



SLOVENSKI STANDARD
SIST EN 61773:1999

01-november-1999

Nadzemni vodi - Preskusi temeljev za nosilne konstrukcije (IEC 1773:1996)

Overhead lines - Testing of foundations for structures

Freileitungen - Prüfung von Gründungen für Bauwerke

Lignes aériennes - Essais de fondations des supports

Ta slovenski standard je istoveten z: EN 61773:1996

[SIST EN 61773:1999](https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03cf3d109/sist-en-61773-1999)

<https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03cf3d109/sist-en-61773-1999>

ICS:

29.240.20 Daljnovodi Power transmission and
distribution lines

SIST EN 61773:1999

en,fr

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61773:1999

<https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03cf3d109/sist-en-61773-1999>

ICS 29.240.20

Descriptors: Overhead lines, foundations for structures, soil investigation, beam, pile

English version

**Overhead lines
Testing of foundations for structures
(IEC 1773:1996)**

Lignes aériennes - Essais
de fondations des supports
(CEI 1773:1996)

Freileitungen - Prüfung
von Gründungen für Bauwerke
(IEC 1773:1996)

This European Standard was approved by CENELEC on 1996-10-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

© 1996 Copyright reserved to CENELEC members

ITEH STANDARD PREVIEW
(standards.iteh.ai)

Ref. No. EN 61773:1996 E

SIST EN 61773:1999

[https://standards.iteh.ai/catalog/standards/sist/522809c7-7fd-4681-96d9-](https://standards.iteh.ai/catalog/standards/sist/522809c7-7fd-4681-96d9-50d03c3d109/sist-en-61773-1999)

[50d03c3d109/sist-en-61773-1999](https://standards.iteh.ai/catalog/standards/sist/522809c7-7fd-4681-96d9-50d03c3d109/sist-en-61773-1999)

Foreword

The text of document 11/111/FDIS, future edition 1 of IEC 1773, prepared by IEC TC 11, Recommendations for overhead lines, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61773 on 1996-10-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 1997-08-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 1997-08-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A, B, C, D, E and F are informative.
Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 1773:1996 was approved by CENELEC as a European Standard without any modification.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61773:1999

[https://standards.iteh.ai/catalog/standards/sist/522809c7-7fd-4681-96d9-](https://standards.iteh.ai/catalog/standards/sist/522809c7-7fd-4681-96d9-50d03c3d109/sist-en-61773-1999)

[50d03c3d109/sist-en-61773-1999](https://standards.iteh.ai/catalog/standards/sist/522809c7-7fd-4681-96d9-50d03c3d109/sist-en-61773-1999)

Annex ZA (normative)

**Normative references to international publications
with their corresponding European publications**

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

NOTE: When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 50(466)	1990	International electrotechnical vocabulary (IEV) - Chapter 466: Overhead lines	-	-
IEC 826	1991	Loading and strength of overhead transmission lines	-	-

iTeh STANDARD PREVIEW
(standards.iteh.ai)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 61773:1999

<https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03cf3d109/sist-en-61773-1999>

NORME
INTERNATIONALE
INTERNATIONAL
STANDARD

CEI
IEC
1773

Première édition
First edition
1996-11

Lignes aériennes –
Essais de fondations des supports

Overhead lines –
Testing of foundations for structures
(standards.iteh.ai)

SIST EN 61773:1999

<https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03c3d109/sist-en-61773-1999>

© CEI 1996 Droits de reproduction réservés — Copyright - all rights reserved

Aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'éditeur.

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher

Bureau central de la Commission Electrotechnique Internationale 3, rue de Varembe Genève, Suisse



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE

X

● Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

	Page
FOREWORD	7
Clause	
1 Scope and object.....	9
2 Normative references	9
3 Definitions	11
4 Categories of tests	11
4.1 Design tests	11
4.2 Proof tests	13
5 Geotechnical data.....	15
5.1 General	15
5.2 Soil investigation results	15
5.3 Geotechnical design parameters	15
5.4 Soil conditions during foundation installation	15
6 Foundation installation.....	17
6.1 General	17
6.2 Variations on foundations for design tests	17
6.3 Installation techniques for foundations subject to design testing.....	17
6.4 Installation records	19
6.5 Minimum period of time required between installation and testing	19
7 Test equipment.....	21
7.1 Load application	21
7.2 Test loading arrangements.....	23
7.3 Reference beam – Design tests	25
7.4 Displacement measurement devices – Design tests.....	25
7.5 Displacement measurement devices – Proof tests	27
7.6 Calibration of measuring instruments	27
8 Test procedure	41
8.1 Number of tests	41
8.2 Testing of pile groups	41
8.3 Loading procedure.....	43
8.4 Test recording	45
9 Test evaluation	47
9.1 General	47
9.2 Design tests	47
9.3 Proof tests	49

Clause	Page
10 Acceptance criteria	49
10.1 General	49
10.2 Design tests	49
10.3 Proof tests	51
11 Test report	51
Annexes	
A Bibliography	53
B Soil investigations	55
C Comments on clear horizontal distance between reaction supports and test foundation	61
D Formats for records of installation and testing	67
E Guidance notes for graphical determination of foundation uplift or compression capacity	77
F Glossary of terms and explanations	87

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 61773:1999](https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03cf3d109/sist-en-61773-1999)

<https://standards.iteh.ai/catalog/standards/sist/522809c7-7f6d-4681-96d9-50d03cf3d109/sist-en-61773-1999>

INTERNATIONAL ELECTROTECHNICAL COMMISSION

OVERHEAD LINES –

TESTING OF FOUNDATIONS FOR STRUCTURES

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 1773 has been prepared by IEC technical committee 11: Overhead lines.

The text of this standard is based on the following documents:

FDIS	Report on voting
11/111/FDIS	11/117/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annexes A, B, C, D, E and F are for information only.

The contents of the corrigendum of March 1997 have been included in this copy.

OVERHEAD LINES –

TESTING OF FOUNDATIONS FOR STRUCTURES

1 Scope and object

This International Standard is applicable to the testing procedures for foundations of overhead line structures. This standard distinguishes between:

- a) foundations predominantly loaded by axial forces, either in uplift or compression, acting in the direction of the foundation central axis. This applies to foundations of rigid lattice towers with typical individual footings, that is concrete pad and chimney foundations, steel grillages, concrete piers, piles and grouted anchors. Guy (stay) foundations are included when they are tested in line with their true guy inclinations;
- b) foundations predominantly loaded by lateral forces, overturning moments, or a combination of both. This applies to single poles with typical compact foundations, for example monoblock foundations, concrete slabs, concrete piers, piles and poles directly embedded in the ground. It may also apply to H-frame structure foundations for which the predominant loads are lateral forces, overturning moments, or a combination of both;
- c) foundations loaded by a combination of forces mentioned under a) and b).

Tests on reduced scale or model foundations are not included. However, they may be useful for design purposes.

Dynamic foundation testing is excluded from the scope of this document.

The object of this standard is to provide procedures which apply to the investigation of the load-carrying capacity and/or the load response (deflection or rotation) of the total foundation as an interaction between the foundation and the surrounding soil and/or rock. The mechanical strength of the structural components is not within the object of this standard. However, in the case of grouted anchors, the failure of structural components, for example the bond between anchor rod and grout, may predominate.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 50(466): 1990, *International Electrotechnical Vocabulary (IEV) – Chapter 466: Overhead lines*

IEC 826: 1991, *Loading and strength of overhead transmission lines*

3 Definitions

For the purpose of this International Standard, the following definitions apply. The definitions listed below supplement those given in IEC 50(466).

3.1 **characteristic strength**: The value guaranteed in appropriate standards. This value is also called the guaranteed strength, the minimum strength, the minimum failing load or the nominal strength and usually corresponds to an exclusion limit, from 2 % to 5 %, with 10 % being, in practice, the upper limit (IEC 826, 1.2.1).

3.2 **damage or serviceability limit load**: The load corresponding to the strength limit of the foundation, which, if exceeded, will lead to damage and noticeable deformation or reduction in strength of the supported structure. The damage load is normally related to displacement criteria and may also be known as the serviceability limit load.

NOTE – When applying this standard to testing foundations which are designed using deterministic loading criteria, reference to this term may be necessary.

3.3 **design load**: The limit load or factored working load or the load derived with respect to a specific return period of a climatical event, for which the foundation has been designed.

3.4 **failure load**: The maximum load which can be applied during testing. It is also known as the limit state failure load and is usually associated with displacements leading to failure of the structure.

3.5 **maximum proof load**: The maximum load applied to the foundation tested during a proof test.

3.6 **test report**: Final document summarizing the results of investigations and foundation tests.

3.7 **working load**: The maximum load likely to be experienced by the foundation under normal working conditions, during the life of the line, with no overload factors included.

NOTE – The term working load does not apply to limit states design methods and is not compatible with IEC 826. However, when applying this standard to testing foundations which are designed using deterministic loading criteria, reference to this term may be necessary.

4 Categories of tests

With respect to the purpose of the test, the level of investigation and the method of execution, this standard refers to two categories of tests:

- a) design tests;
- b) proof tests.

4.1 Design tests

Design tests are normally carried out on specially installed foundations, with one or more of the following objectives:

- a) to verify design parameters or methodologies;
- b) to verify construction procedures;

- c) to establish geotechnical design parameters and/or a design methodology for a specific application;
- d) to verify compliance of foundation design with specifications;
- e) to determine the average failure load and coefficient of variation of the design type in specified soil conditions.

Tests according to c) and/or d) are also known as type tests.

4.1.1 Full scale tests

Design tests should preferably be carried out with full scale units. When tests are carried out to verify design parameters, the test foundation shall be as identical as possible to those proposed for production (see 6.1).

Design tests are carried out to at least the design load or to failure, especially when testing according to 4.1 c) and/or 4.1 d), using limit state design. Limitations of displacements, deflection or rotation under load shall be considered where applicable. The level of instrumentation and of investigation should be appropriate for the purpose of the test.

4.1.2 Reduced scale tests

In the case of large dimension foundations, it might be impractical to undertake design tests on a full size foundation. Design tests on smaller dimension test foundations may be considered, subject to the following conditions:

- a) the test foundation is installed using the same techniques and materials as the production foundation;
- b) where necessary, the test foundation is instrumented in such a manner that the base and shaft resistances can be derived separately;
- c) for foundation types where the capacity is determined by lateral friction, the ratio of the test foundation lateral dimensions to the production foundation lateral dimensions is not less than 0,5. The depths should be equal.

Evaluation of reduced scale tests shall be carried out with great caution, unless the load capacity is based entirely on skin friction (for example piles, caissons or grouted anchors). Great care shall be taken with area/depth ratios and their absolute values.

4.2 Proof tests

These are intended for use during the installation of production foundations to act as a check on the quality of the installation, on the materials being used, and on the absence of any major variations in the assumed geotechnical design parameters. Proof tests may also be carried out on foundations installed in heterogeneous soil conditions where a wide variation in the foundation load-resistance capacity may be expected. Consistency, speed, economy and effectiveness are the key considerations.

Proof tests are taken to a specific percentage of the design load (usually 60 % to 75 %), as stipulated in the contract, but may not exceed the serviceability limit load. Limitations of the displacement shall be considered. The level of instrumentation and investigation may be low, but the reliability of the equipment and procedure shall be high.

Dynamic testing of piles after suitable calibration of the test equipment with design tests may also be used for proof testing.

Typically, proof tests are carried out on foundations installed for structures of a specific line. The foundations shall be fully serviceable after successfully passing the tests.

5 Geotechnical data

5.1 General

An initial soil investigation should be completed prior to the selection of a design test site. A preconstruction soil investigation may be eliminated, either where the geotechnical parameters are based on data derived during the actual installation (for example rock anchors), or where proof tests are used to check installation criteria. However, in this case records should be kept of previous soil investigations and of any assumptions made prior to or during the construction of the foundations.

Procedures for detailed soil investigations are beyond the scope of this standard. However, some general criteria, basic requirements and methods are included in annex B. This standard provides only general criteria for soil investigations of test sites. For details, reference should be made to the appropriate international or national standards and/or to recognized codes of practice (for example [1]*).

5.2 Soil investigation results

The results of the soil investigation and any subsequent laboratory testing shall be accurately recorded, together with a sketch map of the site showing all the pertinent physical and geological features.

5.3 Geotechnical design parameters

The geotechnical parameters used in the design of the foundations being tested, together with the method used to calculate these values, either from laboratory tests or from empirical considerations, shall be recorded.

5.4 Soil conditions during foundation installation

During the installation of any test foundation, the following information shall be recorded:

- a) visual description, including weathering, discontinuities, etc. of each soil/rock stratum and corresponding soil/rock classification;
- b) ground water level;
- c) any local soil/rock phenomena experienced during construction, for example side instability, bottom heave, water ingress, etc.;
- d) relevant meteorological data.

If the foundations are backfilled, the physical and geotechnical properties of the backfill should be established by using field and/or laboratory tests. Details of the method used for backfilling and compaction should be recorded.

* Figures in square brackets refer to the bibliography given in annex A.

6 Foundation installation

6.1 General

Proof tests are conducted on production foundations. Therefore, there should be no difference between the foundations tested and those not subjected to tests. Design tests are generally carried out on specially installed foundations which shall be constructed using the specified materials, to dimensions as close as possible to those required by the design.

6.2 Variations on foundations for design tests

For design tests, the following variations may be considered:

- a) The connection (for example the stub or reinforcing steel) between the foundation and the test apparatus may require modifications to ensure adequate strength when, and if, the foundation is stressed to loads approaching or in excess of its design load. In this case, the connection should have a minimum strength of 1,5 times the maximum test load during the design test. Any such modification shall not intrinsically alter the designed behaviour of the foundation in the ground, for example the lateral stiffness of long, slender columns.
- b) Due to the hip slope of the leg, production foundations might not be loaded vertically. However, the effect of inclined loading on the foundation capacity is low when the true leg slope is limited. Therefore, in order to ease foundation testing, the foundation may be modified so that its test axis is vertical, and the loads may be applied vertically where the maximum true hip slope is less than 20 % (one horizontal to five vertical, see figure 1).

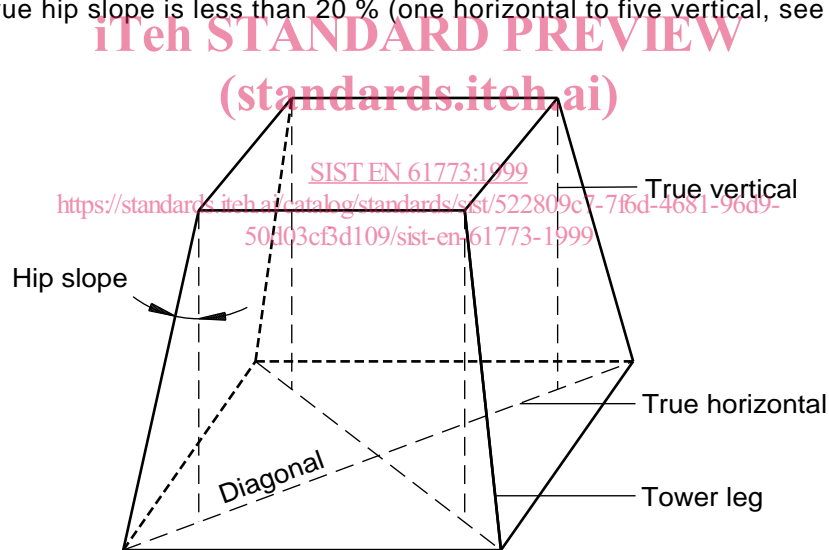


Figure 1 – Leg slope (hip slope) for towers with the shape of a regular frustum or truncated cone

6.3 Installation techniques for foundations subject to design testing

It is essential that all items which will affect the strength of the test foundations, for example method of construction and compaction of fill material, shall be equivalent to those used for the production foundations.

The techniques used for installation of the test foundations, should, where possible, be as close as is practical to those which are intended to be used on the production foundation.