



Industrial Power Distribution

By Ralph E. Fehr

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Industrial Power Distribution provides a broad overview of electricity utilization in the industrial environment. It serves as both an introductory teaching book and a comprehensive reference. Based on over 20 years of experience in electric power system design and analysis, the author strikes a careful balance between application and theory, and provides insight to answer “why” instead of just how. Chapter topics cover utility source, medium voltage distribution, balanced fault calculations and protective equipment selection, unbalanced faults, raceway design, switchgear and motor control centers, ladder logic, motors and motor starting, shunt capacitors, and power quality. For use by industry professionals in review courses or as a reference manual.

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Industrial Power Distribution By Ralph E. Fehr Bibliography

- Sales Rank: #2255395 in Books
- Published on: 2001-10-26
- Original language: English
- Number of items: 1
- Dimensions: 8.98" h x .79" w x 6.93" l, .95 pounds
- Binding: Paperback
- 264 pages

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Editorial Review

From the Back Cover

This book provides a broad overview of electricity utilization in the industrial environment. *Industrial Power Distribution* serves as both an introductory textbook and a comprehensive reference. Based on over 20 years of experience in electric power system design and analysis, author **Ralph E. Fehr III** strikes a careful balance between application and theory, and provides insight to answer "why" instead of just "how."

Features include:

- references to standards, codes, and design practices
- extensive examination of transformer connections
- concise yet thorough coverage of short circuit analysis
- practical guide to raceway design
- in-depth exploration of ladder logic introduction to power quality issues

Each chapter concludes with questions to verify the comprehension of key concepts and problems to check the ability to perform realistic power system design and analysis.

About the Author

Ralph Fehr received the B.S. degree in electrical engineering from the Pennsylvania State University in 1983 and the M.E. degree in electrical engineering (power) from the University of Colorado at Boulder in 1987. He has worked in the generation engineering field, designing power distribution and control systems for nuclear and fossil-fired power plants. Mr. Fehr also has worked for electric utilities for more than 15 years in the operations, planning, and design areas, including transmission, distribution, and substation engineering.

Teaching has always been an important aspect of Mr. Fehr's career. On an adjunct basis, he has taught courses ranging from computer operating systems to mathematics to power system analysis for several institutions, including the University of New Mexico at Albuquerque, St. Petersburg Junior College, and the University of South Florida at Tampa. Since 1996, he also has taught a review course for candidates for the professional engineer examination through the Florida Engineering Society.

Mr. Fehr is a senior member of the Institute of Electrical and Electronics Engineers (IEEE) and is a registered professional engineer in New Mexico and Florida. His biography is published in *Who's Who in Science and Engineering*.

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Electricity has been an essential part of our lives since the late nineteenth century. During the early twentieth century, electricity began replacing steam as the primary power source in industrial plants. As factories became larger and more complex, so did their power requirements. Accordingly, engineers were faced with a new challenge: how to distribute electricity safely, reliably, and economically within the industrial facility. Although this challenge has been addressed for over a century, the theories, requirements, and procedures for safe, reliable, and economical industrial power distribution have not been presented in textbook form. This

work attempts to do so by drawing on more than one hundred years of lessons learned and refinements made in the electrical power distribution field.

The book begins by analyzing the source of the electricity: the utility system. Requirements, including the delivery voltage and the topology of the source, are explored, along with their impact on the operation and reliability of the industrial facility. Next, a powerful calculation method using the per-unit system is reviewed, and this method is applied extensively throughout the text. Other power source issues, such as short-circuit availability and transformer sizing are discussed, followed by a brief presentation on metering methods.

The next area covered is medium-voltage distribution systems within the industrial facility. Guidelines for selecting the optimum voltage are presented. Various transformer connections are analyzed to determine their effects on the behavior of the electrical system. Ferroresonance and methods of eliminating its undesirable effects are introduced. Methods of conductor sizing consistent with the National Electrical Code® (NEC®) are also presented.

Two chapters are devoted to the calculation of fault currents and the sizing of protective equipment such as circuit breakers and fuses. The method of symmetrical components is used to analyze unbalanced fault conditions.

Raceway design, including the design of conduit, duct banks, and cable trays, is covered consistently with NEC® specifications.

Switchgear and motor control centers, two types of equipment used extensively to distribute electricity within industrial facilities, are examined in detail, with a focus on specification and selection requirements.

Methods of starting and controlling motors are discussed; variable frequency drives are briefly introduced. A detailed tutorial on ladder logic is included. The application of shunt capacitors for power factor correction is presented, and a chapter on power quality rounds out the text.

Tabular data reprinted by permission from IEEE Std. 141-1993 and 242-1986, are presented throughout the text. The IEEE disclaims any responsibility or liability resulting from the placement and use in the described manner. Additional engineering data are presented in the appendices: units of measurement, circuit analysis techniques, impedance data, ampacity data reprinted from the NEC™, conduit data, and others. These data provide a valuable reference source for the engineer.

This volume serves not only as an informative textbook, but also as a concise reference book. Objectives are clearly stated at the beginning of each chapter, and a succinct summary is presented at the end of each chapter. Questions to test the reader's comprehension of important concepts and problems to check the reader's ability to apply theory to solve practical problems are provided for each chapter.

The material in the text affords a solid foundation in the field of industrial power distribution, preparing the reader for more in-depth exploration of any of the topics presented. The book may be used at the upper-division undergraduate or graduate level. An understanding of basic power system analysis is the only prerequisite for fully comprehending the material presented.

Ralph Fehr

Users Review

From reader reviews:

Linda Matthews:

The book Industrial Power Distribution make one feel enjoy for your spare time. You need to use to make your capable much more increase. Book can to become your best friend when you getting pressure or having big problem along with your subject. If you can make reading a book Industrial Power Distribution for being your habit, you can get far more advantages, like add your personal capable, increase your knowledge about many or all subjects. You could know everything if you like available and read a reserve Industrial Power Distribution. Kinds of book are a lot of. It means that, science e-book or encyclopedia or others. So , how do you think about this e-book?

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