



Electrical Power Testing

Level II Certification Content Outline

Standard Model/Computer-Based Testing

The candidate for NICET certification as a Level II Electrical Power Testing technician should have the knowledge and experience to:

Under general supervision, isolate and ground power equipment safely; connect test equipment; and conduct and document standard tests of basic (single-function) equipment.

Note: For each exam, the skills and knowledge listed under each task are suggestive of those involved in that task, but are not intended to constitute an exhaustive listing.

1.1 Field Testing

(Approximately 58 - 63% of the exam)

2.1a Transformers and Regulators

2.1a.1 Perform visual and mechanical inspection.

Knowledge:

NFPA-70B, Chapters 11, 21
NETA ATS, NETA MTS
Transformer cooling devices and functions
General structure and functions of transformers and regulators
Inspection procedures for nitrogen pressure regulating systems
Desiccant inspection procedures

Skills:

Gather nameplate data.
Read and record data from temperature, pressure, and liquid-level gauges.
Inspect for leaks.
Inspect transformer sudden pressure devices.
Pressurize the tank as needed.
Verify that basic nitrogen pressure regulating systems are in working order.
Verify desiccant condition.

2.1a.2 Take liquid samples.

Knowledge:

NETA ATS, NETA MTS
ASTM D-923, D-3613
Procedures for accessing, drawing, and storing liquids

Skills:

Take liquid sample for oil quality and dissolved gas analysis in accordance with ASTM D-923.
Follow correct disposal procedures for waste liquid.

2.1a.3 Perform basic electrical tests.

Knowledge:

NETA ATS, NETA MTS
IEEE C57 Scope
NFPA 70B, Chapters 11, 21
Test procedures and constraints
Structures, electrical pathways, and functions specific to particular types of transformers and regulators

Skills:

Measure insulation resistance: winding to winding; and each winding to ground.
Measure the resistance of each winding at the designated tap position.
Measure the resistance through all bolted connections with a low resistance ohmmeter.
Measure turns ratio at the designated tap position.
Calculate dielectric absorption ratio and polarization index.
Calculate turns ratio.

2.1b Breakers and Contactors

2.1b.1 Perform general visual inspection and mechanical testing.

Knowledge:

NFPA 70B, Chapters 11, 15, 17
NETA ATS, NETA MTS
Structure and functions of low and medium voltage breakers and contactors, including mechanical interlocks, positive interlocks, rejection hardware, and stored energy release mechanisms
Grease and solvent compatibilities and applications

Skills:

Assess condition of lubricant in operating mechanisms.
Inspect and test the mechanical operating systems and components for functionality and wear.
Retrieve data from MSDS.
Read and record pressure and liquid-level gauges.
Follow basic breaker and contactor operating and inspection procedures.



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2.1b.2 Take liquid samples.

Knowledge:

NETA ATS, NETA MTS
ASTM D-923

Procedures for accessing, drawing, and storing liquids

Skills:

Retrieve data from MSDS.

Follow proper disposal procedures for waste liquid.

2.1b.3 Perform contact resistance, insulation resistance, overpotential, and overcurrent protective tests.

Knowledge:

NFPA-70B, Chapters 11, 15, 17
NETA ATS, NETA MTS

Structure and functions of breakers and contactors

Skills:

Operate a high current circuit breaker test set.

Operate basic breakers and contactors, including auxiliary devices.

Operate a low resistance ohmmeter.

Operate an insulation resistance test set.

Operate an AC overpotential test set.

Operate a DC overpotential test set.

Operate a multimeter.

2.1c Cables and Busways

2.1c.1 Visually inspect cables and busways for damage.

Knowledge:

NFPA-70B, Chapter 11, 19, 20
NETA ATS, NETA MTS

Basic construction of cables

Basic construction of busways

Construction and application of cable terminations

Skills:

Determine the integrity of cables and identify threats to the insulation.

2.1c.2 Perform basic maintenance including tightening and cleaning.

Knowledge:

NFPA 70, Chapter 3

NFPA 70B, Chapters 11, 19, 20

NETA ATS, NETA MTS

Skills:

Perform tightening to the proper torque and cleaning to maintain functionality and to avoid damaging or endangering equipment.

Inspect cable and busway support (bracing/racking).

2.1c.3 Perform basic electrical tests.

Knowledge:

NFPA 70B, Chapters 11, 19, 20
NETA ATS, NETA MTS

Skills:

Perform phase verification test.

Perform insulation resistance test.

Perform shield continuity test.

Perform DC overpotential withstand test.

2.1d Switchgear, Switchboards, Motor Control Centers, Switching Devices, & Fuses

2.1d.1 Perform visual inspection.

Knowledge:

NFPA 70, Articles 240, 250, 312, 404, 408, and 490
NFPA 70B, Chapters 11, 15, 16, 18

NETA ATS, NETA MTS

Construction and application of cable terminations

Skills:

Determine the physical condition of the equipment.

Verify correct operation of all mechanical and key interlocks.

2.1d.2 Clean and lubricate devices.

Knowledge:

Major components of switchgear assemblies

Grease and solvent compatibilities and applications

Skills:

Clean devices to maintain functionality, limit corrosion, and avoid damaging or endangering equipment.

Retrieve data from MSDS.

2.1d.3 Perform insulation resistance, path resistance, and continuity tests.

Knowledge:

NFPA 70B, Chapters 11, 15, 16, 18

NETA ATS, NETA MTS

Skills:

Operate a low resistance ohmmeter to measure continuity.

Operate an insulation resistance test set to measure insulation resistance.

Operate an AC overpotential test set to measure insulation acceptability.

Operate a DC overpotential test set to measure insulation resistance.

Operate a multimeter.

Determine proper connection points and equipment circuits.



2.1e Protective Relays and Metering

2.1e.1 Perform visual inspection.

Knowledge:

NFPA 70B, Chapter 11
NETA ATS, NETA MTS
Basic configuration of relays and meters

Skills:

Determine the physical condition of the equipment.

2.1e.2 Perform testing of basic devices, including motor overload relays, relay trip devices, over current relays, under/over voltage relays, and ammeters/voltmeters.

Knowledge:

NFPA 70B, Chapter 11, 16
NETA ATS, NETA MTS

Skills:

Identify signal and trip circuits.
Read and interpret time/current characteristic curves.
Operate a protective relay test set.
Operate a multimeter.
Determine proper connection points and equipment circuits.

2.1f Rotating Machinery

2.1f.1 Clean devices.

Knowledge:

Major components of rotating machinery
Grease & solvent compatibilities and applications

Skills:

Retrieve data from MSDS.
Clean devices to maintain functionality, limit corrosion, and avoid damaging or endangering equipment.

2.1f.2 Perform electrical tests.

Knowledge:

Test procedures and constraints
Structures, electrical pathways, and functions specific to particular types of rotating machinery
NETA ATS/MTS

Skills:

Measure the insulation resistance.
Measure the winding resistance.
Measure the resistance through bolted electrical connections.
Measure and calculate polarization index.

2.1g Battery Systems

2.1g.1 Visually inspect battery systems.

Knowledge:

NFPA 70B, Chapter 11
NETA ATS, NETA MTS
Basic construction of batteries
Appearance of corrosion
Basic causes of battery corrosion
Basic causes of plate deterioration, sediment buildup, and post seal integrity

Skills:

Determine whether corrosion is present, and determine its severity.
Describe the location and severity of deposits.
Inspect post seals for leakage.
Inspect battery cell jars and plates for sediment buildup and cracking.
Identify common anomalies, such as sulfation, hydration, plate shedding.

2.1g.2 Perform mechanical checks of racks and housings.

Knowledge:

Functions and basic functional requirements of battery rack mounting systems and housings

Skills:

Visually and mechanically inspect mounting of batteries in rack systems, including spill prevention systems.
Visually and mechanically inspect housings.

2.1g.3 Check fastener integrity.

Knowledge:

NFPA 70B, Chapter 11
NETA ATS, NETA MTS
Types of fasteners & how proper contact is maintained

Skills:

Use applicable hand tools, including proper use of Torque wrench and application of torque to battery connections.

2.1g.4 Measure intercell connection resistance.

Knowledge:

NFPA 70B, Chapter 11
NETA ATS, NETA MTS
Meaning and significance of the terms resistance and impedance
Appearance and function of electrical connections between cells

Skills:

Identify series and parallel components and circuits.
Determine the proper points at which to connect test equipment.
Operate a low resistance ohmmeter.
Correct high connection readings.



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2.1g.5 Clean devices.

Knowledge:

NETA ATS, NETA MTS

Skills:

Retrieve data from MSDS.

Clean devices to maintain functionality, limit corrosion, and avoid damaging or endangering equipment.

2.1g.6 Check electrolyte levels and measure specific gravity, cell voltages, and cell temperatures.

Knowledge:

NFPA 70B, Chapter 11

NETA ATS, NETA MTS

Battery structure including cells, electrolyte, and terminals

How to access electrolyte

Skills:

Operate a multimeter.

Operate a hydrometer.

Operate a thermometer.

2.1h Surge Arresters, Capacitors, and Reactors

2.1h.1 Perform visual inspections for corona and thermal discoloration, and state of connections and mountings.

Knowledge:

NFPA 70B, Chapter 11

NETA ATS, NETA MTS

Basic configuration of surge arresters, capacitors, and reactors

Appearance of corona and thermal discoloration

Skills:

Determine whether corrosion or evidence of corona, thermal damage, or tracking are present, and determine their severity.

Describe the location and severity of corrosion or other damage.

2.1h.2 Perform electrical tests on capacitors, reactors, and surge arresters.

Knowledge:

NFPA 70B, Chapter 11

NETA ATS, NETA MTS

Meaning and significance of the terms capacitance, resistance, and continuity

Safety hazards related to working with capacitors

Skills:

Identify series and parallel components and circuits. Determine the proper points at which to connect test equipment.

Measure capacitance.

Measure capacitor, reactor, and surge arrester insulation resistances.

Measure reactor winding resistance.

Perform a fuse continuity test.

2.1h.3 Clean devices.

Knowledge:

NETA ATS, NETA MTS

Skills:

Clean devices to maintain functionality, limit corrosion, and avoid damaging or endangering equipment.

Retrieve data from MSDS.

2.1i Grounding Systems

2.1i.1 Perform visual inspections for corrosion and broken components.

Knowledge:

NFPA 70B, Chapter 11, 14

NETA ATS, NETA MTS

Basic causes of corrosion in grounding systems

Basic configuration of grounding systems

Appearance of corrosion

Skills:

Determine whether corrosion or breaks are present, and determine their severity.

Describe the location and severity of corrosion or other damage.

Verify the correct size of ground conductor per specifications.

2.1i.2 Perform continuity and ground grid tests.

Knowledge:

NFPA 70B, Chapter 11, 14

NETA ATS, NETA MTS

IEEE 81

Meaning and significance of grounding

Test procedures for fall of potential, 2-point, clamp-on, slope method, intersecting curves, earth resistivity, step potential, and touch potential tests

Meaning and significance of the terms resistance, grounding, ground grid, and continuity

Skills:

Identify series and parallel components and circuits.

Operate a low resistance ohmmeter.

Operate a multimeter.

Operate ground resistance test sets, including 3-terminal ground resistance, 4-terminal ground resistance, and clamp-on ground resistance test sets.

2.1j Infrared Surveys

No tasks at this level



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1.2 Safety

(Approximately 20 - 25% of the exam)

2.2a General Safety

2.2a.1 Identify fire hazards and required safety procedures.

Knowledge:

Causes of and requirements for fire
Storage and transportation requirements for flammable materials
OSHA 29 CFR 1910.106
NFPA 30

Skills:

Recognize materials and situations that present fire hazards.
Identify burn permit requirements for the facility.

2.2a.2 Identify safety implications of voltage ratings or classes of electrical and safety equipment.

Knowledge:

ANSI C.84.1
IEEE 141, Section 3.1
NFPA 70, Article 490
NFPA 70E, Chapters 1 and 2

Skills:

Identify voltage ratings from various sources.
Select appropriately rated safety equipment.
Maintain proper clearances from energized equipment.

2.2a.3 Select correct personal protective equipment (PPE) such as hard hat, rubber gloves, safety glasses, hearing protection, arc-rated clothing, fire retardant materials, foot wear, insulated blankets, mats, and sleeves.

Knowledge:

NFPA 70E 130.7
Purpose of PPE
Minimum arc-rating of PPE for specific hazard categories

Skills:

Read and interpret manufacturers' specifications.
Assure that you are properly equipped for the job circumstances.
Perform visual inspection and field verification tests on equipment.
Recognize expiration date of personal protective equipment.
Properly use, care for, and clean PPE.

2.2a.4 Follow safe procedures when working with batteries, including the use of correct personal protective equipment.

Knowledge:

Personal protective equipment required for battery work
Hazards associated with battery handling and testing
Spill prevention, hazmat and chemical control procedures
MSDS requirements
NFPA 70E, Articles 310 and 320

Skills:

Take proper measures in response to eye or skin contamination.
Take precautions to avoid and respond to spills and leaks.

2.2b Lockout and Tagout

2.2b.1 Perform lockout and tagout.

Knowledge:

Lockout and tagout procedures
OSHA 1910.147
OSHA 1910.269 (d)
NFPA 70E, Article 120

Skills:

Recognize potential sources of energy.
Read and interpret switching instructions.
Properly apply lock and tags.

2.2b.2 Perform equipment isolation.

Knowledge:

Symbols and layout of basic one-line, riser, or other power distribution diagrams
IEEE 315
ANSI Y32.9
NEMA ICS 19
NFPA 70B, Annexes F, G

Skills:

Read and interpret equipment switching instructions.
Use voltage detector to test for zero potential.
Operate switching mechanism.
Select and use appropriate PPE for switching and grounding.

2.2b.3 Perform equipment grounding.

Knowledge:

Requirements of equipment grounding
NFPA 70E, Articles 100 and 120
ASTM F855
OSHA 1910.269 (n)

Skills:

Follow prescribed OSHA grounding procedures.
Select proper grounds.
Apply proper zero energy checks and safely apply grounds.



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2.3 Troubleshooting and Analysis

(Approximately 2 - 7% of the exam)

2.3.1 Calculate basic electrical quantities.

Knowledge:

Ohm's Law
Basic electrical properties of AC and DC circuits

Skills:

Calculate voltage, current, and resistance in series and parallel circuits.
Calculate power (watts) in a circuit.

2.4 Documentation

(Approximately 7 - 12% of the exam)

2.4.1 Recognize and interpret IEEE electrical device function numbers and NEMA ratings.

Knowledge:

IEEE C37.2, Sections 3 and 4
IEEE 315
NEMA ICS 19
NFPA 70B, Annexes F, G

Skills:

Recognize and interpret device numbers and ratings such as those for transformers, circuit breakers, disconnects, switches, etc., as defined by IEEE and NEMA

2.4.2 Accurately record nameplate and other pertinent test data.

Knowledge:

NETA ATS, NETA MTS
NFPA 70B, Annex H
Acceptable test voltages, currents, and test methods for Level II electrical tests
Acceptable test limits for all Level II electrical tests such as circuit breaker tests, basic transformer tests, insulating liquids tests, etc.

Skills:

Read and interpret manufacturers' instructions.
Recognize which test data shall be recorded
Accurately record test results.

2.4.3 Plot graphs of data from tests performed by Level II technicians.

Knowledge:

Meaning of scales

Skills:

Select appropriate scales.
Translate test measurement units to the desired scale.
Plot and identify points and label scales.

2.4.4 Prepare simple reports on daily activities.

Knowledge:

Proper grammar and vocabulary

Skills:

Accurately record work performed.

2.4.5 Report accidents.

Knowledge:

OSHA accident report form

Skills:

Provide data for an OSHA-required accident report form.

2.5 Management and Planning

(Approximately 2 - 7% of the exam)

2.5.1 Maintain Business Communications.

Knowledge:

Parts of a business letter
Proper sentence structure

Skills:

Communicate verbally and in writing about tests performed by Level II technicians and the needs of the client.

2.5.2 Operate a computer.

Knowledge:

Microsoft Windows
Microsoft Word, Excel, Internet Explorer, and Outlook

Skills:

Navigate directories.
Install software and drivers.
Perform data and software backups.
Prepare a basic letter in MS Word.
Create a basic spreadsheet in MS Excel.
Access and navigate the Internet using MS Internet Explorer.
Send and receive e-mail with attachments using MS Outlook.

Note on Standards: A number of technical standards are listed in this Content Outline because they stand as authoritative sources of some of the critical knowledge required to properly perform a particular task. Successful candidates are expected to have a working knowledge of the relevant parts of the referenced standards. In other words, the candidate is expected to have the same knowledge of a referenced standard when taking a NICET test as he/she should have available by recall and interpretive thought when performing the task. (In some cases, standards are listed because they are the ultimate source of knowledge that is more typically acquired through secondary sources.)