SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 SAFETY REQUIREMENTS

Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Electrical Calibration and testing and the Hot Springs and Fort Meade campus as required by drawings and specifications.

B. Visits to the site by Bidders may be made only by appointment with the Medical Center Engineering Officer.

C. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.

1.3 STATEMENT OF BID ITEM(S)

A. ITEM I, **This project shall consist of required testing & calibration of existing electrical systems for Hot Springs and Fort Meade as described in project drawings and specifications. The following tests shall be required:**

Testing of switchgear and switchboard assemblies for physical and electrical conditions, resistance tests of bus connections, testing of interlocks, ground resistance tests, insulation tests and other tests as required in specifications. Project also consists of testing of transformers, low voltage circuit breakers, medium voltage circuit breakers, protective relays and other devices as required by drawings and specifications.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.

2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor’s employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.

2. Before starting work the General Contractor shall give one week’s notice to the Contracting Officer so that security can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer.

4. VA reserves the right to close down or shut down the project site and order General Contractor’s employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Document Control:

1. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.

2. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

D. Motor Vehicle Restrictions

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.

2. A limited number of (2 to 5) permits shall be issued for General Contractor and its employees for parking in designated areas only.

1.6 OPERATIONS AND STORAGE AREAS

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

D. Working space and space available for storing materials shall be as determined by the Resident Engineer COR.

E. Workmen are subject to rules of Medical Center applicable to their conduct.

F. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR where required by limited working space.

1. Do not store materials and equipment in other than assigned areas.

G. Phasing:

The Medical Center must maintain its operation 24 hours a day 7 days a week. Any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. All work requiring outages shall be required to be performed after normal working hours and/or on weekends. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks.

To insure such executions, Contractor shall furnish the COR with a schedule of approximate dates on which the Contractor intends to accomplish work associated with each power outage. In addition, Contractor shall notify the COR two weeks in advance of each required outage. Arrange such phasing dates to insure accomplishment of this work in successive phases mutually agreeable to COR and Contractor.

H.Utilities Services: Schedule all electrical outages with COTR.

1.7 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

1.8 TEMPORARY TOILETS

A. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.9 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract.

B. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Use of open salamanders or any temporary heating devices which may be fire hazards or may smoke and damage finished work, will not be permitted.

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SECTION 01 35 26
SAFETY REQUIREMENTS

1.1 APPLICABLE PUBLICATIONS:

A. Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

B. National Fire Protection Association (NFPA):

10-2013.....Standard for Portable Fire Extinguishers

30-2012.....Flammable and Combustible Liquids Code

51B-2014.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

70-2014.....National Electrical Code

70B-2013.....Recommended Practice for Electrical Equipment Maintenance

70E-2015 .....Standard for Electrical Safety in the Workplace

99-2012.....Health Care Facilities Code

241-2013.....Standard for Safeguarding Construction, Alteration, and Demolition Operations

C. The Joint Commission (TJC)

TJC Manual .....Comprehensive Accreditation and Certification Manual

D. U.S. Occupational Safety and Health Administration (OSHA):

29 CFR 1904 .....Reporting and Recording Injuries & Illnesses

29 CFR 1910 .....Safety and Health Regulations for General Industry

29 CFR 1926 .....Safety and Health Regulations for Construction Industry

CPL 2-0.124.....Multi-Employer Citation Policy

1.2 DEFINITIONS:

A. OSHA “Competent Person” (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

1.3 TRAINING:

A. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.

B. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented “repeat” deficiencies in the execution of safety requirements will require retaking the requisite formal course.

C. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.

D. Submit training records associated with the above training requirements to the Project Manager for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 [__] calendar days prior to the date of the preconstruction conference for acceptance. Also provide:

The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements must be attached.;

No work shall be performed unless a designated competent person is present on the job site.

1.4 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work will be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.

2. Verification of the absence of voltage after de-energization and lockout/tagout is considered “energized electrical work” (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.

3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Resident Engineer.

A. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted).

B. Ground-fault circuit interrupters. GFCI protection shall be provided where an employee is operating or using cord- and plug-connected tools related to construction activity supplied by 125-volt, 15-, 20-, or 30-ampere circuits. Where employees operate or use equipment supplied by greater than 125-volt, 15-, 20-, or 30- ampere circuits, GFCI protection or an assured equipment grounding conductor program shall be implemented in accordance with NFPA 70E - 2015, Chapter 1, Article 110.4(C)(2).

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SECTION 16001
QUALIFICATIONS
FOR
ELECTRICAL SWITCHGEAR AND DISTRIBUTION
MAINTENANCE TESTING SERVICE

1.1 GENERAL

A. The contractor shall be a corporately independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers and installers of equipment or systems evaluated by the testing firm.

B. The contractor shall be regularly engaged in the testing of electrical equipment devices, installations and systems.

C. The contractor shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or be a Full member company of the International Electrical Testing Association.

1.2 FIELD SERVICE REQUIREMENTS

A. The work under this contract shall be performed under the supervision of a Registered professional Engineer. The Registered Professional Engineer shall be on site initially to discuss with the VA Resident Engineer the procedures used to test, survey, report and service the equipment required to be serviced under this contract. The Registered Professional Engineer shall supervise the services and personally review the final report and discuss with the VA Resident Engineer the results of the services, any recommendations, future actions and professional opinions which are contained in the report.

B. Field service work shall be performed directly by field service engineers who have successfully demonstrated their knowledge and experience in the field of Electrical Power Distribution Systems Testing. The field service engineer shall be capable of 1.) testing assessing, evaluation, servicing, and reconditioning components; 2.) assuring that the equipment on which work has been performed is safe, reliable and acceptable for its intended purpose; and 3.) identifying defective equipment, and potential safety problems, environmental hazards, or code violations.

C. The lead Field Service Engineer/Technician must have minimum qualifications as follows:

1. Current certification by the National Institute for Certification in Engineering Technologies (NICET) or the National Electrical Testing Association (NETA), plus at least five (5) years experience in electrical switchgear and power distribution systems testing; or

2. Persons who, by their education, training, and specialized experience can qualify for certification buy who have not yet applied or taken the certification exams. These people must submit three (3) references on projects of similar size and complexity and demonstrate that they have the required specialized knowledge and five (5) years experienced in electrical switchgear and power distribution systems testing; or

3. Persons with higher qualifications, such as a BS degree in Engineering, provided that they submit three (3) references on projects of similar size and complexity and demonstrate that they have the acquired specialized knowledge and five (5) years experience in electrical switchgear and power distribution systems testing.

1.3 SUBMITTALS

The contractor shall submit proof of the above qualifications for lead Field Service Engineer/Technician prior to award. Failure to do so shall constitute grounds for rejecting the bid. After contract award, similar data for all certified technicians who will be assigned to work on the project must also be submitted and approved before starting work on the contract.

SECTION 16052
ELECTRICAL SYSTEM TESTING AND CALIBRATION

1.1 GENERAL

A. The Contractor shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections required by this section.

B. It is the intent of these tests to assure that all electrical equipment is operational within industry and manufacturer's tolerance.

C. Upon completion of the tests and inspections noted in these specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the name of the testing contractor responsible for the service performed.

D. The tests and inspections shall determine suitability for continued reliable operation.

E. Any system, material, or workmanship that is found defective on the basis of maintenance tests shall be reported in writing to the Resident Engineer.

F. The Testing Contractor shall have available sufficient protective barriers and warning signs to conduct specified tests safely.

1.2 SUBMITTALS

A. Test Report:

1. The test report shall include the following:

a. Summary project

b. Description of equipment tested

c. Description of test

d. Test results

e. Conclusions and recommendations

f. Appendix, including appropriate test forms

g. List of test equipment used

2. Furnish three (3) copies of the completed bound report to the VA no later than 30 days after testing of the devices is completed. Final acceptance will be withheld until the reports are submitted and explained to the VA.

1.3 QUALIFICATIONS

See Section 16001.

1.4 REQUIREMENTS

A. The equipment to be serviced includes:

HOT SPRINGS SITE

1. The 12.5 KV metal-clad switchgear in Building 64 consisting of five (45) Westinghouse DHP air circuit breakers, lightning arrestors, three phase capacitor bank, sixteen (16) overcurrent relays, and miscellaneous accessories.

2. Two primary system underground feeders are included..

3. The 12.5 KV distribution system consisting of sixteen (16) padmount transformers to be included:

Title	Dual Source	Serves
TF-10A	Yes	Dom Complex
TF-10B	Yes	Dom Complex
TF-12XR	Yes	Hospital Radiology, CT
TF-12A	Yes	Hospital
TF-12B	Yes	Hospital
TF-17	Yes	Building 17
TF-18	Yes	Boiler Plant
TF-20	Yes	Apartments
TF-23	Yes	Museum
TF-24	Yes	Quarters
TF-27	Yes	Quarters
TF-28	Yes	Quarters
TF-43	Yes	Laundry
TF-53	Yes	Dietetics
TF-65	Yes	Computer Building
TF-66	Yes	Fire Station

4. The secondary service switchboards in the following buildings:

Buildings	Voltage

12 120/208

12 480 (radiology)

53 120/208

18 120/208

10 120/208

65 120/208

5. All distribution panelboards, and motor control centers. Panelboards rated 225 amp or smaller are excluded.

6. The emergency power system consisting of:

Location	Device
Building 12 (Hospital)	Engine – Generator
Building 12	Transfer sw – life safety
Building 12	Transfer sw – critical
Building 12	Transfer sw – equipment
Building 10 (Dom)	Engine – generator
Building 10	Transfer sw
Building 18 (Boiler Pit)	Transfer sw
Building 18	Engine – generator

FORT MEADE SITE:

1. The 12.4 KV metal-clad switchgear in Bldg. 154 consisting of eight (8) Cutler Hammer medium voltage circuit breakers controlled by type SEL 751A (x5) and SEL 351A (x2).

2. The secondary service switchboards in the following buildings:

   a. All distribution panelboards and motor control centers. Panelboards rate 225 amp or smaller are excluded.

   b. All dry transformers

Building	Voltage
113	120/208
113-CLINIC	277/480

145	120/208
146	120/208
148	277/480
147	120/208
137	120/208
165 (MRI)	277/480

3. The emergency power system consisting of:

Location	Device
Bldg 113 (Hospital)	Engine – generator
Bldg 113	Transfer sw – life safety
Bldg 113	Transfer sw – critical
Bldg 113	Transfer sw - equipment
Bldg 113	Transfer sw – Eq2 Chiller
Bldg 113	Transfer sw – DC Biomed
Bldg 145 (Hospital)	Engine – generator
Bldg. 145	Transfer sw – EM
Bldg. 145	Transfer sw – MCC
Bldg. 145	Transfer sw – ELEV.
Bldg. 145	Transfer sw – Panel M
Bldg 148 (NHCU)	Engine – generator
Bldg 148	Transfer sw
Bldg 137 *Boiler Plant)	Engine – generator
Bldg 137	Transfer – sw

4. The 12.4 KV station generator at Bldg. 155 is excluded.

1.5 APPLICABLE CODES, STANDARDS AND REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. Except where a specific data is given the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. The publications are referenced in the text by the basic designation only.

1. National Electrical Manufacturer's Association – NEMA.

2. American Society for Testing and Materials – ASTM.

D877…….
D923…….
D971…….
D974…….
D1500…….
D1524…….
D1816…….
D2285…….
D3612…….

3. Institute of Electrical and Electronic Engineers – IEEE

4. International Electrical Testing Association - NETA Maintenance Testing Specifications.

5. American National Standards Institute – ANSI.

6. State and local codes and ordinances.

7. Insulated Cable Engineers Association – ICEA

8. Association of Edison Illuminating companies – AEIC.

9. Occupational Safety and Health Administration – OSHA.

10. National Fire Protection Association – NFPA.

70…..National Electrical Code (NEC)

1.6 TEST EQUIPMENT

A. All test equipment shall be in good mechanical and electrical conditions.

B. Split-core current transformers and clamp-on tong type ammeters require careful consideration in regard to position of the conductor within the core, and clear, tight fit of the core pole faces.

C. Selection of metering equipment should be based on a knowledge of the waveform of the variable being measured. Modern digital Multi-Mate's may be average or root mean squared (rms.) sensing and may include or exclude the dc component. When the variable contains harmonics or dc offset and, in general, any deviation from a pure sine wave, average sensing, rms scaled meters may be misleading.

D. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.

E. Accuracy of metering in test equipment shall be appropriate for the test being performed but no in excess of 2% of the scale being used.

F. Waveshape and frequency of test equipment output waveforms should be appropriate for the test and tested equipment.

G. The testing firm shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy.

1.7 POWER OUTAGES

A. It is the contractor's responsibility to make all tests at shutdown periods previously requested and granted by the Resident Engineer. Any interruption of the normal or emergency power to any building or section thereof at the Medical Center shall not be allowed unless prior approval has been obtained from the Resident Engineer. Contractor must submit a schedule (days, dates and hours) of when shutdowns in each building will be required. The schedule may be revised by Resident Engineer before approval is granted.

B. Special consideration shall be exercised in assuring power outages occur at a time when the power demand is at its lowest level. Contractor shall submit request for power outages in writing ten (10) workdays before desired shutdown to allow for adequate engineering coordination and scheduling. All scheduling shall be done at the convenience of the Medical Center.

C. The 12.4 KV feeder breakers at Fort Meade may be removed from service only during this non-cooling season (September through May).

D. All costs for overtime work performed by the Contractor due to power outage schedule constraints imposed by the VA shall be included in the Contractor's original bid.

1.8 SWITCHGEAR AND SWITCHBOARD ASSEMBLIES PROCEDURES

A. Visual and Mechanical Inspection.

1. Inspect for physical, electrical, and mechanical condition.

2. Compare equipment nameplate information with latest one line diagram when available and report discrepancies.

3. Check for proper anchorage, required area clearances, physical damage, and proper alignment.

4. Inspect all bus connections for high resistance. Use low resistance ohmmeter, or check tightness of bolted bus joints by calibrated/torque wrench method. In lieu of above torquing, perform infrared survey.

5. Test all electrical and mechanical interlock systems for proper operation and sequencing.

a. Closure attempt shall be made on locked open devices. Opening attempt shall be made on locked closed devices.

b. Key exchange shall be made with devices operated in off-normal positions.

6. Clean switchgear.

7. Inspect accessible insulators for evidence of physical damage or contaminated surfaces.

8. Verify proper barrier and shutter installation and operation.

9. Lubrications.

10. Exercise all active components.

11. Inspect all mechanical indicating devices for proper operation.

B. Electrical Tests

1. Perform ground resistance tests in accordance with Section 7.13.

2. Perform insulation resistance tests on each bus section, phase-to-phase and phase-to-ground for one (1) minute. Test voltages shall be in accordance with Table A2.

3. Perform control wiring performance test. Use the elementary diagrams of the switchgear to identify each remote control and protective device. Conduct tests to verify satisfactory performance of each control feature.

4. Control Power Transformer – Dry Type.

a. Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general conditions.

b. Verify that primary and secondary fuse ratings or circuit breakers match drawings.

c. Perform insulation resistance test. Measurements shall be made from winding-to-winding and windings-to-ground. Test voltages and minimum resistances shall be in accordance with Table A3. Results to be temperature corrected in accordance with Table A5.

C. Test Values

1. Bolt torque levels shall be in accordance with Table A1, unless otherwise specified by manufacturer.

2. Insulation resistance test shall be performed in accordance with Table A2. Values of insulation resistance less than this table or manufacturer's minimum should be investigated. Test results are evaluated on a go, no-go basis by slowly raising the test voltage to the required value. The final test voltage shall be applied for one (1) minute.

1.9 TRANSFORMERS: DRY-TYPE, AIR COOLED, 600 VOLT AND BELOW

A. Visual and Mechanical Inspection

1. Inspect for physical damage, cracked insulators, tightness of connections, defective wiring, and general mechanical and electrical conditions.

2. Check tightness of accessible bolted electrical joints in accordance with Table A1.

3. Make a close examination for shipping brackets or fixtures that may not have been removed during original installation. Ensure resilient mounts are free.

4. Verify proper core grounding.

5. Verify roper equipment grounding.

6. Thoroughly clean unit.

1.10 TRANSFORMERS-LIQUID FILLED PADMOUNT 15KV CLASS

A. Visual and mechanical inspection

1. Inspect for physical damage, cracked insulators, tightness of connections, defective wiring, and general mechanical and electrical conditions.

2. Verify proper auxiliary device operation.

3. Check tightness of accessible bolted electrical joints in accordance with Table A1.

4. Verify proper liquid level in all tanks and bushings.

5. Verify proper equipment grounding.

B. Electrical Tests

1. Sample insulating liquid in accordance with ASTM D923. Sample shall be laboratory tested for:

a. Dielectric breakdown voltage: ASTM D877 or ASTM D1816.

b. Acid neutralization number: ASTM D974.

c. Interfacial tension: ASTM D971 or ASTM D2285.

d. Color: ASTM D1500.

e. Visual Condition: ASTM D1524.

f. Perform dissolved gas analysis (DGA) in accordance with ANSI/IEEE C57.104 or ASTM D3612.

C. Load Tap Changer Inspection

Transformers of 500 kilovolt amps (KVA) or larger shall have the load tap changer inspected for tight connections, proper contact pressures and signs of burning and pitting.

1.11 CABLES – MEDIUM VOLTAGE – 15KV CLASS

A. Visual and Mechanical Inspection.

1. Inspect exposed sections for physical damage.

2. Inspect for shield grounding, cable support, and termination.

3. Inspect fireproofing in common cable areas.

1.12 CIRCUIT BREAKERS – LOW VOLTAGE – INSULATED CASE

A. Visual and Mechanical Inspection.

1. Check circuit breaker for proper mounting.

2. Operate circuit breaker to ensure smooth operation.

3. Inspect case for cracks or other defects.

4. Check tightness of connections with calibrated torque wrench. Refer to manufacturer's instructions or Table A1 for proper torque levels. In lieu of this test, perform infrared survey in accordance with Section 9.

5. Check internals on unsealed units.

B. Electrical Tests

1. Perform a contact resistance test.

2. Perform an insulation resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.

1.13 CIRCUIT BREAKERS – LOW VOLTAGE – POWER

A. Visual and Mechanical Inspection

1. Inspect for physical damage.

2. Perform mechanical operation test.

3. Check cell fit and element alignment.

4. Check tightness of connections with calibrated torque wrench. Refer to manufacturer's instructions or Table A1 for proper torque levels.

5. Check arc chutes for damage.

6. Clean entire circuit breaker using approved methods and materials.

7. Lubricate as required.

B. Electrical Tests

1. Activate auxiliary protective devices, such as ground fault or under voltage relays, to ensure operation of shunt trip devices. Check the operation of electrically operated breakers in their cubicle.

2. Check charging mechanism.

1.14 CIRCUIT BREAKERS – MEDIUM VOLTAGE – 15KV CLASS – AIR

A. Visual and Mechanical Inspection

1. Inspect for physical damage, cleanliness, and adequate lubrication.

2. Inspect anchorage, alignment, and grounding.

3. Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism.

4. Check tightness of bolted bus joints by calibrated torque wrench method. Refer to manufacturer's instructions or Table A1 for proper torque levels.

5. Check cell fit and element alignment.

6. Check racking mechanism.

7. Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct.

8. Ensure that all maintenance devices are available for servicing and operating the breaker.

9. Lubricate all moving current carrying parts.

10. Check for proper operation of the cubicle shutter.

11. Clean all bushings.

B. Electrical Tests

1. Measure contact resistance.

2. Measure insulation resistance pole-to-pole, pole-to-ground, and across open poles. Use a minimum test voltage of 2500 volts.

3. With breaker in the test position, make the following tests:

a. Trip and close breaker with the control switch.

b. Trip each breaker by operating manually each of its protective relays.

4. Perform power factor tests.

C. Test Values

1. Determine contact resistance in micro ohms. Investigate deviations of more than 50%.

2. Minimum insulation resistance should comply with Table 2.

3. Poser factor and arc chute watts loss should be compared with results from previous tests of similar breakers, or referred to manufacturer's published data.

1.15 PROTECTIVE RELAYS

A. Visual and Mechanical Inspection

1. Inspect relays for physical damage.

2. Inspect cover gasket, cover glass, presence of foreign material or moisture, condition of spiral spring, disc clearance, contacts, and case shorting contacts if present.

3. Check mechanically for freedom of movement, proper travel and alignment, and tightness of mounting hardware and tap plugs.

B. Electrical Tests

1. Perform the following tests on the nominal settings:

a. Pickup parameters on each operating element.

b. Perform timing test at two (2) points on time dial curve.

c. Pickup target and seal-in units.

d. Special tests as required to check operation of restrain, directional and other elements in accordance with manufacturer's instruction manual.

1.16 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection

1. Inspect for physical damage.

2. Verify proper connection of transformers with system requirements.

3. Verify tightness of all bolted connections and assure that adequate clearances exist between primary circuits to secondary circuit wiring.

4. Verify that all required ground and shorting connections provide good contact.

5. Test proper operation of transformer withdrawal mechanism (trip out) and grounding operation when applicable.

1.17 METERING AND INSTRUMENTATION

A. Visual and Mechanical Inspection

1. Examine all devices for broken parts and wire connection tightness.

1.18 GROUND FAULT SYSTEM (NEC 230-95)

A. Visual and Mechanical Inspection

1. Inspect for physical damage.

2. Inspect neutral main bonding connections to assure:

a. Zero sequence-sensing system in grounding.

b. Ground strap sensing systems are founded through sensing device.

c. Ground connection is made ahead of neutral disconnect link on zero sequence sensing systems.

d. Grounded conductor (neutral) is solidly grounded.

3. Manually operate monitor panels (if present) for:

a. Trip test.

b. No trip test.

c. Non-automatic reset.

4. Record proper operation and test sequence.

1.19 MEDIUM VOLTAGE SURGE PROTECTION DEVICES

A. Visual and Mechanical Inspection

1. Inspect for physical damage.

2. Inspect for proper mounting and adequate clearances.

3. Check tightness of connections by calibrated torque wrench method. Refer to manufacturer's instructions of Table A1 for proper torque levels.

4. Check ground lead on each device for individual attachment to ground bus or ground electrode.

5. Verify that stroke counter is properly mounted and electrically connected.

B. Electrical Tests

1. Perform insulation resistance tests from pole(s) to case for one *1) minute. Test voltage and minimum resistance shall be in accordance with manufacturer's instructions or Table A4.

2. Measure the capacitance of all pole-to-pole combinations and compare with manufacturer's published data.

3. Verify that internal discharge resistors are operating properly.

1.20 EMERGENCY SYSTEMS

A. Engine Generator – (Prime Mover is not addressed in this specification)

1. Visual and Mechanical Inspection.

a. Inspect for physical damage.

b. Inspect for proper anchorage and grounding.

2. Electrical and Mechanical Tests

a. Perform a dielectric absorption test on generator winding with respect to ground. Determine polarization index.

b. Test protective relay devices in accordance with applicable section of these specifications.

B. Automatic Transfer Switches

1. Visual and Mechanical Inspection

a. Inspect for physical damage.

b. Check switch to ensure positive interlocks between normal and alternate sources; mechanical and electrical.

2. Electrical Tests

a. Perform insulation resistance tests phase-to-phase and phase-to-phase with switch in both source positions, where possible.

b. Perform a contact resistance test or measure wmillivolt drop across all main contacts.

c. Verify settings and operation of control devices.

(1) Voltage and frequency sensing relays.

(2) All time delay relays.

(3) Engine start and shutdown relays.

d. Perform automatic transfer tests:

(1) Simulate loss of normal power.

(2) Return to normal power.

(3) Simulate loss of emergency power.

3. a. Normal voltage sensing relays.

b. Engine starts sequence.

c. Time delay upon transfer.

d. Alternate voltage – sensing relays.

e. Automatic transfer operation.

f. Interlocks and limit switch function.

g. Time delay and re-transfer upon normal power restoration.

h. Engine cool-down and shutdown feature.

4. Test Values.

a. Insulation resistance test voltages with minimum values to be in accordance with Table A4.

b. Determine contact resistance in micro ohms. Investigate any value exceeding 500 micro ohms and any values, which deviate from adjacent poles by more than fifty percent (50%).

1.21 Infra-Red Scanning/Thermographic Survey shall be performed on electrical equipment.

1. Use and infra-red scanning camera to detect hot spots in the Electrical Power Distribution System. Objective of this work is to detect any loose, broken, or corroded connections in the system. Problem connections shall be replaced with new connectors, and/or tightened with torque wrench to meet the equipment manufacturers' specifications.
2. Note that since this work item must be done while the electrical power distribution system is energized, appropriate safety precautions must be taken before, during and after scanning the system.