

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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Credits

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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: _____ |
| | | |
| Specification | Electrical Details | |
| <input type="checkbox"/> Cover | <input type="checkbox"/> Front Elevation Switchboards | |
| <input type="checkbox"/> Bidding forms | <input type="checkbox"/> Front Elevation MCCs | |
| <input type="checkbox"/> General Conditions & Division 1 | <input type="checkbox"/> _____ | |
| <input type="checkbox"/> Non-electrical sections | <input type="checkbox"/> _____ | |
| <input type="checkbox"/> Division 13 sections | | |
| <input type="checkbox"/> Division 15 sections | Site Details | |
| <input type="checkbox"/> Division 16 sections | <input type="checkbox"/> Concrete Bases for Lighting Poles | |
| Construction Estimates | <input type="checkbox"/> Transformer Concrete Pads & Grounding | |
| <input type="checkbox"/> Schematic design | <input type="checkbox"/> Equipment Concrete Pads & Grounding | |
| <input type="checkbox"/> Design development | <input type="checkbox"/> Manholes, Ductbanks, Grounding | |
| <input type="checkbox"/> Construction documents | <input type="checkbox"/> Trench, backfill & reseed | |
| | <input type="checkbox"/> Pavement | |
| | <input type="checkbox"/> _____ | |
| Drawings | Drawing Check | |
| <input type="checkbox"/> Title block & drawing size | <input type="checkbox"/> Overlay electrical drawings | |
| <input type="checkbox"/> Site plans | <input type="checkbox"/> Complete drawing checklists | |
| <input type="checkbox"/> Demolition plans | <input type="checkbox"/> Complete site checklists | |
| <input type="checkbox"/> Symbol list | <input type="checkbox"/> _____ | |
| <input type="checkbox"/> Abbreviation list | <input type="checkbox"/> _____ | |
| <input type="checkbox"/> General notes | | |
| <input type="checkbox"/> Power plans | In House Review | |
| <input type="checkbox"/> Lighting plans | <input type="checkbox"/> Conceptual review | |
| <input type="checkbox"/> Fixture schedule | <input type="checkbox"/> Schematic Design | |
| <input type="checkbox"/> One-line power diagram | <input type="checkbox"/> Design Development | |
| <input type="checkbox"/> Switchboard schedules | <input type="checkbox"/> Construction Documents | |
| <input type="checkbox"/> MCC schedules | | |
| <input type="checkbox"/> Distribution panelboard schedules | Client Submission | |
| <input type="checkbox"/> Lighting panelboard schedules | <input type="checkbox"/> Schematic Design | |
| <input type="checkbox"/> Fire detection & alarm plans | <input type="checkbox"/> Design Development | |
| <input type="checkbox"/> Fire detection & alarm one-line diagram | <input type="checkbox"/> Construction Documents | |
| <input type="checkbox"/> Building grounding grid plan | | |
| <input type="checkbox"/> Lightning protection plan | | |

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

| | |
|---|--|
| | Page 3 of 3 |
| Project Status <input type="checkbox"/> SD <input type="checkbox"/> DD <input type="checkbox"/> CD | Project: _____ Proj. No: _____ PM/PE: _____ Date: _____ |
| Design Closeout | |
| <input type="checkbox"/> Complete project data sheet | |
| <input type="checkbox"/> Project profile completed | |
| <input type="checkbox"/> File the design calculations | |
| <input type="checkbox"/> Complete the design notebook | |
| Has Power Company Reviewed Designed Service? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Required | |
| Charges: \$ _____ <input type="checkbox"/> Unknown | |
| Has Power Company Been Sent Electrical Loads, Drawings and Specs? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Required | |
| <input type="checkbox"/> Send client record documents | |
| <input type="checkbox"/> _____ | |
| <input type="checkbox"/> _____ | |

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

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FIGURE 1.2 Drawing design 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: _____ |

| | |
|--|--|
| <input type="checkbox"/> Primary Metering <input type="checkbox"/> Owner <input type="checkbox"/> Power Co. | <input type="checkbox"/> Main Protective Device <input type="checkbox"/> Fuse/Sw <input type="checkbox"/> Size & Class of Fuse |
| <input type="checkbox"/> Transformers <input type="checkbox"/> Primary Voltage <input type="checkbox"/> Primary Connection <input type="checkbox"/> Delta <input type="checkbox"/> Wye <input type="checkbox"/> Double Bushing <input type="checkbox"/> Secondary Voltage <input type="checkbox"/> Secondary Connection <input type="checkbox"/> Delta <input type="checkbox"/> Wye <input type="checkbox"/> Grounding <input type="checkbox"/> KVA & Percent Impedance (Min.) <input type="checkbox"/> Type: (Oil, Dry, Padmount, Open, WP, etc.) <input type="checkbox"/> Secondary Compartment C/Bs <input type="checkbox"/> Surge Arresters <input type="checkbox"/> Power Company Supplied | <input type="checkbox"/> Power Breaker <input type="checkbox"/> Insulated Case <input type="checkbox"/> Molded Case <input type="checkbox"/> Indv. Mount <input type="checkbox"/> Group Mount <input type="checkbox"/> Stationary <input type="checkbox"/> Drawout <input type="checkbox"/> Manual <input type="checkbox"/> Electrical <input type="checkbox"/> Thermal/Magnetic <input type="checkbox"/> Solid State <input type="checkbox"/> Number of Poles & Trip/Frame Amps <input type="checkbox"/> 100% Duty <input type="checkbox"/> 80% Duty <input type="checkbox"/> Shunt Trip <input type="checkbox"/> Interlocks or Ties |
| <input type="checkbox"/> Secondary Distribution <input type="checkbox"/> Voltage <input type="checkbox"/> Fault Current Available <input type="checkbox"/> Cables and Raceways <input type="checkbox"/> Manholes and Pullboxes <input type="checkbox"/> Termination and Splices | <input type="checkbox"/> Ground Fault Protection <input type="checkbox"/> Selective <input type="checkbox"/> Time Delay <input type="checkbox"/> Service Ground <input type="checkbox"/> Water Service <input type="checkbox"/> Building Steel <input type="checkbox"/> Ground Rod <input type="checkbox"/> Ground Grid - Substation <input type="checkbox"/> Ground Grid - Building |
| Secondary Switchboard <input type="checkbox"/> Switchboard (NEMA PB-2 and UL 891) <input type="checkbox"/> Switchgear (ANSI C37 and UL 1558) <input type="checkbox"/> Rating <input type="checkbox"/> Current <input type="checkbox"/> Voltage <input type="checkbox"/> Phase <input type="checkbox"/> Wire <input type="checkbox"/> Fault Rating <input type="checkbox"/> Service Entrance? | <input type="checkbox"/> Revenue Metering <input type="checkbox"/> Active <input type="checkbox"/> Reactive <input type="checkbox"/> CT's <input type="checkbox"/> PT's <input type="checkbox"/> Owner Metering <input type="checkbox"/> Volt <input type="checkbox"/> Amp <input type="checkbox"/> Watt <input type="checkbox"/> VA <input type="checkbox"/> Watt Hr <input type="checkbox"/> VARS <input type="checkbox"/> AMSS <input type="checkbox"/> VMSS <input type="checkbox"/> Electronic |
| <input type="checkbox"/> Enclosure <input type="checkbox"/> Free-standing <input type="checkbox"/> Non-freestanding | <input type="checkbox"/> Busing <input type="checkbox"/> Full Neutral <input type="checkbox"/> Ground Bus <input type="checkbox"/> Equipment Ground <input type="checkbox"/> Grounding Electrode Conductor <input type="checkbox"/> Connection |
| <input type="checkbox"/> Accessible <input type="checkbox"/> Front <input type="checkbox"/> Rear <input type="checkbox"/> Side | |

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: _____ |
| | | |
| Site Drawings - Details | | |
| <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>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 <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 <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:
 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 |

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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 | |
| 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? If yes: indicate Make/Model _____ Type: _____ Date Installed: _____ | | Y N N/A |
| Will this project extend/expand the existing system? | | Y N N/A |
| Does the existing system conform to current Codes? | NFPA BOCA ADA NEC | Y N N/A Y N N/A Y N N/A 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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