bureau of Standards, are welcome.

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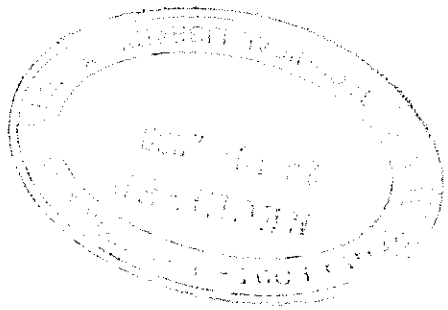

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Foreword

This Kenya Standard was prepared by the Wood Poles Technical Committee under the guidance of the Civil Engineering Industry Standards Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

The use of timber on the power to National Grids and Telecommunication Lines has continued to grow in line with other infrastructural developments in the country. The standard has tried to incorporate the diversity of timber in the country; that growing naturally in the forests and that grown in plantations.

The standard provides the requirements for transmission poles giving the loads that can be applied on various categories of poles. This standard will provide the basic design input required in the design of transmission systems, and consequently lead to better utilization of the National Timber Resource.

During the preparation of this standard, reference was made to the following documents:

BS 1990, British Standard: Wood poles for overhead power and telecommunication lines.

SABS 754, South African National Standard: Eucalyptus poles, cross-arms and spacers for power distribution and telephone systems.

The assistance derived from these sources is hereby acknowledged.

Wood poles for power and telecommunication lines — Specification

1 Scope

This Kenya Standard specifies requirements for wood poles for power transmission, distribution and telecommunication overhead lines.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this KS 516. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this KS 516 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

KS 02-94, *Specification for preservation of timber*

KS 592, *Specification for hot dip galvanized coating on iron and steel articles*

KS 02-93: *Glossary of terms used in timber*

3 Terms and definitions

For the purpose of this standard, the definitions given in KS02-93[1] shall apply except where otherwise defined as follows:

3.1
butt
the thick end of a pole

3.2
crook
natural curvature that extends over not more than 2 m of the length of a pole

3.3
reverse crook
crook in two directions in one plane

3.4
defective pole
a pole which fails in one or more respects to comply with the relevant requirements of the specification

3.5
end check
separation along the grain of the wood and across the growth rings and occurring at the end of a pole

3.6
surface check
separation along the grain of the wood and across the growth rings but not extending to the end of the pole

3.7
ring shake
complete separation of the wood fibres that appears as an arc or a complete circle, that occurs between the growth rings and that is a natural defect that may be present in some trees

[1] KS 02-93: Glossary of terms used in timber

3.8
knot cluster
group of three or more closely associate knots

3.9
unsound knot
knot which is not solid across the face usually as a result of decay and/or a knot showing signs of separation from the surrounding wood such that it is unlikely to retain its place

3.10
post treatment defect
defect that has developed after treatment and that results in the exposure of untreated wood

3.11
sweep
natural curvature that extends over more than 2 m of the length of a pole

3.12
reverse sweep
sweep in two directions in one plane

4 Species of wood

Poles shall be of any species of wood as shown in Table 1.

Table 1 — Species of wood

Standard or trade name	Scientific names	Other names
Iron Bark	*Eucalyptus paniculata*	Gum or Eucalyptus
Spotted Gum	*Eucalyptus citriodora (corymbia citiodora)* or *Eucalyptus maculata (corymbia maculata)*	Lemon Scented Gum or Eucalyptus
Tallow wood	*Eucalyptus microcorys*	Spotted Gum or eucalyptus blue gum
Blue gum	Eucalyptus globulus	
Regnans saligna gum	*Eucalyptus regnans*	Giant Gum (mountain ash)
	Eucalyptus saligna	Blue gum (*Saligna* gum)
	Eucalyptus grandis	River Red Gum

5 Felling

The trees shall be cut as close to the ground level as possible. The ends shall be sawn to give a flat section and branches shall be dressed downflush with the trunk. The poles shall then be stacked in open crib formation on flat clear ground.

6 Moisture content

The average moisture content of individual poles shall not exceed 25 % at the time of treatment or at the time of measurement of any growth seasoning defects.

7 Defects

7.1 Poles shall be generally of sound wood, free from decay, insect attack, rot pockets and any damages caused by handling and processing that would affect the strength of the pole. The growth and seasoning defects shall be limited to the requirements as set out below.

7.2 Knots

The diameter of any single sound knot shall not exceed 1/6 of the circumference and the sum of the diameters of all sound knots in any 500 mm portion shall not exceed ¼ of the circumference at that average cross-section.

7.3 Unsound knots

The allowable diameter of any unsound or combined diameters of a group of unsound knots shall not exceed one half of the allowances given for sound knots.

7.4 Spiral grain

Spirality of grain shall not exceed one complete turn when measured over any 6 m length of the pole.

7.5 End check

The number running from the pith to the outer surface of the pole shall not exceed 4 in number. The length shall not exceed 2 times the butt diameter at the butt and 1 times top diameter at the top.

7.6 Surface check

The maximum width of any surface check shall not exceed 15 mm and the maximum length of any surface check, measured over the distance for which the width of the surface check exceeds 4 mm shall not exceed six times the average diameter of the pole.

7.7 Ring shakes

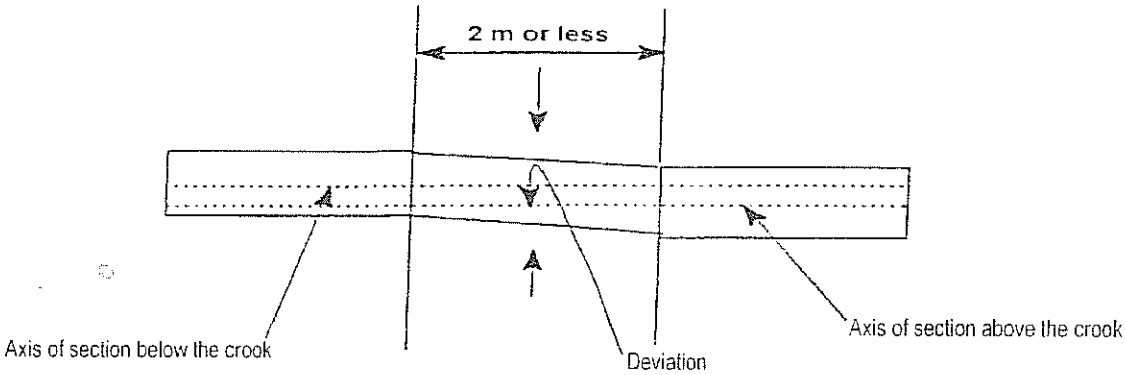
The tip shall be free from ring shakes but one ring shake not exceeding 1/3 of the circumference of the butt of the pole shall be permitted at the butt provided that no part extends to within 50 mm of the periphery.

8 Straightness

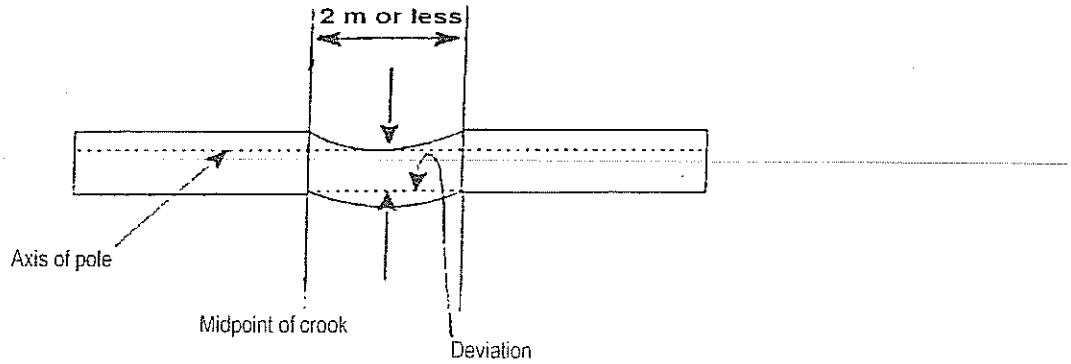
8.1 A straight line from the centre of the butt to the centre of the tip shall lie entirely within the body of the pole.

8.2 Poles shall be free from crooks that deviate more than 75 mm from straightness in any 2 m, length see Figure 1.

Case 1 – Where the reference axis are approximately parallel.



Case 2 – Where axis of sections above and below the crook coincide or are practically coincided.



Case 3 – Where axis of section above and below the crook is not parallel or coincident with axis below the crook.

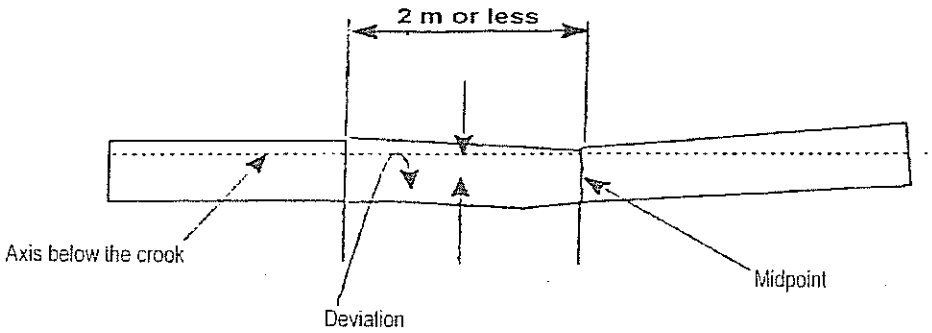


Figure 1 — Measurement of deviation from straightness

9 Theoretical groundline

Unless otherwise specified by the purchaser, the theoretical groundline (TGL) of a pole shall be as given in Table 2.

Table 2 — Pole groundline from butt

Overall length of the pole (m)	Theoretical ground line (TGL) from butt (m)
Up to and including 7.0	1.2
7.1 – 9.0	1.5
9.1 – 12.0	1.8
12.1 and above	2.0

10 Length

10.1 The length shall be measured between the extreme ends of a pole to the nearest 10 mm.

10.2 Tolerances on ordered length shall be ± 1 % of the length of the pole.

11 Diameter

The diameter of a pole shall be measured at the top and at the mark representing groundline and shall be as given in Table A.1. The maximum difference between the major and minor axes at the top of the pole shall not exceed 25 mm for all poles up to 125 mm top diameter and 35 mm for poles of larger top diameter.

12 Banding and nail plates

12.1 Banding

12.1.1 Each end of each pole shall be banded by not less than one band of galvanised mild steel strapping, of width not less than 19 mm and thickness not less than 0.9 mm. The strapping is to be firmly tensioned into position by the use of a suitable strapping machine capable of applying a tensile force of not less than one half of the ultimate tensile strength of the strapping being used. Each band is to be nailed to the pole at two diametrically opposed positions, using galvanised clout nails of not less than 3 mm diameter and length not less than 38 mm.

12.1.2 Banding position

The bands are to be applied not more than 100 mm away from the end of each pole.

12.1.3 Time of banding

After seasoning and dressing of the poles and prior to preservative treatment.

12.2 Nail plates

12.2.1 Nail plates shall be used only for flat or slant end cuts, either at the top of the pole or at the ends of

cross-arms and spacers. The nail plate shall be made of steel and have a zinc coating that complies with the requirements of KS 592. The plate shall have a minimum thickness of 1.2 mm and have a minimum nail length of 14 mm. The size of the plate will be such that the area covered by the plate is at least 60 % of the area of applicable pole end.

12.2.2 Securing of plate

Each nail shall be fully embedded in the pole end and no nail shall be bent. The nail plate shall be so positioned in the middle of a cut end that its edges do not protrude over the round face of the timber.

13 Strength

The strength of eucalyptus poles shall be determined as provided for in Annex A.

14 Preservation

14.1 The poles shall have a minimum sap wood thickness of 15 mm as observed at each end of pole.

14.2 The poles shall be treated as per KS 02-94. The retention shall be measured as specific sapwood retention.

15 Marking

15.1 Each pole shall be legibly and indelibly marked with the following information:

a) manufacturer's name or trade mark;

b) date of treatment;

c) the number of this Kenya Standard;

d) length of pole;

e) diameter class;

f) hazard class;

g) species of pole;

h) method of treatment.

15.2 The marking shall be placed 3.5 m from the butt of the pole.

Annex A
(normative)

Design data for the strength of poles unstayed and stayed

A.1 Loads

The ultimate average load (i.e. excluding the safety factors) for eucalyptus poles may be obtained from Table A.1. For other sizes of poles the loads should be calculated individually.

The loads given in Table A.1 are based on the following material properties for eucalyptus wood:

Mean ultimate bending strength 62.9 N/mm^2

Mean modulus of elasticity 10646 N/mm^2

NOTE The strength values have been derived from tests on small clear specimens tested in the green condition and modified for pole – small clear strength relationships. The coefficients of variation for the two strength values are 17.9 % and 26.5 % respectively.

A.2 Apparatus

A.2.1 Crib, capable of securing the pole under test from the butt end to the ground line and that will ensure no significant movement of the clamped butt during a test and prevent any rotational movement of the pole.

A.2.2 Clamping device, to secure the pole in the crib, of curvature that suits the diameter of the pole under test and that will not damage the pole during test.

A.2.3 Winch, or similar device, of suitable capacity and preferably motor driven, that is capable of applying force to the pole under test, the force being applied horizontally and at an average angle of approximately 90° to the pole, through a cable of such a length that during the test, the angle varies between slightly less than and slightly more than 90°.

NOTE The position of the crib relative to the winch has to be altered by varying lengths of poles under test.

A.2.4 Force indicator or recorder, calibrated to indicate or record (as relevant), to within 2.5 %, the actual force applied to the pole.

A.3 Procedure

A.3.1 Using the clamping device, securely clamp the butt of the pole in the crib, at the theoretical ground line (TGL) of the pole as per Table 2. If the pole displays crook or sweep, ensure that the concave side of the crook or sweep faces towards the winch. Secure the cable to the pole and at a position 600mm ± 25 mm or 100 ± 25 mm, as relevant (see A.4), from the top end, and so position and secure the crib or winch (or both) that the angle between the axis of the pole and the cable is slightly less than 90°.

A.3.2 Take up the slack and without jerking the pole, apply force gradually and at as uniform a rate as possible till the pole fails. Then stop the test and release the force.

A.3.3 Record the value at failure. Record the distance at which the pole failed (Distance from the TGL), any defects (physical or otherwise) at the point of failure and the diameter of pole at that point.

A.4 Calculation

Calculate the value of F as follows:

$$F = \frac{\sigma \times D3}{10.2 \times L}$$

Where

F is the force, in Newtons, required to cause a minimum fibre stress in Cantilever loading of 62.9 MPa;

σ is the minimum fibre stress, i.e. 55 MPa;

D is the minimum diameter, in millimetres, of pole at the TGL (i.e. 1500 mm from the butt end), based on the specified minimum top diameter and a taper of 5mm per metre of length; and

L is the distance, in millimetres, between the TGL and 600 mm from the top end in the case of poles and cross-arms of length at least 6.0m and between the TGL and 100 mm from the top in other cases.

Table A.1 — Dimensions and strength values for poles

1	2	3	4	5
Length	Minimum top diameter	Minimum diameter at theoretical Ground line	Force required to cause a fiber stress of 55MPa	
			Cantilever loading	Midpoint loading
m	mm	mm	kN	kN
2.0	80	82.5	7.57	7.37
2.0	100	102.5	14.52	13.89
2.0	120	122.5	24.78	23.44
2.0	140	142.5	39.01	36.58
2.0	160	162.5	57.84	53.90
2.5	80	85	3.68	6.03
2.5	100	105	6.94	11.26
2.5	120	125	11.70	18.90
2.5	140	145	18.27	29.38
2.5	160	165	26.91	43.15
3.0	100	107.5	4.78	9.58
3.0	120	127.5	7.98	15.99
3.0	140	147.5	12.36	24.75
3.0	160	167.5	18.10	36.25
3.0	180	187.5	25.39	50.85
3.5	100	110	3.78	8.42
3.5	120	130	6.24	13.97
3.5	140	150	9.58	21.54
3.5	160	170	13.94	31.45
4.5	100	115	2.83	6.92
4.5	120	135	4.57	11.36
4.5	140	155	6.92	17.38
4.5	160	175	9.97	25.23
4.5	180	195	13.79	35.14
6.0	80	102.5	1.49	3.43
6.0	100	122.5	2.54	6.08
6.0	120	142.5	4.00	9.84
6.0	140	162.5	5.[illegible]	14.89
6.0	160	182.5	8.4[illegible]	21.44
6.0	180	202.5	1[illegible]	29.66
7.0	80	107.5	1.3[illegible]	3.13
7.0	100	127.5	2.28	5.47
7.0	120	147.5	3.53	8.77

7.0	140	167.5	5.17	13.19
7.0	160	187.5	7.25	18.87
7.0	180	207.5	9.83	26.00
8.0	80	112.5	1.30	2.92
8.0	100	132.5	2.13	5.04
8.0	120	152.5	3.24	8.01
8.0	140	172.5	4.69	11.96
8.0	160	192.5	6.52	17.02
8.0	180	212.5	8.77	23.35
9.0	120	157.5	3.05	7.44
9.0	140	177.5	4.37	11.03
9.0	160	197.5	6.02	15.63
9.0	180	217.5	8.04	21.35
10.0	140	182.5	4.15	10.32
10.0	160	202.5	5.67	14.55
10.0	180	222.5	7.52	19.80
10.0	200	242.5	9.73	26.17
11.0	140	187.5	3.99	9.76
11.0	160	207.5	5.41	13.69
11.0	180	227.5	7.13	18.55
11.0	200	247.5	9.19	24.45
11.0	220	267.5	11.60	31.49
12.0	140	192.5	3.89	9.31
12.0	160	212.5	5.23	13.00
12.0	180	232.5	6.85	17.55
12.0	200	252.5	8.77	23.05
12.0	220	272.5	11.02	29.60
13.0	140	197.5	3.81	8.94
13.0	160	217.5	5.09	12.42
13.0	180	237.5	6.63	16.71
13.0	200	257.5	8.45	21.89
13.0	220	277.5	10.57	28.04
14.0	160	222.5	4.99	11.95
14.0	180	242.5	6.46	16.02
14.0	200	262.5	8.20	20.92
14.0	220	282.5	10.22	26.73
15.0	160	227.5	4.92	11.55
15.0	180	247.5	6.34	15.43
15.0	200	267.5	8.00	20.09
15.0	220	287.5	9.93	25.61
16.0	160	232.5	4.88	11.22
16.0	180	252.5	6.24	14.93
16.0	200	272.5	7.85	19.39
16.0	220	292.5	9.71	24.65
18.0	160	242.5	4.84	10.69
18.0	180	262.5	6.13	14.14
18.0	200	282.5	7.65	18.25

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