Overhead lines - Methods for testing self-damping characteristics of conductors

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Overhead lines - Methods for testing self-damping characteristics of conductors (IEC 62567:2013)

Lignes électriques aériennes -
Méthodes d'essai des caractéristiques d'auto-amortissement des conducteurs
(CEI 62567:2013)

Freileitungen -
Methoden zur Prüfung der Eigendämpfungseigenschaften von Leitern
(IEC 62567:2013)

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Comité Européen de Normalisation Electrotechnique
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Foreword

The text of document 7/629/FDIS, future edition 1 of IEC 62567, prepared by IEC/TC 7 "Overhead electrical conductors" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62567:2013.

The following dates are fixed:

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Endorsement notice

The text of the International Standard IEC 62567:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

Publication	Year	Title	EN/HD	Year
IEC 60050-466	1990	International electrotechnical vocabulary (IEV) - Chapter 466: Overhead lines	-	-
IEEE Std. 563	1978	IEEE Guide on conductor self-damping measurements	-	-
IEEE Std. 664	1993	IEEE Guide for laboratory measurement of the power dissipation characteristics of aeolian vibration dampers for single conductors	-	-

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INTRODUCTION

Conductor self-damping is a physical characteristic of the conductor that defines its capacity to dissipate energy internally while vibrating. For conventional stranded conductors, energy dissipation can be attributed partly to inelastic effects within the body of the wires (hysteresis damping at the molecular level) but mostly to frictional damping, due to small relative movements between overlapping individual wires, as the conductor flexes with the vibration wave shape.

Self-damping capacity is an important characteristic of the conductors for overhead transmission lines. This parameter is a principal factor in determining the response of a conductor to alternating forces induced by the wind.

As the conductor self-damping is generally not specified by the manufacturer, it can be determined through measurements performed on a laboratory test span. Semi-empirical methods to estimate the self-damping parameters of untested conventional stranded conductors are also available but often lead to different results. Further, a great variety of new conductor types is increasingly used on transmission lines and some of them may have self-damping characteristics and mechanisms different from the conventional stranded conductors.

A “Guide on conductor self-damping measurements” was prepared jointly in the past by the IEEE Task Force on Conductor Vibration and CIGRE SC22 WG01, to promote uniformity in measuring procedures. The Guide was published by IEEE as Std. 563-1978 and also by CIGRE in Electra n°62-1979.

Three main methods are recognized in the above documents and divided into two main categories which are usually referred to as the "forced vibration" and ''free vibration" methods.

The first forced vibration method is the “Power [Test] Method” in which the conductor is forced into resonant vibrations, at a number of tunable harmonics, and the total power dissipated by the vibrating conductor is measured at the point of attachment to the shaker.

The second forced vibration method, known as the “Standing Wave Method” or more precisely “Inverse Standing Wave Ratio [Test] Method” (ISWR), determines the power dissipation characteristics of a conductor by the measurement of antinodal and nodal amplitudes on the span, for a number of tunable harmonics.

The free vibration method named “Decay [Test] Method” determines the power dissipation characteristics of a conductor by measuring, at a number of tunable harmonics, the decay rate of the free motion amplitude following a period of forced vibration.

Several laboratories around the world have performed conductor self-damping measurements in accordance with the above mentioned Guide. However, large disparities in self-damping predictions have been found among the results supplied by the various laboratories. The causes of these disparities have been identified into five main points:

1) The different test methods adopted for the self-damping measurements.
2) The different span end conditions set up in the various test laboratories (rigid clamps, flexure members, etc.)
3) The different types of connection between the shaker and the conductor (rigid or flexible) and the different location of the power input point along the span.
4) The different conductor conditioning before the test (creep, running in, etc.)
5) The different manufacturing processes of the conductor.

OVERHEAD LINES – METHODS FOR TESTING SELF-DAMPING CHARACTERISTICS OF CONDUCTORS

1 Scope

The scope of this Standard is to provide test procedures based on the above-mentioned documents and devoted to minimize the causes of discrepancy between test results, taking into consideration the large experience accumulated in the last 30 years by numerous test engineers and available in literature, including a CIGRE Technical Brochure specifically referring to this standard (see Bibliography).

This Standard describes the current methodologies, including apparatus, procedures and accuracies, for the measurement of conductor self-damping and for the data reduction formats. In addition, some basic guidance is also provided to inform the potential user of a given method's strengths and weaknesses.

The methodologies and procedures incorporated in this Standard are applicable only to testing on indoor laboratory spans.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-466:1990, *International Electrotechnical Vocabulary. Chapter 466: Overhead lines*

IEEE Std. 563-1978, *IEEE Guide on conductor self-damping measurements*

IEEE Std. 664-1993, *IEEE Guide for laboratory measurement of the power dissipation characteristics of aeolian vibration dampers for single conductors*

3 Terms and definitions

For the purpose of this International Standard, the definitions of the International Electrotechnical Vocabulary (IEV) apply, in particular IEC 60050-466. Those which differ or do not appear in the IEV are given below.

3.1
conductor self-damping:
the self-damping of a conductor subjected to a tensile load T is defined by the power P_c dissipated per unit length by the conductor vibrating in a natural mode, with a loop length $\lambda/2$, an antinode displacement amplitude Y_0 and a frequency f

3.2
node
in a vibrating conductor, nodes are the points in which the vibration amplitude is the smallest

3.3
anti-node
in a vibrating conductor, anti-nodes are the points in which the vibration amplitude is the greatest