

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”

An Overview

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Background

- Wind induced vibration, specifically Aeolian Vibration, can cause serious damage to overhead conductors primarily due to fatigue of the individual wires.
- Fretting exacerbates the problem. Combined phenomenon is known as “Fretting-Fatigue”
- If vibration is severe enough, wires can fail at locations where there is a sudden change in bending stiffness as seen by the conductor. Maximum bending stress occurs at suspension clamps, deadend clamps, splices, marker balls, dampers, etc)
- Vibration severity is governed by the **“Energy Balance Principle”**
That is, the **energy input** to the conductor by the wind is **balanced** by the **energy dissipated** primarily by the inherent self-damping of the conductor and the external damping provided by dampers. Energy is also dissipated in other forms.

$$\text{Wind Energy} = \text{Self-Damping} + \text{External Damping} + \text{other}$$

- Wind Energy: Many studies on wind energy input have been performed in the lab
- Internal Damping: Energy dissipated by friction between conductor strands during vibration
- External Damping: Energy dissipated by add-on dampers such as Stockbridge Dampers
- Other – Aerodynamic, kinetic, metallurgical

Need for the Standards

- Need information on internal damping properties of the conductor (aka self-damping) to assess whether external dampers are required
- Need information on the characteristics and efficiency of external dampers so they can be designed properly
- Need Laboratory Test Methods
 - i) to measure self-damping properties of conductors
 - ii) to measure characteristics and efficiencies of external dampers

Purpose of the Standards

- IEEE Std 563-1978, “*IEEE Guide on Conductor Self-Damping Measurements*” describes test methods to measure self-damping properties of conductors in a laboratory
- IEEE Std 664-1993, “*IEEE Guide for Laboratory Measurement of the Power Dissipation Characteristics of Aeolian Vibration Dampers for Single Conductors*” describes test methods for measuring the energy dissipation characteristics and efficiency of vibration dampers in a laboratory

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IEEE Std 563-1978 - Outline

1. Scope

1.1 Power Method

1.2 Inverse Standing Wave Ratio (ISWR) Method

2. List of Symbols

3. Self-Damping Definition

4. Conductor Definition

5. Test Span Arrangement

6. Test Method

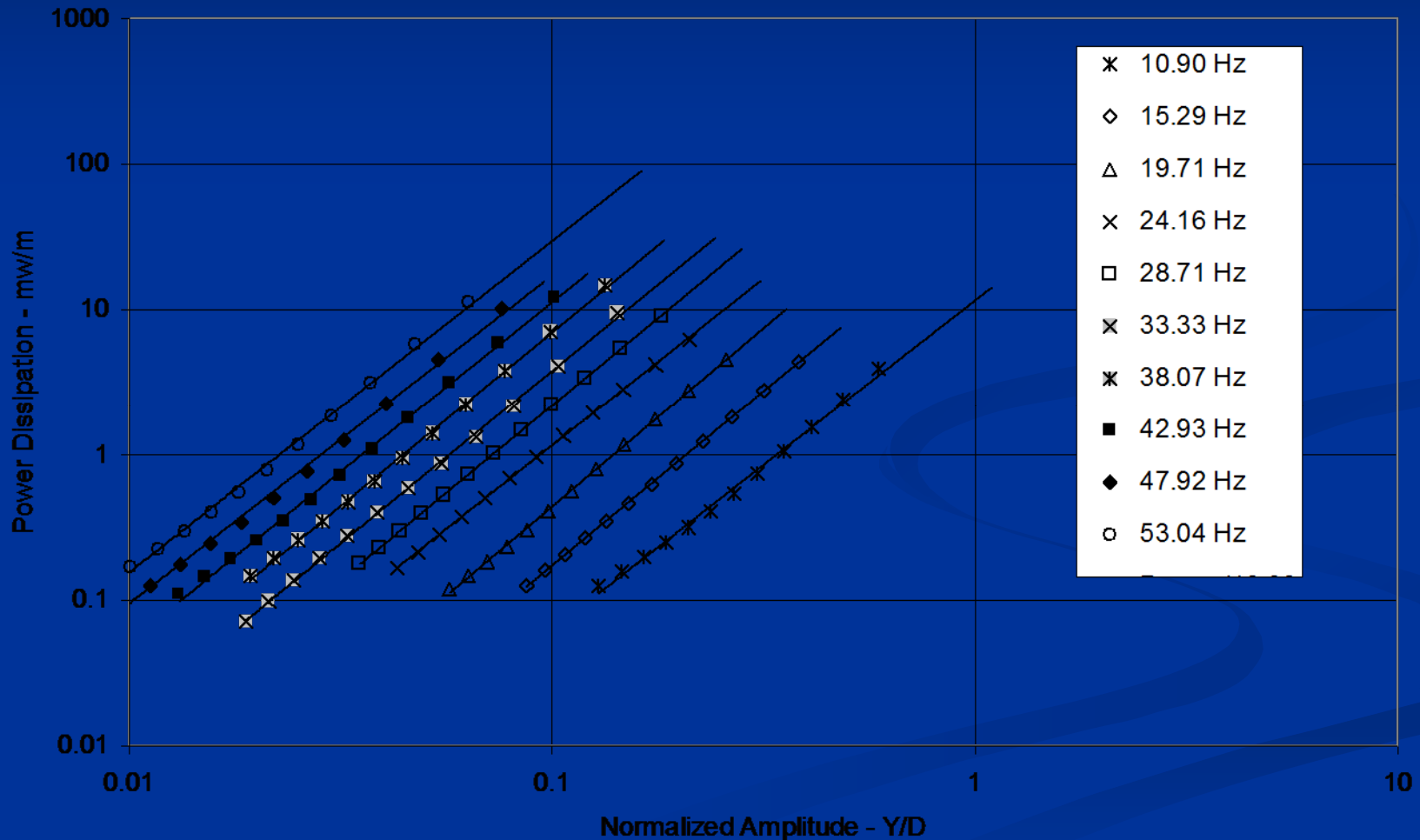
7. Power Measurements

8. Recommended Values of Test Parameters

9. References

IEEE Std 563 – Sample Data

Figure 1-10. 705 Hz 100 W 0.5% BTG



IEEE Std 563-1978 - Status (as of Summer 2009)

- IEEE Std 563 was originally issued in 1978
- standard has not been revised
- last re-affirmed in 2007
- due for maintenance (ie. reaffirmation, revision or withdrawal) in 2012

IEEE Std 664-1993 - Outline

1. Scope
2. Definition
3. General Technical Considerations
4. Span Method
5. Forced Response Method
6. Reporting and Recommendations
7. Bibliography

IEEE Std 664-1993 Span Methods

- 1) Inverse Standing Wave Ratio (ISWR) Method
- 2) Power Method
- 3) Logarithmic Decay Method

- Uses span to test conductor and damper together to obtain combined total power dissipation due to self-damping of the conductor *PLUS* damping due to external damper
- Used in conjunction with IEEE Std 563. The power dissipation due to conductor self-damping is subtracted from the combined total damping to obtain the power dissipation of the external damper

$$\textit{Combined Pwr Dissipation} - \textit{SD Pwr Dissipation} = \textit{Damper Pwr Dissipation}$$

- Efficiency of damper can be determined in terms of reduction of vibration amplitude

Forced Response Method

- Performed with damper mounted directly to a vibration shaker
- Used to determine the power dissipation characteristics of the damper
- Plots Power Dissipation (watts) vs. Vibration Frequency (Hz)

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Questions??