DRAFT TANZANIA STANDARD

Wood poles and blocks for power and telecommunication lines – Specification
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Tanzania Bureau of Standards (TBS) is the statutory national standards body for Tanzania established under the Standards Act No. 3 of 1975, repealed and replaced by the Standards Act No. 2 of 2009.

The Building and Construction Divisional Standards Committee under whose supervision this Tanzania Standard was prepared, consists of representatives from the following organizations:

- Ministry of Works, Transportation and Communication (MoWTC)
- National Housing and Building Research Agency (NHBRA)
- Commission for Science and Technology (COSTECH)
- Tanzania National Service (JKT HQ)
- National Estates and Designing Consultants Company Ltd (NEDCO)
- University of Dar es Salaam (College of Engineering and Technology)
- Engineers Registration Board (ERB)
- National Construction Council (NCC)
- National Housing Corporation (NHC)
- Contactors Registration Board (CRB)
- Institute of Engineers Tanzania (IET)
- Architects and Quantity Surveyors Registration Board (AQRB)

The organizations marked with an asterisk (*) in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this Tanzania Standard:

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- Tanzania Forestry Research Institute (TAFORI)
- Sao Hill Timber Limited

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Introduction

One of the important factors involved in the design and economical use of wood poles for the support of aerial communication and power lines is the value of the maximum fibre strength for the different species of timber used for wood poles. The fibre strength is affected by the amount of seasoning the wood poles have received. The growth characteristics of timber and their freedom from decay and other defects are of importance in the determination of the mechanical strength of the poles for assessing the safe loads in service.

In this respect, the attention of pole users is drawn to the difficulty of defining and working to precise requirements on all aspects of a natural product such as timber. Some properties have of necessity been specified in general terms only. It is therefore recommended that the supervision of seasoning tests and of preservation processes and the acceptance of poles should be assigned only to qualified and experienced inspectors.
0  National Foreword

The Tanzania Bureau of Standards is the statutory national standards body for Tanzania, established under standards Act No. 3 of 1975, amended by Act No. 1 of 1977 and then Act No. 3 was replaced by the Act No. 2 of 2009.

This draft Tanzania Standard was prepared by BCDC 6 Sawn timber, Sawn logs and Wood based Components Technical Committee, under the supervision of the Building and Construction Divisional Committee (BCDC).

During the preparation of this draft Tanzania Standard assistance was derived from:

- SANS754:2015 Eucalyptus poles, cross-arms and spacers for power distribution and communications systems
- ANSI 05.1 — Specifications and dimensions for wood poles published by American National Standards Institute.
- TANESCO S11 Wood poles and blocks -- Specification 11

In reporting the results of a test made in accordance with this Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4 (see clause 2).
1 Scope
This Tanzania Standard specifies materials and performance requirements for solid wood poles. The poles described herein are considered as simple cantilever members subject to transverse loads only.

2 References
For the purpose of this Tanzania Standard, the following current references shall apply:
TZS 657 Glossary of terms used in timber industry
TZS 661 Copper/chromium/arsenic compositions for timber preservations - Methods of timber treatment
TZS 685, Specification for wood preservation by means of pressure creosoting
TZS 1347, Preservative – Treated timber
TZS 4, Rounding off numerical values

3 Definitions
For the purpose of this Tanzania Standard, the definitions given in TZS 657 (see clause 2) shall apply.

4 Felling
Trees shall be sawn off as close to the ground as possible and no timber shall be removed, trimmed or cut from the butt end so as to reduce its natural size. The ends shall be sawn to give a flat section and branches shall be dressed down flush with the trunk. Bark shall be removed as soon as practicable after felling except for eucalyptus, which requires a longer seasoning time.

5 Materials requirements

5.1 Species
Poles shall be made from the following species and will have a minimum fibre strength of 39 MPa:

<table>
<thead>
<tr>
<th>Trade name</th>
<th>Botanical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redwood or scots pine</td>
<td>(Pinussylvestris)</td>
</tr>
<tr>
<td>Corsican pine</td>
<td>(Pinusnigra)</td>
</tr>
<tr>
<td>Douglas fir</td>
<td>(Pseudotsugamenziesii)</td>
</tr>
<tr>
<td>Dunkeld (hybrid)larch</td>
<td>(Larixeurolepis)</td>
</tr>
<tr>
<td>European larch</td>
<td>(Larix decidua)</td>
</tr>
<tr>
<td>European spruce</td>
<td>(Piceaabies)</td>
</tr>
<tr>
<td>Lodgepole pine</td>
<td>(Pinuscontorta)</td>
</tr>
<tr>
<td>Sitka spruce</td>
<td>(Piceasitchensi)</td>
</tr>
<tr>
<td>East African pencil cedar</td>
<td>(Juniperusprocera)</td>
</tr>
<tr>
<td>Eucalyptus</td>
<td>(Eucalyptus saligna or Eucalyptus)</td>
</tr>
</tbody>
</table>
NOTE 1: Including other species which meet the minimum requirement
NOTE 2: The preferred dressed sizes of poles should be as given in table 3 and table 4.

5.2 Grading

5.2.1 Prohibited defects
a) Cross-breaks (cracks),
b) Decay, except as permitted for firm red heart in 5.2.2(a), defective butts in 5.2.3(d) and decayed knots in 5.2.3(f),
c) Dead streaks, except as permitted in 5.2.3(f),
d) Hollow butts or tops, except as permitted under hollow pith centres,
e) Marine borer damage,
f) Holes, open or plugged, except holes for test purposes, which shall be plugged,
g) Nails, spikes and other metal not specifically authorized by the purchaser.

5.2.2 Permitted defects
a) Firm red heart – Firm red heart not accompanied by softening or other disintegration (decay) of the wood is permitted.
b) Hollow pith centres – Hollow pith centres in the tops or butts and in knots are permitted in poles that are to be given full-length treatment.
c) Sapstain – Sapstain that is not accompanied by softening or other disintegration (decay) of the wood is permitted.
d) Scars - Turpentine acid face scars are permitted anywhere on the pole surface.

5.2.3 Limited defects
a) Bark inclusions - Depressions containing bark inclusions shall be not more than 50 mm in depth measured from the surface of the pole.
b) Compression wood - The outer 25 mm of all poles shall be free from compression wood visible on either end.
c) Dead streaks - A single, sound dead streak is permitted in East African pencil cedar, provided the greatest width of the streak is less than 25 % of the circumference of the pole at the point of measurement.
d) Defective butts – Hollowing in the butt caused by “splinter pulling” in felling the tree is permitted, provided that the area of such hollow is less than 10 % of the butt area. Also hollow heart does not occur closer than 50 mm to the side surface and provided that the depth of the hollow does not exceed 600 mm, measured from the butt surface.
e) Insect damage – Insect damage, consisting of holes 1.5 mm or less in diameter, or surface scarring or channeling is permitted provided there is no active infestation and the strength of the pole is not affected by the degree of damage.
f) Knots – At any cross section along the length of a pole no knot with a diameter measured at right angles to the length of the pole, which is greater than 1/5 of the circumference shall be permitted. Also the sum of knot diameters at the cross section shall not exceed 1/4 of the circumference of the pole.
NOTE - The limitations of knots are based on past practice and satisfactory performance.

g) **Scars (cat face)** – No pole shall have a scar or turpentine cat face located within 600 mm of the groundline. Other sound scars are permitted elsewhere on the pole surface, provided they are smoothly trimmed and do not interfere with the cutting of any grain, and provided that:

i) the circumference at any point on trimmed surface located between the butt and 600 mm below the groundline is not less than the minimum circumference specified at 1.5 m from the butt for the class and length of the pole (see table 2 and table 3)

ii) the depth of the trimmed scar is not more than 50 mm, if the diameter is 250 mm or less, or 1/5 the pole diameter at the location of the scar if the diameter is more than 250 mm.

h) **Shakes** – Shakes in the butt surface which are not closer than 50 mm to the side surface of the pole are permitted, provided they do not extend to the groundline. Shakes or a combination of connected shakes which are closer than 50 mm to the side surface of the pole are permitted provided they do not extend further than 600 mm from the butt surface and do not have an opening wider than 3 mm. Shakes in the top surface are permitted in poles that are to be given full length preservative treatment provided that the diameter of the shake is not greater than 50% the diameter of the top of the pole.

i) **Sweep and Crook** – Shall be permitted to the extent that a straight line from the center of the top to the centre of the pole at 1.5m from the butt remains within the pole.

![Figure 1 - Measurement of sweep in one plane and one direction](image)

j) **Slope of grain** - Spiral grain shall not exceed a slope of 1 in 6.

k) **Splits and checks** – Two checks of approximately the same width, each check terminating at the pith centre and separated by 12.5mm or less of wood fibre at any point on the pole circumference, shall be considered a single continuous check. Splits and checks shall be permitted provided that:

i) A split is not allowed at the top of the pole.

ii) A check or a combination of two single checks on pole top (each check terminating at the pith centre and separated by not less than one sixth of the length of the
circumference) having one or both portions located in a vertical plane within 30° of the top bolt hole shall not extend downward along the pole more than 150mm. All other splits or combination checks shall not extend downward along the pole more than 300mm; and that

iii) A split or a combination of two single checks on the butt of the pole, shall not extend upward along the pole, in its entirety, more than 300mm.

Table 1 — Maximum permissible defects

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of defect</td>
<td>Permissible maximum</td>
<td></td>
</tr>
<tr>
<td><strong>Checks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) End checks&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Number&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Butt</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>b) Length (as it appears on the surface)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top</td>
<td>2 × top dia.</td>
<td>2 × top dia.</td>
</tr>
<tr>
<td>Butt</td>
<td>5 × butt dia.</td>
<td>2 × butt dia.</td>
</tr>
<tr>
<td>c) Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Top</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual width</td>
<td>1/10 dia. or 15 mm (whichever is less)</td>
<td>6 mm</td>
</tr>
<tr>
<td>Sum of widths</td>
<td>50 mm</td>
<td>–</td>
</tr>
<tr>
<td>If top dia. exceeds 180 mm:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual width</td>
<td>1/10 dia. or 25 mm (whichever is less)</td>
<td>1/10 dia. or 15 mm (whichever is less)</td>
</tr>
<tr>
<td>Sum of widths</td>
<td>50 mm</td>
<td>–</td>
</tr>
<tr>
<td>b) Surface checks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Number&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3 at any cross section</td>
<td>3 at any cross section</td>
</tr>
<tr>
<td>2) Individual length</td>
<td>8 × dia.&lt;sup&gt;d&lt;/sup&gt;</td>
<td>8 × dia.&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>3) Individual width</td>
<td>15 mm</td>
<td>10 mm</td>
</tr>
<tr>
<td>4) Sum of widths</td>
<td>40 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>Knots and knot-holes larger than 10 mm (not applicable to a pole or cross-arm tested and found to comply with 4.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Size of individual knots and knot-holes</td>
<td>1/6 circumference</td>
<td>1/6 circumference</td>
</tr>
<tr>
<td>b) Sum of sizes of knots in clusters in worst 150 mm of length</td>
<td>1/3 circumference</td>
<td>1/3 circumference</td>
</tr>
</tbody>
</table>

<sup>a</sup>The number of end checks in spacers shall be limited to three per end, their length shall be a maximum of 1/4 of the length of the spacer, and their width shall be a maximum of 10 mm.

<sup>b</sup>End checks that extend through the centre of an end and appear in two opposite positions of the periphery are regarded as two checks.

<sup>c</sup>Provided that where three checks occur together at any cross section, the sum of their lengths shall not exceed half the length of the pole or cross-arm.

<sup>d</sup>The diameter of the pole or cross-arm midway along the length of the check.

### 5.3 Strength

When so required (see 12), for proof testing or verification, by the inspection body or purchaser, and after all machining has been completed, poles (except streetlight poles) and cross arms shall be tested in accordance with 11.1.1. Each pole and cross-arm shall be capable of withstanding, without showing any signs of failure, a force F calculated in accordance with the appropriate formula given in annex B. The force F corresponds to a mean fibre stress (in bending) of 63 MPa. Each pole or cross-arm that is tested shall be
marked by the supplier with an additional tag that displays the individual test number of each pole or cross-arm. The tag shall be applied to the butt of the pole or cross-arm.

NOTE 1 The calculated mean fibre stress of 63 MPa is based on the minimum top diameter in the class.

NOTE 3 Spacers need not be strength tested.

6 Dimensions and permitted tolerances

6.1 Size of poles

This Tanzania Standard shall be applicable to preferred dressed sizes of poles as given in table 2 and table 3.

NOTE – All circumferences and diameters are applicable to debarked and seasoned or dry poles.

6.2 Diameters

Many nominally round poles have a natural elliptical cross section; the diameter measurements of such poles shall be of the minor axes.

6.3 Length

Length shall be measured between the extreme ends of the pole or in case of a pole with a sweep (see 5.2.3(i)); length shall be measured to the short end of the slope.

6.4 Tolerances

Poles shall be not more than 75 mm shorter or 150 mm longer than the nominal length (see 7.2).

6.5 Classification

The true diameter class shall be determined by measuring the diameter at 1.5 m from the butt end. This dimension will determine the true class of a pole, provided that its top diameter (measured at the minimum length point) is large enough.
Table 2 – Preferred dimensions of poles for power distributions

<table>
<thead>
<tr>
<th>Pole Class</th>
<th>Pole Length (m)</th>
<th>Min. Pole Top Diameter (mm)</th>
<th>Max. Pole Top Diameter (mm)</th>
<th>Min. Dia 1.5m from Butt (mm)</th>
<th>Minimum testing force (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>9</td>
<td>130</td>
<td>150</td>
<td>168</td>
<td>4.05</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>130</td>
<td>155</td>
<td>173</td>
<td>3.86</td>
</tr>
<tr>
<td>Medium</td>
<td>9</td>
<td>150</td>
<td>170</td>
<td>188</td>
<td>5.67</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>155</td>
<td>180</td>
<td>198</td>
<td>5.79</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>160</td>
<td>180</td>
<td>208</td>
<td>5.96</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>160</td>
<td>185</td>
<td>213</td>
<td>5.75</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>160</td>
<td>190</td>
<td>223</td>
<td>5.99</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>170</td>
<td>190</td>
<td>233</td>
<td>6.26</td>
</tr>
<tr>
<td>Intermediate</td>
<td>10</td>
<td>180</td>
<td>200</td>
<td>223</td>
<td>8.27</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>180</td>
<td>210</td>
<td>228</td>
<td>7.84</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>185</td>
<td>210</td>
<td>238</td>
<td>8.02</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>190</td>
<td>215</td>
<td>248</td>
<td>8.24</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>190</td>
<td>215</td>
<td>253</td>
<td>8.02</td>
</tr>
<tr>
<td>Stout</td>
<td>10</td>
<td>200</td>
<td>220</td>
<td>243</td>
<td>10.70</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>210</td>
<td>230</td>
<td>258</td>
<td>11.37</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>210</td>
<td>230</td>
<td>263</td>
<td>10.82</td>
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<td></td>
<td>13</td>
<td>215</td>
<td>235</td>
<td>273</td>
<td>11.00</td>
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<td></td>
<td>14</td>
<td>215</td>
<td>235</td>
<td>278</td>
<td>10.64</td>
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<td></td>
<td>15</td>
<td>220</td>
<td>240</td>
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<td></td>
<td>16</td>
<td>220</td>
<td>240</td>
<td>293</td>
<td>10.66</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>225</td>
<td>245</td>
<td>303</td>
<td>11.00</td>
</tr>
<tr>
<td></td>
<td>18</td>
<td>225</td>
<td>245</td>
<td>308</td>
<td>10.82</td>
</tr>
</tbody>
</table>

* The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc.

Table 3 – Preferred dimensions of poles for aerial telecommunications

<table>
<thead>
<tr>
<th>Pole class</th>
<th>Pole Length (m)</th>
<th>Pole Top Diameter Min (mm)</th>
<th>Pole Top Diameter Max (mm)</th>
<th>Min Dia 1.5m from Butt (mm)</th>
<th>Groundline Distance from the Butt (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>6</td>
<td>90</td>
<td>120</td>
<td>120</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>90</td>
<td>120</td>
<td>130</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>90</td>
<td>120</td>
<td>135</td>
<td>1.3</td>
</tr>
<tr>
<td>Medium</td>
<td>7</td>
<td>120</td>
<td>140</td>
<td>150</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>120</td>
<td>140</td>
<td>155</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>120</td>
<td>140</td>
<td>160</td>
<td>1.5</td>
</tr>
<tr>
<td>Stout</td>
<td>9</td>
<td>130</td>
<td>150</td>
<td>175</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>130</td>
<td>150</td>
<td>185</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>130</td>
<td>150</td>
<td>195</td>
<td>1.9</td>
</tr>
</tbody>
</table>

* The figures in this column are intended for use only when a definition of groundline is necessary in order to apply requirements relating to scars, straightness, etc.
7 Manufacturing requirements

7.1 General

Outer bark shall be removed from all poles and inner bark shall not be permitted. All poles shall be round with no excessive removal of the sapwood.

7.2 Taper

The taper in a pole from top to the butt shall not exceed 10 mm per meter of the length of a pole.

7.3 Cut of ends

The butts of the poles shall be cut perpendicular to the central axis with a tolerance of 50 mm across the sawn surface. The top of the pole shall be cut slant or gable section, having a $10^\circ$ slope and shall be bound with anti-cracking plate.

7.4 Trimming

Knots on the pole surface, whether partially or fully grown and branch stubs shall be trimmed close. Trimming may be done by shaving machine or by hand.

7.5 Shaving

If shaving is used, the depth of cut shall not be more than necessary to remove inner bark and to trim all branch stubs and overgrown knots smoothly and closely. There shall be no abrupt
change in the contour of the pole surface between the groundline and the above ground sections. The lower 600 mm pole section may be trimmed to remove wood fibres causing butt flare, provided sufficient sapwood remains to obtain the minimum penetration requirements.

No sapwood shall be removed from the butt of the pole to 1 m above proposed ground level, the minimum sapwood thickness being 25 mm. The remainder of the pole should be trimmed to produce a rounded pole while maintaining a minimum sapwood thickness of 20 mm.

7.6 Drilling

Where practicable, poles shall be delivered predrilled to suit the different types of pole duties and configurations. Drilled holes shall be positioned at right angles to any pole top spilt. All drilling and fabrication shall be carried out before preservative treatment.

8 Stacking and preparation of poles at depots

All poles other than spruce shall be stacked in open formation, before and after dressing, on suitable skids so that the lowest timber of each stack is at least 250 mm above the ground. Sufficient dunnage or cross-timbers shall be used to distribute the total mass without imposing under strain on the poles at the lower layers. The surface of the seasoning ground under and around the stacks shall be well drained and kept free from bark, shavings, grass and weeds.

9 Moisture content

Preservation of species other than spruce shall not take place until the average moisture content of each batch of the poles is reduced to not more than 25%. No individual pole in the batch shall have a moisture content greater than 28%.

The moisture content of the poles shall be determined prior to treatment by the calibrated electric moisture meter test method or any other suitable method in accordance with the method described in annex D of TZS 661 (see clause 2).

Poles for preservation shall be protected against heavy and continuous rain.

10 Poles preservation

10.1 The following species shall be pressure impregnated with creosote in accordance with TZS 685 (see clause 2) or with a copper/chromium/arsenic (CCA) mixture in accordance with TZS 661 (see clause 2)

- Red wood
- Corsican pines
- Douglas fir
- Dunkeld larch
- Lodgepole pine
- East African pencil cedar
- Eucalyptus

NOTE: Including other species which meet the minimum requirement
10.2 When pressure impregnating in accordance with TZS 685 (see clause 2), the coal tar creosote used shall comply with type 2 and the average net retention of preservative in a charge shall be not less than 230kg/m$^3$ sapwood net retention.

10.3 When pressure impregnating in accordance with TZS 661 (see clause 2), the copper/chromium/arsenic mixture shall have a solution strength not less than 5 % (m/v) and the sapwood oxide retention of preservatives in a charge shall be not less than 20 kg/m$^3$.

10.4 Since sitka spruce cannot be treated with preservative in the normal way by the procedures described in TZS 685 (see clause 2) and TZS 661 (see clause 2), it shall be treated using a suitable modification of one of the procedures described in those standards to meet the requirements for full sapwood penetration and net retention.

Treatment requirements shall be in accordance with TZS 2110: 2010.

11 Inspection and methods of test

11.1 General

11.1.1 Using one of the methods given in B.2 or B.3 as relevant, determine the strength of each pole or cross-arm in the sample (see Table. C.1 for sampling) before subjecting it to the other appropriate tests.

11.1.2 If holes have been drilled in order to assess compliance of the timber (see C.2.3), poles and cross-arms may be returned to the lot after testing, provided that, immediately after the holes have been drilled and the timber inspected, the holes are filled with preservative at the recommended treating temperature and tightly plugged to their full depth with a completely penetrated preservative-treated pine dowel.

11.1.3 Measure the location of the holes on the gained surface.

11.2 Inspection

Visually examine and then measure (using the relevant methods given in their respective clauses, for compliance with the relevant given requirements.

12 Marking and labeling

12.1 General

Each pole shall have an Aluminium gouge plate or brand mark at least 75 mm long, 55 mm wide and 1 mm thick placed 3 m from the butt and shall be marked with certain information in characters not less than 3.5 mm high, 3.5 mm wide and gouged or branded 3 mm deep. Spacing between codes shall be between 20 mm and 30 mm. The coded information shall include the following:

a) the name or mark of the preserver and/or the depot supplying the pole;
b) pole length in metres;
c) pole class (L for light, M for medium, I for Intermediate and S for stout);
d) Species code, i.e. $CP$ Corsican pine,
SP  Scots pine or Redwood,
EA  East African pencil cedar,
SS  Sitka spruce,
LP  Lodgepole pine,
LD  Larch Dunkeld,
E   Eucalyptus and

e) last two digits of year of preservation.

f) whether proof-testing of the strength of poles or cross-arms (as appropriate) is required, (see 4.3);

12.2 The layout of these markings shall be as is shown in figure 3.

12.3 Pole treated with creosote shall carry no other distinguishing mark. Appropriate letters shall denote other forms of preservation.

12.4 In the butt end

Each pole shall also have the pole length in metres and the pole class impressed on the pole butt.
Figure 3 – Markings layout

All characters are to have a minimum height of 25 mm and souped or branded 5 mm wide and 3 mm deep minimum.
Annex A

Stayblocks and brace/kicking blocks

A.1 Materials requirements

Preferably stayblock and brace blocks may be sourced from mninga (*angolensispterocarpusangolensis*) or mtundu (*croton macrostachys*) but species listed in 5.1 may be used with specified preservative treatment.

A.2 Dimensions and characteristics

The stayblocks and brace blocks may be cut from sawn timber or from the round timber to produce rectangular, round or half round sections, whichever is economical, from the available material. Stayblocks and brace blocks shall be in accordance with Figure 4 and Figure 5 respectively; and with the following requirements:

A.2.1 The width of stayblocks and brace blocks shall be as near as possible to the dimension stated but must be within the range of 200 mm to 300 mm. If it is convenient to cut stayblocks and brace blocks from larger size poles, then the side shall be cut as indicated in the figures to reduce the maximum width. The longitudinally cut surfaces of stayblocks and brace blocks shall be straight and clean-cut, while annual rings shall be approximately parallel to the wide face. Planing is not required. Wain is permitted on one face. The blocks shall be bored as indicated in figures 4 and 5.

A.2.2 These stayblocks and brace blocks have been designed for a minimum failing load and resistance to uplift of 65 kN. Uplift calculations are based on installation of sand of density of 550 kg/m³, which is considered to be representative of average worst ground conditions, with a minimum angle between stay pole of 30°.

A.3 Preservative treatment

The blocks shall be treated by either coal tar creosote in accordance with TZS 685 (see clause 2) or copper/chromium/arsenic mixture in accordance with TZS 661 (see clause 2) after fabrication using Bethel/Rueping processes.
Figure 4 – Stayblocks dimensions

Figure 5 – Brace blocks dimensions
Annex B
(normative)

Bending strength (MOR) for poles and cross-arms

B.1 Strength values for poles and cross-arms
The mean bending strength of eucalyptus species specified in this standard is 63 MPa.

B.2 Cantilever loading test for poles 6m and longer

B.2.1 Apparatus

B.2.1.1 Crib, capable of securing the pole under test from the butt end to the TGL, and that will
a) ensure no significant movement of the clamped butt during a test, and
a) prevent any rotational movement of the pole.

B.2.1.2 Wooden saddles, or similar suitable clamping devices (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 the test.

B.2.1.3 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 a
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 for varying lengths of poles under
test.

B.2.1.4 Force indicator or recorder, calibrated to indicate or record (as relevant), to within 2.5
%, the actual force applied to the pole.

B.2.2 Procedure

B.2.2.1 Using the wooden saddles, securely clamp the butt of the pole in the crib, over a
distance of 1.5 m ± 25 mm from the butt end. 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
at a position 600 mm ± 25 mm or 100 mm ± 25 mm, as relevant (see B.2.3), 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°.

B.2.2.2 Take up the slack and, without jerking the pole, apply force (gradually and at as
uniform a rate as possible) until the force reaches the appropriate value of F, calculated using
the formula given in B.2.3. Then stop the test and release the force.

B.2.2.3 Consider the pole to be defective if any visible sign of failure was noted during the test.

B.2.3 Calculation

Calculate the value of F as follows:

\[ F = \frac{\sigma \times D^3}{10.2 \times L_1} \]
where

\[ F \] is the force, in newtons, required to cause a mean fibre stress in cantilever loading of 63 MPa;

\[ \sigma \] is the mean fibre stress, i.e. 63 MPa;

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

\[ L_1 \] 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 6.0 m, and between the TGL and 100 mm from the top end in other cases.

B.3 Midpoint loading test for poles and cross-arms shorter than 6 m

B.3.1 Apparatus

B.3.1.1 Two suitable anchorages, that

a) will not damage the pole/cross-arm during the test, and
b) are such that the distance between them can be adjusted to the appropriate test span, i.e. the length of the pole/cross-arm under test, minus 600 mm or minus 200 mm, as relevant (see B.3.3).

B.3.1.2 Suitable force applicator, that is positioned centrally between the anchorages, for example

a) either a hydraulic or a pneumatic ram of adequate capacity and stroke, that has a pressure foot of radius such as to fit the diameter at midlength of the pole/cross-arm under test and that will not damage the pole/cross-arm during the test, or
b) a suitable winch and cable.

B.3.1.3 Force indicator or recorder, calibrated to indicate or record (as relevant), to within 2.5%, the actual force applied to the pole/cross-arm.

B.3.2 Procedure

B.3.2.1 So position the pole/cross-arm under test in the apparatus that the anchorages secure the pole/cross-arm at positions 300 mm ± 25 mm or 100 mm ± 25 mm (as relevant) from its ends and that, if the pole/cross-arm displays crook or sweep, the concave side of the crook/sweep faces towards the ram or the convex side of the crook/sweep faces towards the winch, as appropriate.

B.3.2.2 If a winch and cable is used, take up the slack and, without jerking the pole/cross-arm, apply force to the midlength point of the pole/cross-arm. If a ram is used, extend the ram (without impacting the pole/cross-arm) until it touches the midlength point of the pole/cross-arm. In each case, increase the force (gradually and at as uniform a rate as possible) until it reaches the appropriate value of \( F \), calculated using the formula given in B.3.3. Then stop the test and release the force.

B.3.2.3 Consider the pole/cross-arm to be defective if any visible sign of failure was noted during the test.

B.3.2.4 If the force is applied in any plane other than the horizontal and vertical plane upward, a correction factor shall be applied to force \( F \).

B.3.3 Calculation

Calculate the value of \( F \) as follows:
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<td>10</td>
<td>32</td>
<td>2</td>
</tr>
</tbody>
</table>

a Applicable only to penetration, to the moisture content of poles and to the moisture content of cross-arms and spacers not treated with a mixture of copper-chromium-arsenic compounds.