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BRITISH STANDARD 1320 : 1946

HIGH VOLTAGE OVERHEAD LINES ON WOOD POLES

FOR LINE VOLTAGES UP TO AND INCLUDING 11 kV

BRITISH STANDARDS INSTITUTION

BRITISH STANDARD SPECIFICATION

HIGH-VOLTAGE OVERHEAD LINES

ON WOOD POLES FOR

Line Voltages up to and including 11 kV

with Conductors

not exceeding 0·05 sq. in.

B.S. 1320 : 1946

12/6
Price 1/6 net, post free

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INCORPORATED BY ROYAL CHARTER

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THIS BRITISH STANDARD, having been approved by the Electrical Industry Committee, and endorsed by the chairman of the Engineering Divisional Council, was published under the authority of the General Council as a British Standard on 21st August, 1946.

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The Electrical Industry Committee,† under whose supervision this British Standard was prepared, consists of representatives from the following Government Departments and Scientific and Industrial Organisations :

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*Central Electricity Board
*Electricity Commissioners
*General Post Office
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Crown Agents for the Colonies
Office of the High Commissioner for India
Copper Development Association

† The Electrical Industry Committee is the British National Committee of the International Electrotechnical Commission

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BRITISH STANDARD SPECIFICATION FOR

HIGH-VOLTAGE OVERHEAD LINES

FOR LINE VOLTAGES UP TO AND INCLUDING 11 kV WITH CONDUCTORS NOT EXCEEDING 0·05 SQ. IN.

FOREWORD

The purpose of this specification is to standardise both three-phase and single-phase light high-voltage overhead lines for working voltages up to and including 11 kV by a type of construction to give improved performance by a reduction of some of the troubles associated with types of construction hitherto used. Its general adoption and the standardisation of components should effect considerable economies in first cost and subsequent maintenance, thereby facilitating the provision of supplies to remote and isolated premises and the development of the few remaining sparsely populated areas of Great Britain that are at present without electricity supplies.

The aim has been to keep the design as simple as possible compatible with reliable operation, and the factors governing the design are based on extensive experience on overhead lines in conjunction with recent research. The loading on conductors and poles is based on the effect of a wind of a recorded velocity of 70 miles per hour acting on the bare conductors.

This specification is based on an original design supplied by the British Electrical and Allied Industries Research Association.

Only copper conductors and only two sizes, i.e., 0·025 sq. in. and 0·05 sq. in. stranded are recommended, and the details of design given are based on the use of these particular conductors. This, however, does not preclude the use of solid conductors or of conductors of other metals. Where such other conductors are used, the general principles of the design given in this specification shall apply, except where minor modifications thereto are made necessary because of the use of such conductors.

If use is made of composite metal or other conductors of higher tensile strength than copper, it may be advisable, depending on the span length employed and the breaking stress of the stronger metal, to increase the overall factor of safety of such conductors so as to avoid the risk of vibration trouble which may be experienced if the tension of such conductors, in still air at 60°F., is greater than, say, one fifth of the breaking load.

This specification is confined as regards poles to the use of imported red fir, home-grown red fir and larch. If approval is obtained for the use of other timbers the appropriate modulus of rupture must be taken into account.

The practice of erecting lines with unearthed insulator steelwork has proved most satisfactory from an operational point of view, particularly with regard to the reduction of trouble due to lightning. To obtain the maximum benefit of this practice, an insulator is inserted in each stay, except at cable terminating poles, transformer poles and switchgear poles, on which all steelwork is earthed. On transformer poles the electrode used for earthing the steelwork should be situated outside the resistance area of the earthed electrode connected to the low-voltage system neutral (see Appendix C).

The Postmaster-General has modified his requirements for guarding when his line is crossed by a line erected to this specification. These requirements, together with approved drawings, are set out in Appendix A.

This specification is entirely suitable for lines to be erected in most parts of the British Isles. Consideration, however, should be given to altitude and climatic and other conditions of the locality in which the line has to be erected by providing for specially severe conditions, such as an increase in pole strength and/or reduction in span lengths and the like, as may be desirable.

This specification is intended for the use of authorised undertakers and is a statutory alternative to the Overhead Line Regulations, either of which may be adopted. This has been brought about by the making by the Electricity Commissioners of two amending Regulations. The first (set out in Appendix B(1) hereto) amends the Overhead Line Regulations by giving statutory effect to the Specification, in permissive form; and the second (set out in Appendix B(2) hereto) introduces into Regulation 12 of the Electricity Supply Regulations, 1937, the words 'other than overhead lines,' which places it beyond doubt that Regulation 12 extends only to underground mains, and consequently has no effect in relation to this specification.

Authorised undertakers are reminded, however, that the Overhead Line Regulations El.C.53 (Revised) and the Electricity Supply Regulations, 1937, extend to matters not dealt with in this Specification (e.g., Regulation 4 (Inaccessibility of line conductors) El.C.53 (Revised); and that adoption of the specification does not relieve them of their continuing statutory obligation to comply with both of those codes of Regulations so far as applicable and except in-so-far as they are inconsistent with or are superseded by the requirements of the specification.

This specification may be used by non-statutory bodies or persons who may erect and use electric lines for the supply of electricity. Such bodies and persons may, in the circumstances laid down in Section 4 of the Electric Lighting Act, 1888, be served by the Electricity Commissioners with notice requiring them to comply with regulations; and the regulations usually prescribed by the Commissioners in such cases conform generally with those applicable to Authorised Undertakers and are directed to ensure the safety of the public.

EMERGENCY CONDITIONS

As stated in their circular letter dated 16th September, 1942 (Reference A. 950/820), the Electricity Commissioners permit, as an emergency measure, the use of home-grown poles with a factor of safety of 2·5 for lines erected for purely temporary wartime purposes. The columns for 'imported red fir' poles in table 4 are therefore applicable in such cases for ascertaining the maximum permissible loading span for home-grown poles.

SPECIFICATION

SCOPE

1. This specification applies to both three-phase and single-phase high voltage distribution lines where the normal working pressure between any conductor and earth does not exceed 6·6 kV, the maximum size of conductor being as set out in clause 4.

Where a line is intended initially for single-phase and later for three-phase operation, the poles and crossarms required for a three-phase line shall be installed. The sizes of poles and crossarms specified for a single-phase line shall only be used where permanent single-phase operation is intended.

DEFINITIONS

2. The following definitions have been adopted for the purposes of this specification only:

a. Span. The span is the horizontal distance between two adjacent supports.

b. The wind-loading span is half the sum of the two adjacent spans.

c. Equivalent span. The equivalent span of a line (or section of line between rigid points) on which the conductors are free to move longitudinally at the supports (and in which the tension for any condition of load and temperature is therefore the same in all spans) is the span in which tension variations are identical with those in the line or section of line. Its length is obtained by dividing the sum of the cubes of the individual spans by the length of the line or section, and taking the square root of the whole,

i.e., equivalent span =

$$\sqrt{\frac{L_1^3 + L_2^3 + L_3^3 \ldots\ldots}{L_1 + L_2 + L_3 \ldots\ldots}}$$

where L_1, L_2 and L_3 are the individual span lengths of the section.

d. Sag. The sag under any system of conductor loading is the distance, measured in the direction of the resultant load, between the conductor and the mid-point of the straight line joining the adjacent supports.

e. An intermediate pole is a pole on which the conductors are supported on pin insulators.

f. A section pole is a pole on which the conductors are made-off on each side on tension insulators.

g. A terminal pole is a pole on which the conductors are erected on one side only and are made-off on tension insulators.

h. Factor of safety. The factor of safety of any component is the ratio of its ultimate strength to the maximum working load for which it is designed.

i. Bonding wire. A conductor connecting together metal components.

j. Earthing wire. A conductor connecting metal components or a bonding wire to an earth electrode.

k. A road. A surfaced way used by vehicular traffic.

DESIGN DATA

3. *a. Conductors.* The tension of a line conductor at a temperature of 22°F. and subjected to a wind exerting a transverse pressure equivalent to 16 lb. per sq. ft. calculated on the whole of the projected area of the conductor shall not exceed its breaking load divided by 2·5.

b. Poles. Poles in conjunction with stays, if any, shall withstand the longitudinal, transverse and vertical loads resulting from the loading condition stated in *a.* above, ignoring the effect of wind pressure on the pole itself, with a factor of safety of 2·5 in the case of imported red fir and 3·5 in the case of larch or home-grown red fir poles.

The pole dimensions given in table 4 are calculated on the following basis:

Loading point	6 in. above pole top.
Wind pressure	16 lb. per sq. ft. on the bare conductor only.
Modulus of rupture	7800 lb. per sq. in.

c. Wooden crossarms, crossarm struts and stay insulators. Wooden crossarms, crossarm struts and stay insulators shall have a factor of safety of not less than 3·0.

d. Steelwork. The maximum working load of all steel components including stay wires, but excluding insulator pins, shall not exceed the ultimate tensile strength of the component divided by 2·5.

Insulator pins and other insulator fittings shall comply with B.S. 137.

CONDUCTORS

4. *a. Types and sizes.* The conductors recommended in this specification are 0·025 sq. in. (3/·104 in. diameter) and 0·05 sq. in. (3/·147 in. diameter) hard drawn copper, which shall comply with B.S. 125, the latter size being the maximum permissible.

The maximum size of any copper alloy or composite metal conductor shall be 0·04 sq. in. copper equivalent, and not larger than 7/14 S.W.G., in the case of a steel conductor or a composite conductor in which steel is the chief component.

b. Erection of conductors. It is recommended that the stringing of the conductors shall conform to the conductor stringing, tables 1 and 2.

It is recommended that before making off to the appropriate sag, the conductors be over-tensioned by 60 per cent of their breaking tension, and kept at this tension for at least twenty minutes.

c. Midspan joints. Midspan joints are permissible and where they are used they shall be of the torsion sleeve or of the mechanical cone type and shall develop not less than 95 per cent of the ultimate strength of the conductor and shall have at least the same conductivity.

d. Line connectors. When conductors are joined together at points where they are not under tension, a line connector in accordance with fig. 19 should preferably be used.