



SLOVENSKI STANDARD
SIST IEC 60652:1995
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Preskusi obremenitev konstrukcij nadzemnih vodov

Loading tests on overhead line structures

Essais mécaniques des structures de lignes aériennes

Ta slovenski standard je istoveten z: IEC 60652

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOADING TESTS ON OVERHEAD LINE TOWERS

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by IEC Technical Committee No. 11, Recommendations for Overhead Lines.

A first draft was discussed at the meeting held in Melbourne in 1975. After this meeting, a second draft was submitted to the National Committees in 1976. Taking account of the comments, a draft, Document 11(Central Office)3, was submitted to the National Committees for approval under the Six Months' Rule in February 1977.

Due to four negative votes, a revised draft, Document 11(Central Office)6, was submitted to the National Committees for approval under the Two Months' Procedure in March 1978.

The following countries voted explicitly in favour of publication:

Australia	Norway
Austria	Poland
Belgium	South Africa (Republic of)
Brazil	Spain
Canada	Sweden
Egypt	Switzerland
Finland	Turkey
France	Union of Soviet
Germany	Socialist Republics
Italy	United Kingdom
Japan	United States of America

LOADING TESTS ON OVERHEAD LINE TOWERS

1. Scope

This standard is applicable to the testing of towers and structures of overhead lines for voltages above 45 kV.

2. Object

The object of this standard is to codify the methods of testing towers and structures of overhead lines for voltages above 45 kV. These tests are made on the prototype prior to manufacture (prototype tests).

Under certain conditions, these tests may also be made as acceptance tests on a batch of towers.

3. General test criteria

- 3.1 For a prototype test, the material used shall be made to the same standards as those that will apply to all towers during production. These standards will include bar size, bolt size, metal quality, connections, geometry and surface coatings.
- 3.2 Responsibility for checking the conformity of the structure used for the prototype test with the corresponding production structures shall be decided before the test.
- 3.3 If an acceptance test on the entire tower is required, the components shall be chosen at random from the batch offered for acceptance.
- 3.4 The test tower shall be erected on a rigid base.
- 3.5 The selected tower shall successfully withstand the loads specified for the various conditions stipulated by the relevant IEC standards or by the client of the testing station.
- 3.6 The client of the testing station is the organization, or its nominee, giving direct instructions to the testing station for the test to be undertaken.

4. Load application

Loading cases (values, directions and points of application of loads) are given by the client.

4.1 *Grouping of loads*

If, for practical purposes, some loads (i.e. due to wind on the structure) have to be grouped, the value of the resultant, its direction and its point of application shall be agreed by the client.

4.2 Application of loads in steps

The test covers five steps of 50%, 75%, 90%, 95% and 100% of the specified ultimate loads.

A 25% step may be selected subject to the agreement of the client and the operator of the testing station.

The 95% step has been selected in order that readings may be taken just before the specified 100% step which might not be reached.

In this event, a result from the 95% step would be useful for a decision on the replacement of damaged components, as indicated in Clause 7. If the test station has facilities for continuous recording with simultaneous incremental application of all loads, this step could be omitted.

4.3 Dynamic effects

Loads shall be applied in such a way as to avoid any dynamic effect. However, bolt slips in the joints during the tower test, leading to possible dynamic stresses, shall be accepted.

4.4 Adjustment of loads per step

For each step, except for the final 100% step, the various loads shall be considered to be adjusted if the reading for each of them is within the following limits:

Step	Permissible range
(25%)	(23% - 27%)
50%	48% - 52%
75%	73% - 77%
90%	88% - 92%
95%	93% - 97%
100%	≥ 100%

The 100% step is reached when the loads are equal to or greater than 100% of the specified loads.

As all loads approach 100%, care shall be taken to avoid overloading of any point of application of these loads.

4.5 Duration of load application

For each step, the time during which loads are applied may be as short as possible: it will depend upon the facilities of the testing station, that is, upon the time necessary for the loads to be adjusted in accordance with the table in Sub-clause 4.4 and for the recording of the relevant values.

For the final 100% step, the loads shall be maintained for 1 min.

The client may ask that, for the final 100% step, loads be maintained for a longer period, with a maximum of 5 min; but, should a failure occur during this period, the test shall be considered valid if the structure has held for at least 1 min.

If the material employed for the structure is not steel and has a creep tendency, the client may request for the 100% step, a longer duration of load application before considering the test as valid.

5. Sequence of test loading cases

The sequence of test loading cases shall be determined by the client. It is recommended to choose first those tests having the least influence on the results of the successive tests. Secondly, the choice of test sequence might take account of the simplification of those operations necessary for carrying out the test programme.

6. Check of tower mechanical strength

- 6.1 The structure is considered to be satisfactory if it is able to support the specified ultimate loads (100 % step) for 1 min as stated in Sub-clause 4.5, with no visible local deformation after unloading (such as bowing, buckling), and no breakage of elements or constituent parts.

However, when the structure is designed in such a way that the deformation after unloading is a part of the design data (for instance in a frame calculated with plastic theory, etc.) and on condition that the client be informed before the test, such deformation can be accepted.

- 6.2 Ovalization of holes and permanent deformation of the bolts shall be accepted.

7. Procedure in the event of premature collapse

- 7.1 In the event of collapse of a part under loads of a value lower than the 95 % step, the part that has collapsed may be replaced by another with greater mechanical strength. The modified structure shall be required to pass the test for the specified ultimate load values (100 % step).

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- 7.2 If the collapse of a part occurs at loads between those corresponding to the 95 % and 100 % steps, one of the following two procedures may be adopted by the client or the manufacturer of the tower according to previous agreement.

- 7.2.1 As indicated in Sub-clause 7.1, which is the normal mandatory procedure for the prototype tests.

- 7.2.2 For the acceptance tests, the test may be repeated on another tower of the same batch. The latter structure shall be required to pass the 100 % test.

To build the new structure, any part of the original tested tower can be re-used.

8. Check of quality of materials used for prototype test

- 8.1 If the materials used for the fabrication of the prototype are selected at random from the manufacturer's stocks and if they can be considered as representative of the materials used in production structures, no limitation shall be required on their yield point and ultimate tensile strength value, and on tolerances of their geometrical dimensions other than those specified to the material supplier.

- 8.2 If this requirement is not satisfied, the material of the prototype shall be checked for mechanical characteristics and dimension tolerances.

8.2.1 The client shall consider the test satisfactory if bending and compression members with slenderness ratios smaller than 150 for steel and 100 for aluminium (or any aluminium alloy), and tension members, have the following average yield points:

a) steel or aluminium members having a minimum guaranteed yield point lower or equal to 300 MPa:

$$\text{average value} \leq \text{guaranteed minimum value} \times 1.25;$$

b) steel or aluminium members having a minimum guaranteed yield point greater than 300 MPa:

$$\text{average value} \leq \text{guaranteed minimum value} \times 1.17.$$

The averages are obtained from eight test specimens taken from eight different most heavily loaded members of the structure for each grade of material.

8.2.2 However, for members with slenderness ratio higher than those indicated in Sub-clause 8.2.1 and for redundants, the above limits may be exceeded since their yield point has little influence on their collapse.

8.2.3 For the average value of the ultimate strength, the following limit shall be accepted:

$$\text{average value} \leq \text{guaranteed minimum value} \times 1.20.$$

The average is obtained from the eight test specimens used for the determination of the average value of the yield point of the material.

If all these conditions are not satisfied, the test is not valid and the prototype shall be rejected.

Note. — This clause can, if necessary, be modified in the light of future experience.

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9. Presentation of test results

The test report shall include the following data: 60652:1995

1. The type of tested tower.
2. The name and address of the tower manufacturer and of the tower designer.
3. The name and address of the client.
4. The dates and location of testing.
5. The names of persons present during the tests.
6. A list of various assembly and detail drawings relating to the tower tested, including any modification of the drawings referred to.
7. A dimensioned line diagram of the tower showing the various load points and directions of loading to be applied and a table with the specified loads.
8. Diagram showing the rigging arrangement used to apply the test loads.
9. Brief description of the test facility including the number, location, range and calibration charts or tables of every load transducer or other load measuring devices, as well as the accuracy of the equipment used to measure the test loads.
10. One table per test showing the loads required at the various points on the structure and for the various loading steps.
11. One table per test showing the various deflection values measured.
12. In the case of failure:
 - a table showing the maximum loads applied to the structure just before the collapse;
 - a brief description of the failure;
 - the dimensional and mechanical characteristics of the failed elements.
13. Photographs showing the whole of the structure and, possibly, details of the failure.
14. Environmental meteorological data during the sequences of tests.