INTERNATIONAL STANDARD

ISO 15206

First edition
2010-04-01

Timber poles — Basic requirements and test methods

Poteaux en bois — Exigences de base et méthodes d'essai

Reference number
ISO 15206:2010(E)

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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 15206 was prepared by Technical Committee ISO/TC 165, *Timber structures*.

Introduction

This International Standard covers the requirements for grading and assignment of characteristic values that can be used for the design of timber poles used as cantilevers and/or in compression.

It is the responsibility of the supplier to always ensure that all products supplied are in conformity with the requirements of this International Standard and any other specification with which they are provided. This International Standard is intended for the initial determination of the characteristic values for a given population of poles and additional determination when there is a reason to suspect that the characteristics of a population have changed.

This International Standard recognizes that there are many different visual strength-grading rules for timber in use internationally. These have come into existence to allow for

— different species or groups of species,

— geographic origin,

— different dimensional requirements,

— varying requirements for different uses,

— the quality of material available, and

— historical influences or traditions.

Because of the diversity of existing standards for wood poles for overhead lines in use in different countries, it is impossible to lay down a single set of acceptable visual grading rules.

This International Standard therefore gives the basic principles to be followed when drawing up regional, national, local or buyer requirements for some characteristics and sets limits for others.

In laying down visual grading rules, two main factors are relevant:

— they shall clearly define and limit the strength-affecting characteristics in poles, such that there is very high confidence that poles supplied meet the required characteristic strength value;

— the rules and the text are such that they can be easily understood and be suitable for implementation by grading personnel.

This International Standard is also concerned with the durability characteristics of wood poles for overhead power and telecommunication lines. It assumes that all such poles are constructed from round timber in which the finished product comprises either a central core of heartwood surrounded by a zone of sapwood or the heartwood only. Such assumptions dictate that where sapwood is present, preservative treatment is normally required in order to provide the poles with sufficient enhanced durability, unless the amount of sapwood present is such that its loss would not compromise the integrity of the pole during its service life and the heartwood has sufficient natural durability as required by this International Standard.

Some timber species do not allow an easy differentiation between heartwood and sapwood. Various standards provide recommendations to address this problem; for example, EN 351-1 and AS 2209:1994 (Appendix D) specify the method of treatment of such timber when preservation is required.

Timber poles — Basic requirements and test methods

1 Scope

This International Standard specifies the requirements for grading, test methods, determination of characteristic values, methods of specifying durability and sizes of single poles manufactured from solid timber for telecommunications and electrical distribution purposes, either preservative treated or untreated, under cantilever or compression loading.

It specifies the:

— methods of measuring the sizes of solid wood poles for overhead transmission and telecommunication lines and permissible deviations that are taken into account for the acceptance of the poles;

— requirements for handling and the characteristics for visual strength grading of softwood and hardwood poles, as well as the marking requirements;

— methods of test to determine characteristic values for modulus of elasticity and bending strength of any population of wood poles and moisture content of solid wood poles;

— requirements for durability and preservative treatment of wood poles.

This International Standard is applicable to both softwood and hardwood poles.

This International Standard does not quantify the service life that can be expected from a pole.

NOTE This depends on its geographical location, the associated climate of its service environment and either the natural durability of the heartwood of the species selected or the combination between selection of species, preservative type, and requirements of retention and any incised zones.

It is not applicable to poles used as beams.

2 Normative references

The following referenced documents are indispensable for the application 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 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 21887:2007, *Durability of wood and wood-based products — Use classes*

AS/NZS 1604.1, *Specification for preservative treatment — Part 1: Sawn and round timber*

AS 2209:1994, *Timber — Poles for overhead lines*

AS 2209:1994/Amd.1:1997, *Timber — Poles for overhead lines*

EN 252, *Field test method for determining the relative protective effectiveness of a wood preservative in ground contact*

EN 351-1, *Durability of wood and wood-based products — Preservative-treated solid wood — Part 1: Classification of preservative penetration and retention*

EN 599-1, *Durability of wood and wood-based products — Efficacy of preventive wood preservatives as determined by biological tests — Part 1: Specification according to use class*

EN 13183-1, *Moisture content of a piece of sawn timber — Part 1: Determination by oven dry method*

EN 13183-2, *Moisture content of a piece of sawn timber — Part 2: Estimation by electrical resistance method*

3 Terms and definitions

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

3.1
bark pocket
bark that is partly or wholly enclosed in the wood

3.2
characteristic value
value corresponding to the 5th percentile of the statistical distribution of strength or the mean value of modulus of elasticity, at a 75 % confidence level

3.3
charge
all the wood treated together in one treatment at one time (one complete treatment cycle)

3.4
crack
separation of wood fibres across the grain

NOTE These can be due to internal strains resulting from unequal longitudinal shrinkage, or the fibres being crinkled by compression or other external forces

3.5
critical zone
1,6 m length of pole measured from a point 1 m above the nominal ground line to 600 mm below the nominal ground line

NOTE If the pole is nominated as a stayed pole, an additional zone measured from the top of the pole equivalent to the length between the nominal ground line and the butt of the pole shall be included.

3.6
decay
rot
decomposition of wood by fungi or other micro-organisms resulting in softening, progressive loss of mass and strength, and often a change of texture and colour

3.7
direct testing
testing the preservative treatment achieved by the direct measurement of the penetration and retention of preservative

3.8
double sweep
sweep characterized by two or more bends in one or several planes

3.9
fibre saturation point
FSP
state of a piece of timber when the cell walls are saturated with moisture but no moisture exists in the cell cavities

3.10
fissure
longitudinal separation of fibres

3.11
grain detector
device for detecting the angle of grain in timber

3.12
growth rate
mean number of growth rings per 25 mm

3.13
heart shake
radial end shake originating at the pith

3.14
incised zone
area of the lateral surface of the pole, which has undergone an incising process as an aid to securing deeper and more uniform penetration of preservative

NOTE The minimum limit of the incised zone should be 400 mm above and 400 mm below the specified ground line for the pole in service.

3.15
included sapwood
presence in the heartwood of a complete or incomplete ring, having the colour and the properties of sapwood

3.16
indirect testing
testing the preservative treatment achieved by measurement of a property found to exhibit a correlation between itself and the penetration and retention of preservative

3.17
kerf
groove or slot formed in wood during the process of sawing

3.18
knot
portion of a branch embedded in wood

3.19
knot cluster
knots located such that no grain recovery is evident between adjacent knots

3.20
knot diameter
dimension of the knot measured on the surface of the pole and perpendicular to the axis of the pole

NOTE The diameter takes the entire knot into account, including the sapwood.

3.21
length
distance from the pole butt to the pole tip

3.22
maximum diameter
largest diameter of the pole at the section of measurement

3.23
minimum diameter
smallest diameter of the pole at the section of measurement

3.24
moisture content
ratio of the mass of the quantity of water in a material to the mass of the dry material

3.25
nominal diameter

3.25.1
nominal diameter
〈pole with 5 % or less ovality〉 theoretical diameter, usually the diameter measured at the nominal ground line

3.25.2
nominal diameter
〈pole with greater than 5 % ovality〉 minimum diameter

3.26
nominal ground line
plane normal to the axis of the pole usually located at a distance of 600 mm plus 10 % of the nominal length from the butt end

3.27
ovality
difference between the maximum and minimum diameter at a cross-section expressed as a percentage of the minimum diameter

3.28
pith
innermost part of the pole

3.29
pole
long, round timber for use in a free-standing application

3.30
pole butt
lowermost point of the thicker end of the pole

3.31
pole tip
uppermost point of the narrow end of the pole

3.32
population
group of poles defined by having the same species, source and grade

3.33
resin pocket
cavity that contains or has previously contained resin

NOTE This may be similar to rind galls.

3.34
rind gall
surface wound that has been partially enclosed by the growth of a tree

3.35
ring shake
fissure following the line of a growth ring

3.36
sample
one or more poles taken from a single population

3.37
sampling unit
single preservative-treated pole taken from a charge

3.38
scribe
cranked rod with a swivel handle and a needle at the tip, set to a slight trailing angle

NOTE This is used as a grain detector by pressing the needle into the timber and drawing it across the surface in the apparent direction of the grain.

3.39
section of maximum stress
section of pole where the diameter equals 1,5 times the diameter at the point of application of load if this section is above ground line; otherwise the actual ground-line section

3.40
short crook
local deflection
natural deviation of the axis of the pole occurring on a length less than 1,5 m

3.41
simple sweep
sweep characterized by one bend only

3.42
slope of grain
divergence of the direction of the fibres from the longitudinal axis of the piece

NOTE The slope of grain in poles is usually observed as an inclination of the wood cells on the surface, which is referred to in some International Standards as spiral growth angle.

3.43
standard size pole
pole of a size 8 m or 10 m long and 180 mm to 220 mm diameter at 1,5 m from the butt end, and used for the determination of characteristic values

3.44
star shake
two or more heart shakes

3.45
sweep
deviation of the longitudinal axis of round timber from a straight line

3.46
taper
gradual reduction in diameter of a stem along its height or round timber along its length

3.47
theoretical diameter
diameter of a circle with the same circumference as the actual circumference at the section of measurement

4 Symbols and abbreviated terms

d_g nominal diameter at assumed ground line, in millimetres

d_q nominal diameter at point of load application, in millimetres

d_{max} nominal diameter at section of maximum stress, in millimetres

E modulus of elasticity parallel to grain in bending, in newtons per square millimetre

f_m bending strength — maximum stress at assumed ground line or point of maximum stress if this is above the assumed ground line, in newtons per square millimetre

I_q second moment of area of cross-section at point of load application, in millimetres to the fourth power

l pole length measured from butt to tip, in millimetres

l_g distance from butt to assumed ground line, in millimetres

l_g distance from butt to section of maximum stress or ground line, whichever is the greater, in millimetres

l_q distance from tip to position of applied load, in millimetres

Q applied load, in newtons

$s_a - s_0$ movement of load application point parallel to longitudinal axis of the pole during testing, in millimetres (see Figure C.2)

$t_a - t_0$ deflection at point of load application, in millimetres (see Figure C.2)

E_{mean} mean value of modulus of elasticity parallel to direction of grain, in newtons per square millimetre

$f_{m,k}$ characteristic value of bending strength, in newtons per square millimetre

$f_{m,05}$ sample fifth percentile of bending strength, in newtons per square millimetre

k statistical factor

m mean value (the variable is given in parentheses)

$m(E)$ sample mean values of modulus of elasticity, in newtons per square millimetre

$m(f_m)$ sample mean value of bending strength, in newtons per square millimetre

$m(f_{m,05})$ mean of $f_{m,05}$ values

n number of test poles in a sample

s standard deviation (the variable is given in parentheses)

$s(E)$ sample standard deviation of modulus of elasticity, in newtons per square millimetre

$s(f_m)$ sample standard deviation of bending strength, in newtons per square millimetre

5 General requirements

5.1 Marking

The manufacturer shall declare the species and ensure that all poles are clearly marked to identify the species, in accordance with Clause 8.

NOTE Common names are different depending on language version.

5.2 Tree felling and wood preparation

5.2.1 Tree felling

At the time the trees are felled, it is advisable to ensure that the rising sap is low, except for timber which is to be treated by a sap displacement process. If the trees are felled when the sap is high, it is recommended that measures be taken to avoid pre-treatment decay or attack by insects.

5.2.2 Handling of untreated wood

The method of handling shall avoid any damage that could alter the mechanical performance and durability of the pole, as well as the suitability of the pole for preservative treatment. Species permitted for use in poles are generally specified in the referenced local standards.

5.2.3 Mechanical pre-treatments

Where poles are mechanically pre-treated before preservation, e.g. through incising, testing in accordance with Clause 6 shall be carried out after the mechanical pre-treatment.

5.3 Requirements for pole sizes, tolerances, permissible deviations and damage

For poles used in structural applications, the minimum diameter of a pole shall be not less than 80 % of the maximum diameter at any cross-section over a maximum of 80 % of the length of the pole.

The manufacturer shall declare the size of the poles, specified by the overall length, the nominal diameter at 1,5 m from the butt and the nominal diameter at the tip, measured in accordance with 6.1. The permissible dimensional tolerances are:

— length: −1 % or +2 %;

— diameter: −0 or +40 mm unless otherwise declared by the manufacturer.

NOTE A list of commonly used pole sizes (minimum nominal diameter at 1,5 m from the butt, and length) is given in Annex A.

5.4 Characteristic values

The manufacturer shall declare structural properties in accordance with 8.2.