

McGraw-Hill

PORTABLE

Engineering

SECOND EDITION

ELECTRICAL ENGINEER'S PORTABLE HANDBOOK

- ▶ **Completely updated for 2002 NEC**
- ▶ **New sections on electrical production systems**
- ▶ **New section on blown fiber technology**

Robert B. Hickey

TLFeBOOK

Copyright © 2004, 1999 by The McGraw-Hill Companies, Inc. All rights reserved. Manufactured in the United States of America. Except as permitted under the United States Copyright Act of 1976, no part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

0-07-143349-X

The material in this eBook also appears in the print version of this title: 0-07-141820-2.

All trademarks are trademarks of their respective owners. Rather than put a trademark symbol after every occurrence of a trademarked name, we use names in an editorial fashion only, and to the benefit of the trademark owner, with no intention of infringement of the trademark. Where such designations appear in this book, they have been printed with initial caps.

McGraw-Hill eBooks are available at special quantity discounts to use as premiums and sales promotions, or for use in corporate training programs. For more information, please contact George Hoare, Special Sales, at george_hoare@mcgraw-hill.com or (212) 904-4069.

TERMS OF USE

This is a copyrighted work and The McGraw-Hill Companies, Inc. ("McGraw-Hill") and its licensors reserve all rights in and to the work. Use of this work is subject to these terms. Except as permitted under the Copyright Act of 1976 and the right to store and retrieve one copy of the work, you may not decompile, disassemble, reverse engineer, reproduce, modify, create derivative works based upon, transmit, distribute, disseminate, sell, publish or sublicense the work or any part of it without McGraw-Hill's prior consent. You may use the work for your own noncommercial and personal use; any other use of the work is strictly prohibited. Your right to use the work may be terminated if you fail to comply with these terms.

THE WORK IS PROVIDED "AS IS". MCGRAW-HILL AND ITS LICENSORS MAKE NO GUARANTEES OR WARRANTIES AS TO THE ACCURACY, ADEQUACY OR COMPLETENESS OF OR RESULTS TO BE OBTAINED FROM USING THE WORK, INCLUDING ANY INFORMATION THAT CAN BE ACCESSED THROUGH THE WORK VIA HYPERLINK OR OTHERWISE, AND EXPRESSLY DISCLAIM ANY WARRANTY, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. McGraw-Hill and its licensors do not warrant or guarantee that the functions contained in the work will meet your requirements or that its operation will be uninterrupted or error free. Neither McGraw-Hill nor its licensors shall be liable to you or anyone else for any inaccuracy, error or omission, regardless of cause, in the work or for any damages resulting therefrom. McGraw-Hill has no responsibility for the content of any information accessed through the work. Under no circumstances shall McGraw-Hill and/or its licensors be liable for any indirect, incidental, special, punitive, consequential or similar damages that result from the use of or inability to use the work, even if any of them has been advised of the possibility of such damages. This limitation of liability shall apply to any claim or cause whatsoever whether such claim or cause arises in contract, tort or otherwise.

DOI: 10.1036/007143349X

Contents

Acknowledgments xi
Credits xiii
Preface to the Second Edition xv
Introduction: How to Use This Book xvii

Chapter 1. General Information **1**

1.0 Introduction 1
1.1 Checklists 1
1.2 Electrical Symbols and Mounting Heights 19
1.3 NEMA Device Configurations 33
1.4 IEEE Standard Electrical Power System Device
Function Numbers and Contact Designations 35
1.5 NEMA Standard Enclosures 58
1.6 Formulas and Terms 61
1.7 Typical Equipment Sizes and Weights 62
1.8 Seismic Requirements 62

**Chapter 2. National Electrical Code (NEC) Articles,
Tables, and Data** **69**

2.0 Working Space About Electric Equipment 69
2.1 Over 600 Volts, Nominal 80
2.2 Overcurrent Protection Standard Ampere Ratings 82
2.3 NEC Article 240.21: Location in Circuit
(Feeder Tap Rules) 84
2.4 NEC Article 310: Conductors for General Wiring 92

Acknowledgments

Many thanks to Mark W. Felgate, P.E.; Edward M. Grafe; and the entire electrical staff at van Zelm Heywood & Shadford, Inc. for their valuable input; and to Kristine M. Buccino for her assistance in getting permission to reprint copyrighted material.

A special thanks to Steve Chapman and his team at McGraw-Hill and to Stephanie Landis and her team at North Market Street Graphics, whose wonderful collaborative spirit and many professional talents made the publication of this second edition possible.

And finally, a very special thanks to my wife Pat for her continued encouragement and support.

Credits

Where indicated, reprinted with permission from NFPA 70 (2002), the *National Electrical Code*[®], copyright © 2001, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the referenced subject which is represented only by the standard in its entirety.

Where indicated, reprinted with permission from the *National Electrical Code*[®] *Handbook*, copyright © 2004, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the referenced subject which is represented only by the standard in its entirety.

Where indicated, reprinted with permission from NFPA 72, *National Fire Alarm Code*[®], copyright © 1996, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the referenced subject which is represented only by the standard in its entirety.

Tables 1.7–1.11 are reprinted with permission from *1996 Means Electrical Cost Data*, copyright R.S. Means Co., Inc., Kingston, MA, 781-585-7880, all rights reserved.

ACME Electric, BICSI Cablec Industrial Cable Co., Caterpillar, Cooper Bussman, Cutler-Hammer, Ferraz Shawmut, General Cable Corporation, Illuminating Engineering Society of North America, Institute of Electrical and Electronics Engineers, Kerite (Hubbell Power Systems), Okonite Company, OSRAM Sylvania, Pyrotenax USA, Simens Corporation, Square D (Schneider Electric).

Preface to the Second Edition

This second edition of the *Electrical Engineer's Portable Handbook* includes a number of significant updates and a few worthy additions and enhancements.

All *National Electrical Code*® articles, tables, data, references, and so on have been updated to the 2002 edition of the *Code* in Chap. 2 and elsewhere where they occur. Two major changes throughout the latest edition of the *NEC* are the system of nomenclature/paragraphing hierarchy and the metrification of units as primary in tables and data.

Chapter 3 contains updated motor circuit feeder schedules, a transformer primary and secondary feeder schedule, and a new table of three-phase, three-wire, and four-wire plus ground feeder schedules sized to the overcurrent protection rating. These should prove to be time-saving tools.

The grounding electrode system (main service grounding detail) diagram in Chap. 4 has been updated and an introductory overview of a dissipation array system (DAS) for lightning protection has been added. This is an emerging technology application of a long-known theory that is gaining popularity in some critical installations.

Telecommunications-structured cabling systems information in Chap. 8 has been completely replaced with the latest BICSI standards (including tables, diagrams, and illustrations). An introductory overview to blown optical fiber technology (BOFT) provides insight into this very interesting, cost-competitive, and extremely flexible optical fiber technology. It is particularly amenable to renovation/retrofit applications because of its flexibility and avoids initial capitalization for installing future capacity in new construction.

I hope you will find this second edition of the *Electrical Engineer's Portable Handbook* a truly useful addition to your design tools library.

Bob Hickey

Introduction: How to Use This Book

The concept of this book is that of a *personal tool*, which compacts 20 percent of the data that is needed 80 percent of the time by *electrical design professionals* in the preliminary design of buildings of all types and sizes.

This tool is meant to always be at one's fingertips (open on a drawing board, desk, or computer table; carried in a briefcase; or kept in one's pocket). It is never meant to sit on a bookshelf. It is meant to be used *everyday!*

Because design professionals are individualistic and their practices are so varied, the user is encouraged to *individualize this book* by adding notes or changing data as experience dictates.

Building codes and laws, new technologies, and materials are ever changing in this industry. Therefore, this book should be viewed as a *starter of simple data collection* that must be updated over time. New editions may be published in the future.

Because this book is so broad in scope, yet so compact, information can be presented in only one location, and not repeated. It is expected that the experienced practitioner is generally knowledgeable about the data and knows how to apply it properly. Information is often presented in the form of simple ratios, coefficients, application tips, or rules of thumb that leave the need for commonsense judgment.

This book is unique among handbooks. It provides myriad valuable time-saving data for the experienced practitioner, yet there are enough concept explanations and examples on critical topics to use it as a teaching tool for the fledgling electrical design professional. Also, the topics of Chapters 3 through 7, in particular, are arranged in a sequence that closely approximates the normal design process flow to facilitate speed for the experienced practitioner and learning for the beginner. The Index has been expanded to facilitate quickly locating needed information.

This book is *not a substitute* for professional expertise or other books of a more detailed and specialized nature, but will be a continuing everyday aid that takes the more useful "cream" off the top of other sources.

CHAPTER ONE

General Information

1.0 INTRODUCTION

This chapter provides information of a general nature that is frequently needed by the electrical design professional. Information that follows in subsequent chapters is more specific and closely follows the design process.

1.1 CHECKLISTS

The following checklists should prove useful in the execution of projects.

2 Electrical Engineer's Portable Handbook

FIGURE 1.1 Project to do checklist (electrical).

Page 1 of 3	
Project Status	Project: _____
<input type="checkbox"/> SD	Proj. No: _____
<input type="checkbox"/> DD	PM/PE: _____
<input type="checkbox"/> CD	Date: _____
PreDesign	Design
<input type="checkbox"/> Review Contract Scope	<input type="checkbox"/> Main electric service
<input type="checkbox"/> Review Design Budget with P.M.	<input type="checkbox"/> Power Distribution system
<input type="checkbox"/> Establish design criteria	<input type="checkbox"/> Branch circuits
<input type="checkbox"/> Establish design schedule	<input type="checkbox"/> Building lighting
<input type="checkbox"/> Schedule review meetings & team	<input type="checkbox"/> Site lighting
<input type="checkbox"/> Setup project notebook	<input type="checkbox"/> Main telephone service
<input type="checkbox"/> Code review	<input type="checkbox"/> _____
<input type="checkbox"/> Obtain as-built drawings	<input type="checkbox"/> _____
<input type="checkbox"/> Site survey	
<input type="checkbox"/> Start project data sheet	Other Systems
<input type="checkbox"/> Contact Power Company	<input type="checkbox"/> Communications Consultant
<input type="checkbox"/> Contact Telephone Company	<input type="checkbox"/> AV Consultant
<input type="checkbox"/> Review client's design requirements	<input type="checkbox"/> Food Service Consultant
<input type="checkbox"/> _____	<input type="checkbox"/> Elevator Consultant
<input type="checkbox"/> _____	<input type="checkbox"/> Theatre Consultant
<input type="checkbox"/> _____	<input type="checkbox"/> Division 16 coordinated with Div. 15/13
	<input type="checkbox"/> _____
Load Analysis	Special Systems
<input type="checkbox"/> Schematic, sq.foot basis	<input type="checkbox"/> Fire alarm & smoke detection system
<input type="checkbox"/> Mechanical loads finalized	<input type="checkbox"/> Telephone outlets
<input type="checkbox"/> Process equipment loads finalized	<input type="checkbox"/> TV outlets
<input type="checkbox"/> Final design loads scheduled	<input type="checkbox"/> Elevator System
<input type="checkbox"/> _____	<input type="checkbox"/> Data outlets
	<input type="checkbox"/> Intercom system
Fault Current Analysis	<input type="checkbox"/> Security system
<input type="checkbox"/> Rough estimate pre-design	<input type="checkbox"/> Standby generators & Automatic Transfer Switch
<input type="checkbox"/> Final analysis	<input type="checkbox"/> Energy Management System
	<input type="checkbox"/> Grounding systems
Coordination Study	<input type="checkbox"/> Lightning Protection system
<input type="checkbox"/> Rough selection pre-design	<input type="checkbox"/> _____
<input type="checkbox"/> Final study	<input type="checkbox"/> _____

FIGURE 1.1 Project to do checklist (electrical). (Continued)

		Page 2 of 3
Project Status		Project: _____
<input type="checkbox"/> SD		Proj. No: _____
<input type="checkbox"/> DD		PM/PE: _____
<input type="checkbox"/> CD		Date: _____

<p>Specification</p> <ul style="list-style-type: none"> <input type="checkbox"/> Cover <input type="checkbox"/> Bidding forms <input type="checkbox"/> General Conditions & Division 1 <input type="checkbox"/> Non-electrical sections <input type="checkbox"/> Division 13 sections <input type="checkbox"/> Division 15 sections <input type="checkbox"/> Division 16 sections <p>Construction Estimates</p> <ul style="list-style-type: none"> <input type="checkbox"/> Schematic design <input type="checkbox"/> Design development <input type="checkbox"/> Construction documents <p>Drawings</p> <ul style="list-style-type: none"> <input type="checkbox"/> Title block & drawing size <input type="checkbox"/> Site plans <input type="checkbox"/> Demolition plans <input type="checkbox"/> Symbol list <input type="checkbox"/> Abbreviation list <input type="checkbox"/> General notes <input type="checkbox"/> Power plans <input type="checkbox"/> Lighting plans <input type="checkbox"/> Fixture schedule <input type="checkbox"/> One-line power diagram <input type="checkbox"/> Switchboard schedules <input type="checkbox"/> MCC schedules <input type="checkbox"/> Distribution panelboard schedules <input type="checkbox"/> Lighting panelboard schedules <input type="checkbox"/> Fire detection & alarm plans <input type="checkbox"/> Fire detection & alarm one-line diagram <input type="checkbox"/> Building grounding grid plan <input type="checkbox"/> Lightning protection plan 	<p>Electrical Details</p> <ul style="list-style-type: none"> <input type="checkbox"/> Front Elevation Switchboards <input type="checkbox"/> Front Elevation MCCs <input type="checkbox"/> _____ <input type="checkbox"/> _____ <p>Site Details</p> <ul style="list-style-type: none"> <input type="checkbox"/> Concrete Bases for Lighting Poles <input type="checkbox"/> Transformer Concrete Pads & Grounding <input type="checkbox"/> Equipment Concrete Pads & Grounding <input type="checkbox"/> Manholes, Ductbanks, Grounding <input type="checkbox"/> Trench, backfill & reseed <input type="checkbox"/> Pavement <input type="checkbox"/> _____ <p>Drawing Check</p> <ul style="list-style-type: none"> <input type="checkbox"/> Overlay electrical drawings <input type="checkbox"/> Complete drawing checklists <input type="checkbox"/> Complete site checklists <input type="checkbox"/> _____ <input type="checkbox"/> _____ <p>In House Review</p> <ul style="list-style-type: none"> <input type="checkbox"/> Conceptual review <input type="checkbox"/> Schematic Design <input type="checkbox"/> Design Development <input type="checkbox"/> Construction Documents <p>Client Submission</p> <ul style="list-style-type: none"> <input type="checkbox"/> Schematic Design <input type="checkbox"/> Design Development <input type="checkbox"/> Construction Documents
--	---

4 Electrical Engineer's Portable Handbook

FIGURE 1.1 Project to do checklist (electrical). (*Continued*)

	Page 3 of 3
Project Status	Project: _____
<input type="checkbox"/> SD	Proj. No: _____
<input type="checkbox"/> DD	PM/PE: _____
<input type="checkbox"/> CD	Date: _____

Design Closeout

- Complete project data sheet
- Project profile completed
- File the design calculations
- Complete the design notebook
 - Has Power Company Reviewed Designed Service? Yes No Not Required
 - Charges: \$ _____ Unknown
 - Has Power Company Been Sent Electrical Loads, Drawings and Specs?
 Yes No Not Required
- Send client record documents
- _____
- _____

FIGURE 1.2 Drawing design checklist (electrical).

Page 1 of 3

Project Status

 SD
 DD
 CD

Project: _____
 Proj. No: _____
 PM/PE: _____
 Date: _____

Items Included

 Power Plan
 Lighting Plan
 Site Plan
 Special System Plans
 Symbol List
 Abbreviation List
 One Line - Power Diagram
 One Line - Special Systems
 Switchboard Schedules
 Panelboard Schedules
 Fixture Schedules
 Site Details
 Electrical Details
 Building Grounding Plan
 Lightning Protection Plan
 General Notes

Openings and Floor Plans for Installation and Removal of Electrical and Generator Equipment
 Electrical equipment access and clearances
 Elevator Size Accommodates All Equipment
 Electrical Plans Overlaid on:

- Architectural Plans
- Reflected Ceiling Plans
- Mechanical Plans

General Items to Check

 Title Blocks

- Firm Logo
- Job Number
- Drawing Title
- Drawing Numbers
- Date

 Plan Titles with Scale
 Detail Titles with Scale
 Detail Designation Symbols
 Symbol List Agrees with Drawing
 Abbreviation List Agrees with Drawings

One-Line Power Diagram

 Primary Distribution

- Voltage
- Fault Current Available
- Cables and Raceways
- Manholes and Pullboxes
- Terminations and Splices

 Primary Switchgear

- Enclosure
 - Indoor
 - Weatherproof
 - Walk-in
- Selector Switches
 - Non-fused
 - Fuse Size
- Protective Devices
 - Stationary
 - Drawout
 - Manual
 - Electrical
 - Active
 - Space & Busing
 - Breaker
 - Trip Setting
 - Relay
 - Trip Setting
 - Circuit Numbering
 - Arresters
 - Interlocks
 - Fault Rating

6 Electrical Engineer's Portable Handbook

FIGURE 1.2 Drawing design checklist (electrical). (*Continued*)

Page 2 of 3

Project Status Project: _____
 SD Proj. No: _____
 DD PM/PE: _____
 CD Date: _____

Primary Metering
 Owner Power Co.

Transformers
 Primary Voltage
 Primary Connection
 Delta Wye Double Bushing
 Secondary Voltage
 Secondary Connection
 Delta Wye
 Grounding
 KVA & Percent Impedance (Min.)
 Type:
 (Oil, Dry, Padmount, Open, WP, etc.)
 Secondary Compartment C/Bs
 Surge Arresters
 Power Company Supplied

Secondary Distribution
 Voltage
 Fault Current Available
 Cables and Raceways
 Manholes and Pullboxes
 Termination and Splices

Secondary Switchboard
 Switchboard (NEMA PB-2 and UL 891)
 Switchgear (ANSI C37 and UL 1558)
 Rating Current Voltage
 Phase Wire
 Fault Rating
 Service Entrance?

Enclosure
 Free-standing Non-freestanding

Accessible
 Front Rear Side

Main Protective Device
 Fuse/Sw Size & Class of Fuse
 Power Breaker Insulated Case
 Molded Case
 Indv. Mount Group Mount
 Stationary Drawout
 Manual Electrical
 Thermal/Magnetic Solid State
 Number of Poles & Trip/Frame Amps
 100% Duty 80% Duty
 Shunt Trip
 Interlocks or Ties

Ground Fault Protection
 Selective Time Delay

Service Ground
 Water Service
 Building Steel
 Ground Rod
 Ground Grid - Substation
 Ground Grid - Building

Revenue Metering
 Active Reactive
 CT's PT's

Owner Metering
 Volt Amp Watt VA
 Watt Hr VARS
 AMSS VMSS
 Electronic

Busing
 Full Neutral
 Ground Bus
 Equipment Ground
 Grounding Electrode Conductor
 Connection

FIGURE 1.2 Drawing design checklist (electrical). (Continued)

Page 3 of 3

Project Status Project: _____
 SD Proj. No: _____
 DD PM/PE: _____
 CD Date: _____

Main Feeder Cable and Raceways

Transfer Switches

Type

Automatic Manual

Current Rating and # Poles

Control Connection

Load Feeder Cable and Raceway

3 Pole or 4 Pole

Neutral and Ground Connection

Standby Generator Emergency Generator

Line Circuit Breaker Main Lug

Thermal Magnetic

Solid State

Number of Poles & Trip/Frame Amps

GFP Sel. Timedelay

Load Feeder Cable and Raceway

Neutral and Ground Connections

Power Distribution (Panelboard and MCC)

Bus Data

Current

Voltage

Phase Wire

Fault Current

Full Neutral

Equipment Ground

Insulated

Enclosure

Weatherproof Walk-in

Mounting

Individual Group (Panel Sched.)

Stationary Drawout

Operation

Manual Automatic

Protective Devices

Circuit Numbering

Fuse/Switch

Fuse Size/Class

Combination Starter

Fuse/Switch & Fuses

Circuit Breaker

Mag. Only

Starter Size & Type

Overload Relays

Circuit Breaker

Power

Insulated Case

Molded Case

100% Duty

Mixed Duty

Thermal/Magnetic

Magnetic

Solid State

Number of Poles

Trip/Frame Amps

Ground Fault Protection

Selective Time Delay

Interlocks

Key Electric

FIGURE 1.3 Site design checklist (electrical).

Page 1 of 2

Project Status

 SD
 DD
 CD

Project: _____
 Proj. No: _____
 PM/PE: _____
 Date: _____

Site Drawings - Plans

- Title
- Scale
- Benchmark
- Topo Lines

Top Elevation on:

- Transformer Pads
- Switchgear Pads
- Pole Bases for Site Lighting
- Standby Generator Pads
- Manholes
- Pullboxes

- Existing Utility Poles and Numbers
- New Utility Poles and Guys (by whom)
- Pole Transformers (by whom)
- Pad Mount Transformers (by whom)
- Revenue Meters
- Site Lighting Poles
- Generator (Outdoor)
- Switchgear (Outdoor)
- Manholes
- Pullboxes

Check Site Planting, Grades, Fences, Equipment for Truck Access to:

- Padmount Transformers
- Utility Poles
- Site Lighting Poles

Aerial Distribution

- Electric Primary
- Electric Secondary
- Telephone
- Site Lighting
- TV

Underground Distribution

- Electric Primary
- Electric Secondary
- Telephone
- TV
- Site Lighting
- Conduit Sleeves Under Pavement

Fuel Oil Systems

- Fuel Oil Tank
- Supply and Return Lines
- Fill Cap and Fill Lines
- Vent Cap and Vent Lines
- Tank Level Gauge Line
- Soil Condition - Anodes, FG
- Direction of Line Pitch

Check Truck Wheel Loading Cover:

- Fuel Oil Tanks
- Underground Lines
- Manholes
- Pullboxes

FIGURE 1.3 Site design checklist (electrical). (Continued)

	Page 2 of 2
Project Status	Project: _____
<input type="checkbox"/> SD	Proj. No: _____
<input type="checkbox"/> DD	PM/PE: _____
<input type="checkbox"/> CD	Date: _____

Site Drawings - Details

- Titles
- Scale
- Utility Pole Riser
- Revenue Meter Riser

Trench Cross Sections

- Electric, Telephone and TV Lines
- Duct Banks, Concrete and Grounding

- Padmount Transformer, Concrete Pad & Grounding
- Exterior Switchgear, Concrete Pad & Grounding
- Generator, Concrete Pad & Grounding
- Manholes, Concrete, Cable Racks & Grounding
- Pullboxes, Concrete, & Grounding
- Pole Bases for Site Lighting and Signs

Fuel Oil Systems

- Fuel Oil Tank, Concrete Pad
- Trench Cross Sections for Supply & Return Lines
- Fill, Vent and Level Gage Lines
- Fuel Fill Cap
- Fuel Vent Cap

FIGURE 1.4 Existing condition service & distribution checklist.

Page 1 of 3
 Project: _____
 Proj. No: _____
 PM/PE: _____
 Date: _____

Power Company Service

Power Company: _____
 Rep Name: _____
 Telephone: _____

Type of Service:
 Primary Secondary Unknown

Underground Overhead
 Combination Unknown

Transformation
 Pad Pole N/A Unknown
 KVA: _____ Unknown
 % Impedance: _____ Unknown
 Primary Voltage _____ Unknown
 Secondary Voltage: _____ Unknown

Short Circuit Fault Current Available
 Power Company Sym
 Primary MVA
 Secondary: _____ A
 Unknown

Power Company Pole #: _____ Unknown

New Poles: Street Line Private
 N/A Unknown

Primary Service
 Raceway Size: _____ Unknown
 Type: RSC PVC PVC/Conc.
 DB: _____ Unknown
 Cable: _____ Unknown
 Ground Conductor: _____ Unknown

Secondary Service
 Raceway Size: _____ Unknown
 Type: RSC PVC PVC/Conc.
 DB: _____ Unknown
 Cable: _____ Unknown

Type of Power Available at Site Line
 Primary 1PH 3PH Unknown
 Sec 1PH 3 PH Unknown

Has Power Company Been Contacted for Existing Loads and Requirements for new services?
 Yes No Not Req.

Comments:

Main Electric Service

Main Entrance Capacity:
 Size _____ A Unknown
 Total Load _____ KW _____ KVA
 Power Factor _____ Unknown
 Largest Connected Motor N/A
 _____ HP Unknown
 Starter Size & Type _____ Unknown

FIGURE 1.4 Existing condition service & distribution checklist. (Continued)

Page 2 of 3
 Project: _____
 Proj. No: _____
 PM/PE: _____
 Date: _____

<p>Main Protective Device:</p> <p><input type="checkbox"/> Fuse/Switch <input type="checkbox"/> MCCB <input type="checkbox"/> ICCB</p> <p><input type="checkbox"/> Power breaker _____ <input type="checkbox"/> Unknown</p> <p>Duty: <input type="checkbox"/> 80% <input type="checkbox"/> 100% <input type="checkbox"/> Unknown</p> <p>Type of Trip: <input type="checkbox"/> Thermal <input type="checkbox"/> Magnetic <input type="checkbox"/> Solid State</p> <p>GFP <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Selective <input type="checkbox"/> Time Delay</p> <p>Current Limiting <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p>CT's Required: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p>PT's Required: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p>Who Supplies CT's and PT's: _____ <input type="checkbox"/> Unknown</p> <p>Revenue Meters</p> <p><input type="checkbox"/> Active <input type="checkbox"/> Reactive <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Inside <input type="checkbox"/> Outside <input type="checkbox"/> Unknown</p> <p>Type of Construction</p> <p><input type="checkbox"/> Panelboard <input type="checkbox"/> Switchboard</p> <p><input type="checkbox"/> Unitized <input type="checkbox"/> MCC _____</p> <p>Grounding Electrode Conductor Size _____</p> <p><input type="checkbox"/> Ground Rod <input type="checkbox"/> Water Service</p> <p>Rating of Gear _____ AIC Sym. <input type="checkbox"/> Unknown</p> <p>Comments: _____ _____ _____</p>	<p>Power Distribution System <input type="checkbox"/> N/A</p> <p>Main Distribution Bus _____ A <input type="checkbox"/> Unknown</p> <p>Rating _____ AIC Sym <input type="checkbox"/> Unknown</p> <p>Distribution Devices</p> <p><input type="checkbox"/> Fuse/Switch <input type="checkbox"/> MCCB <input type="checkbox"/> ICCB</p> <p><input type="checkbox"/> Power breaker _____ <input type="checkbox"/> Unknown</p> <p>Duty: <input type="checkbox"/> 80% <input type="checkbox"/> 100% <input type="checkbox"/> Unknown</p> <p>Type of Trip: <input type="checkbox"/> Thermal <input type="checkbox"/> Magnetic <input type="checkbox"/> Solid State</p> <p>GFP <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Selective <input type="checkbox"/> Time Delay</p> <p>Current Limit <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown</p> <p>Raceways <input type="checkbox"/> Aluminum <input type="checkbox"/> RSC <input type="checkbox"/> ISC</p> <p><input type="checkbox"/> EMT <input type="checkbox"/> PVC <input type="checkbox"/> Unknown</p> <p>Conductor Type _____ <input type="checkbox"/> Unknown</p> <p>Voltage Systems #1 _____ <input type="checkbox"/> Unknown</p> <p>#2 _____</p> <p>Raceway Location <input type="checkbox"/> Exposed <input type="checkbox"/> Unknown</p> <p>Concealed in: <input type="checkbox"/> Walls <input type="checkbox"/> Ceilings <input type="checkbox"/> Floors <input type="checkbox"/> Unknown</p> <p>Busway <input type="checkbox"/> Aluminum <input type="checkbox"/> Copper <input type="checkbox"/> WP</p> <p><input type="checkbox"/> N/A <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Feeder <input type="checkbox"/> Plug-in <input type="checkbox"/> Standard</p> <p><input type="checkbox"/> LVD <input type="checkbox"/> CL</p> <p>Plug In Unit: <input type="checkbox"/> Fuse/Switch <input type="checkbox"/> N/A</p> <p><input type="checkbox"/> Circuit Breaker <input type="checkbox"/> Unknown</p> <p>Dry Type Transformer</p> <p><input type="checkbox"/> 1 PH <input type="checkbox"/> 3 PH <input type="checkbox"/> N/A <input type="checkbox"/> Unknown</p> <p>Minimum Impedance _____ %</p>
---	--

12 Electrical Engineer's Portable Handbook

FIGURE 1.4 Existing condition service & distribution checklist. (Continued)

Page 3 of 3

Project: _____
Proj. No: _____
PM/PE: _____
Date: _____

Sub Panels:
 1 PH 3 PH N/A Unknown
Rating: _____ AIC sym Unknown
Branch Breakers: Standard
 Switching Duty Unknown

Comments:

FIGURE 1.5 Design coordination checklist (electrical).

		Page 1 of 3
Project Status <input type="checkbox"/> SD <input type="checkbox"/> DD <input type="checkbox"/> CD	Project: _____ Proj. No: _____ PM/PE: _____ Date: _____	
Electrical Drawings - Plans	<u>Coord./% Complete</u>	
Check that electrical floor plans match architectural and mechanical plans.	Y	N N/A
Check that the location of floor mounted equipment is consistent between disciplines.	Y	N N/A
Check that the location of light fixtures matches architectural reflected ceiling plan.	Y	N N/A
Check that elevator power, telephone and recall systems are shown and coordinated with architectural and fire protection	Y	N N/A
Check that light fixtures do not conflict with the structure or the mechanical HVAC system.	Y	N N/A
Check electrical connections to major equipment. Check that horsepower rating, phase, voltage, starter and drive types are consistent with other trade schedules.	Y	N N/A
Check that locations of panelboards are consistent with architectural floor plans, mechanical floor plans, plumbing & fire protection floor plans.	Y	N N/A
Check that the panelboards are indicated on the electrical riser diagram.	Y	N N/A
Check that HVAC control power needs are addressed.		
Check that notes are referenced.	Y	N N/A
Check that locations of electrical conduit runs, floor trenches, and openings are coordinated with structural plans.	Y	N N/A
Check that electrical panels are not recessed in fire rated walls.	Y	N N/A
Check that locations of exterior electrical equipment are coordinated with site paving, grading and landscaping.	Y	N N/A
Check that structural supports are provided for rooftop electrical equipment.	Y	N N/A
Food Service Drawings		
Check that the equipment layout matches other trade floor plans.	Y	N N/A
Check that there are no conflicts with columns.	Y	N N/A
Check that equipment is connected to utility systems.	Y	N N/A

14 Electrical Engineer's Portable Handbook

FIGURE 1.5 Design coordination checklist (electrical). (Continued)

		Page 2 of 3		
Project Status		Project: _____		
<input type="checkbox"/> SD		Proj. No: _____		
<input type="checkbox"/> DD		PM/PE: _____		
<input type="checkbox"/> CD		Date: _____		
		<u>Coord./% Complete</u>		
Check that equipment as scheduled on the drawings matches the kitchen floor plans and specifications.	Y	N	N/A	
Check that floor depressions and floor troughs are coordinated.	Y	N	N/A	
Check that kitchen equipment is schedule and coordinated with floor plans.	Y	N	N/A	
Communication Drawings				
Check that equipment layout matches Architect and Consultant Plans.	Y	N	N/A	
Check for conflicts between equipment/device spacing, clearances and access.	Y	N	N/A	
Check for Architect's or Consultant's typical elevations and details showing special device location and mounting heights.	Y	N	N/A	
Check empty raceway systems for coordination with Consultant's equipment and wiring.	Y	N	N/A	
Check for coordination between Specialty Contractor responsibility and Electrical Contractor responsibility.	Y	N	N/A	
A/V Drawings				
Check that equipment layout matches Architect and Consultant Plans.	Y	N	N/A	
Check for conflicts between equipment/device spacing, clearances and access.	Y	N	N/A	
Check for Architect's or Consultant's typical elevations and details showing special device location and mounting heights.	Y	N	N/A	
Check empty raceway systems for coordination with Consultant's equipment and wiring.	Y	N	N/A	
Check for coordination between Specialty Contractor responsibility and Electrical Contractor responsibility.	Y	N	N/A	
Theatre Drawings				
Check that equipment layout matches Architect and Consultant Plans.	Y	N	N/A	
Check for conflicts between equipment/device spacing, clearances and access.	Y	N	N/A	

FIGURE 1.5 Design coordination checklist (electrical). (Continued)

		Page 3 of 3	
Project Status		Project: _____	
<input type="checkbox"/> SD		Proj. No: _____	
<input type="checkbox"/> DD		PM/PE: _____	
<input type="checkbox"/> CD		Date: _____	
		Coord./% Complete	
Check for Architect's or Consultant's typical elevations and details showing special device location and mounting heights.	Y	N	N/A
Check empty raceway systems for coordination with Consultant's equipment and wiring.	Y	N	N/A
Check for coordination between Specialty Contractor responsibility and Electrical Contractor responsibility.	Y	N	N/A
Specifications			
Check that bid items explicitly state what is intended.	Y	N	N/A
Check specifications for phasing of construction.	Y	N	N/A
Check that architectural finish schedule agrees with specification index.	Y	N	N/A
Check that major equipment items are coordinated with contract drawings.	Y	N	N/A
Check that items specified "as indicated" and "where indicated" in the specifications are in fact indicated on the contract drawings.	Y	N	N/A
Check that the table of contents matches the sections contained in the body of the specifications.	Y	N	N/A

FIGURE 1.6 Fire alarm system checklist.

		Page 1 of 3		
		Project: _____		
		Proj. No: _____		
		PM/PE: _____		
		Date: _____		
Part One - Central Reporting Requirements				
Emergency Forces Notification		Y	N	N/A
Auxiliary Alarm System: (Alarms transmitted directly to municipal communication center)		Y	N	N/A
Central Station: (Alarms transmitted to a station location with 24 hour supervision?)		Y	N	N/A
Central Station System: (Alarms automatically transmitted to, recorded in, maintained and supervised from an approved central supervising station)		Y	N	N/A
Proprietary Protective System: (Alarms automatically transmitted to a central supervising station on the Agency property with trained personnel and 24 hour supervision)		Y	N	N/A
Remote Station System: (Alarms transmitted to a location remote from the building where circuits are supervised and appropriate action is taken)		Y	N	N/A
Part Two - Fire Alarm System				
Is there a building presently equipped with a Fire Alarm System?		Y	N	N/A
If yes: indicate Make/Model _____				
Type: _____				
Date Installed: _____				
Will this project extend/expand the existing system?		Y	N	N/A
Does the existing system conform to current Codes?	NFPA	Y	N	N/A
	BOCA	Y	N	N/A
	ADA	Y	N	N/A
	NEC	Y	N	N/A
Is the existing system a conventional or an addressable system?		Y	N	N/A
Is all existing equipment of the same make and manufacturer?		Y	N	N/A
Is the "Fire Alarm Control Panel", located at the Primary Building Entrance or Main Lobby?		Y	N	N/A
Is the "Fire Alarm Control Panel" and "Annunciator" currently located at a location approved by the State or local Fire Marshal?		Y	N	N/A
Are system components readily available?		Y	N	N/A

FIGURE 1.6 Fire alarm system checklist. (Continued)

Page 2 of 3			
Project: _____			
Proj. No: _____			
PM/PE: _____			
Date: _____			
Have you inspected the existing Fire Alarm System?	Y	N	N/A
Have you received Agency information on the operational status of the existing system?	Y	N	N/A
Is the building equipped with adequate peripheral devices (i.e., pull stations, back up power, heat and smoke detectors, horn/speaker and strobe lights?)	Y	N	N/A
Is the existing panel and annunciator capable of accommodating the system expansion due to the new renovations?	Y	N	N/A
Have you requested copies of the latest State Fire Marshal citations?	Y	N	N/A
Are there smoke detectors at the elevator lobbies for the elevator recall system where required by Code?	Y	N	N/A
Are there smoke detectors in locations required by the Elevator Code (ASME/ANSI A 17.1)?	Y	N	N/A
Are there adequate quantities of horn/speaker and strobe lights in the corridors?	Y	N	N/A
Is the building equipped with a Fire-Fighter's phone system at each stairwell and elevator lobby?	Y	N	N/A
Have you verified that smoke detectors in residential rooms have been located away from cooking stoves and shower stalls?	Y	N	N/A
Have you specified "single-station", and not "system" detectors in the sleeping residential areas?	Y	N	N/A
Have air handling units been equipped with duct-smoke detectors, as required by NFPA Codes?	Y	N	N/A
Are air handling units annunciated at the building annunciator for easy identification of alarm location?	Y	N	N/A
Is the existing system connected to a Fire Department or other answering service?	Y	N	N/A
If a new building, is the system specified compatible with the existing campus system?	Y	N	N/A
Is the system specified as a "Proprietary" system?	Y	N	N/A
Does the Specification cite three manufacturers of equal quality meeting DPW and Agency requirements?	Y	N	N/A

- [read *Dream Year: Make the Leap from a Job You Hate to a Life You Love* pdf](#)
- [download online Retribution: The Battle for Japan, 1944-45 pdf, azw \(kindle\), epub, doc, mobi](#)
- [read Black & Decker The Complete Guide to Garages: Includes: Building a New Garage, Repairing & Replacing Doors & Windows, Improving Storage, Maintaining \(Black & Decker Complete Guide\)](#)
- [download online The Essential Difference: Male and Female Brains and the Truth About Autism](#)
- [Breaking the Deadlock: The 2000 Election, the Constitution, and the Courts pdf, azw \(kindle\), epub](#)

- <http://diy-chirol.com/lib/Fix-It-and-Forget-It-New-Cookbook--250-New-Delicious-Slow-Cooker-Recipes-.pdf>
- <http://unpluggedtv.com/lib/Retribution--The-Battle-for-Japan--1944-45.pdf>
- <http://thewun.org/?library/Principles-of-Asynchronous-Circuit-Design--A-Systems-Perspective--European-Low-Power-Initiative-for-Electronic>
- <http://www.satilik-kopek.com/library/The-Essential-Difference--Male-and-Female-Brains-and-the-Truth-About-Autism.pdf>
- <http://kamallubana.com/?library/Weaveworld--Voyager-Classics-.pdf>