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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

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InterNational Electrical Testing Association

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American National Standard

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3. Qualifications of Testing Organization and Personnel
   - 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

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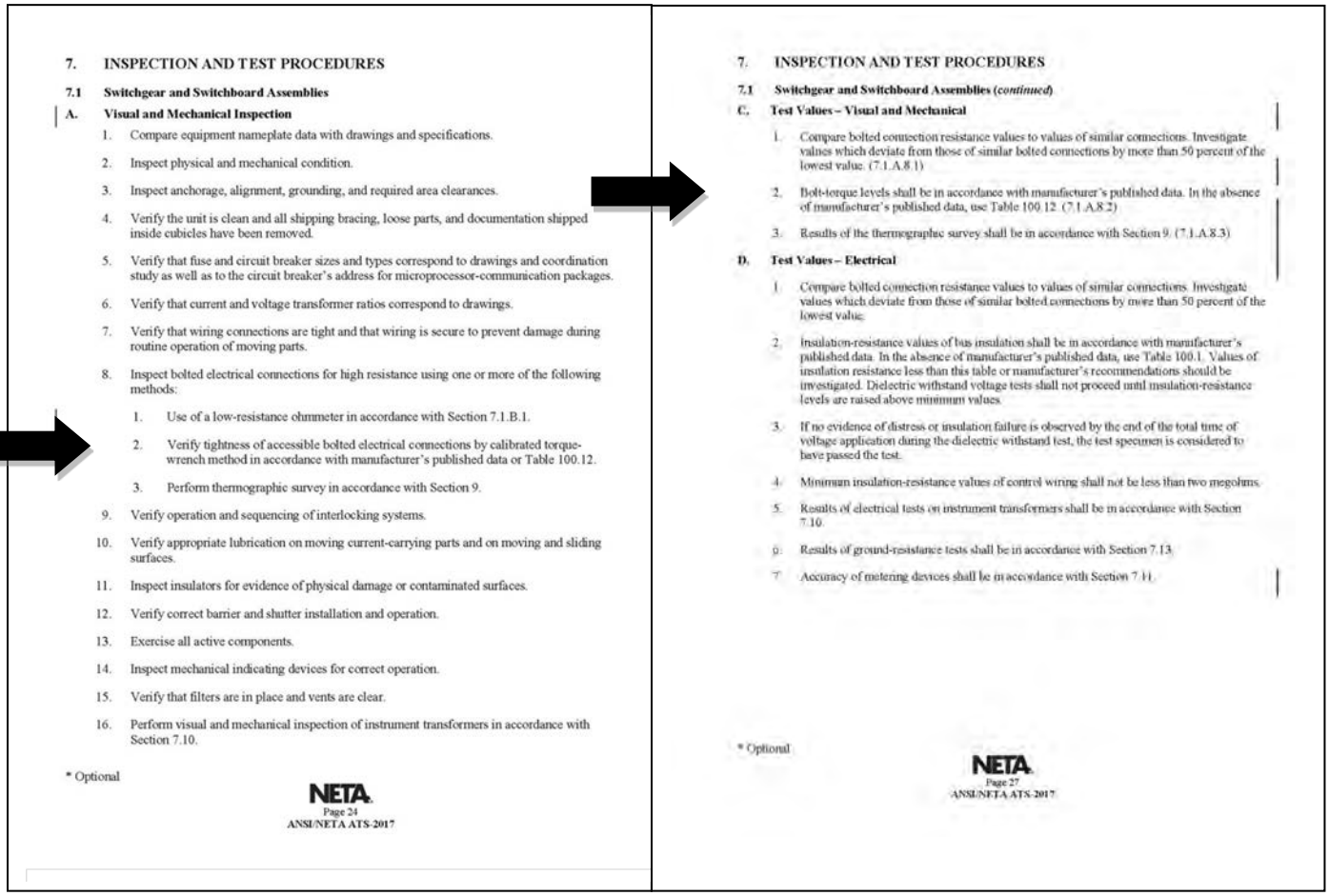
Results of Visual and Mechanical Inspections

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.



7. INSPECTION AND TEST PROCEDURES

7.1 Switchgear and Switchboard Assemblies

A. Visual and Mechanical Inspection

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:
   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.

* Optional

NETA
Page 24
ANSI/NETA ATS-2017

7. INSPECTION AND TEST PROCEDURES

7.1 Switchgear and Switchboard Assemblies (*continued*)

C. 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.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)

D. 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 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 7.11.

* Optional

NETA
Page 27
ANSI/NETA ATS-2017

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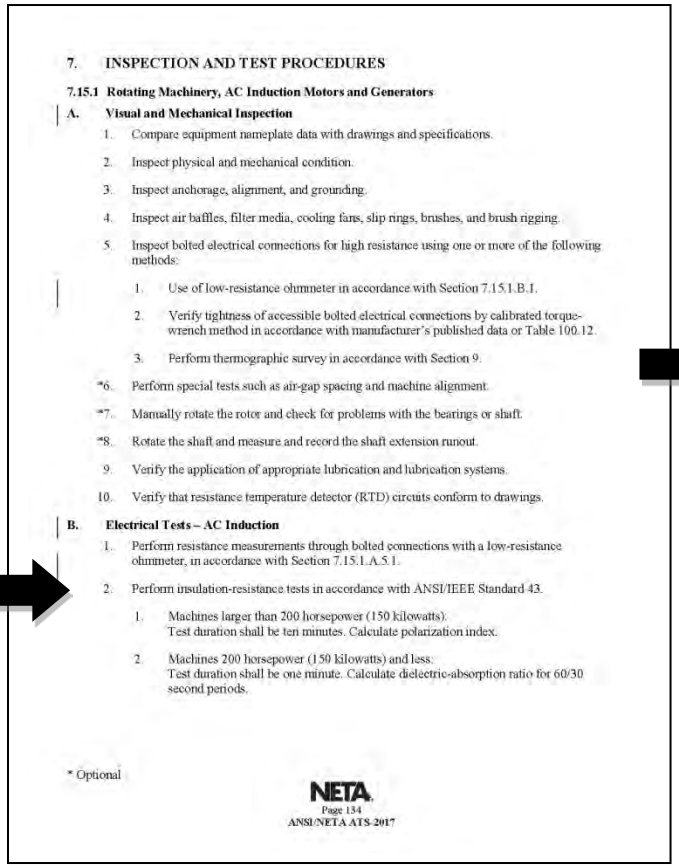
Results of Electrical Tests

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

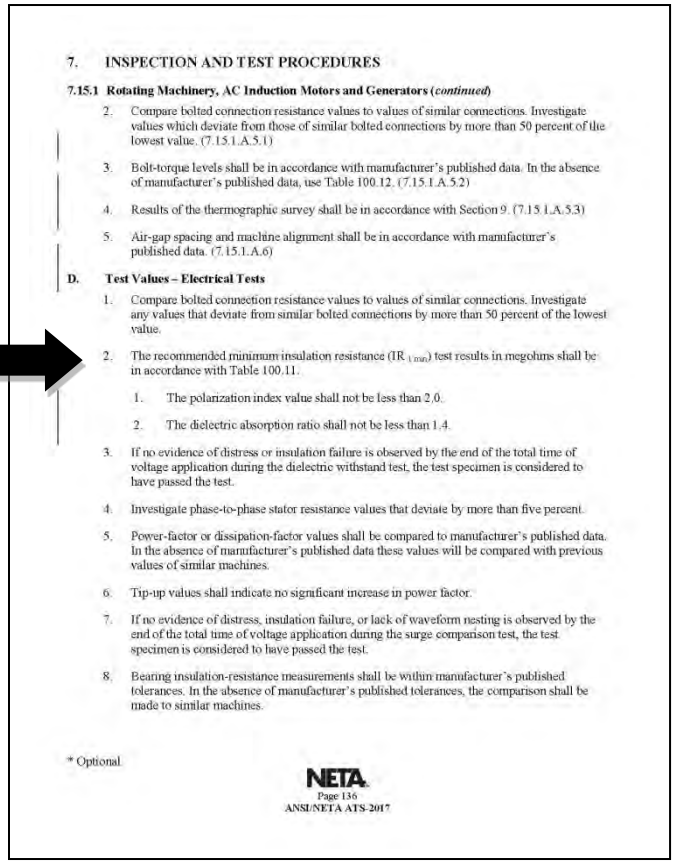
1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Inspect anchorage, alignment, and grounding.
4. Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging.
5. Inspect bolted electrical connections for 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.
2. The recommended minimum insulation resistance ($IR_{1\,min}$) 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

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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

CONTENTS

CONTENTS

TABLES

CONTENTS

APPENDICES

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