

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

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

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# Preface to the Second Edition

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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

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# Introduction: How to Use This Book

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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.

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# **CHAPTER ONE**

## **General Information**

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### **1.0 INTRODUCTION**

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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**

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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: _____
<b>PreDesign</b>	<b>Design</b>
<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	<b>Other Systems</b>
<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"/> _____
<b>Load Analysis</b>	<b>Special Systems</b>
<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
<b>Fault Current Analysis</b>	<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
<b>Coordination Study</b>	<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: _____
		Proj. No: _____
		PM/PE: _____
		Date: _____
		Project Status
<input type="checkbox"/> SD		
<input type="checkbox"/> DD		
<input type="checkbox"/> CD		

  

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

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**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

**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

**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

## 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

 SD  
 DD  
 CD

Project: \_\_\_\_\_  
 Proj. No: \_\_\_\_\_  
 PM/PE: \_\_\_\_\_  
 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)

	Project Status	Page 2 of 2
	<input type="checkbox"/> SD	Project: _____
	<input type="checkbox"/> DD	Proj. No: _____
	<input type="checkbox"/> CD	PM/PE: _____
		Date: _____
 <b>Site Drawings - Details</b>		
<input type="checkbox"/> Titles		
<input type="checkbox"/> Scale		
<input type="checkbox"/> Utility Pole Riser		
<input type="checkbox"/> Revenue Meter Riser		
 Trench Cross Sections		
<input type="checkbox"/> Electric, Telephone and TV Lines		
<input type="checkbox"/> Duct Banks, Concrete and Grounding		
 <input type="checkbox"/> Padmount Transformer, Concrete Pad & Grounding		
<input type="checkbox"/> Exterior Switchgear, Concrete Pad & Grounding		
<input type="checkbox"/> Generator, Concrete Pad & Grounding		
<input type="checkbox"/> Manholes, Concrete, Cable Racks & Grounding		
<input type="checkbox"/> Pullboxes, Concrete, & Grounding		
<input type="checkbox"/> Pole Bases for Site Lighting and Signs		
 Fuel Oil Systems		
<input type="checkbox"/> Fuel Oil Tank, Concrete Pad		
<input type="checkbox"/> Trench Cross Sections for Supply & Return Lines		
<input type="checkbox"/> Fill, Vent and Level Gage Lines		
<input type="checkbox"/> Fuel Fill Cap		
<input type="checkbox"/> 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><b>Main Protective Device:</b></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  <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><b>Power Distribution System</b>   <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  <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  <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          #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  <input type="checkbox"/> N/A   <input type="checkbox"/> Unknown</p> <p><input type="checkbox"/> Feeder   <input type="checkbox"/> Plug-in   <input type="checkbox"/> Standard  <input type="checkbox"/> LVD   <input type="checkbox"/> CL</p> <p>Plug In Unit: <input type="checkbox"/> Fuse/Switch   <input type="checkbox"/> N/A  <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>
---	--

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

Page 3 of 3	
Project: _____	
Proj. No: _____	
PM/PE: _____	
Date: _____	
Sub Panels:	
<input type="checkbox"/> 1 PH <input type="checkbox"/> 3 PH <input type="checkbox"/> N/A <input type="checkbox"/> Unknown	
Rating: _____ AIC sym <input type="checkbox"/> Unknown	
Branch Breakers: <input type="checkbox"/> Standard	
<input type="checkbox"/> Switching Duty <input type="checkbox"/> 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: _____
<b>Electrical Drawings - Plans</b>	<b><u>Coord./% Complete</u></b>	
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
<b>Food Service Drawings</b>		
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

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**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	
<b>Communication Drawings</b>				
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	
<b>A/V Drawings</b>				
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	
<b>Theatre Drawings</b>				
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: _____		
<b>Coord./% Complete</b>			
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
<b>Specifications</b>			
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: _____		
<b>Part One - Central Reporting Requirements</b>				
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
<b>Part Two - Fire Alarm System</b>				
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	



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