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# IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

Sponsor
**Transmission and Distribution Committee**
**of the**
**IEEE Power Engineering Society**

and

**Static Power Converter Committee**
**of the**
**IEEE Industry Applications Society**

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**IEEE Standards Board**

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**Abstract:** This guide applies to all types of static power converters used in industrial and commercial power systems. The problems involved in the harmonic control and reactive compensation of such converters are addressed, and an application guide is provided. Limits of disturbances to the ac power distribution system that affect other equipment and communications are recommended. This guide is not intended to cover the effect of radio frequency interference.
**Keywords:** harmonic control, harmonics, reactive power compensation

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## Foreword

(This foreword is not a part of IEEE Std 519-1992, IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.)

This recommended practice was prepared by a joint task force sponsored by the Working Group on Power System Harmonics of the Transmission and Distribution Committee of the IEEE Power Engineering Society and the Harmonic and Reactive Compensation Subcommittee of the Industrial Power Conversion Committee of the IEEE Industry Applications Society. This recommended practice is an update of the IEEE guide that was published in 1981. The work to revise the guide was started in 1984 and has incorporated the evolving understanding of the effect of static power converters and other nonlinear loads on electric power systems.

This recommended practice recognizes the responsibility that users have not to degrade the voltage of the utility serving other users by requiring nonlinear currents from the utility. It also recognizes the responsibility of the utilities to provide users with close to a sine wave of voltage. The recommended practice suggests guidelines for accomplishing this.

At the time that this standard was completed, the task force had the following membership:

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# IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

## 1. Introduction, Scope, and Application

### 1.1 Introduction

The uses of nonlinear loads connected to electric power systems include static power converters, arc discharge devices, saturated magnetic devices, and, to a lesser degree, rotating machines. Static power converters of electric power are the largest nonlinear loads and are used in industry for a variety of purposes, such as electrochemical power supplies, adjustable speed drives, and uninterruptible power supplies. These devices are useful because they can convert ac to dc, dc to dc, dc to ac, and ac to ac.

Nonlinear loads change the sinusoidal nature of the ac power current (and consequently the ac voltage drop), thereby resulting in the flow of harmonic currents in the ac power system that can cause interference with communication circuits and other types of equipment. When reactive power compensation, in the form of power factor improvement capacitors, is used with these nonlinear loads, resonant conditions can occur that may result in high levels of harmonic voltage and current distortion when the resonant condition occurs at a harmonic associated with nonlinear loads.

### 1.2 Scope

This recommended practice intends to establish goals for the design of electrical systems that include both linear and nonlinear loads. The voltage and current waveforms that may exist throughout the system are described, and waveform distortion goals for the system designer are established. The interface between sources and loads is described as the point of common coupling; and observance of the design goals will minimize interference between electrical equipment.

This recommended practice addresses steady-state limitation. Transient conditions exceeding these limitations may be encountered. This document sets the quality of power that is to be provided at the point of common coupling. This document does not cover the effects of radio-frequency interference; however, it does include electromagnetic interference with communication systems.