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ABSTRACT

The standard covers nonsupervisory work involved in installation, test, repair, and maintenance of electric power plant and/or overhead and underground primary electrical distribution systems. These jobs require knowledge and application of electrical principles, procedures, materials, and safety standards governing work on electrical systems above 550 volts. Two grade levels, WG-8 and WG-10, are differentiated in the description of job duties, skill and knowledge requirements, area of responsibility, the physical effort required, and the working conditions. Two typical work situations are described for the WG-10 level. (Author/AG)

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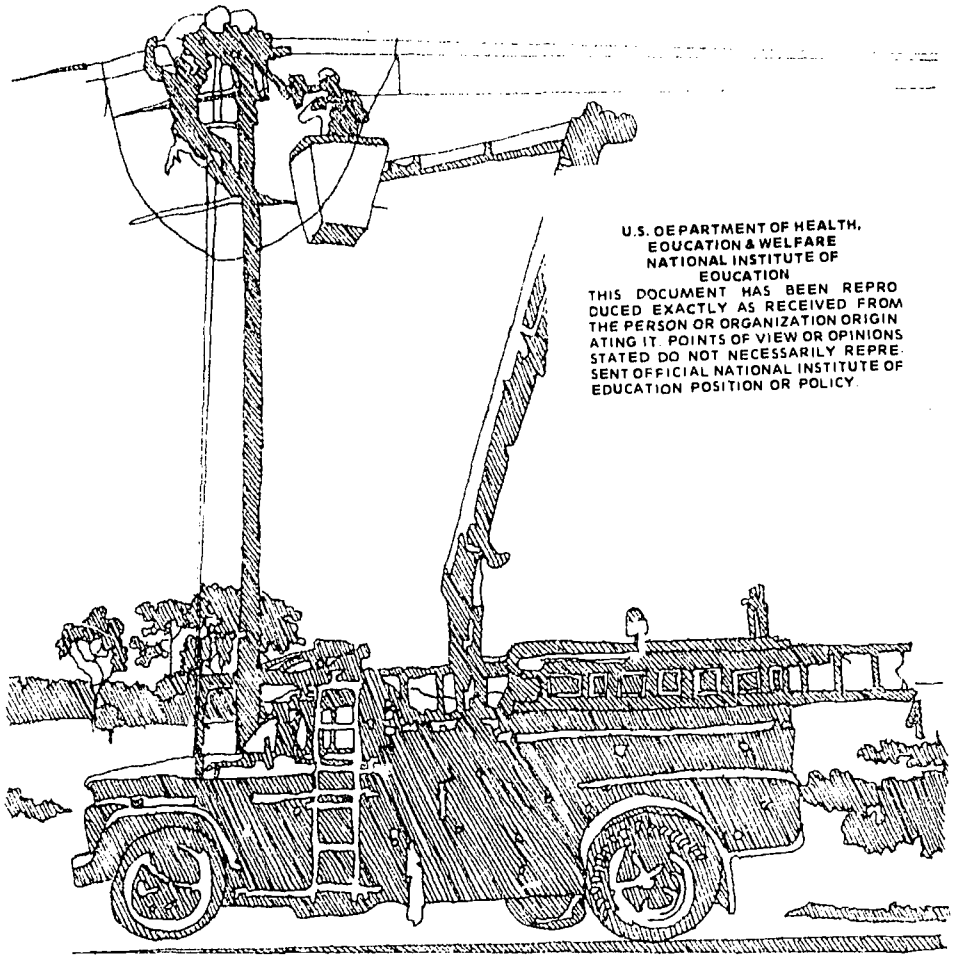
JOB GRADING STANDARD FOR

ELECTRICIAN (HIGH VOLTAGE) WG-2810



U.S. CIVIL SERVICE COMMISSION
BUREAU OF POLICIES AND STANDARDS

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WORK COVERED

This standard covers nonsupervisory work involved in installation, test, repair, and maintenance of electric power plant and/or overhead and underground primary electrical distribution systems. These jobs require knowledge and application of electrical principles, procedures, materials, and safety standards governing work on electrical systems above 550 volts.

WORK NOT COVERED

This standard does not cover work involved in:

—Installing, maintaining, and repairing electrical wiring systems, fixtures, controls, and equipment on board ships or in industrial, residential, or office buildings. (See Electrician, WG–2805.)

—Controlling the generation or distribution of electric power at power generating plants, power distribution centers, and substations. (See Electric Power Controller, WG–5407.)

TITLES

Jobs graded by this standard at WG–10 and above are to be titled *Electrician (High Voltage)*. Jobs graded by this standard below WG–10 (other than Helper and Intermediate jobs) are to be titled *Electrical Worker (High Voltage)*.

GRADE LEVELS

This standard describes two grade levels, WG–8 and WG–10. Two typical work situations are described for the WG–10 level. The standard does not describe all possible grades for this occupation. If jobs differ substantially from the level of skill, knowledge, and responsibility described in the typical jobs in this standard, they may be graded above or below the grades of these jobs based on the application of sound job-grading methods.

HELPER AND INTERMEDIATE JOBS

Jobs that are part of a planned program of training and development for advancement to a higher grade are graded by the U.S. Civil Service Commission's Job Grading Standards for Trades Helper and Intermediate Jobs. (WG–10 in this standard is to be used as the journeyman grade in applying the intermediate job-grading table.)

Duties: As a worker on an electrical team or line crew, the Electrical Worker (High Voltage) WG-8 does routine installation, maintenance, and repairs on electrical distribution systems or power plant equipment. As directed by a higher-grade employee, the electrical worker:

—Works on power cables, transformers, insulators, and control equipment such as switches and circuit breakers, in power plants or on distribution lines;
—Installs and connects transformers on hangers and platforms making hot taps and splicing on primary voltages;
—Installs proper insulators and materials;
—Installs underground cable and conduit, strings light and power wire on cross arms, makes electrical connections, and splices cable;
—Erects and replaces poles;
—Maintains various tools and equipment in good working condition;
—May operate crew truck and associated equipment. Uses hand tools of the trade.

Skill and Knowledge: The Electrical Worker (High Voltage) WG-8 must be familiar with high voltage electrical components and have knowledge of where and how wiring and controls are installed and operated. He must have:

—Ability to do common tasks of the trade such as pulling in cable using beckets, messengers, and fair leads; splicing cable using splicing sleeves, insulating tape, lead sleeves, and scotch cast or other resin sealing compound; or performing hot line work, removing or replacing taps, checking the phasing of circuits, etc., using hot sticks, phasing sticks, and bucket trucks or climbing gear;
—Knowledge of basic electrical theory such as Ohm's law and series and parallel circuits in order to understand and interpret instructions and assignments. Ability to use test equipment such as ohmmeters and continuity checkers to determine such things as high resistance connections or open circuits. Ability to work on hot high voltage electrical systems using safety equipment such as hot sticks, rubber blankets, and insulated gloves;
—Ability to diagnose commonly encountered problems such as locating defective switches or blown fuses;
—Ability to understand commonly used drawings and diagrams of distribution networks and equipment interconnections;

—Ability to work safely under hazardous conditions such as working in the presence of high voltage conductors when working aloft or when working in cramped quarters such as on underground lines or in powerplant switching banks.

Responsibility: The Electrical Worker (High Voltage) WG-8 receives detailed instructions from his supervisor or higher grade worker. Decisions made are covered by specific, well-established work methods and procedures. The supervisor or higher grade worker (normally the crew leader) is usually available for advice during work progress. Work is subject to review in progress and upon completion.

Physical Effort: The Electrical Worker (High Voltage) WG-8 performs moderately heavy lifting, pulling, and carrying of equipment and material. He climbs ladders and poles. He works in awkward and strained positions, sometimes for prolonged periods. Coordination of hands, eyes, legs, and body is needed to perform assignments safely in restricted space.

Working Conditions: The Electrical Worker (High Voltage) WG-8 works above ground, occasionally on poles, as well as below ground in manholes and vaults. He is exposed to danger from explosions of equipment and cables in manholes, as well as danger from high voltage electrical shock, burns from splicer's solder, broken bones, cuts, and bruises. He is exposed to heat and noise when working in powerplants, to extremes of weather when working outside, and to odors, and wet slippery surfaces in manholes.

WG-2810-10 **Electrician (High Voltage), WG-10** WG-2810-10

Duties: The Electrician (High Voltage) WG-10, installs, tests, repairs, and maintains generators, transformers, converters, regulators, switches, circuit breakers, recording instuments, control systems, and other circuit elements. He works in powerhouses and substations, and on underground and overhead high voltage primary distribution systems serving an activity or group of activities such as a military base or similar self-contained distribution system. The Electrician (High Voltage) WG-10:

—Dismantles, repairs, and assembles generators, synchronous motors, motor generators, and rotary converters. Installs, alters, and replaces generation and distribution equipment in powerplants, substations, transformer vaults, or distribution centers;

—Cleans, adjusts, and repairs electrical equipment such as air and oil circuit breakers and remotely controlled supervisory and telemetering equipment;

—Constructs and installs rigid conduits. Pulls in conductors, assembles bus bars, phases out and connects conductors. Splices cables and seals connections;

—Troubleshoots distribution circuits and generating and controlling equipment to locate and correct the causes of outages and improper operation. Makes emergency cutouts and substitutions of power lines and equipment, sometimes working on distribution systems when they are hot.

In addition, the Electrician (High Voltage) WG-10 may perform a variety of tasks such as repairing electrical auxiliary equipment in boiler and engine rooms, filtering and testing transformer oil, and checking condition of insulators, oil circuit breakers, and other equipment.

Skill and Knowledge: The Electrician (High Voltage) WG-10 applies comprehensive trade knowledge of electrical principles, elements, and systems operations such as:

—Ability to install, repair, and maintain commonly used electric power generating and distributing equipment. For example: Ability to true commutators and slip rings of rotary equipment while turning in their bearings, using dressing stones, undercutters, and grinders. Ability to replace and adjust mechanical contacts and tripping and time-delay intervals of circuit breakers and relays, using feeler gages, dressing tools, and timing devices. Ability to determine types and sizes of wire, conduits, trans-

formers, etc., and methods of installation and repair to assure proper and safe operation of distribution system, using knowledge of equipment capability, and of modifying factors such as local operating conditions.

—Knowledge of electrical theory such as power factor, transformers, series and parallel circuits, line loading, line losses, and dielectric or conductive properties of materials in order to calculate circuit values, determine when operating limitations of equipment are exceeded, etc. Ability to plan and carry through most operations in the installation or troubleshooting and repair of high-voltage generating, controlling and distributing systems, such as repairing switch gear, installing and hooking up transformers, locating defects in cables, or selecting materials to make installations or repairs. Ability to use instruments such as insulation megger or oscillator and tone detector to locate faults in underground cables, or to use phasing stick or phase rotation meter to check out rotation of cables before switching into a hot circuit.

—Ability to read and understand circuit diagrams of interconnections such as the generators, buses, switches and circuit breakers in a powerhouse or the feeders, substations, transformers, and interconnections of a primary distribution system, in order to diagnose problems in the electrical system.

—Ability to diagnose problems and determine corrective action for electric power equipment such as switch gear, transformer banks, and circuit breakers in powerhouses and substations; and underground and overhead power lines.

Responsibility: The Electrician (High Voltage) WG-10 performs all assigned tasks on his own responsibility according to instructions from the supervisor. He plans work sequences and selects tools and materials needed to complete assignments. His work is subject to spot check during progress and upon completion, for compliance with instructions. He determines the nature of the maintenance or repair needed. He is responsible for knowing and judging the effects that alterations will have on the total system and for insuring that lines and equipment function properly. He may be responsible for providing assistance to lower grade crew members.

Physical Effort: The Electrician (High Voltage) lifts, carries, and pulls parts of units, test equipment, and tools. He kneels, stoops, crouches, and stands for long periods of time. He uses coordination of eyes, hands, legs, and body in installing, repairing, or testing elec-

trical equipment in confined spaces such as manholes or enclosed switch gear, or in structures such as overhead bus and conduit assemblies or overhead distribution lines. He climbs ladders and poles.

Working Conditions: The Electrician (High Voltage) WG–10 works indoors and outdoors. He is exposed to heat and noise in power plants, to extremes of weather when outside, and to poor illumination, unpleasant odors, and wet, slippery surfaces in manholes. There is the possibility of burns from splicer's solder, broken bones, cuts and bruises when handling tools and equipment, strains from awkward positions, and injury by falls, explosions of equipment or cables, and high-voltage electric shock.

WG-2810-10 **Electrician (High Voltage), WG-10** WG-2810-10

Duties: The Electrician (High Voltage), WG-10, installs, modifies, connects, inspects, troubleshoots, and repairs overhead and underground primary electrical distribution lines serving an activity or group of activities such as a military base or similar self contained distribution system. He services lines, substations, transformers, insulators, lighting arresters, switches, fuses, ground connects and similiar equipment. The Electrician (High Voltage) WG-10:

—Troubleshoots cable systems to locate shorts, opens, grounds, crosses, electrolysis damage, capacitance imbalance, or cable breaks, using such common electrical test devices as voltmeter, ohmmeter, and megger;

—Strings wires and hoists conductors up to the cross arms. Pulls wires to proper tension or sag, based on space length, material and size of conductors, prevailing temperature, and loading district. Installs and pulls cable underground from source of feed through ducts;

—Splices wires by removing insulation, scraping clean, twisting together and soldering, or connecting conductors with mechanical connectors, splicing clamps and tape;

—Forms and seals various types of cable joints such as straight, bridge, cap sleeve, vertical, disc, or knuckle joints. Tapes conductors of lead covered cable and solders jumper wires to shielding or sleeve. Fits sleeve over joint section. Wipes the joint to the final shape and surface required, assuring that the solder seal will not be loosened by cable movement;

—Floats solder seams in split lead sleeves or sheath using acetylene torch or electrode soldering outfit. Bends and grounds underground cable to minimize electrolytic damage;

—Directs the roofing, cutting, gains and stepping of poles. Determines the diameter and depth of pole holes based on size of pole to be set and holding power of the soil. Directs the erection and raising of poles, and installation and replacement of cross arms;

—Checks condition of transformers, switches, and cable. Tests insulating oil of transformers and oil switches for breakdown and contamination. Checks transformer operating temperatures;

—Checks voltage at secondary terminals and make repairs to defective, loose, or corroded connections;

—Operates tripping mechanism of primary circuit breakers and performs needed repair and replacement work.

In addition, the Electrician (High Voltage) WG-10 may perform a variety of tasks such as: feels cable temperature in manholes; visually checks for cracks or breaks in walls of manhole or vault; pumps water from manholes, removes debris, and repairs ground bonds; checks ground wire connections and cable for cracks, breaks, and punctures.

Skill and Knowledge: The Electrician (High Voltage) WG-10 applies comprehensive trade knowledge of electrical principles, elements, and systems operations such as:

—Ability to work on all commonly used power distribution equipment. For example: Ability to replace and adjust mechanical contacts and tripping and time delay intervals of circuit breakers and relays using feeler gages, dressing tools, and timing devices. Ability to determine types and sizes of wire, conduit, transformers, etc., using knowledge of equipment capability and modifying factors such as local operating conditions;

—Knowledge of the complete primary distribution system of the activity including normal routing, parallel feeders, possible interconnections, and capacity of lines and equipment. Ability to make emergency hook-ups and restore power after outages;

—Knowledge of electrical theory such as power factor, transformers, series and parallel circuits, line loading, line losses and dielectric or conductive properties of materials in order to calculate circuit values, determine when operating limitations of equipment are exceeded, or recognize excessive current flow or other signs of improper operation;

—Ability to interpret wiring diagrams and apply appropriate techniques and methods of maintenance, repair, and testing;

—Ability to perform troubleshooting techniques on electrical distribution systems;

—Ability to plan, lay out, and complete installation, modification, and repair on high voltage controlling and distribution systems such as repairing switchgear, installing and hooking up transformers, and locating defects in cables. Ability to use insulation megger or oscillator and tone detector to locate faults in underground cables or use phase stick or phase rotation meter to check out rotation of cables before switching into a hot circuit;

—Knowledge of various equipment, types of wires, conduits, and other electrical supplies and devices, and the ability to integrate

them into electrical systems and equipment worked on to insure proper, and safe operation;
—Skill in the use of hand tools and a wide variety of test equipment.

Responsibility: Performs all assigned task on own responsibility according to instructions from the supervisor. Plans work sequences, selecting tools, and materials needed to complete assignments. Work is subject to spot check during progress and upon completion for compliance with instructions. Determines nature of maintenance or repair needed, and responsible for knowing and judging effects that alterations have on the total system, and insuring that lines and equipment function properly. May be responsible for providing assistance to lower grade crew members. Responsible for the use and safekeeping of tools, materials, and equipment.

Physical Effort: Moderately heavy physical effort is exerted as Electrician (High Voltage) WG-10 works aloft on poles, at ground level, and in ground trenches, or manholes. Work requires bending, stooping, climbing, and standing for long periods. Coordination of eyes, hands, legs, and body is needed in installing, repairing, and testing electrical equipment in confined spaces such as manholes and overhead structures.

Working Conditions: Works outside most of the time, subject to extremes of weather conditions and in close proximity to high voltage lines and equipment. Work requires extensive pole climbing with some work in underground facilities. Subject to injury by contact with high voltage lines, broken bones in falls from poles, strains from awkward positions, and less serious cuts and bruises when handling tools and materials.

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