DUS EAS 489

DRAFT UGANDA STANDARD

First Edition
2016-mm-dd

Concrete poles for telephone, power and lighting purposes — Specification

Reference number
DUS EAS 489: 2008

Compliance with this standard does not, of itself confer immunity from legal obligations

A Uganda Standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application

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National foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to co-ordinate the elaboration of standards and is

(a) a member of International Organisation for Standardisation (ISO) and

(b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and

(c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

This Draft Uganda Standard, DUS EAS 489: 2008, *Concrete poles for telephone, power and lighting purposes — Specification,* is identical with and has been reproduced from an East African Standard, EAS 489: 2008*, Concrete poles for telephone, power and lighting purposes — Specification,* and is being proposed for adoption as a Uganda Standard.

This standard was developed by the Building and civil engineering Standards Technical Committee (UNBS/TC 3).

Wherever the words, “East African Standard" appear, they should be replaced by "Uganda Standard."

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EAST AFRICAN STANDARD

Concrete poles for telephone, power and lighting purposes — Specification

EAST AFRICAN COMMUNITY

First Edition 2006

Foreword

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

In order to achieve this objective, the Partner States in the Community through their National Bureaux of Standards, have established an East African Standards Committee.

The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. 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 procedures of the Community.

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.

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Concrete poles for telephone, power and lighting purposes — Specification

1 Scope

This East African Standard specifies the characteristics of pre-cast reinforced, partially prestressed and prestressed concrete poles. Possible uses for the poles include electrical reticulation and distribution, railway traction, telephone line support, street lighting standards and high mast lighting structures.

NOTE When concrete poles are used as traction poles, load/deflection characteristics, cross-section at ground level and resistance to impact may have to be considered.

2 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this EAS 489. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this EAS 489 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:

EAS 131, *Concrete — Specification*

ISO 1920, *Testing of concrete*

EAS 18-1, *Cement — Part 1: Composition, specification and conformity criteria for common cement*

BS EN 12620, *Aggregates for concrete*

IEC 62305, *Protection against lightning*

EAS 30, *Steel bars for reinforcement of concrete — Specification*

EAS 411-1, *Steel for the prestressing of concrete — Part 1: General requirements*

EAS 411-2, *Steel for the prestressing of concrete — Part 2: Cold-drawn wire*

EAS 411-3, *Steel for the prestressing of concrete — Part 3: Quenched and tempered wire*

EAS 411-4, *Steel for the prestressing of concrete — Part 4: Strand*

KS ISO 6934-5, *Steel for the prestressing of concrete — Part 5: Hot rolled steel bars with or without subsequent processing*

EN 934-2, *Admixtures for concrete, mortar and grout — Part 2: Concrete admixtures — Definitions and requirements*

3 Terms and definitions

For the purposes of this East African Standard, the following definitions apply:

3.1
acceptable
acceptable to the parties concluding the purchase contract, and subject to meeting all the requirements of this standard and to inspections carried out by the responsible competent authority

3.2
defective
a pole that fails in one or more respects to comply with the requirements of this standard

3.3
failure
the inability of a pole under test to support further load

3.4
load factor
the ratio of the ultimate load to the working load

3.5
partially prestressed poles
poles whose resistance to bending is assisted by partial (not excluding tension in concrete) prestressing of reinforcement, and that, when tested under the proof load, show no cracks of width exceeding 0.1 mm

3.6
permanent set
the deflection of the pole tip from the initial position, after removal of a specific test load. The apparent deflection due to movement of the pole butt in the test rig is not included in this measurement

3.7
pole
a pole or mast-like structure made from pre-cast reinforced, partially prestressed or prestressed concrete and intended to resist mainly transverse loads

3.8
pole strength
the required ultimate load capacity of the pole

3.9
prestressed poles
poles whose resistance to bending is assisted by prestressing of reinforcement, and that, when tested under the proof load, show no cracks

3.10
proof load
a load that exceeds the working load of the pole by 10 %

3.11
reinforced poles
poles that, when tested under the proof load, show no cracks of width exceeding 0.25 mm

3.12
ultimate load
the test load that theoretically is numerically equal to the working load multiplied by a load factor. (In this standard, the ultimate load is stipulated in Table 2.)

3.13
working load
The load that will give rise to bending moments at least equal to the maximum moment likely to occur under service conditions. (The working load shall be as required {see Annex B}.)

4 Requirements

4.1 Types

In terms of manufacturing methods, a pole shall be of one of the following types, as required (see Annex B):

a) Reinforced concrete pole [RC];

b) Partially prestressed concrete pole [PPC]; or

c) Prestressed concrete pole [PC].

4.2 Dimensions

4.2.1 Length

The overall length of a pole shall be as required (see Annex B). The preferred lengths shall be as shown in Table 2.

When determined in accordance with 6.4.1, the actual length L of a pole (see Figure 1) shall not differ from the required length by more than 50 mm.

4.2.2 Tip dimensions

When determined in accordance with 6.4.2, the tip dimensions of a pole shall be as stated by the manufacturer {(see 5.1 c)}, subject to a tolerance of ± 3 mm.

4.2.3 Straightness

When determined in accordance with 6.5, any deviation of a pole from straightness shall not exceed 0.5 % of the total length of the pole.

4.2.4 Cover to reinforcement

4.2.4.1 Reinforced concrete poles

When determined in accordance with 6.7, the minimum thickness of the cover over all reinforcement in the case of centrifugally spun poles shall be at least 15 mm over the entire length of the pole. In the case of poles made by any other process, the cover shall be at least 20 mm. In all cases, the cover to reinforcement shall be at least equal to the maximum diameter of the reinforcement bar. When no concrete cover for reinforcement is provided at the tip of the pole, a cover shall be provided by resin or other suitable sealants, as required (see Annex B).

4.2.4.2 Prestressed concrete poles

In pre-tensioned work, the cover of concrete measured from the outside of the prestressing tendon shall be at least 30 mm or the size of the cable or bar, whichever is bigger.

4.3 Finish

A pole shall have a smooth external surface that is free from honeycombing. All arrises shall be clean and true, and shall have a neat appearance.

4.4 Holes, recesses or fittings

If so required (see Annex B), holes and recesses shall be formed in the poles during manufacture. These holes and recesses may be used for the attachment of cross-arms and other equipment. When subjected to load tests, poles with holes or recesses (or both) shall be tested in two perpendicular directions except in cases where the plane of loading is defined, in which cases, the poles shall be tested in the plane of loading. When ferrous metal fittings are incorporated in the poles, such fittings shall have surface treatment as required (see Annex B).

4.5 Length/strength combinations

A pole shall be of one of six strength classes, as required (see Annex B).

The six strength classes are 25 SC, 50 SC, 75 SC, 100 SC, 125 SC and 150 SC.

Of these strength classes, only four classes are preferred for each length of pole. Values of ultimate load for the preferred strength classes are shown in Table 2.

The magnitude of the ultimate load *F* (see Figure 1), when the strength class is known, is calculated as follows:

$$F = a \times L$$

where

F is the ultimate load, in kilonewtons;

a is a coefficient corresponding to the strength class as shown in Table 1; and

L is the pole length, in metres.

Table 1 — Class strengths and coefficients

1	2
Strength class	**Coefficient** ***a***
25 SC	0.25
50 SC	0.50
75 SC	0.75
100 SC	1.00
125 SC	1.25
150 SC	1.50

NOTE Poles may be manufactured by jointing together single pole segments with suitable connecting pieces in such a manner that the jointed pole acts as one unit.

Dimensions in metres

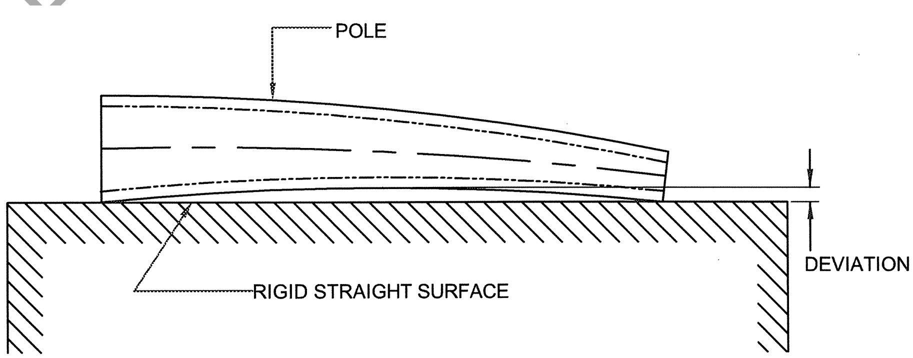

Figure 1 — Loading scheme

F is the ultimate load as specified in Table 2, in kilonewtons;

L is the pole length, in metres;

C is the clamping length, in metres;

H is the height of the pole above clamping length, in metres.

The clamping length *C* is given in Table 2 and is calculated as follows:

$$C = 0.1\,L + 0.6$$

Table 2 — Ultimate loads

1	2	3	4	5	6	7	8
Pole length **L** m	**Clamping length** **C** **m**	**Ultimate load** F kN					
		Strength class [1)]					
		25 SC	**50 SC**	**75 SC**	**100 SC**	**125 SC**	**150 SC**
3	0.9	0.8	1.5	2.3	3.0		
4	1.0	1.0	2.0	3.0	4.0		
5	1.1	1.3	2.5	3.8	5.0		
6	1.2	1.5	3.0	4.5	6.0		
7	1.3	1.8	3.5	5.3	7.0		
8	1.4	2.0	4.0	6.0	8.0		
9	1.5	2.3	4.5	6.8	9.0		
10	1.6	2.5	5.0	7.5	10.0		
11	1.7	2.8	5.5	8.3	11.0		
12	1.8	3.0	6.0	9.0	12.0		
13	1.9	3.3	6.5	9.8	13.0		
14	2.0	3.5	7.0	10.5	14.0		
15	2.1		7.5	11.3	15.0	18.8	
18	2.4		9.0	13.5	18.0	22.5	
21	2.7			15.8	21.0	26.3	31.5
24	3.0			18.0	24.0	30.0	36.0

[1)] To determine the strength class of a pole given the length in metres and the ultimate load in kilonewtons, divide the ultimate load the pole length and multiply the answer by 100.

4.6 Resistance to proof load

NOTE The proof load equals the ultimate load as shown in Table 2, divided by the required load factor (see Annex B) and multiplied by 1.1.

When a pole is tested in accordance with 6.6.2.2 under the proof load appropriate to the pole length and the strength class, it shall comply with all the relevant requirements given in Table 3.

Table 3 — Resistance to proof load

1	2	3	4
Parameters	**Requirement**		
	Type of pole		
	RC	**PPC**	**PC**
Deflection of pole tip at proof load	≤ 7.5 % *H* [1)]		≤ 5 % *H* [1)]
Crack width at proof load	≤ 0.25 mm	≤ 0.1 mm	Not visible
Permanent set as percentage of deflection at proof load	≤ 20 %	≤ 15 %	≤ 10 %
Crack closure when load is released	Complete		Not applicable
Failure load	No failure		

[1)] For the meaning of *H*, refer to Figure 1.

4.7 Ultimate load

When a pole is tested in accordance with 6.6, the ultimate load shall be as given in Table 2.

4.8 Torsional capacity (if required)

When a pole is tested in accordance with 6.8, it shall resist the required torsional load without failure (see Annex B).

4.9 Tip crushing test (if required)

When required (see Annex B), a tip-crushing test shall be carried out in accordance with Annex E.

5 Marking

5.1 Details required

The finished poles shall be clearly and indelibly marked with the following information:

a) the manufacturer's name, trade name or trade mark, year of manufacture, at a position 1.5 m above the designated ground level;

b) the overall length of the pole, in metres;

c) the tip dimensions of the pole, in millimetres;

d) the strength class (see 4.5);

e) the type of pole (see 4.1);

f) the date of manufacture; and

g) the weight of pole (mass).

5.2 Means and location

The marking shall be legibly impressed either on the pole or on a corrosion-resistant tag that is so anchored to the pole that it does not protrude beyond the surface of the pole. The marking shall be in such a position that it can easily be read after installation of the pole.

6 Sampling, inspection and methods of test

6.1 Scale of sampling

6.1.1 Lot

In a consignment, 500 poles or a part thereof of the same overall length, same dimensions and belonging to the same batch of manufacturer shall be grouped together to constitute a lot.

6.1.2 For ascertaining the conformity of the materials in the lot to the requirements of this specification, samples shall be tested from each lot separately.

6.1.3 The number of poles to be selected from the lot shall depend on the size of the lot and shall be according to Table 4.

6.2 Number of tests and criteria for conformity

Inspect all poles in the sample for compliance with the requirements of the standard for which tests to assess compliance are given in 6.4 to 6.8 (inclusive).

6.2.1 All the poles selected according to 6.1.3 shall be tested for overall length, cross-section and straightness. A pole, which fails to satisfy one or more of these requirements, shall be considered as defective. All the poles in the lot shall be considered as complying with these requirements if the number of defective poles found in the sample is less than or equal to the corresponding acceptance number given in Table 4, Column 3.

6.2.2 The lot, having been found satisfactory according to 6.2.1, shall be further tested for proof strength and ultimate load of the poles. For this purpose, the number of poles given in Table 4, Column 4 shall be tested, these poles may be selected from those already tested according to 6.2.1 and found satisfactory. All these poles tested for proof strength and ultimate load shall satisfy the corresponding specification requirements. If one or more poles fail, twice the number of poles required for proof strength and ultimate load tests shall be selected from the lot again and subjected to this test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of this test.

6.3 Sequence of tests

Subject all poles in the sample to the tests given in 6.4 to 6.7 (inclusive). Carry out the tests in the order given. When so required, carry out the test given in 6.8.

Table 4 — Scale of sampling

No. of poles in the lot	**Sample size**	Dimensional requirements acceptance number	**Proof strength test**	**Ultimate load test**
(1)	(2)	(3)	(4)	(5)
Up to 100	10	1	2	1
101 to 200	15	1	3	1
201 to 300	20	2	4	1
301 to 500	30	3	5	2

6.4 Dimensions

6.4.1 Length

Measure, to the nearest 2 mm, the length of the pole and check for compliance with 4.2.1.

6.4.2 Tip dimensions

Measure, to the nearest 1 mm, the tip dimensions of the pole and check for compliance with 4.2.2.

6.5 Straightness test

For measuring straightness or uprightness of a pole, it shall be placed lengthwise on a rigid straight surface, as shown in Figure 2. Then using a measuring steel scale, graduated in mm, measure the distance (deviation) of pole surface from the rigid surface at several locations along the length of the pole. Turn the pole 90° along the longer edge and repeat the procedure. At least two measurements in each one-metre length of the pole should be taken. The largest value of the measured distance (deviation) shall be taken for determining uprightness. Express the deviation from straightness as a percentage of the total length of the pole and check for compliance with 4.2.3.

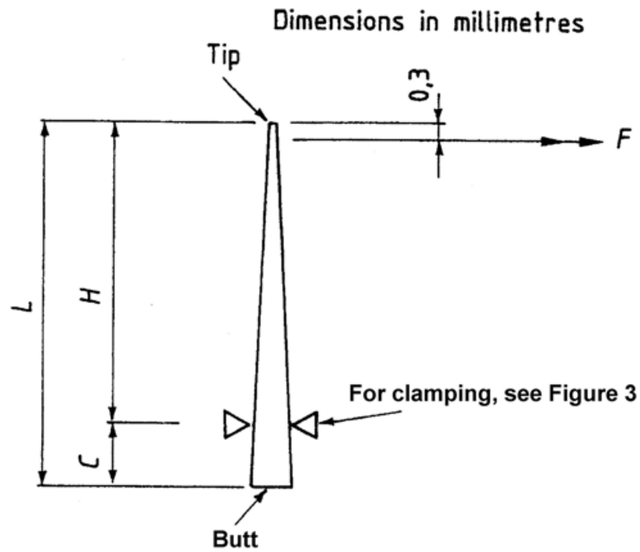

Figure 2 — Measurement of straightness of pole

6.6 Load tests

6.6.1 Apparatus

NOTE The layout of the testing equipment is given in Figure 3

6.6.1.1 Clamping device, that holds the butt section of a pole. It incorporates steel or concrete cribs (or similar rigid devices) that prevent any longitudinal or rotational movement of the clamped portion of the pole. The cribs are of dimensions and construction such that the butt section is not damaged during the test.

6.6.1.2 Support trolleys, used to support the pole so that vertical movement of the tip of the pole and stresses due to the self-weight of the pole are minimized. The trolleys provide a frictional resistance that is as low as practically possible.

6.6.1.3 Loading equipment, consisting of a pulling device that is secured round the pole at a position 300 mm from the tip and that applies the load to the pole. The pulling device is attached to a cable pulled by a winch. The winch (or the pulley around which the cable passes) is set far enough away from the pole to ensure that the angle between the initial and final positions of the cable is minimal. The winch applies the loads slowly and at right angles to the longitudinal axis of the pole.

6.6.1.4 Load measuring device (a load cell or other acceptable measuring device), so supported that the force needed to pull it does not significantly add to the measured load and that, if the pole breaks, it is not damaged.

6.6.1.5 Crack measuring gauges, of thickness 0.25 mm and 0.1 mm, as shown in Figure 4.

6.6.1.6 Laser, attached to the centre of the clamped portion of the pole and aimed at the centre of the tip of the pole. The use of a laser ensures that any movement of the butt end of the pole within the clamping device does not cause incorrect readings of deflection and permanent set. Alternative apparatus may be used.

6.6.2 Procedure

6.6.2.1 Apply the test loads so as to cause the pole to bend about its weakest axis or, when the plane of loading is defined, the axis normal to the plane of loading. Apply the loads for at least 2 min and record the value of the test loads to an accuracy of ±0.05 kN. Measure deflection and permanent set to the nearest 5 mm.

6.6.2.2 For a proof load test, apply the loads in increments of 10 % of the designed proof load of the pole (see 3.10) up to the proof load (i.e. 110 % of the working load (see Annex B)). Record the deflection of the tip of the pole at each of the load increments. Use the appropriate crack-measuring gauge (see Figure 4) or any other appropriate measuring instrument to measure visible cracks. A crack shall be deemed to be of width 0.25 mm (or 0.1 mm) if the 0.25 (or 0.1 mm) gauge enters it to a depth of 2 mm at closely spaced intervals over a continuous length of about one-quarter of the pole circumference at this point. Remove the load, and measure and record the permanent set of the tip of the pole and check whether the cracks have closed. Check for compliance with 4.6.

6.6.2.3 For an ultimate load test, apply the appropriate ultimate load (see Table 2) at 10 % increments until 90 % of the designed ultimate load is reached, or until failure. Further (in the absence of failure) increase the load in steps of 5 % of the designed ultimate load, until this ultimate load is reached or until failure. Check for compliance with 4.7.

Alternatively, and should the testing equipment make this possible, the load may be applied at a continuous linear rate of increase, adjusted to reach the designed ultimate load within a time equal to the ultimate load factor (see Annex B) multiplied by a time of 30 min. The test shall continue until failure or until the designed ultimate load is reached. Check for compliance with 4.7.

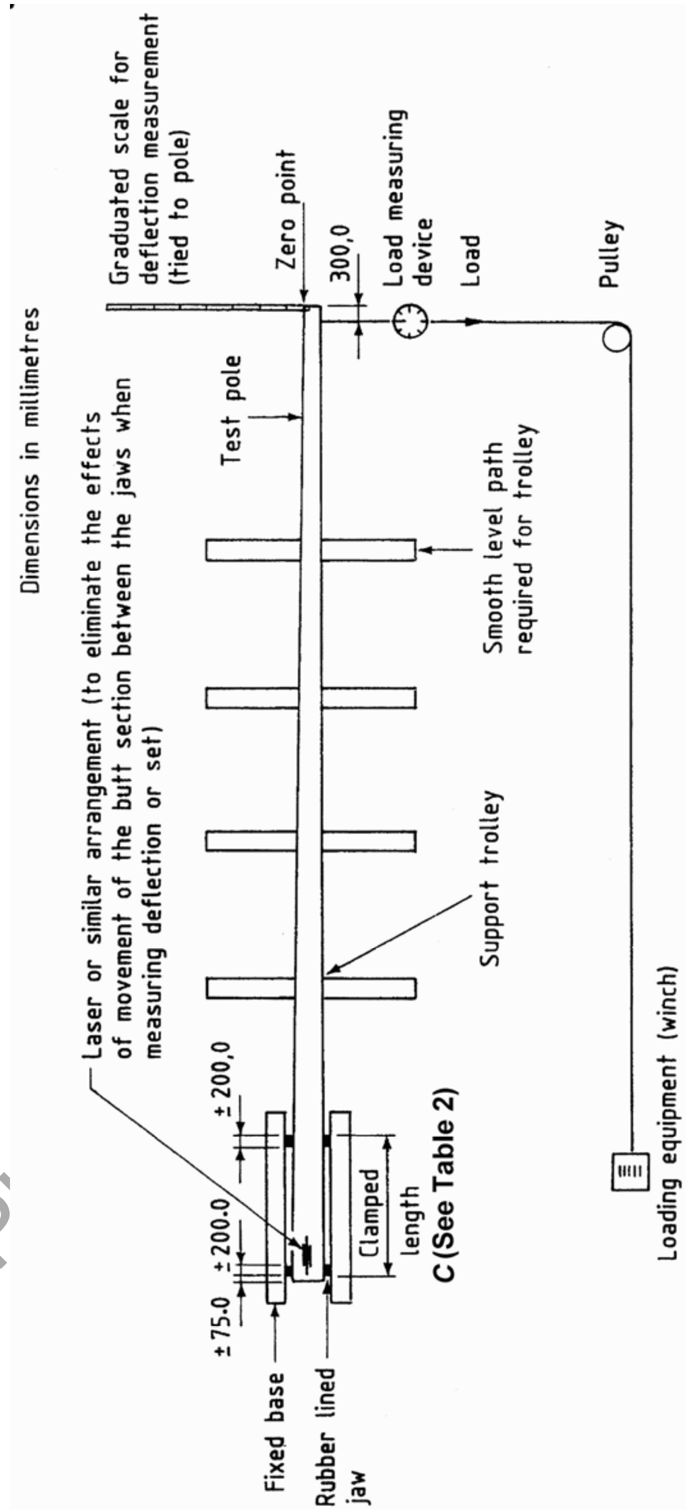

Figure 3 — Typical arrangement for testing concrete poles

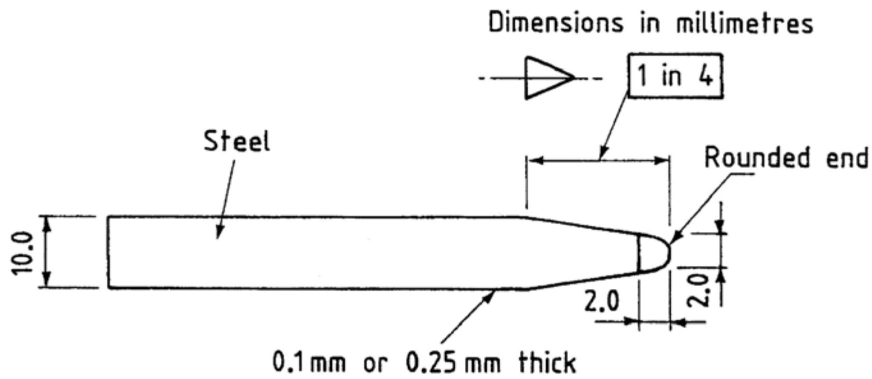

Figure 4 — Crack measuring gauge

6.7 Cover to reinforcement

Using any acceptable method, measure, to the nearest 2 mm, the thickness of the cover over the reinforcement. Three sets of measurements shall be taken: one near the tip, one near the middle and one near the butt of the pole. The cover shall be measured on opposite faces of the concrete.

6.8 Torsional capacity (if required)

Clamp the butt end of the pole as described in 6.6. Support the pole near its tip on a low-friction bearing and apply torque by any suitable means at a point 600 mm from the tip of the pole (or at a distance that coincides with the position where the maximum torsion will occur). Measure and record the torque at failure of the pole to the nearest 10 Nm.

Annex A
(normative)

Materials for use in the manufacture of concrete poles

A.1 General

Materials for the concrete used in the manufacture of concrete poles shall be so selected as to produce a high-density, low-porosity concrete. The concrete shall meet the requirements of EAS 131.

A.2 Cement

The cement used in the manufacture of concrete poles shall comply with the requirements EAS 18-1.

A.3 Aggregate

The aggregate shall consist of natural sand, or crushed or uncrushed gravel, stone, or rock, or any combination of these and shall comply with the requirements of BS EN 12620.

A.4 Water

The water used in the manufacture of the concrete should preferably be potable water drawn from municipal water mains.

A.5 Reinforcement

Reinforcement shall comply with the requirements of EAS 30 or KS ISO 6934 Parts 1-5, or shall be any other high tensile steel wire whose properties regarding resistance to corrosion, fatigue and relaxation equal or exceed the requirements of the above-mentioned standards. Reinforcing bars and wires shall be free from loose or heavy rust, scale, oil and grease, or any material that might interfere with the bond between the reinforcement and the concrete. Slight rust may, however, be permitted.

A.6 Admixtures

Admixtures used shall not have any harmful effects on the properties of the concrete. Admixtures containing calcium chloride or rust-inhibiting admixtures shall not be used.

A.7 Additives

The use of additives to enhance the properties of the concrete will be allowed. These shall be in accordance to the requirements of EN 934-2.

A.8 Pigments

The concrete may be dyed by the addition of mineral pigments provided they have no deleterious effects.

A.9 Concrete

The cementitious content of the concrete shall be at least 350 kg/m^3.

The mix design, mixing and compaction of the concrete shall be such as to obtain the necessary strength in the pole and shall comply with the following:

a) the cement shall be measured by mass to an accuracy of 5 %;

b) mechanical mixing shall be carried out until a homogeneous mixture is obtained;

c) to ensure that proper compaction can be achieved, the concrete shall be transported under conditions which minimize segregation of the mix or the commencement of the initial set of the concrete (or both);

d) compaction shall be carried out by vibration, centrifugation or other efficient means;

e) after compaction in the mould, the concrete shall be protected and cured in accordance with EAS 30;

f) where accelerated hardening is used, this shall not adversely affect the required properties of the finished products; and

g) the concrete shall have a temperature between 5 °C and 32 °C when it is placed in the mould and shall remain at a temperature above 5 °C until the concrete has reached the strength specified by the design. Whichever means are used (heating the aggregates, the water or the moulds) it is important to prevent any harm from being caused by ice or excessive heat.

The 28 day compressive strength of concrete, when tested in accordance with ISO 1920, shall be at least 40 N/mm^2. The 150 mm (preferred size) moulds shall be used.

Annex B
(normative)

Notes to purchasers

The following requirements shall be specified in tender invitations and in each order or contract:

a) the working load (see 3.13) and the required load factor to select the ultimate load from Table 2 (see 3.12);

b) the type of pole (RC, PPC or PC) (see 4.1);

c) the length of the poles (see 4.2.1);

d) tip dimensions of the poles (see 4.2.2);

e) when relevant, the method of providing cover for reinforcement at the tips of the poles (see 4.2.4);

f) provisions for attachments (if required) (see 4.4);

g) surface treatment of ferrous metal fittings incorporated in the poles (see 4.4);

h) the strength class (see 4.5);

i) the torsional capacity (if required) (see 4.8); and

j) whether a tip crushing test (see 4.9) is required.

Annex C
(normative)

Notes on the design, earthing, transportation and storage of concrete poles

C.1 Design

For concrete poles to comply with the requirements of this standard and for them to have a long service life, it is essential that the concrete used in the manufacture of the poles be of good quality and sufficient strength as set out in Annex A. If cement meeting the requirements of EAS 18-1 is used, the compressive strength of the concrete at 28 d should be at least 40 N/mm^2. If rapid hardening Portland cement is used, the required strength should be attained at 7 d.

The reinforcement should be in the form of a cage having continuous longitudinal bars extending the full length of the pole.

Provision for attachments to the poles may be made, and may be in the form of suitably spaced transverse holes and recesses or of anchoring fittings embedded in the concrete.

C.2 Earthing

The earthing of the poles may be performed in accordance with IEC 62305.

C.3 Transportation and storage

The transportation and storage of the poles should be done in accordance with the provisions of ISO 19338[1)]. Additional recommendations are indicated below.

C.3.1 Handling and transportation

C.3.1.1 Precast units shall be designed to resist, without permanent damage, all stresses induced by handling, storage and transport. The minimum age for handling and transporting shall be specified by the engineer or designer, and is related to the concrete strength, the type of unit and other factors.

C.3.1.2 The position of lifting and supporting points, the method of lifting, and the type of equipment and transport to be used shall be as specified by the engineer or as agreed by him, and shall be practical and safe to use, and such that no damage is likely to result from the lifting equipment.

C.3.1.3 Units shall be marked with indelible identity, location and orientation marks as and where necessary.

C.3.1.4 The engineer shall, in all cases, specify the points of support during storage, and shall ensure that these are so chosen as to prevent unacceptable permanent distortion of the units; resilient supporting arrangements that permit small settlements without inducing stresses in the units are preferred. The engineer shall also ensure that, when a stack is several units high, the units are vertically above one another to prevent bending stresses in any unit. Where disfigurement would be detrimental, packing pieces shall not discolour or otherwise permanently damage the units.

C.3.1.5 Trapped water and dirt shall not be allowed to accumulate in the units.

NOTE The freezing of trapped water can cause severe damage.

C.3.1.6 Where necessary, precautions shall be taken to prevent projecting reinforcement from causing rust stains, and to minimize efflorescence.

[1)] ISO 19338, Performance and assessment requirements for design standards on structural concrete

C.3.1.7 During transportation, the following additional factors shall be considered:

a) overloading of the transporting vehicle;

b) centrifugal force resulting from cornering;

c) oscillation [a slim unit might flex (vertically or horizontally) sufficiently to cause damage; and

d) the possibility of damage due to chafing.

C.3.2 Transportation of poles

Unless the transport vehicle is specially designed to carry poles (e.g. timber jinker), timber bearers of size at least 100 mm x 100 mm should be placed across the tray of the vehicle at the appropriate spacing, to maintain the overhang within the limits of 3 m to 5 m.

Resilient intermediate supports, such as car tyres, should be added when poles that are longer than 15 m are being carried. To provide maximum support, a car tyre should be compressed to about 50 of its original width when fully loaded. The use of rigid intermediate supports is not recommended.

The vehicle should be provided with bolster pins to the full height of the load carried. Each layer of poles should be chocked fore and aft, on both sides, using timber wedges (of size at least 100 mm x 100 mm x 200 mm long) securely nailed or pinned to the timber bearers or to the crossmembers of the specialized pole carrier.

To prevent relative movement between the poles in any one layer, the poles should be loaded with their butts in contact, without the use of packing material. Loosening of packing material during transportation can lead to movement of the load. It is better to group poles of the same size together so that they are in contact over their full length (either butt-to-butt formation or butt-to-tip formation). When poles are loaded in more than one layer, timber spacers/bearers of size at least 100 mm x 100 mm should be placed between each layer vertically above the bottom row of bearers. Poles in the second and subsequent layers should be chocked fore and aft, as specified for those in the bottom layers. There should be at least two poles in the top layer.

When there are two or more layers, the poles in the second and subsequent layers may alternate tip to butt with the preceding layer, to provide the best load sharing between axles.

The completed load should be encircled completely by two parallel fore and aft chains, each pair located at bearing points and provided with a suitable means of tightening, such as a turnbuckle and ratchet, a conventional turnbuckle or a lever type chain hitch. In addition, a central "belly" chain, with adjacent spacers between each layer of poles, should be placed round the load, as an extra safety measure. This chain should not be secured to the tray of the vehicle.

Poles of mixed sizes should be arranged to provide the best possible sharing of weight across the tray of the vehicle. When poles of different diameter are placed in one layer, a short support bearer in conjunction with car tyres should be used to assist in the support of an overlaying bearer. Each car tyre should be nailed or otherwise secured to its support bearer. To provide maximum support to the overlaying bearer, the car tyre should be compressed to about 50 % of its original width when fully loaded. Whenever poles of different lengths are to be carried, the longer poles should be placed in the bottom layer. Shorter poles should be supported on bearers spaced according to the pole length. When such bearers are not vertically above a lower bearer, car tyre supports should be placed to provide a resilient support.

During unloading, it may be necessary to move a pole sideways to gain access to the fitting of a lifting chain or sling. Before a chock is removed prior to such movement of a pole, a secondary chock should be fitted outside the chock to be removed, so that the extent of movement of the pole is controlled. Until lifting chains or slings are fitted to a pole and are secured, this pole and every other pole remaining on the truck should be chocked on both sides to prevent accidental sideways movement.

The vehicle should not be moved if any part of the load is not secure and, wherever possible, it should be so positioned that a cross fall will not cause the load to move. If a cross fall cannot be avoided, the top side pole of each layer should be the first to be unloaded. In all cases, whether on level ground or on a cross fall, an outer pole should be unloaded never an inner pole.

When the vehicle is being moved between pole location pegs on site, fore and aft chains should be fitted in addition to the chocks if the vehicle speed is more than 10 km/h and the ground is not smooth and level.

When poles are unloaded by crane on site, a single point lift may be used for all poles. The balance point is approximately 40 % of the pole length from its base. To guard against localized abrasion at the lifting point, a protective timber "corset" of length approximately 0.75 m, or a wrapping of canvas or jute bagging may be lashed to the pole under the lifting chain or sling. Alternatively, a fabric sling may be used.

At all stages of loading, transport or unloading, care should be taken to avoid impact and to guard against damage to the poles.

C.3.3 Storage of poles

Poles should be stored in a prepared hard standing area with the poles supported on timber bearers spaced as described above for transportation of the poles.

Poles may be stacked several units high, with timber spacers between each layer and with either timber or steel chocks placed to prevent the poles from rolling. Supports for multiple layer stacking should be maintained vertically above one another. For safety in stacking, tapered poles should be stacked in a tip-to-butt formation. In the absence of relevant test data on the supporting capacity of the pole sections, the stacking height should be limited to five tiers.

Poles of different lengths or diameters should not be mixed in one stack.

Weed and grass growth should be kept under control in areas where poles are being stored.

Annex D
(normative)

Quality verification of concrete poles

D.1 When a purchaser requires ongoing verification of the quality of concrete poles, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection, it should be noted that KS ISO 9001: 2000 covers the provision of an integrated quality system.

D.2 If the poles do not bear the standardization mark and no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of a consignment, and a purchaser wishes to establish by inspection and testing of samples of the final product whether a consignment of the poles complies with this standard, the sampling requirements described in 6.1 of this standard shall apply.

Annex E
(informative)

Tip crushing test

Use the specimens tested in 6.6.2.3 but, if a failure occurred in the section of the pole between 300 mm and 900 mm from the top, use a new specimen. Place the top section of the specimen centrally between, and with its longitudinal axis parallel to, two rigid half-round rods of diameter 25 mm. Ensure that the rounded portions of the rods are in continuous contact with the pole for a distance of 225 mm approximately 600 mm from the top of the specimen. Apply force uniformly until failure occurs. Measure and record the force at failure to the nearest 0.5 kN.

