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IEEE Recommended Practice for Electric Power Systems in Commercial Buildings

Sponsor

**Power Systems Engineering Committee
of the
IEEE Industry Applications Society**

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Abstract: A guide and general reference on electrical design for commercial buildings is provided. It covers load characteristics; voltage considerations; power sources and distribution apparatus; controllers; services, vaults, and electrical equipment rooms; wiring systems; systems protection and coordination; lighting; electric space conditioning; transportation; communication systems planning; facility automation; expansion, modernization, and rehabilitation; special requirements by occupancy; and electrical energy management. Although directed to the power oriented engineer with limited commercial building experience, it can be an aid to all engineers responsible for the electrical design of commercial buildings. This recommended practice is not intended to be a complete handbook; however, it can direct the engineer to texts, periodicals, and references for commercial buildings and act as a guide through the myriad of codes, standards, and practices published by the IEEE, other professional associations, and governmental bodies.

Keywords: Commercial buildings, electric power systems, load characteristics

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Foreword

(This Foreword is not a part of IEEE Std 241-1990, IEEE Recommended Practice for Electric Power Systems in Commercial Buildings.)

The purpose of IEEE Std 241-1990, the “Gray Book,” is to promote the use of sound engineering principles in the design of commercial buildings. It is hoped that it will alert the electrical engineer or designer to the many problems that can be encountered in designing electrical systems for commercial buildings and to develop a concern for the professional aspects of commercial building engineering. The Gray Book is not intended to be a complete handbook; however, it will direct the engineer to texts, periodicals, and references pertaining to commercial buildings and will also act as a guide through the myriad of codes, standards, and practices published by the IEEE and other professional associations and governmental bodies.

The fourth edition of this recommended practice has been written to update readers on the state of the art and ensure quality electrical engineering design for commercial buildings. Material contained in previous editions of this book has been reused or updated, where practical.

All of the previous contributions to the Gray Book are hereby thanked by the present working group for their diligence and dedication; there would not have been a fourth edition without their many contributions to the technical accuracy and substance of this recommended practice.

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IEEE Recommended Practice for Electric Power Systems in Commercial Buildings

1. Introduction

1.1 Scope

IEEE Std 241-1990, IEEE Recommended Practice for Electric Power Systems in Commercial Buildings, commonly known as the “Gray Book” is published by the Institute of Electrical and Electronics Engineers (IEEE) to provide a recommended practice for the electrical design of commercial buildings. It has been prepared on a voluntary basis by engineers and designers functioning as the Gray Book Working Group within the IEEE Power Systems Engineering Committee.

This recommended practice will probably be of greatest value to the power oriented engineer with limited commercial building experience. It can also be an aid to all engineers responsible for the electrical design of commercial buildings. However, it is not intended as a replacement for the many excellent engineering texts and handbooks commonly in use, nor is it detailed enough to be a design manual. It should be considered a guide and general reference on electrical design for commercial buildings.

Tables, charts, and other information that have been extracted from codes, standards, and other technical literature are included in this recommended practice. Their inclusion is for illustrative purposes; where the correctness of the item is important, the latest referenced document should be used to assure that the information is complete, up to date, and correct. It is not possible to reproduce the full text of these items in this recommended practice.

1.1.1 Voltage Levels

It is important to establish, at the outset, the terms describing voltage classifications. Table 1, which is adapted from IEEE Std 100-1988, IEEE Standard Dictionary of Electrical and Electronics Terms, Fourth Edition (ANSI) [5],¹ indicates these voltage levels. ANSI/NFPA 70-1990, National Electrical Code (NEC) [3],² described in 1.6.1, uses the term “over 600 volts” generally to refer to what is known as “high voltage.” Many IEEE Power Engineering Society (PES) standards use the term “high voltage” to refer to any voltage higher than 1000 V. All nominal voltages are

¹The numbers in brackets correspond to those in the references at the end of each chapter. IEEE publications are available from the Institute of Electrical and Electronics Engineers, IEEE Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331.

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