Chapter 1 Administration

1.1 Scope.
1.2 Purpose.

Chapter 2 Referenced Publications

2.1 General.
2.2 NFPA Publications.
2.3 Other Publications.
2.4 References for Extracts in Recommendations Sections.

Chapter 3 Definitions

3.1 General.
3.2 NFPA Official Definitions.
3.3 General Definitions.

Chapter 4 Why an Effective Electrical Preventive Maintenance (EPM) Program Pays Dividends

4.1 Why EPM?
4.2 Value and Benefits of a Properly Administered EPM Program.
4.3 EPM and Energy Conservation.
4.4 Case Histories.

Chapter 5 What Is an Effective Electrical Preventive Maintenance (EPM) Program?

5.1 Introduction.
5.2 Essential Elements of an EPM Program.
5.3 Planning an EPM Program.
5.4 Personnel.
5.5 Survey and Analysis.
5.6 Programmed Inspections.

Chapter 6 Planning and Developing an Electrical Preventive Maintenance (EPM) Program

6.1 Introduction.
6.2 Survey of Electrical Installation.
6.3 Identification of Critical Equipment.
6.4 Establishment of a Systematic Program.
6.5 Methods and Procedures.
6.6 Maintenance of Imported Electrical Equipment.
6.7 Maintenance of Electrical Equipment for Use in Hazardous (Classified) Locations.
6.8 Outsourcing of Electrical Equipment Maintenance.
6.10 Counterfeit Components, Devices, Tools, and Equipment.

Chapter 7 Personnel Safety

7.1 Introduction.
7.2 Grounding of Equipment to Provide Protection for Electrical Maintenance Personnel.
Chapter 8 Fundamentals of Electrical Equipment Maintenance

8.1 Design to Accommodate Maintenance.
8.2 Scheduling Maintenance.
8.3 Equipment Safety.
8.4 Protective Scheme.
8.5 Acceptance Testing.
8.6 Guidelines and Impact of Additions/Rework to Retrofitting Equipment.
8.7 Equipment Cleaning.
8.8 Special Handling and Disposal Considerations.
8.9 Supervisory Control and Data Acquisition (SCADA) Systems.
8.10 Lubrication.
8.11 Threaded Connections and Terminations.

Chapter 9 System Studies

9.1 Introduction.
9.2 Short-Circuit Studies.
9.3 Coordination Studies.
9.4 Load-Flow Studies.
9.5 Reliability Studies.
9.6 Risk Assessment Studies.
9.7 Maintenance-Related Design Study.

Chapter 10 Power Quality

10.1 Introduction.
10.2 Harmonics.
10.3 Transients (Surges).
10.4 Voltage Sags and Swells.
10.5 Long-Duration Undervoltages and Sustained Voltage Interruptions.
10.6 Unbalanced Voltages and Single Phasing.
10.7 Symptoms — Grounding.
10.8 Noise in Electrical and Electronic Systems.
10.9 Interharmonics.
10.10 Voltage Fluctuations and Flicker.
10.11 Power Quality Audit.
10.12 Power Quality References.

Chapter 11 Testing and Test Methods

11.1 Introduction.
11.2 Acceptance Tests and Maintenance Tests.
11.3 As-Found and As-Left Tests.
11.4 Frequency of Tests.
11.5 Special Precautions and Safety.
11.6 Qualifications of Test Operators.
11.7 Test Equipment.
11.8 Forms.
11.9 Insulation Testing.
11.10 Low-Voltage Circuit Breakers.
11.11 Transformer Tests.
11.12 Protective Relays.
11.13 Grounding Systems.
11.14 Battery Testing.
Chapter 12 Maintenance of Electrical Equipment Subject to Long Intervals Between Shutdowns

12.1 Introduction.
12.2 General Aspects of Maintaining Medium- and Low-Voltage Distribution Systems.
12.3 Utilization.
12.4 Process Instrumentation and Control.

Chapter 13 Ground-Fault Protection

13.1 Introduction.
13.2 Ground-Fault Protective Equipment for Excessive Leakage Currents.
13.3 Ground-Fault Protective Equipment to Prevent Damage.

Chapter 14 Grounding

14.1 Introduction.
14.2 Symptoms and Causes of Inadequate Grounding.
14.3 Grounding System Inspection, Testing, and Monitoring.
14.4 Solutions to Inadequate Grounding.

Chapter 15 Substations and Switchgear Assemblies

15.1 Substations.
15.2 Switchgear Assemblies.
15.3 Circuit Interrupters.
15.4 Air Circuit Breakers.
15.5 Vacuum Circuit Breakers.
15.6 Oil Circuit Breakers.
15.7 Interrupter Switches.
15.8 Gas-Insulated Substations and Gas-Insulated Equipment.
15.9 Auxiliary Equipment.
15.10 Torque Tables.

Chapter 16 Motor Control Equipment

16.1 Introduction.
16.2 Components and Maintenance of Motor Controls.
16.3 Enclosures.
16.4 Bus Bar, Wiring, and Terminal Connections.
16.5 Disconnects.
16.6 Molded Case Breakers.
Chapter 17 Insulated-Case/Molded-Case Circuit-Breakers

17.1 Introduction.
17.2 Application Considerations.
17.3 Phase-Fault Current Conditions.
17.4 Ground-Fault Tripping.
17.5 Types of Insulated-Case/Molded-Case Circuit Breakers.
17.6 Special-Purpose Breakers.
17.7 Types of Maintenance.
17.8 Inspection and Cleaning.
17.9 Loose Connections.
17.10 Mechanical Mechanism Exercise.
17.11 Electrical Testing.

Chapter 18 Fuses

18.1 Fuses Rated 1000 Volts or Less.
18.2 Fuses Rated over 1000 Volts.

Chapter 19 Power Cables

19.1 Introduction.
19.2 Visual and Mechanical Inspection.
19.3 Aerial Installations.
19.4 Raceway Installations.
19.5 Electrical Testing.
19.6 Inspection and Testing Records.

Chapter 20 Cable Tray and Busway

20.1 Introduction.
20.2 Cable.
20.3 Cable Tray.
20.4 Low-Voltage (600-Volt) Busway.

Chapter 21 Power and Distribution Transformers

21.1 Introduction.
21.2 Liquid-Filled Transformers.
21.3 Dry-Type Transformers.

Chapter 22 Electronic Equipment

22.1 Introduction.
22.2 Reasons for Maintenance.
22.3 Special Precautions.
22.4 Preventive Maintenance Operations.

Chapter 23 Lighting
23.1 Introduction.
23.2 Cleaning.
23.3 Relamping.
23.4 Voltage.
23.5 Lamps and Ballasts.
23.6 Disposal.

Chapter 24 Wiring Devices

24.1 Introduction.
24.2 Connector and Receptacle.
24.3 Receptacles.
24.4 Adapters.
24.5 General-Use Snap Switches.
24.6 Cover Plates.
24.7 Boxes.
24.8 Pin and Sleeve Devices.

Chapter 25 Rotating Equipment

25.1 Introduction.
25.2 Safety Precautions.
25.3 Stator and Rotor Windings.
25.4 Brushes, Collector Rings, and Commutators.
25.5 Bearings and Lubrication.
25.6 Cleaning and Drying Insulation Structures.
25.7 General Overhaul.
25.8 Records.
25.9 Testing.
25.10 Energy Efficiency of Motors.

Chapter 26 Vibration

26.1 Introduction.
26.2 Machine Vibration.
26.3 Types of Instruments.
26.4 Resonance.
26.5 Methods of Balance.
26.6 Assembly and Installation Guidelines.
26.7 Baseline Data.
26.8 Noise.

Chapter 27 Hazardous (Classified) Location Electrical Equipment

27.1 Types of Equipment.
27.2 Maintenance of Electrical Equipment for Use in Hazardous (Classified) Locations.

Chapter 28 Uninterruptible Power Supply (UPS) Systems

28.1 Introduction.
28.2 Types of UPS Systems.
28.3 UPS System Maintenance Procedures — General.
28.4 UPS Testing.
28.5 System Tests.
Chapter 29 Portable Electrical Tools and Equipment

29.1 Introduction.
29.2 Employee Training.
29.3 Tool Maintenance.
29.4 Cord and Attachment Plug Care.
29.5 Extension Cords.
29.6 Major Overhauls.
29.7 Leakage Current Testing.

Chapter 30 Reliability-Centered Maintenance (RCM)

30.1 General.
30.2 Operations and Maintenance (O&M) Documentation.
30.3 Technical Support.
30.4 Availability Metric.

Chapter 31 EPM from Commissioning (Acceptance Testing) Through Maintenance

31.1 Introduction.
31.2 Purpose.
31.3 Requirements.
31.4 Commissioning Planning Stages.
31.5 Developing of Functional Performance Tests (FPTs).
31.6 Testing Implementation.
31.7 Costs of Commissioning.

Chapter 32 Electrical Disaster Recovery

32.1 Introduction.
32.2 Catastrophic Event Categories.

Chapter 33 Photovoltaic Systems

33.1 Introduction.
33.2 Maintenance of the Photovoltaic System.
33.3 Markings and Labeling.

Chapter 34 Electric Vehicle Charging Systems

34.1 Introduction.
34.2 Maintenance of the Electric Vehicle Charging Stations.

Chapter 35 Wind Power Electric Systems and Associated Equipment

35.1 Introduction.
35.2 Towers and Foundations.
35.3 Yaw Systems.
35.4 Generators.
35.5 Pitch Systems.
35.6 Instrumentation and Controls.
35.7 Supervisory Control and Data Acquisition System (SCADA).
35.8 Transformers and Converters.
35.9 Circuit Breakers.
35.10 Cable Support Systems, Cables, and Terminations.
35.11 Collector Substations and Switchgear.
35.12 Associated Electrical Equipment.
35.13 Power Quality.

Annex A Explanatory Material
Annex B How to Instruct
Annex C Reserved
Annex D Reserved
Annex E Suggestions for Inclusion in a Walk-Through Inspection Checklist
Annex F Symbols
Annex G Diagrams
Annex H Forms
Annex I NEMA Configurations
Annex J Primary Contact Matrix
Annex K Long-Term Maintenance Guidelines
Annex L Maintenance Intervals
Annex M Equipment Storage and Maintenance During Construction
Annex N Reliability Centered Maintenance
Annex O Energy Efficiency of Motors
Annex P Identification of Transformers by Cooling Class
Annex Q Case Histories
Annex R Informational References