**Section 220.80 Surface High-Voltage Distribution**

a) High-voltage circuits; protective devices.

1) Circuit breakers protecting high-voltage circuits supplying power to portable or mobile equipment must:

A) be properly tested and maintained in accordance with this Section;

B) have adequate interrupting capacity for the circuit application as rated by the manufacturer;

C) be equipped with devices for protection against;

i) short circuit,

ii) overload,

iii) grounded phase, and

iv) undervoltage unless protection against undervoltage is provided on board the portable or mobile equipment receiving power from the circuit. A magnetic starter, which opens upon and must be reset manually following a loss of power, satisfies the undervoltage requirement.

2) High-voltage circuits supplying power to stationary equipment must be protected from an overload or short circuit by a circuit breaker or fuses of the correct type and capacity. Circuit breakers must, in addition, on solidly grounded or resistance grounded systems, deenergize the circuit on the occurrence of a phase-to-ground fault.

3) Circuit breakers and fuses must have adequate interrupting capacity rated to clear the short circuit current of the system. All electrical components and devices must be rated for the normal voltage and current of the system.

b) Monthly testing, examination, and maintenance of circuit breakers; procedures; high-voltage.

Circuit breakers and auxiliary devices located on the surface protecting surface or underground circuits, or both, must be examined and tested at least once (1) each month by a person qualified to perform testing and calibration, or qualified to perform electrical work under Section 220.50(e).

1) The examination must include observations of all readily accessible components of the circuit breaker and its auxiliary devices, and the manual activating of any of the auxiliary devices causing circuit breakers to operate. Examination of oil circuit breakers must include visual observation of all external components of the circuit breaker, including excessive oil spillage and/or the oil level of the tank. Repairs or adjustments as are indicated by such tests and examinations must be carried out immediately.

2) Tests must include:

A) Breaking continuity of the ground check conductor where ground check monitoring is used, and

B) Actuating any auxiliary protective relays.

C) Actual system trips during the inspection interval may be used in place of the test specified in subsections (b)(2)(A) and (B) where such actual operations are maintained as part of the records.

3) The operator must maintain written records of each test, examination, repair, or adjustment of all circuit breakers protecting high-voltage circuits. Such records must be kept in a book containing the following information:

A) The name of the person making the inspection;

B) The equipment inspected;

C) The inspected equipment's location;

D) The date of inspection;

E) The problems discovered and their corrections;

F) The signature of the supervisor of the person inspecting the equipment.

c) Annual testing, examination, and maintenance of circuit breakers; procedures; high-voltage.

Circuit breakers and auxiliary devices located on the surface protecting surface or underground circuits, or both, must be tested and calibrated at the time of installation and at least annually thereafter by a person qualified to perform testing and calibration or qualified to perform electrical work under Section 220.50(e).

1) The annual test and examination must include:

A) In resistance grounded systems:

i) Operation of the circuit breaker by passing a sufficient amount of current through the ground fault current sensing circuit to trip the circuit breaker. The ground resistor must be checked for continuity and ohmic value,

ii) If ground check monitoring is used, tripping the circuit breaker by breaking continuity of the ground check conductor, or using the manufacturer's recommended test,

iii) Verifying all current transformer secondary circuits,

iv) Verifying the operation and calibration of all over-current trip devices or relays,

v) Verifying the operation of the circuit breaker trip system, and

vi) Verifying the operation of under-voltage devices where their use is required under subsection (a)(1).

B) In ungrounded and solidly grounded systems:

i) If ground check monitoring is used, tripping the circuit breaker by breaking continuity of the ground check conductor, or using the manufacturer's recommended test,

ii) Verifying the operation of all current transformer secondary circuits,

iii) Verifying the operation and calibration of all over-current trip devices or relays,

iv) Verifying the operation of the circuit breaker trip system, and

v) Verifying the operation of under-voltage devices where their use is required under subsection (a)(1).

2) Repairs, calibrations, or adjustments indicated as necessary by the examination and test required in subsection (c) must be carried out before being returned to service.

3) Calibrations must include adjusting all relays and associated components according to manufacturer's specifications.

4) An authorized representative of the Department may require additional testing or calibration of circuit breakers and auxiliary devices when it is necessary to protect the health, safety and welfare of the miners. Examples of conditions for which the Department may require additional testing or calibration include the finding of any present or repeated dangerous conditions or malfunctions, incomplete or inadequate recordkeeping, or any indication that procedures have not been followed.

5) The operator must maintain written records of each test, examination, repair, or adjustment of all circuit breakers protecting high-voltage circuits. Such records must be kept in a book containing the following information:

A) The name of the person making the inspection;

B) The equipment inspected;

C) The inspected equipment's location;

D) The date of inspection;

E) The problems discovered and their corrections;

F) The signature of the supervisor of the person inspecting the equipment.

d) Grounding resistors.

The grounding resistor, where required must be of the proper ohmic value to limit the voltage drop in the grounding circuit external to the resistor to not more than one hundred (100) volts under ground fault conditions. The grounding resistor shall be rated for maximum fault current continuously and insulated from ground for a voltage equal to the phase-to-phase voltage of the system.

e) Grounding resistors; continuous current rating.

The ground fault current rating of grounding resistors must meet the "extended time rating" set forth in Institute of Electrical and Electronics Engineers, Inc., 345 E. Forty-Seventh Street, New York City, New York 10017, Standard No. 32 (1972, reaffirmed in 1984) (The reference does not include any later amendments or editions.)

f) Protection of high-voltage circuits; neutral grounding resistors.

1) High-voltage circuits supplying portable or mobile equipment must contain either a direct or derived neutral which must be grounded through an extended time grounding resistor at the source transformers.

2) A grounding circuit, originating at the grounded side of the grounding resistor, must extend along with the power conductors and serve as a grounding conductor for the frames of all high-voltage equipment supplied power from that circuit.

3) The grounding circuit conductor must conform to Section 220.70(c).

4) High-voltage stationary equipment may be served from impedance grounded, solidly grounded or ungrounded systems.

5) Grounding transformers, where used to derive a neutral, must:

A) be rated for continuous phase-to-ground fault current operation; and

B) be located at the transformers supplying power to the circuit.

g) High-voltage cables; minimum design requirements.

1) Cables used in high-voltage systems must be equipped with metallic shielding around each power conductor with one (1) or more grounding conductors having a total cross-sectional area of not less than one-half (½) the power conductor. The metallic shielding must completely enclose each individual conductor or must meet the requirements for shielding set forth in Standard WC8 of the Insulated Cable Engineers Association-National Electrical Manufacturers' Association, 2101 L. Street, N.W., Washington, D.C. 20037 for type SH or SHD portable power cables (The reference to Standard WC8 is as revised July 1987 and does not include any later revisions or amendments). Cables used as trailing cables must contain an insulated conductor for the ground continuity check circuit if the circuit requires a conductor.

2) All high-voltage cables must be rated for the intended current and voltage. Splices made in such cables must provide continuity of all components and must meet the requirements of Section 220.60(e).

h) Cable couplers and connection boxes; minimum design requirements.

1) Cable couplers; requirements.

A) Couplers that are used in medium or high-voltage power circuits must be of the three (3)-phase type and enclosed in a full metallic shell.

B) Cable couplers must be rated for the intended current and voltage.

C) The metallic shell of cable couplers must be grounded to the grounding conductor in the cable.

D) Couplers must be constructed in such manner so that the ground check monitoring conductor when required will break first and the grounding conductor will break last when being uncoupled.

2) Connection Boxes

A) Cable connection boxes must be designed and constructed to guard all energized parts from personal contact.

B) The box lid/plate/ door must be interlocked so that the circuit will be deenergized when opened.

C) The current-carrying parts must be deenergized and discharged before performing any work inside such boxes, unless the particular load carrying cable is in an isolated compartment from the rest of the connection box. In this case, only the load carrying cable need be deenergized to be worked on or removed. While deenergizing and discharging the box, protective gloves must be worn.

i) Connection of single-phase loads.

Single-phase loads must be connected phase-to-phase in resistance grounded systems.

j) Installation of high-voltage transmission cables.

High-voltage transmission cables must be installed or placed so as to afford protection against damage. They must be placed to prevent contact with low-voltage or communication circuits.

k) High-voltage power lines; clearances above ground.

High-voltage power lines located above driveways, haulageways, and railroad tracks must be installed so as to provide the minimum vertical clearance as specified in Rule 232 of the National Electrical Safety Code published by the Institute of Electrical and Electronics Engineers, Inc., 345 E. 47th Street, New York, New York 10017 (1981). (The reference does not include any later amendments or editions.); provided, however, that in no event shall any high-voltage power line be installed less than fifteen (15) feet above ground, walkways, or working areas.

l) Booms and masts; minimum distance from high-voltage lines.

The booms and masts of equipment operated on the surface of any coal mine must not be operated within ten (10) feet of an energized overhead powerline. Where the voltage of overhead powerlines is sixty-nine thousand (69,000) volts, or more, the minimum distance from the boom or mast must be as follows:

|  |  |  |
| --- | --- | --- |
| Nominal Powerline Voltage(In 1,000 volts) |  | Minimum DistanceFeet |
| 69-114 |  | 12 |
| 115-229 |  | 15 |
| 230-499 |  | 25 |
| 500 or more |  | 35 |

m) Movement of equipment: minimum distance from high-voltage lines.

When any part of any equipment operated on the surface of any coal mine is required to pass under or by any energized high-voltage power line and the clearance between such equipment and powerline is less than that specified in subsection (l) for booms and masts, such power lines must be deenergized or other precautions must be taken.

n) Operating of rear dump trucks under powerlines.

In cases where dump trucks are operated under powerlines, the minimum vertical clearance that must be maintained over dumping areas, must be five (5) feet more than the maximum height of the truck bed measured with the truck bed in the extreme raised position.

o) Disconnecting devices.

Disconnecting devices must be installed at the beginning of each branch line in high-voltage circuits, except disconnecting devices in high-voltage transmission lines, which must be accessible and located as near as practicable to the entrance to the high-voltage stationary installations supplied from the overhead powerlines, and must be equipped or designed in such manner that it can be determined by visual observation that the circuit is deenergized when such devices are open.

p) Identification of circuit breakers and disconnecting switches.

Circuit breakers and disconnecting switches must be labeled to show which units they control, unless identification can be made readily by location.

q) High-voltage equipment grounding.

Low resistance ground fields used in high-voltage systems serving portable or mobile equipment must be separated from the other ground fields by twenty-five (25) feet or more.

r) Movement of portable substation and transformers.

Portable substations, transformers, and high-voltage switch gear must be deenergized before they are moved from one location to another, and must be examined by a qualified person under Section 220.50(e) to assure safe operating condition prior to reenergization.

s) Performing work in proximity to energized high-voltage circuits.

Work must not be performed within four (4) feet of any exposed energized high-voltage conductor unless the provisions of subsections (v) through (dd) have been complied with, with respect to guarding of all energized conductors; except that, a person qualified under Section 220.50(e) and wearing protective lineman's gloves rated for the phase-to-phase voltage of the system, may disconnect and connect conductors to the load side of opened fused cutouts or disconnecting switches.

t) Work on high-voltage line; deenergizing and grounding.

High-voltage lines must be deenergized and grounded before work is performed on them, except that repairs may be permitted on energized high-voltage line if:

1) Such repairs are made by a qualified person under subsection (ff) in accordance with procedures and safeguards set forth in subsection (u) through (dd) as applicable; and

2) The operator has tested and properly maintained the protective devices necessary in making such repairs.

u) Work on high-voltage line.

1) A high-voltage line is not regarded as deenergized for the purpose of performing work on it, until it has been determined by a qualified person under subsection (ff) that such high-voltage line has been deenergized and grounded. Such qualified person must by visual observation:

A) Determine that the disconnecting devices on the high-voltage circuit are in open position; and

B) Insure that each ungrounded conductor of the high-voltage circuit upon which work is to be done is properly connected to the system grounding medium. In the case of resistance grounded or solid wye-connected systems, the neutral wire is the system grounding medium. In the case of an ungrounded power system, either the steel armor or conduit enclosing the system or a surface grounding field is a system grounding medium.

2) Work must not be performed on any high-voltage line which is supported by any pole or structure which also supports other high-voltage lines until:

A) All lines supported on the pole structure are deenergized and grounded in accordance with all of the provisions of this Part which apply to the repair of deenergized surface high-voltage lines; or

B) The provisions of subsections (v) through (dd) have been complied with, with respect to the energized lines which are supported on the pole or structure.

3) Work must not be performed on energized surface high-voltage lines except in accordance with the provisions of subsection (u) through (dd) inclusive.

v) Repairs to energized high-voltage lines.

An energized high-voltage line may be repaired only when:

1) The operator has determined that:

A) Such repairs cannot be scheduled during a period when the power circuit could be properly deenergized and grounded;

B) Such repairs will be performed on power circuits with a phase-to-phase nominal voltage no greater than fifteen thousand (15,000) volts;

C) Such repairs on circuits with a phase-to-phase nominal voltage of five thousand (5,000) volts or more will be performed only with the use of live line tools; and

D) Weather conditions will not interfere with such repairs or expose those persons assigned to such work to an imminent danger.

2) The operator has designated a qualified person under subsection (ff) as the person responsible for carrying out such repairs and such person, in order to insure protection for himself and other qualified persons assigned to perform such repairs from the hazards of such repairs, has prepared and filed with the operator:

A) A general description of the nature and location of the damage or defect to be repaired;

B) The general plan to be followed in making such repairs;

C) A statement that a briefing of all qualified persons assigned to make such repairs was conducted informing them of the general plan, their individual assignments, and the dangers inherent in such assignments;

D) A list of the proper protective equipment and clothing that will be provided; and

E) Such other information as the person designated by the operator feels necessary to describe properly the means or methods to be employed in such repairs.

3) Work performed on power lines energized at more than fifteen thousand (15,000) volts must be done in accordance with a plan submitted to and approved by the State Mine Inspector.

w) Work on energized high-voltage surface line; reporting.

Any operator designating and assigning qualified persons to perform repairs on energized high-voltage surface lines under the provisions of subsection (v) must maintain a record of such repairs. Such record must contain a notation of the time, date, location, and general nature of the repairs made, together with a copy of the information filed with the operator by the qualified person designated as responsible for performing such repairs.

x) Simultaneous repairs.

When two (2) or more persons are working on an energized high-voltage surface line simultaneously, and any one of them is within reach of another, such person must not be allowed to work on different phases or on equipment with different potentials.

y) Installation of protective equipment.

1) Before repair work on energized high-voltage surface lines is begun, protective equipment must be used to cover all bare conductors, ground wires, guys, telephone lines, and other attachments in proximity to the area of planned repairs. Such protective equipment must be installed from a safe position below the conductors or other apparatus being covered. Each rubber protective device employed in making repairs must have a dielectric strength of twenty thousand (20,000) volts or more and must comply with the provisions of the American Society for Testing and Materials (ASTM) 655 Fifteenth Street N.W.; Washington, D.C. 20005 as follows:

|  |  |  |
| --- | --- | --- |
| ITEM | ASTM STANDARD | DATE OF ADOPTION |
|  |  |  |
| Rubber Insulating gloves | D120-87  | July 31, 1987 |
| Rubber matting for use around electrical apparatus | D178-88  | Nov. 29, 1987Feb. 26, 1988 |
| Rubber insulating blankets | D1048-88 | Feb. 26, 1988 |
| Rubber insulating hoods | D1049-83 | June 24, 1983 |
| Rubber insulating line hose | D1050-85 | August 30, 1985 |
| Rubber insulating sleeves | D1051-87 | July 31, 1987 |

AGENCY NOTE: The standards do not include any later amendments or editions.

2) Protective equipment of material other than rubber must provide equal or better electrical and mechanical protection.

3) Only live line tool poles having a manufacturer's certification to withstand the following minimum tests shall be used:

A) One hundred thousand (100,000) volts per foot of length for five (5) minutes when the tool is made of fiberglass;

B) Seventy-five thousand (75,000) volts per foot of length for three (3) minutes when the tool is made of wood; or

4) Measuring tapes or measuring ropes containing metal must not be used when working on or near energized parts.

z) Protective clothing; use and inspection.

1) All persons performing work on energized high-voltage surface lines must wear protective rubber linemen's gloves, sleeves, and climber guards if climbers are worn. Protective rubber gloves must not be worn wrong side out or without protective leather gloves. Protective devices worn by a person assigned to perform repairs on high-voltage surface lines must be worn continuously from the time he leaves the ground until he returns to the ground and such person must visually inspect the equipment assigned him for defects before each use.

2) All rubber protective equipment used for work on energized high-voltage surface lines must be electrically tested in accordance with the American National Standards Institute and the American Society for Testing and Materials Standards (ASTM), 655 Fifteenth Street N.W.; Washington, D.C. 20005 as follows:

|  |  |  |
| --- | --- | --- |
| ITEM | ASTM STANDARD | DATE OF ADOPTION |
|  |  |  |
| Rubber Insulating gloves | D120-87  | July 31, 1987 |
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| Rubber insulating sleeves | D1051-87 | July 31, 1987 |

AGENCY NOTE: The references do not include any later editions or references.

aa) Protective equipment; inspection.

Each person must visually inspect protective equipment and clothing provided him in connection with work on high-voltage surface lines before using such equipment and clothing and any equipment or clothing containing any defect or damage must be discarded and replaced with proper protective equipment or clothing prior to the performance of any electrical work on such lines.

bb) Protective equipment; testing and storage.

1) All rubber protective equipment used on work on energized high-voltage surface lines must be electrically tested by the operator in accordance with subsection (z)(2) and such testing must be conducted in accordance with the following schedule:

A) Rubber gloves, once each month(except that gloves previously tested under Section 220.80(z)(2) that are not in use and have been kept in a storeroom or warehouse may be treated the same as new gloves);

B) Rubber sleeves, once every three (3) months;

C) Rubber blankets, once every six (6) months;

D) Insulator hoods and line hose, once a year;

E) Aerial lift arm current test, before each use; and

F) Other electric protective equipment, once a year.

2) Rubber gloves must not be stored wrong side out.

3) Blankets must be rolled when not in use, line hose and insulator hoods must be stored in their natural position and shape.

cc) Operating disconnecting or cutout switches.

 Disconnecting or cutout switches on energized high-voltage surface lines must be operated only with insulated sticks, fuse tongs, or pullers which are adequately insulated and maintained to protect the operator from the voltage to which he is exposed. When such switches are operated from the ground, the person using such devices must wear protective rubber lineman's gloves except where switches are bonded to a metal mat as provided in subsection (t).

dd) Tying into energized high-voltage surface circuits.

 If the work of forming an additional circuit by tying into an energized high-voltage surface line is performed from the ground any person performing such work must wear and employ all the protective equipment and clothing required and tested under the provisions of subsections (z), (aa), and(bb). In addition, the insulated stick used by such person must have been designed for such purpose and must be adequately insulated and be maintained to protect such person from the voltage to which he is exposed.

ee) Use of grounded messenger wires; ungrounded systems.

 Solely for purposes of grounding ungrounded high-voltage power systems, grounded messenger wires used to suspend the cable of such systems may be used as a grounding medium.

ff) Repair of energized surface high-voltage line; qualified person.

 An individual is a qualified person for the purpose of repairing energized surface high-voltage lines, under subsections (t) through (ee) only if such person:

1) has had at least two (2) years experience in electrical maintenance, and

2) has had at least two (2) years experience in the repair of energized high-voltage lines located on poles and structures.

(Source: Amended at 13 Ill. Reg. 5955, effective April 18, 1989)