



ANSI/NETA ATS-2017

ATS

STANDARD FOR

ACCEPTANCE
TESTING SPECIFICATIONS

FOR ELECTRICAL POWER EQUIPMENT & SYSTEMS

2017 **NETA**
STANDARDS[®]

ANSI/NETA ATS-2017

AMERICAN NATIONAL STANDARD

STANDARD FOR
ACCEPTANCE TESTING SPECIFICATIONS for
Electrical Power Equipment
and Systems

Secretariat
InterNational Electrical Testing Association



American National Standards Institute



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 - 3.1 Testing Organization
 - 3.2 Testing Personnel
- 4. Division of Responsibility
 - 4.1 The Owner’s Representative
 - 4.2 The Testing Organization
- 5. General
 - 5.1 Safety and Precautions
 - 5.2 Suitability of Test Equipment
 - 5.3 Test Instrument Calibration
 - 5.4 Test Report
 - 5.5 Test Decal

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FOREWORD

(This Foreword is not part of American National Standard ANSI/NETA ATS-2017)

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.

NETA has been an Accredited Standards Developer for the American National Standards Institute since 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 standards takes into account both national and international standards. NETA's standards may be used internationally as well as in the United States. 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.

The *NETA Acceptance Testing Specifications* was developed for use by those responsible for assessing the suitability for initial energization of electrical power equipment and systems and to specify field tests and inspections that ensure these systems and apparatus perform satisfactorily, minimizing downtime and maximizing life expectancy.

Since 1972, several revisions of the *Acceptance Testing 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 *Acceptance Testing Specifications* have been published in 1991, 1995, 1999, 2003, 2007, 2009, and 2013.

On February 2, 2017, the American National Standards Institute approved the *NETA Acceptance Testing Specifications for Electrical Power Equipment and Systems* as an American National Standard.

Suggestions for improvement of this standard are welcome. They should be sent to the InterNational Electrical Testing Association, 3050 Old Centre Avenue, Suite 102, Portage, MI 49024, or emailed to neta@netaworld.org.

PREFACE

(This Preface is not part of American National Standard ANSI/NETA ATS-2017)

It is recognized by the Association that the needs for acceptance 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:

Notation of Changes

Material included in this edition of the document but not part of the 2013 edition is marked with a black vertical line to the left of the insertion of text, deletion of text, or alteration of text.

The Document Structure

The document is divided into thirteen 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 Tests and Commissioning
Section 9	Thermographic Survey
Section 10	Electromagnetic Field Testing
Section 11	Corona Studies (Reserved)
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 acceptance testing of electrical power distribution equipment and systems. It is not intended that this document list how to test specific pieces of equipment or systems.

Sequence of Tests and Inspections

The tests and inspections specified in this document are not necessarily presented in chronological order and may be performed in a different sequence.

Expected Test Results

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

- A. Visual and Mechanical Inspection
- B. Electrical Tests
- C. Test Values – Visual and Mechanical
- D. Test Values – Electrical

PREFACE (Continued)

(This Preface is not part of American National Standard ANSI/NETA ATS-2017)

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 C., *Test Values – Visual and Mechanical*. For example, Section 7.1 *Switchgear and Switchboard Assemblies*, item 7.1.A.8.2 calls for verifying tightness of connections using a calibrated torque wrench method. Under the *Test Values – Visual and Mechanical* Section 7.1.C.2, the expected results for that particular task are listed within Section C., with reference back to the original task description on item 7.1.A.8.2.

<p>7. INSPECTION AND TEST PROCEDURES</p> <p>7.1 Switchgear and Switchboard Assemblies</p> <p>A. Visual and Mechanical Inspection</p> <ol style="list-style-type: none">1. Compare equipment nameplate data with drawings and specifications.2. Inspect physical and mechanical condition.3. Inspect anchorage, alignment, grounding, and required area clearances.4. Verify the unit is clean and all shipping bracing, loose parts, and documentation shipped inside cubicles have been removed.5. Verify that fuse and 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. Verify that wiring connections are tight and that wiring is secure to prevent damage during routine operation of moving parts.8. Inspect bolted electrical connections for high resistance using one or more of the following methods:<ol style="list-style-type: none">1. Use of a low-resistance ohmmeter in accordance with Section 7.1.B.1.2. 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 thermographic survey in accordance with Section 9.9. Verify operation and sequencing of interlocking systems.10. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.11. Inspect insulators for evidence of physical damage or contaminated surfaces.12. Verify correct barrier and shutter installation and operation.13. Exercise all active components.14. Inspect mechanical indicating devices for correct operation.15. Verify that filters are in place and vents are clear.16. Perform visual and mechanical inspection of instrument transformers in accordance with Section 7.10. <p>* Optional</p> <p>NETA Page 24 ANSI/NETA ATS-2017</p>	<p>7. INSPECTION AND TEST PROCEDURES</p> <p>7.1 Switchgear and Switchboard Assemblies (continued)</p> <p>C. Test Values – Visual and Mechanical</p> <ol style="list-style-type: none">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.A.8.1)2. Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.12. (7.1.A.8.2)3. Results of the thermographic survey shall be in accordance with Section 9. (7.1.A.8.3) <p>D. Test Values – Electrical</p> <ol style="list-style-type: none">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 shall 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. Dielectric withstand voltage tests shall 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 dielectric withstand test, the test specimen is considered to have passed the test.4. Minimum insulation-resistance values of control wiring shall not be less than two megohms.5. Results of electrical tests on instrument transformers shall be in accordance with Section 7.10.6. Results of ground-resistance tests shall be in accordance with Section 7.13.7. Accuracy of metering devices shall be in accordance with Section 7.14. <p>* Optional</p> <p>NETA Page 27 ANSI/NETA ATS-2017</p>
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PREFACE (Continued)

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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.B.2 (item 2 within the *Electrical Tests* section) calls for performing an insulation-resistance test in accordance with IEEE Standard 43. In section D, *Test Values – Electrical*, 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

A. Visual and Mechanical Inspection

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Inspect anchorage, alignment, and grounding.
4. Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging.
5. Inspect bolted electrical connections for high resistance using one or more of the following methods:
 1. Use of low-resistance ohmmeter in accordance with Section 7.15.1.B.1.
 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 thermographic survey in accordance with Section 9.
- *6. Perform special tests such as air-gap spacing and machine alignment.
- *7. Manually rotate the rotor and check for problems with the bearings or shaft.
- *8. Rotate the shaft and measure and record the shaft extension runout.
9. Verify the application of appropriate lubrication and lubrication systems.
10. Verify that resistance temperature detector (RTD) circuits conform to drawings.

B. Electrical Tests – AC Induction

1. Perform resistance measurements through bolted connections with a low-resistance ohmmeter, in accordance with Section 7.15.1.A.5.1.
2. Perform insulation-resistance tests in accordance with ANSI/IEEE Standard 43.
 1. Machines larger than 200 horsepower (150 kilowatts).
Test duration shall be ten minutes. Calculate polarization index.
 2. Machines 200 horsepower (150 kilowatts) and less.
Test duration shall be one minute. Calculate dielectric-absorption ratio for 60/30 second periods.

* Optional

NETA
Page 134
ANSI/NETA ATS-2017

7. INSPECTION AND TEST PROCEDURES

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

2. 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. (7.15.1.A.5.1)
3. Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.12. (7.15.1.A.5.2)
4. Results of the thermographic survey shall be in accordance with Section 9. (7.15.1.A.5.3)
5. Air-gap spacing and machine alignment shall be in accordance with manufacturer's published data. (7.15.1.A.6)

D. 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.
 1. The polarization index value shall not be less than 2.0.
 2. The dielectric absorption ratio shall not be less than 1.4.
2. The recommended minimum insulation resistance (IR_{min}) test results in megohms shall be in accordance with Table 100.11.
 1. The polarization index value shall not be less than 2.0.
 2. The dielectric absorption ratio shall not be less than 1.4.
3. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.
4. Investigate phase-to-phase stator resistance values that deviate by more than five percent.
5. Power-factor or dissipation-factor values shall be compared to manufacturer's published data. In the absence of manufacturer's published data these values will be compared with previous values of similar machines.
6. Tip-up values shall indicate no significant increase in power factor.
7. If no evidence of distress, insulation failure, or lack of waveform nesting is observed by the end of the total time of voltage application during the surge comparison test, the test specimen is considered to have passed the test.
8. Bearing insulation-resistance measurements shall be within manufacturer's published tolerances. In the absence of manufacturer's published tolerances, the comparison shall be made to similar machines.

* Optional

NETA
Page 136
ANSI/NETA ATS-2017

PREFACE (*Continued*)

(This Preface is not part of American National Standard ANSI/NETA ATS-2017)

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 and calibration 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	
2.1	Codes, Standards and Specifications	2
2.2	Other References	8
2.3	Contact Information	8
3.	QUALIFICATIONS OF TESTING ORGANIZATION AND PERSONNEL	
3.1	Testing Organization	10
3.2	Testing Personnel	10
4.	DIVISION OF RESPONSIBILITY	
4.1	The Owner's Representative	11
4.2	The Testing Organization	11
5.	GENERAL	
5.1	Safety and Precautions	12
5.2	Suitability of Test Equipment	12
5.3	Test Instrument Calibration	13
5.4	Test Report	14
5.5	Test Decal	15
6.	POWER SYSTEM STUDIES	
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	Harmonic-Analysis Studies	22
7.	INSPECTION AND TEST PROCEDURES	
7.1	Switchgear and Switchboard Assemblies	23
7.2.1.1	Transformers, Dry-Type, Air-Cooled, Low-Voltage, Small	28
7.2.1.2	Transformers, Dry-Type, Air-Cooled, Large	30
7.2.2	Transformers, Liquid-Filled	33
7.3.1	Cables, Low-Voltage, Low-Energy - RESERVED	38
7.3.2	Cables, Low-Voltage, 600-Volt Maximum	39
7.3.3	Cables, Medium- and High-Voltage	41
7.4	Metal-Enclosed Busways	44
7.5.1.1	Switches, Air, Low-Voltage	46
7.5.1.2	Switches, Air, Medium-Voltage, Metal-Enclosed	48
7.5.1.3	Switches, Air, Medium- and High-Voltage, Open	51
7.5.2	Switches, Oil, Medium-Voltage	54
7.5.3	Switches, Vacuum, Medium-Voltage	57
7.5.4	Switches, SF ₆ , Medium-Voltage	60
7.5.5	Switches, Cutouts	63
7.6.1.1	Circuit Breakers, Air, Insulated-Case/Molded-Case	65
7.6.1.2	Circuit Breakers, Low-Voltage Power	68
7.6.1.3	Circuit Breakers, Air, Medium-Voltage	71
7.6.2	Circuit Breakers, Oil, Medium- and High-Voltage	75
7.6.3	Circuit Breakers, Vacuum, Medium-Voltage	80
7.6.4	Circuit Breakers, SF ₆	84
7.7	Circuit Switchers	88

CONTENTS

7.8	Network Protectors, 600-Volt Class	91
7.9.1	Protective Relays, Electromechanical and Solid-State	95
7.9.2	Protective Relays, Microprocessor-Based	104
7.10.1	Instrument Transformers, Current Transformers	107
7.10.2	Instrument Transformers, Voltage Transformers	110
7.10.3	Instrument Transformers, Coupling-Capacitor Voltage Transformers.....	112
7.10.4	Instrument Transformers, High-Accuracy Instrument Transformers (RESERVED)	115
7.11.1	Metering Devices, Electromechanical and Solid-State.....	116
7.11.2	Metering Devices, Microprocessor-Based.....	117
7.12.1.1	Regulating Apparatus, Voltage, Step Voltage Regulators.....	119
7.12.1.2	Regulating Apparatus, Voltage, Induction Regulators – WITHDRAWN.....	123
7.12.2	Regulating Apparatus, Current - RESERVED	124
7.12.3	Regulating Apparatus, Load Tap-Changers.....	125
7.13	Grounding Systems	128
7.14	Ground-Fault Protection Systems, Low-Voltage.....	130
7.15.1	Rotating Machinery, AC Induction Motors and Generators.....	133
7.15.2	Rotating Machinery, Synchronous Motors and Generators.....	137
7.15.3	Rotating Machinery, DC Motors and Generators	142
7.16.1.1	Motor Control, Motor Starters, Low-Voltage.....	145
7.16.1.2	Motor Control, Motor Starters, Medium-Voltage.....	147
7.16.2.1	Motor Control, Motor Control Centers, Low-Voltage.....	151
7.16.2.2	Motor Control, Motor Control Centers, Medium-Voltage	152
7.17	Adjustable Speed Drive Systems	153
7.18.1.1	Direct-Current Systems, Batteries, Flooded Lead-Acid	156
7.18.1.2	Direct-Current Systems, Batteries, Vented Nickel-Cadmium	159
7.18.1.3	Direct-Current Systems, Batteries, Valve-Regulated Lead-Acid	161
7.18.2	Direct-Current Systems, Chargers	163
7.18.3	Direct-Current Systems, Rectifiers - RESERVED	165
7.19.1	Surge Arresters, Low-Voltage	166
7.19.2	Surge Arresters, Medium- and High-Voltage.....	168
7.20.1	Capacitors and Reactors, Capacitors.....	170
7.20.2	Capacitors and Reactors, Capacitor Control Devices - RESERVED	172
7.20.3.1	Capacitors and Reactors, Reactors (Shunt and Current-Limiting) Dry-Type.....	173
7.20.3.2	Capacitors and Reactors, Reactors (Shunt and Current-Limiting) Liquid-Filled	175
7.21	Outdoor Bus Structures.....	179
7.22.1	Emergency Systems, Engine Generator.....	181
7.22.2	Emergency Systems, Uninterruptible Power Systems.....	183
7.22.3	Emergency Systems, Automatic Transfer Switches	186
7.23	Communications - RESERVED	189
7.24.1	Automatic Circuit Reclosers and Line Sectionalizers, Automatic Circuit Reclosers, Oil/Vacuum	190
7.24.2	Automatic Circuit Reclosers and Line Sectionalizers, Automatic Line Sectionalizers, Oil.....	194
7.25	Fiber-Optic Cables	197

CONTENTS

8.	SYSTEM FUNCTION TESTS AND COMMISSIONING	198
9.	THERMOGRAPHIC SURVEY	199
10.	ELECTROMAGNETIC FIELD TESTING	200
11.	CORONA STUDIES - RESERVED	202

TABLES

100.1	Insulation Resistance Test Values, Electrical Apparatus and Systems, Other Than Rotating Machinery	204
100.2	Switchgear Withstand Test Voltages	205
100.3	Recommended Dissipation Factor/Power Factor at 20° C; Liquid-Filled Transformers, Regulators, and Reactors,	206
100.4	Insulating Fluid Limits	
100.4.1	Test Limits for New Insulating Oil Received in New Equipment	207
100.4.2	Test Limits for Silicone Insulating Liquid in New Transformers	207
100.4.3	Typical Values for Less-Flammable Hydrocarbon Insulating Liquid	208
100.5	Transformer Insulation Resistance, Acceptance Testing.....	209
100.6	Medium-Voltage Cables, Acceptance Test Values	
100.6.1	DC Test Voltages	210
100.6.2	AC Test Voltages	211
100.6.3	Partial Discharge Requirements for Shielded Power Cable.....	212
100.6.4	Very Low Frequency Testing Levels	212
100.7	Inverse Time Trip Test at 300% of Rated Continuous Current, Molded-Case Circuit Breakers	213
100.8	Instantaneous Trip Tolerances for Field Testing of Circuit Breakers.....	214
100.9	Instrument Transformer Dielectric Tests, Field Acceptance	215
100.10	Maximum Allowable Vibration Amplitude.....	216
100.11	Insulation Resistance Test Values, Rotating Machinery, for One Minute at 40° C	217
100.12	US Standard Fasteners, Bolt Torque Values for Electrical Connections	
100.12.1	Heat-Treated Steel - Cadmium or Zinc Plated	218
100.12.2	Silicon Bronze Fasteners	219
100.12.3	Aluminum Alloy Fasteners	219
100.12.4	Stainless Steel Fasteners.....	220
100.13	SF ₆ Gas Tests	221
100.14	Insulation Resistance Conversion Factors	
100.14.1	Test Temperatures to 20° C.....	222
100.14.2	Test Temperatures to 40° C.....	223
100.15	High-Potential Test Voltage, Automatic Circuit Reclosers	224
100.16	High-Potential Test Voltage for Acceptance Test of Line Sectionalizers	225
100.17	Dielectric Withstand Test Voltages, Metal-Enclosed Bus.....	226
100.18	Thermographic Survey, Suggested Actions Based on Temperature Rise	227
100.19	Dielectric Withstand Test Voltages, Electrical Apparatus Other than Inductive Equipment...	228
100.20	Rated Control Voltages and their Ranges for Circuit Breakers	
100.20.1	Circuit Breakers.....	229
100.20.2	Solenoid-Operated Devices	230
100.21	Accuracy of IEC Class TP Current Transformers Error Limit	231
100.22	Minimum Radii for Power Cable, Single & Multiple Conductor Cables with Interlocked Armor, Smooth or Corrugated Aluminum Sheath or Lead Sheath.....	232

CONTENTS

APPENDICES

Appendix A – Definitions	235
Appendix B – RESERVED	238
Appendix C – About the InterNational Electrical Testing Association.....	239
Appendix D – Form for Comments	241
Appendix E – Form for Proposals	242

1. GENERAL SCOPE

1. These specifications cover the suggested field tests and inspections that are available to assess the suitability for initial energization and final acceptance of electrical power equipment and systems.
2. The purpose of these specifications is to assure that tested electrical equipment and systems are operational, are within applicable standards and manufacturer's tolerances, and are installed in accordance with design specifications.
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 issues associated with their use. It is the responsibility of the user to review all applicable regulatory limitations prior to the use of these specifications