

STANDARD FOR MAINTENANCE TESTING SPECIFICATIONS

for Electrical Power Distribution
Equipment and Systems



InterNational Electrical
Testing Association



American National Standard

2007

ANSI/NETA MTS-2007

AMERICAN NATIONAL STANDARD

STANDARD FOR
MAINTENANCE TESTING SPECIFICATIONS
for Electrical Power Distribution Equipment
and Systems

Secretariat
InterNational Electrical Testing Association



Approved by
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 - 4.1 The Owner’s Representative
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5. General
 - 5.1 Safety and Precaution
 - 5.2 Suitability of Test Equipment
 - 5.3 Test Instrument Calibration
 - 5.4 Test Report

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FOREWORD

(This Foreword is not part of American National Standard ANSI/NETA MTS-2007)

The InterNational Electrical Testing Association (NETA) was formed in 1972 to establish uniform testing procedures for electrical equipment and apparatus. NETA developed specifications for the acceptance of new electrical apparatus prior to energization and for the maintenance of existing apparatus to determine its suitability to remain in service. The first NETA *Acceptance Testing Specifications for Electrical Power Equipment and Systems* was produced in 1972. Upon completion of this project, the NETA Technical Committee began work on a maintenance document, and *Maintenance Testing Specifications for Electrical Power Equipment and Systems* was published in 1975.

Since 1975, several revisions of the *Maintenance Specifications* have been published; in 1989 the NETA Technical Committee, with approval of the Board of Directors, set a four-year review and revision schedule. Unless it involves a significant safety or urgent technical issue, each comment and suggestion for change is held until the appropriate review period. Each edition includes new and completely revised sections. The document uses the standard numbering system of ANSI and IEEE. Since 1989, revised editions of the *Maintenance Testing Specifications* have been published in 1993, 1997, 2001, and 2005.

The *NETA Maintenance Testing Specifications* was developed for use by those responsible for the continued operation of existing electrical systems and equipment to guide them in specifying and performing the necessary tests to ensure that these systems and apparatus perform satisfactorily, minimizing downtime and maximizing life expectancy. This document aids in ensuring safe, reliable operation of existing electrical power systems and equipment. Maintenance testing can identify potential problem areas before they become major problems requiring expensive and time-consuming solutions.

In the early 1990's, NETA's Board of Directors approved the concept of issuing a maintenance testing standard for each of the major components identified in Section 7 of the *Maintenance Testing Specifications* with the goal of each one becoming an ANSI Standard. In 2001 the NETA Board of Directors revised their decision to standardize each subsection of Section 7 of the *Maintenance Testing Specifications* and decided instead to put the document forth in its entirety as a candidate for recognition as an American National Standard.

NETA applied for accreditation as a Standards Developer for the American National Standards Institute and was approved as an organizational member in 1996. NETA's scope of standards activity is different from that of the IEEE, NECA, NEMA, and UL. In matters of testing electrical equipment and systems NETA continues to reference other standards developers' documents where applicable.

NETA's review and updating of presently published specifications takes into account both national and international standards. The use of our document is not restricted to the United States but is also used internationally. NETA firmly endorses a global standardization. IEC standards as well as American consensus standards are taken into consideration by NETA's Section Panels and reviewing committees.

Suggestions for improvement of this standard are welcome. They should be sent to the InterNational Electrical Testing Association, 2700 W. Centre Ave., Suite A, Portage, MI 49024.



PREFACE

It is recognized by the Association that the needs for maintenance testing of commercial, industrial, governmental, and other electrical power systems vary widely. Many criteria are used in determining what equipment is to be tested and to what extent.

To help the user better understand and navigate more efficiently through this document, we offer the following information:

The Document Structure

The document is divided into twelve separate and defined sections:

Section	Description
Section 1	General Scope
Section 2	Applicable References
Section 3	Qualifications of Testing Organization and Personnel
Section 4	Division of Responsibility
Section 5	General
Section 6	Power System Studies
Section 7	Inspection and Test Procedures
Section 8	System Function Test
Section 9	Thermographic Survey
Section 10	Electromagnetic Field Testing
Tables	Reference Tables
Appendices	Various Informational Documents

Section 7 Structure

Section 7 is the main body of the document with specific information on what to do relative to the inspection and maintenance testing of electrical power distribution equipment and systems. It is not intended that this document explain how to test specific pieces of equipment or systems.

Expected Test Results

Section 7 consists of sections specific to each particular type of equipment. Within those sections there are, typically, three main bodies of information:

1. Visual and Mechanical Inspection
2. Electrical Tests
3. Test Values



PREFACE (continued)

Results of Visual and Mechanical Inspections

Some, but not all, visual and mechanical inspections have an associated test value or result. Those items with an expected result are referenced under Section 3.1 Test Values – Visual and Mechanical. For example, Section 7.1 Switchgear and Switchboard Assemblies, item 7.1.1.7.2 calls for verifying tightness of connections using a calibrated torque wrench method. Under the Test Values – Visual and Mechanical Section 7.1.3. 1.2, the expected results for that particular task are listed within Section 3.1, with reference back to the original task description on item 7.1.1.7.2.


7. INSPECTION AND TEST PROCEDURES

7.1 Switchgear and Switchboard Assemblies

1. Visual and Mechanical Inspection

1. Inspect physical, electrical, and mechanical condition including evidence of moisture or corona.
2. Inspect anchorage, alignment, grounding, and required area clearances.
3. Prior to cleaning the unit, perform as-found tests, if required.
4. Clean the unit.
5. Verify that fuse and/or circuit breaker sizes and types correspond to drawings and coordination study as well as to the circuit breaker's address for microprocessor-communication packages.
6. Verify that current and voltage transformer ratios correspond to drawings.
7. Inspect bolted electrical connections for high resistance using one of the following methods:
 1. Use of a low-resistance ohmmeter in accordance with Section 7.1.2.
 2. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or Table 100.12.
 3. Perform a thermographic survey in accordance with Section 9.
8. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 1. Attempt closure on locked-open devices. Attempt to open locked-closed devices.
 2. Make key exchange with all devices included in the interlock scheme as applicable.
9. Use appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
10. Verify correct barrier and shutter installation and operation.
11. Exercise all active components.
12. Inspect mechanical indicating devices for correct operation.
13. Verify that filters are in place and/or vents are clear.
14. Perform visual and mechanical inspection of instrument transformers in accordance with Section 7.10.

* Optional


Page 25
ANSI/NETA MTS-2007

7. INSPECTION AND TEST PROCEDURES

7.1 Switchgear and Switchboard Assemblies (continued)

2. Verify correct function of control transfer relays located in switchgear with multiple power sources.
9. Verify operation of switchgear/switchboard heaters and their controller, if applicable.
10. Perform system function tests in accordance with Section 8.

3. Test Values


3.1 Test Values – Visual and Mechanical

1. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value. (7.1.1.7.1)
2. Bolt-torque levels should be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.12. (7.1.1.7.2)
3. Results of the thermographic survey shall be in accordance with Section 9. (7.1.1.7.3)

3.2 Test Values – Electrical

1. Compare bolted connection resistance values to values of similar connections. Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
2. Insulation-resistance values of bus insulation should be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1. Values of insulation resistance less than this table or manufacturer's recommendations should be investigated. Overpotential tests should not proceed until insulation-resistance levels are raised above minimum values.
3. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the overpotential test, the test specimen is considered to have passed the test.
4. Minimum insulation-resistance values of control wiring should be comparable to previously obtained results but not less than two megohms.
5. Results of electrical tests on instrument transformers should be in accordance with Section 7.10.
6. Results of ground resistance tests should be in accordance with Section 7.13.
7. Accuracy of meters should be in accordance with Section 7.11.

* Optional


Page 27
ANSI/NETA MTS-2007



PREFACE (continued)

Results of Electrical Tests

Each electrical test has a corresponding expected result, and the test and the result have identical numbers. If the electrical test is item four, the expected result under the Test Values section is also item four. For example, under Section 7.15.1 Rotating Machinery, AC Induction Motors and Generators, item 7.15.1.2.2 (item 2 within the Electrical Tests section) calls for performing an insulation-resistance test in accordance with IEEE Standard 43. Under the Test Values – Electrical section, the expected results for that particular task are listed in the Test Values section under item 2.

7. INSPECTION AND TEST PROCEDURES

7.15.1 Rotating Machinery, AC Induction Motors and Generators


1. Visual and Mechanical Inspection

1. Inspect physical and mechanical condition.
2. Inspect anchorage, alignment, and grounding.
3. Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging.
4. Inspect bolted electrical connections for high resistance using one of the following methods:
 1. Use of low-resistance ohmmeter in accordance with Section 7.15.1.2.
 2. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.12.
 3. Perform thermographic survey in accordance with Section 9.
5. Perform special tests such as air-gap spacing and machine alignment, if applicable.
6. Verify the application of appropriate lubrication and lubrication systems.
7. Verify the absence of unusual mechanical or electrical noise or signs of overheating.
8. Verify that resistance temperature detector (RTD) circuits conform to drawings.

2. Electrical Tests – AC Induction

1. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, if applicable, in accordance with Section 7.15.1.1.
2. Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43.
 1. Machines larger than 200 horsepower (150 kilowatts):
Test duration shall be for ten minutes. Calculate polarization index.
 2. Machines 200 horsepower (150 kilowatts) and less:
Test duration shall be for one minute. Calculate the dielectric-absorption ratio.
3. Perform dc overpotential tests on machines rated at 2300 volts and greater in accordance with ANSI/IEEE Standard 95.
4. Perform phase-to-phase stator resistance test on machines 2300 volts and greater.
- *5. Perform insulation power-factor or dissipation-factor tests.

* Optional


Page 135
ANSI/NETA MTS-2007

7. INSPECTION AND TEST PROCEDURES


7.15.1 Rotating Machinery, AC Induction Motors and Generators (continued)

3.2 Test Values – Electrical Tests

1. Compare bolted connection resistance values to values of similar connections. Investigate any values that deviate from similar bolted connections by more than 50 percent of the lowest value.
2. The dielectric absorption ratio or polarization shall be compared to previously obtained results and should not be less than 1.0. The recommended minimum insulation resistance ($IR_{1 \text{ min}}$) test results in megohms should be corrected to 40° C and read as follows:
 1. $IR_{1 \text{ min}} = KV + 1$ for most windings made before 1970, all field windings, and others not described in 2.2 and 2.3.
(KV is the rated machine terminal-to-terminal voltage, in rms kV)
 2. $IR_{1 \text{ min}} = 100$ megohms for most dc armature and ac windings built after 1970 (form-wound coils).
 3. $IR_{1 \text{ min}} = 5$ megohms for most machines and random-wound stator coils and form-wound coils rated below 1 kV.

NOTE: Overpotential, high-potential, and surge comparison tests shall not be performed on machines having values lower than those indicated above.
3. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the overpotential test, the test specimen is considered to have passed the test.
4. Investigate phase-to-phase stator resistance values that deviate by more than 10 percent.
5. Power-factor or dissipation-factor values shall be compared with previous values of similar machines.
6. Tip-up values should indicate no significant increase in power factor.
7. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the overpotential test, the test specimen is considered to have passed the test.
8. Bearing insulation-resistance measurements should be within manufacturer's published tolerances. In the absence of manufacturer's published tolerances, the comparison shall be made to similar machines.
9. Test results of surge protection devices shall be in accordance with Section 7.19 and Section 7.20.

* Optional


Page 137
ANSI/NETA MTS-2007



PREFACE (*continued*)

Optional Tests

The purpose of these specifications is to assure that all tested electrical equipment and systems supplied by either contractor or owner are operational and within applicable standards and manufacturer's published tolerances and that equipment and systems are installed in accordance with design specifications.

Certain tests are assigned an optional classification. The following considerations are used in determining the use of the optional classification:

1. Does another listed test provide similar information?
2. How does the cost of the test compare to the cost of other tests providing similar information?
3. How commonplace is the test procedure? Is it new technology?

Manufacturer's Instruction Manuals

It is important to follow the recommendations contained in the manufacturer's published data. Many of the details of a complete and effective testing procedure can be obtained from this source.

Summary

The guidance of an experienced testing professional should be sought when making decisions concerning the extent of testing. It is necessary to make an informed judgment for each particular system regarding how extensive a procedure is justified. The approach taken in these specifications is to present a comprehensive series of tests applicable to most industrial and larger commercial systems. In smaller systems, some of the tests can be deleted. In other cases, a number of the tests indicated as optional should be performed.

Likewise, guidance of an experienced testing professional should also be sought when making decisions concerning the results of test data and their significance to the overall analysis of the device or system under test. Careful consideration of all aspects of test data, including manufacturer's published data and recommendations, must be included in the overall assessment of the device or system under test.

The Association encourages comment from users of this document. Please contact the NETA office or your local NETA Accredited Company.

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CONTENTS

1.	GENERAL SCOPE	1
2.	APPLICABLE REFERENCES	2
3.	QUALIFICATIONS OF TESTING PERSONNEL	11
4.	DIVISION OF RESPONSIBILITY.....	12
5.	GENERAL.....	13
5.1	Safety and Precautions.....	13
5.2	Suitability of Test Equipment.....	13
5.3	Test Instrument Calibration	14
5.4	Test Report.....	15
6.	POWER SYSTEM STUDIES	16
6.1	Short-Circuit Studies.....	16
6.2	Coordination Studies.....	17
6.3	Arc-Flash Hazard Analysis.....	18
6.4	Load-Flow Studies.....	20
6.5	Stability Studies	21
6.6	Switching-Transients Studies – Reserved.....	22
6.7	Motor-Starting Studies – Reserved.....	22
6.8	Harmonic-Analysis Studies	23
6.9	Ground-Mat Studies – Reserved.....	24
6.10	Cable-Ampacity Studies – Reserved	24
6.11	Reliability Studies – Reserved.....	24
7.	INSPECTION AND TEST PROCEDURES.....	25
7.1	Switchgear and Switchboard Assemblies	25
7.2.1.1	Transformers, Dry-Type, Air-Cooled, Low-Voltage, Small	29
7.2.1.2	Transformers, Dry-Type, Air-Cooled, Large.....	31
7.2.2	Transformers, Liquid-Filled.....	35
7.3.1	Cables, Low-Voltage, Low-Energy – Reserved	39
7.3.2	Cables, Low-Voltage, 600 Volt Maximum.....	40
7.3.3	Cables, Medium- and High-Voltage	42
7.4	Metal-Enclosed Busways.....	45
7.5.1.1	Switches, Air, Low-Voltage	47
7.5.1.2	Switches, Air, Medium-Voltage, Metal-Enclosed.....	50
7.5.1.3	Switches, Air, Medium- and High-Voltage, Open	53
7.5.2	Switches, Oil, Medium-Voltage	56
7.5.3	Switches, Vacuum, Medium-Voltage.....	59
7.5.4	Switches, SF ₆ , Medium-Voltage.....	63
7.5.5	Switches, Cutouts.....	67
7.6.1.1	Circuit Breakers, Air, Insulated-Case/Molded-Case	69
7.6.1.2	Circuit Breakers, Air, Low-Voltage Power	73
7.6.1.3	Circuit Breakers, Air, Medium-Voltage	77
7.6.2.	Circuit Breakers, Oil, Medium- and High-Voltage	81
7.6.3	Circuit Breakers, Vacuum, Medium-Voltage	86
7.6.4	Circuit Breakers, SF ₆	90
7.7	Circuit Switchers.....	94



CONTENTS (continued)

7.8	Network Protectors, 600-Volt Class	97
7.9.1	Protective Relays, Electromechanical and Solid-State	101
7.9.2	Protective Relays, Microprocessor-Based	108
7.10	Instrument Transformers.....	110
7.11	Metering Devices	116
7.12.1.1	Regulating Apparatus, Voltage, Step-Voltage Regulators	118
7.12.1.2	Regulating Apparatus, Voltage, Induction Regulators	124
7.12.2	Regulating Apparatus, Current – Reserved	128
7.12.3	Regulating Apparatus, Load Tap-Changers.....	129
7.13	Grounding Systems.....	133
7.14	Ground-Fault Protection Systems	134
7.15.1	Rotating Machinery, AC Induction Motors and Generators.....	137
7.15.2	Rotating Machinery, Synchronous Motors and Generators.....	141
7.15.3	Rotating Machinery, DC Motors and Generators	147
7.16.1.1	Motor Control, Motor Starters, Low-Voltage.....	150
7.16.1.2	Motor Control, Motor Starters, Medium-Voltage.....	153
7.16.2.1	Motor Control, Motor Control Centers, Low-Voltage.....	157
7.16.2.2	Motor Control, Motor Control Centers, Medium-Voltage	157
7.17	Adjustable-Speed Drive Systems.....	158
7.18.1.1	Direct-Current Systems, Batteries, Flooded Lead-Acid	161
7.18.1.2	Direct-Current Systems, Batteries, Nickel-Cadmium – Reserved.....	164
7.18.1.3	Direct Current Systems, Batteries, Valve-Regulated Lead-Acid.....	165
7.18.2	Direct-Current Systems, Chargers	168
7.18.3	Direct-Current Systems, Rectifiers – Reserved	170
7.19.1	Surge Arresters, Low-Voltage Surge Protection Devices.....	171
7.19.2	Surge Arresters, Medium- and High-Voltage Surge Protection Devices	173
7.20.1	Capacitors and Reactors, Capacitors.....	175
7.20.2	Capacitors and Reactors, Capacitor Control Devices – Reserved	177
7.20.3.1	Capacitors and Reactors, Reactors (Shunt and Current-Limiting), Dry-Type.....	178
7.20.3.2	Capacitors and Reactors, Reactors (Shunt and Current-Limiting), Liquid-Filled..	180
7.21	Outdoor Bus Structures.....	184
7.22.1	Emergency Systems, Engine Generator.....	186
7.22.2	Emergency Systems, Uninterruptible Power Systems.....	188
7.22.3	Emergency Systems, Automatic Transfer Switches	191
7.23	Communications – Reserved	194
7.24.1	Automatic Circuit Reclosers and Line Sectionalizers, Automatic Circuit Reclosers, Oil/Vacuum	195
7.24.2	Automatic Circuit Reclosers and Line Sectionalizers Automatic Line Sectionalizers, Oil.....	199
7.25	Fiber-Optic Cables.....	202
7.26	Electrical Safety Equipment	203
8.	SYSTEM FUNCTION TESTS.....	205
9.	THERMOGRAPHIC SURVEY	206
10.	ELECTROMAGNETIC FIELD TESTING	207
11.	CORONA STUDIES – RESERVED.....	209



CONTENTS (continued)

TABLES

100.1	Insulation Resistance Test Values	212
100.2	Switchgear Withstand Test Voltages	213
100.3	Dissipation Factor/Power Factor at 20° C	214
100.4	Suggested Limits for Service-Aged Insulating Fluids	215
100.5	Transformer Insulation Resistance	218
100.6	Medium-Voltage Cables, Maintenance Test Values	219
100.7	Molded-Case Circuit Breakers, Inverse Time Trip Test.....	220
100.8	Instantaneous Trip Tolerances for Field Testing of Circuit Breakers.....	221
100.9	Instrument Transformer Dielectric Tests, Field Maintenance	222
100.10	Maximum Allowable Vibration Amplitude.....	223
100.11	Periodic Electrical Test Values for Insulating Aerial Devices	224
100.12	US Standard Fasteners, Bolt Torque Values for Electrical Connections.....	225
100.13	SF ₆ Gas Tests	227
100.14	Insulation Resistance Conversion Factors	228
100.15	High-Potential Test Voltage for Automatic Circuit Reclosers	230
100.16	High-Potential Test Voltage for Periodic Test of Line Sectionalizers	231
100.17	Metal-Enclosed Bus Dielectric Withstand Test Voltages.....	232
100.18	Thermographic Survey, Suggested Actions Based on Temperature Rise	233
100.19	Overpotential Test Voltages for Electrical Apparatus Other than Inductive Equipment	234
100.20	Rated Control Voltages and Their Ranges for Circuit Breakers.....	235
100.21	Accuracy of IEC Class TP Current Transformers, Error Limit.....	238
100.22	Minimum Radii for Power Cable.....	239

APPENDICES

Appendix A	– Definitions.....	243
Appendix B	– Frequency of Maintenance Tests.....	245
Appendix C	– About the InterNational Electrical Testing Association.....	249
Appendix D	– Form for Comments	251
Appendix E	– Form for Proposals	252



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1. GENERAL SCOPE

1.1 Maintenance Testing Specifications

1. These specifications cover the suggested field tests and inspections that are available to assess the suitability for continued service and reliability of electrical power distribution equipment and systems.
2. The purpose of these specifications is to assure that tested electrical equipment and systems are operational and within applicable standards and manufacturer's tolerances and that the equipment and systems are suitable for continued service.
3. The work specified in these specifications may involve hazardous voltages, materials, operations, and equipment. These specifications do not purport to address all of the safety problems associated with their use. It is the responsibility of the user to review all applicable regulatory limitations prior to the use of these specifications.



2. APPLICABLE REFERENCES

2.1 Codes, Standards, and Specifications

All inspections and field tests shall be in accordance with the latest edition of the following codes, standards, and specifications except as provided otherwise herein.

1. American National Standards Institute – ANSI

2. ASTM International – ASTM

ASTM D 92	<i>Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester</i>
ASTM D 445	<i>Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)</i>
ASTM D 664	<i>Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration</i>
ASTM D 877	<i>Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids using Disk Electrodes</i>
ASTM D 923	<i>Standard Practices for Sampling Electrical Insulating Liquids</i>
ASTM D 924	<i>Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids</i>
ASTM D 971	<i>Standard Test Method for Interfacial Tension of Oil against Water by the Ring Method</i>
ASTM D 974	<i>Standard Test Method for Acid and Base Number by Color-Indicator Titration</i>
ASTM D 1298	<i>Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method</i>
ASTM D 1500	<i>Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)</i>
ASTM D 1524	<i>Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field</i>



2. APPLICABLE REFERENCES

2.1 Codes, Standards, and Specifications (*continued*)

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|-------------|---|
| ASTM D 1533 | <i>Standard Test Methods for Water in Insulating Liquids by Coulometric Karl Fischer Titration</i> |
| ASTM D 1816 | <i>Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VDE Electrodes</i> |
| ASTM D 2029 | <i>Standard Test Methods for Water Vapor Content of Electrical Insulating Gases by Measurement of Dew Point</i> |
| ASTM D 2129 | <i>Standard Test Method for Color of Clear Electrical Insulating Liquids (Platinum-Cobalt Scale)</i> |
| ASTM D 2284 | <i>Standard Test Method of Acidity of Sulfur Hexafluoride</i> |
| ASTM D 2285 | <i>Standard Test Method for Interfacial Tension of Electrical Insulating Oils of Petroleum Origin against Water by the Drop-Weight Method</i> |
| ASTM D 2477 | <i>Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Insulating Gases at Commercial Power Frequencies</i> |
| ASTM D 2685 | <i>Standard Test Method for Air and Carbon Tetrafluoride in Sulfur Hexafluoride by Gas Chromatography</i> |
| ASTM D 2759 | <i>Standard Practice for Sampling Gas from a Transformer under Positive Pressure</i> |
| ASTM D 3284 | <i>Standard Test Method for Combustible Gases in the Gas Space of Electrical Apparatus Using Portable Meters</i> |
| ASTM D 3612 | <i>Standard Test Method for Analysis of Gases Dissolved in Electrical Insulating Oil by Gas Chromatography</i> |
| ASTM D 3613 | <i>Standard Practice for Sampling Electrical Insulating Oils for Gas Analysis and Determination of Water Content</i> |
3. Association of Edison Illuminating Companies – AEIC
 4. Canadian Standards Association – CSA



2. APPLICABLE REFERENCES

2.1 Codes, Standards, and Specifications (*continued*)

5. Electrical Apparatus Service Association – EASA
ANSI/EASA AR100 *Recommended Practice for the Repair of Rotating Electrical Apparatus*
6. Institute of Electrical and Electronic Engineers – IEEE
ANSI/IEEE C2 *National Electrical Safety Code*
ANSI/IEEE C37 *Guides and Standards for Circuit Breakers, Switchgear, Relays, Substations, and Fuses*
Compilation
ANSI/IEEE C57 *Distribution, Power, and Regulating Transformers*
Compilation
ANSI/IEEE C62 *Surge Protection*
Compilation
ANSI/IEEE 43 *IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery*
ANSI/IEEE 48 *IEEE Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV*
IEEE 81 *IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part I: Normal Measurements*
ANSI/IEEE 81.2 *IEEE Guide for Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems*
ANSI/IEEE 95 *IEEE Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage*
IEEE 100 *The Authoritative Dictionary of IEEE Standards Terms*
IEEE 141 *IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants (Red Book)*
ANSI/IEEE 142 *IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems (Green Book)*
ANSI/IEEE 241 *IEEE Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book)*
ANSI/IEEE 242 *IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book)*



2. APPLICABLE REFERENCES

2.1 Codes, Standards, and Specifications (*continued*)

IEEE 386	<i>IEEE Standard for Separable Insulated Connectors System for Power Distribution Systems above 600 V</i>
ANSI/IEEE 399	<i>IEEE Recommended Practice for Power Systems Analysis (Brown Book)</i>
IEEE 400	<i>IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems</i>
ANSI/IEEE 421.3	<i>IEEE Standard for High-Potential-Test Requirements for Excitation Systems for Synchronous Machines</i>
ANSI/IEEE 446	<i>IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications (Orange Book)</i>
ANSI/IEEE 450	<i>IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications</i>
ANSI/IEEE 493	<i>IEEE Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems (Gold Book)</i>
ANSI/IEEE 519	<i>IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems</i>
ANSI/IEEE 602	<i>IEEE Recommended Practice for Electric Systems in Health Care Facilities (White Book)</i>
ANSI/IEEE 637	<i>IEEE Guide for the Reclamation of Insulating Oil and Criteria for Its Use</i>
IEEE 644	<i>Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines</i>
ANSI/IEEE 739	<i>IEEE Recommended Practice for Energy Management in Commercial and Industrial Facilities (Bronze Book)</i>
ANSI/IEEE 902	<i>IEEE Guide for Maintenance, Operation and Safety of Industrial and Commercial Power Systems (Yellow Book)</i>
IEEE 1015	<i>IEEE Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems (Blue Book)</i>
IEEE 1100	<i>IEEE Recommended Practice for Powering and Grounding Sensitive Electronic Equipment (Emerald Book)</i>
ANSI/IEEE 1106	<i>IEEE Recommended Practice for Maintenance, Testing, and Replacement of Nickel-Cadmium Batteries for Stationary Applications</i>



2. APPLICABLE REFERENCES

2.1 Codes, Standards, and Specifications (*continued*)

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| ANSI/IEEE 1159 | <i>IEEE Recommended Practice on Monitoring Electrical Power Quality</i> |
| ANSI/IEEE 1188 | <i>IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications</i> |
| IEEE 1584 | <i>IEEE Guide for Performing Arc-Flash Hazard Calculations</i> |
| IEEE 1584a | <i>IEEE Guide for Performing Arc-Flash Hazard Calculations – Amendment 1</i> |
| 7. Insulated Cable Engineers Association – ICEA | |
| ANSI/ICEA
S-93-639/NEMA
WC 74 | <i>5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy</i> |
| ANSI/ICEA
S-94-649 | <i>Standard for Concentric Neutral Cables Rated 5,000 – 46,000 Volts</i> |
| ANSI/ICEA
S-97-682 | <i>Standard for Utility Shielded Power Cables Rated 5,000 – 46,000 Volts</i> |
| 8. InterNational Electrical Testing Association – NETA | |
| ANSI/NETA ETT | <i>Standard for Certification of Electrical Testing Technicians</i> |
| ANSI/NETA MTS
7.2.1.1 | <i>Standard for Electrical Maintenance Testing of Dry-Type Transformers</i> |
| ANSI/NETA MTS
7.2.1.2 | <i>Standard for Electrical Maintenance Testing of Liquid-Filled Transformers</i> |
| NETA ATS | <i>Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems</i> |



2. APPLICABLE REFERENCES

2.1 Codes, Standards, and Specifications (*continued*)

9. National Electrical Manufacturers Association – NEMA
 - NEMA AB4 *Guidelines for Inspection and Preventive Maintenance of Molded-Case Circuit Breakers Used in Commercial and Industrial Applications*
 - ANSI/NEMA 84.1 *Electrical Power Systems and Equipment Voltage Ratings (60 Hz)*
 - NEMA MG1 *Motors and Generators*
10. National Fire Protection Association – NFPA
 - ANSI/NFPA 70 *National Electrical Code*
 - ANSI/NFPA 70B *Recommended Practice for Electrical Equipment Maintenance*
 - ANSI/NFPA 70E *Standard for Electrical Safety in the Workplace*
 - ANSI/NFPA 99 *Standard for Healthcare Facilities*
 - ANSI/NFPA 101 *Life Safety Code*
 - ANSI/NFPA 110 *Emergency and Standby Power Systems*
 - ANSI/NFPA 780 *Installation of Lightning Protection Systems*
11. Occupational Safety and Health Administration – OSHA
12. Scaffold Industry Association, Inc. – SIA
 - ANSI/SIA A92-2 *Vehicle Mounted Elevating and Rotating Aerial Devices*
13. State and local codes and ordinances
14. Underwriters Laboratories, Inc. – UL

