

Medium Voltage Electrical Testing Services **26.01.00**

Description:

The purpose of the section is to highlight the current applicable UMCP Design Standards for the Inspection and testing requirements of medium voltage level systems.

Related Sections:

- TBD

Effective Date:

July 10, 2009

Applicable Standards:

- NETA - International Electrical Testing Association
- NICET - National Institute for Certification in Engineering Technologies
- Federal OSHA criteria for Accreditation of testing laboratories, Title 29, PARTS 1907, 1910, and 1936
- All work shall be performed in accordance with applicable regulations of the
 - Occupational Safety and Health Administration (OSHA)
 - Maryland Occupational Safety and Health Administration
 - National Fire Protection Association - NFPA 70E
 - ANSI-C2 National Electrical Safety Code and the American National Standards for Personnel Protection

General Requirements:

The inspection and testing of medium voltage components shall be performed by an independent testing agency.

The inspection and testing shall be applied for, coordinated and paid by the construction contractor.

The testing agency shall furnish all labor, materials, equipment, supervision, and insurance necessary to provide electrical acceptance testing including load surveys, power line disturbance studies, calibration and adjustment of relays, PCB sampling, ground resistance tests, transformer tap adjustments and testing on high voltage apparatus such as cables, switchgear, and transformers at the University of Maryland installations on demand.

1. Submittal Requirements:

The construction contractor shall submit the following to the Department of Capital Projects and get approval in writing prior to entering into a contract with the testing agency or initiating any testing.

- Documentation supporting the testing agency qualifications
- The name(s) and certifications of the members of the testing teams.
- The name and State of Maryland registration number of the registered electrical engineer responsible for testing and evaluation of the test data.
- Certificate of the testing firm's insurance containing evidence of the "Hold Harmless" clause protecting the University of Maryland from all, suits, actions or claims.

2. Qualifications of Testing Agency:

Testing Agency shall be limited to any firm, company, or corporation in the electrical testing industry providing the following qualifications are met:

- They shall be regularly engaged in the technical testing, maintenance, and repair of electrical materials, devices, appliance, electrical installation, and systems for the purpose of preventing injury to persons or damage to property and other equipment. This type of business shall constitute the firm's principal source of revenue. Equipment installation and/or services normally performed by manufacturers, contractors, consulting firms, producers, suppliers, vendors or installer shall constitute less than twenty-five percent (25%) of total revenue.

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- The testing firm shall meet federal OSHA criteria for Accreditation of testing laboratories, Title 29, PARTS 1907, 1910, and 1936.
- They shall be engaged in such practice for a minimum of two (2) years and must have a minimum of one (1) registered professional electrical engineer, licensed in the State of Maryland who has been regularly engaged in over 600 volt acceptance testing for a periods of not less than five (5) years and shall be responsible for all phases of testing and maintaining electrical power systems including short circuit analysis, protection coordination studies, and the evaluation of test and maintenance data. The engineer shall review and evaluate all results and issue a certified test report.
 - Any company with fewer than twelve (12) test technicians may meet the professional Engineer requirement by contracting with a State of Maryland registered Professional Engineer for review of all short circuit studies, overcurrent coordination studies, and other engineering reports, who meets the previously listed criteria.
 - Any company which employs twelve (12) or more test technicians for twelve (12) consecutive months must employ a full time State of Maryland registered Professional Engineer who meets the above criteria.
- The testing firm must have in their employee a minimum of two (2) two-person test teams who are employed full time by the firm for testing services.
 - The members of the testing teams shall be currently certified by the International Electrical Testing Association (NETA) in Electrical Power Distribution System Testing, or certified as an Engineering Technician in Electrical Testing Engineering Technology by the National Institute for Certification in Engineering Technologies (NICET).
- They must agree to perform all work according to the guidelines of the approved testing standards for equipment of their class and type. However, job specifications shall take precedence over approved testing standards for equipment of their class and type guidelines.
- They shall be corporately and financially independent testing organizations which can function as unbiased testing authorities, professionally independent of the manufacturers, contractors, counseling firms, producers, suppliers, vendors or installer of equipment or systems of a type evaluated by the design organization. such a testing organization or laboratory is defined as follows:
 - The testing organization or laboratory is legally constituted to perform testing and is independent of manufacturers, contractors, consulting firms, producers, suppliers, vendors and installers. "Independent" as used herein shall be defined as an organization or laboratory which meets all of the following criteria:
 - Such individual group, organization or laboratory shall be free of common ownership or control of manufacturers, contractors, consulting firms, producers, suppliers, vendors, or installers of equipment. As used herein, the following terms shall have the following means:
 - To own means to own, control or influence a majority of the voting rights in the testing organization or laboratory.
 - To control means to be able to formulate, determine, or veto basic business policy decisions of the testing organization or laboratory. It is not necessary for another company to own the testing organization or laboratory to control it; it may exercise control through use of dominant minority voting rights, proxy voting, contractual arrangements or otherwise.
 - A manufacturer means an individual, group or organization whose primary business is to design or assemble, or cause to be assembled, products which would customarily be tested and evaluated for conforming to the manufacturer's specified performance criteria by a member of the International Electrical Testing Association or distribution of electrical power.
 - A contractor means an individual, group or organization whose primary business is the construction and/or installation of electrical power distribution equipment, systems or facilities.

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- A consulting firm means an individual, group or organization whose primary business is the concept, design, supervision, and/or management of projects that include electrical power distribution equipment, systems or facilities.
- It has no managerial affiliation with manufacturers, contractors, consulting firms, producers, suppliers, vendors or installers.
- It has sufficient breadth of interest or activity so that the loss or award of a specific contract to determine the compliance of a product with the applicable test standard would not be a substantial factor in the financial well-being of the organization or laboratory
- The employment security status of the personnel of the organization or laboratory is free of influence or control of manufacturers, suppliers, vendors, and installers.
- The organization of laboratory is not engaged in the promotion of the product.
- The testing organization or laboratory shall have a minimum of four (4) or twenty-five percent (25%) of their field testing personnel (whichever is greater) approved as NETA Certified Test Technicians or NICET Certified.

3. Safety And Precautions

- No work involving reaching into or dismantling of equipment, work in the immediate vicinity of exposed electrical connections, or work involving the handling of hazardous materials shall be performed by any employee of the test agency except in the immediate presence of another employee of the test agency who is capable of rendering assistance in case of an emergency.
- It is the intent of this contract that all test procedures shall be provided by a two-person team of the testing agency.

4. Local Conditions Covering Work

- The testing firm shall cooperate with those in authority on the premises in bringing, storing, or removal of all materials and equipment, to observe all rules and regulations in force on the premises, avoid unnecessary dust or accumulated debris, or the undue interference with the convenience, sanitation or routine of the University of Maryland, and to prevent the loss of, or damage to the property of the University of Maryland and/or its employees.
- The testing firm shall repair any and all damage he/she may cause to the building or property, to the full satisfaction of the staff of the UMCP/FM Department.
- Special precautions shall be exercised in accordance with the regulations of the particular institution when testing at some hospital centers.

5. Response Time

- The testing agency shall respond to routine test requests by the Contractor or the University of Maryland within 72 hours of request.
- Response time for location/identification of equipment failures shall be within three (3) hours of receipt of request.

6. Technical Standards and Library

- The testing procedures to be performed under this contract shall be in accordance with the latest applicable requirements of ANSI, ASTM, IEEE, ICEA, NFPA, OSHA, EPA, NETA, and the Doble Engineering Company. The testing agency shall maintain in-house the latest copies of these standards, codes, and recommended practices.
 - In particular, copies of standards and codes pertaining to the following electrical equipment and testing practices must be available in-house for ready reference upon demand:
 - Power cables of all types and of all distribution voltage ratings.
 - Medium voltage switchgear of all types.
 - Medium voltage circuit breakers and switches of all types.
 - Dry-type and liquid-filled power and distribution transformers.

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- Protective relaying and protection system requirements.
 - Current transformer and potential transformers.
 - Voltage regulators.
 - Surge arresters and capacitors.
 - Metering apparatus.
 - Motors.
 - Generators and Motor Generator sets.
 - Grounding systems.
- The testing company must have in its in-house technical library the following reference electrical manuals of the latest edition:
 - OSHA CFR 29
 - IEEE Color Book Series
 - Electrical Engineering Handbook
 - Applies Protective Relaying Handbook
 - NETA Acceptance Testing Specifications
 - Electrician's and Technician's Handbooks
 - NFPA-70E
 - ANSI-C2
 - ANSI-C39

Furthermore, reference library of various electrical equipment manufacturer's technical pamphlets or manuals for the variety of electrical equipment commonly in use must be maintained in-house. The manuals and reference technical data must be published by the manufacturers of switchgear, circuit breakers, transformers, protective relays, cables, bus ducts, motors, metering and other power and control equipment being tested regularly.

7. University Of Maryland Rights of Inspection And Test

The University of Maryland reserves the right to make or cause to be made such inspections and tests as deemed advisable to ascertain that the requirements of these specifications are being fulfilled. Should it be found that the standards herein specified are not being satisfactorily maintained, the University of Maryland may, by written notice to the Contractor, terminate this testing agency services. In such event, the University of Maryland may take over the work and prosecute it to completion, by contract or otherwise, and the contractor and his sureties shall be liable to the University of Maryland for any additional costs occasioned by the University of Maryland.

8. Testing and Inspection Procedures

- Prior to the energization of any new and/or relocated high voltage apparatus (above 600 volts) such as cables, transformers, and switchgear, the following field inspections and tests shall be performed. It shall be the responsibility of the electrical contractor doing the construction to advise and coordinate the test procedures including cable preparation with the testing agency.
- In Power Company service entrance applications, unless otherwise required by the Power Company, it shall be the responsibility of other than the testing agency to deliver draw-out elements of overcurrent relays to the Power Company's Laboratory for inspecting, testing, and setting prior to the equipment being placed in service.
- The scope of inspection and testing services for medium voltage electrical equipment includes but is not limited to the following:
 - Switchgear and switchboard assemblies
 - Transformers
 - Dry-Type
 - Liquid Filled

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- Small Dry-Type
 - Cables - Medium Voltage
 - Metal Enclosed Bus
 - Air Switches
 - Medium Voltage - Metal Enclosed
 - Medium Voltage - Open
 - Circuit Breakers - Medium Voltage
 - Air Filled
 - Oil Filled
 - Vacuum
 - Protective Relays
 - Instrument Transformer
 - Metering and Instrumentation
 - Grounding System
 - Motor Control - Medium Voltage
 - Surge Arresters - Medium Voltage
 - Capacitors
 - Automatic Circuit Reclosers - Medium Voltage - Oil and Vacuum
 - Automatic Line Sectionalizers - Medium Voltage - Oil
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- The testing scope and procedures for those items noted in paragraph 10C above shall be in accordance with Section 7 of the latest edition of NETA Acceptance Testing Specifications for electrical Power Distribution Equipment and Systems. Optional test procedures noted in Section 7 are not required to be accomplished except as follows:
 - Section 7.3.2.2. - Cable insulation resistance testing utilizing a megohm-meter shall be provided.
 - Section 7 of the latest NETA Acceptance Testing specifications for Electrical Power Distribution Equipment and Systems is made inclusive of this contract by reference.

9. Test Equipment and Test Equipment Calibration

- All test equipment required to price the services outlined in this guideline section shall be in the testing agency's inventory or shall be procured by the testing agency, if required, at no additional cost to the University of Maryland.
- The testing firm shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.
 - The accuracy shall be directly traceable to the National Institute of Standards and Technology.

10. PCB Analysis Unit Prices

- Upon request by staff engineers of the Department of Capital Projects, the testing firm shall obtain the following suspected PCB contaminates, analyze same for degree of contamination, and report the results.
- These services shall be billed at the contractual hourly rate for labor plus the contractual unit price for the PCB laboratory analysis noted in the Bid Form.
- All testing shall be in accordance with EPA prescribed methods.
 - Provide unit price for laboratory analysis for PCB contamination of a suspected oil sample.
 - Provide a unit price for a wipe sample of suspected contaminated surfaces.
 - Provide a unit price for concrete core samples. Core samples shall be one (1) inch diameter by three (3) inches deep.
 - The samples shall be obtained with a diamond bit and water coolant system. The core samples shall be pulverized and dried for a 24 hour period. The PCB shall then be extracted from each sample for a period of two (2) hours using EPA recommended techniques. The analysis is completed by injection into a gas chromatographic system with subsequent computation and report in PPM.

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- Though there are no present EPA specifications or standards for these criteria, laboratory analysis shows a 1:2 extraction ratio for this process.
- The holes shall be patched with Super Por-Rok, or approved equal, non- shrink grout.

11. Demand Visits

- In addition to the acceptance testing of medium voltage electrical equipment the testing agency shall also provide fault identification services for cable, transformer, switchgear, etc., failures on demand.
- Additional services such as load surveys and device testing for over and under 600 volt applications may be required.

12. Test Results

- All test data shall be recorded on standard National Electrical Testing Association (NETA) forms or forms developed by a manufacturer for use with specific test equipment and approved by the University of Maryland.
- All test results shall be typewritten when submitted in their final forms and shall include the assigned University of Maryland project number, job name and location.
- Under "Remarks" Column, an analysis of the test data shall be given indicating whether data recorded is or is not within accepted limits.
- Normally five (5) copies of final report shall be submitted with copies going to each of the following:
 - Department of Capital Projects (2 copies).
 - Consulting Engineer responsible for the particular project (1 copy).
 - In Power Company service entrance application, all test results and applicable field inspection reports shall be forwarded to the applicable Power Company (1 copy).

Test result reports shall be submitted with copies as noted within five (5) working days of the date of the test.

Immediately upon the completion of the testing of each high voltage system component (cables, transformers, switches, etc.), the testing agency technician shall provide written certification to the contractor and University of Maryland that the tested component is or is not suitable to be energized. This document shall be the Contractor's authorization to/or not to energize the equipment.

The above noted document shall be on a standard NETA form or approved substitution.

- All test results shall be certified by an electrical engineer registered in the State of Maryland. Each test report shall bear the signature and seal of the professional engineer who shall certify the data and conclusions presented therein. The stamp and seal shall be affixed to the first page of the body of the Report, not a cover or title sheet.

13. EST Firm's Liability Insurance

- **Responsibility for Damage Claims**
 - The testing firm shall indemnify and hold harmless and defend the University of Maryland and all its representatives from all suites, actions, or claims of any character brought on account of any injuries or damages sustained by any person or property including State property and State employees, agents or representatives in consequence of any work performed under this testing contract, either by the testing firm or any Sub-Contractor, or their employees, agents, or representatives.
- **Liability Insurance**
 - The testing firm and/or any Sub-Contractor shall maintain such insurance as will protect him/her from claim under Workmen's Compensation Acts, by coverage with Insurance Companies acceptable to the State Insurance Commissioner for damages which may arise, from operations under this

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testing contract, whether such operations be by himself/herself or by any sub-contractor or anyone directly or indirectly employed by the testing firm.

- He/she shall protect himself/herself and the state from any other claims.
- The limits for Bodily Injury Liability shall not be less than \$500,000/\$1,000,000; that is, \$500,000 is the limit for injury per occurrence and \$1,000,000 in the aggregate. The minimum limit for Property Damage Liability shall be \$500,000 per occurrence and \$1,000,000 aggregate.
- The above policies for Bodily Injury and Property Damage Liability Insurance shall be so written as to include Contingent Bodily Injury against claims from the operations of the Sub-Contractors.
- Certificates of the testing firm's insurance containing evidence of the Hold Harmless Clause protecting the University of Maryland shall be filed with the Department of Architecture, Engineering & construction and shall be subject to their approval for adequacy of protection.

14. Charges

- The charges for this testing contract shall be submitted on a monthly basis and shall be payable by the construction contractor on a monthly basis. Invoices shall be separate, by project identification.
- The hourly rate quoted for a two-person testing crew per hour shall include charge for administrative expenses, overhead expenses, vehicle mileage and profits.
 - The maximum allowable round trip travel time for any testing procedure anywhere in the state, shall be five (5) hours.
- Site visits by the testing company shall be certified by either the on-job electrical contractor's foreman or by a responsible staff member of the using agency. This certification, on an approved form, shall be submitted with each job invoice and shall state the number of hours at the job site, travel time, and the names of the individuals doing the work.