



WEST VIRGINIA SECRETARY OF STATE

MAC WARNER

ADMINISTRATIVE LAW DIVISION

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Office of West Virginia
Secretary Of State

NOTICE OF PUBLIC COMMENT PERIOD

AGENCY: Coal Mine Health And Safety TITLE-SERIES: 36-12
RULE TYPE: Legislative Exempt Amendment to Existing Rule: Yes Repeal of existing rule: No
RULE NAME: Rule Governing Electrical Provisions for Underground Mining
CITE STATUTORY AUTHORITY: W. Va. Code §§22A-6-4 and 22A-6-5

COMMENTS LIMITED TO:

Written

DATE OF PUBLIC HEARING:

LOCATION OF PUBLIC HEARING:

DATE WRITTEN COMMENT PERIOD ENDS: 11/16/2020 5:00 PM

COMMENTS MAY BE MAILED OR EMAILED TO:

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PLEASE INDICATE IF THIS FILING INCLUDES:

RELEVANT FEDERAL STATUTES OR REGULATIONS: No

(IF YES, PLEASE UPLOAD IN THE SUPPORTING DOCUMENTS FIELD)

INCORPORATED BY REFERENCE: No

(IF YES, PLEASE UPLOAD IN THE SUPPORTING DOCUMENTS FIELD)

PROVIDE A BRIEF SUMMARY OF THE CONTENT OF THE RULE:

This rule specifies the electrical provisions for underground mining.

SUMMARIZE IN A CLEAR AND CONCISE MANNER CONTENTS OF CHANGES IN THE RULE AND A STATEMENT OF CIRCUMSTANCES REQUIRING THE RULE:

Pursuant to the regulatory review and reform initiatives established in West Virginia Code §29A-3-20 (2016) and Executive Order No. 3-18, this proposed legislative-exempt rule modifies and updates Series 12 of Title 36 of the Code of State Rules to cross-reference the correct authorizing portions of the West Virginia Code, to reflect the appropriate designations for certain State agencies such as the Office of Miners Health Safety and Training, to correct typographical errors, add definitions, further define requirements when electrical troubleshooting or testing, describe requirements for testing of electrical gloves, clarifies locking and tagging procedures, to utilize the current citation formats, and to renumber provisions according to the outline required under W. Va. Code R. §§153-1-5.22 and §153-1-6.

SUMMARIZE IN A CLEAR AND CONCISE MANNER THE OVERALL ECONOMIC IMPACT OF THE PROPOSED RULE:

A. ECONOMIC IMPACT ON REVENUES OF STATE GOVERNMENT:

This proposed legislative-exempt rule is not anticipated to impact the revenues of state government.

B. ECONOMIC IMPACT ON SPECIAL REVENUE ACCOUNTS:

This proposed legislative-exempt rule is not anticipated to impact special revenue accounts.

C. ECONOMIC IMPACT OF THE RULE ON THE STATE OR ITS RESIDENTS:

This proposed legislative-exempt rule is not anticipated to impact the state or its residents.

D. FISCAL NOTE DETAIL:

Effect of Proposal	Fiscal Year		
	2020 Increase/Decrease (use "-")	2021 Increase/Decrease (use "-")	Fiscal Year (Upon Full Implementation)
1. Estimated Total Cost	0.00	0.00	0.00
Personal Services	0.00	0.00	0.00
Current Expenses	0.00	0.00	0.00
Repairs and Alterations	0.00	0.00	0.00
Assets	0.00	0.00	0.00
Other	0.00	0.00	0.00
2. Estimated Total Revenues	0.00	0.00	0.00

E. EXPLANATION OF ABOVE ESTIMATES (INCLUDING LONG-RANGE EFFECT):

N/A

BY CHOOSING 'YES', I ATTEST THAT THE PREVIOUS STATEMENT IS TRUE AND CORRECT.

Yes

Wesley H White -- By my signature, I certify that I am the person authorized to file legislative rules, in accordance with West Virginia Code §29A-3-11 and §39A-3-2.

TITLE 36
LEGISLATIVE EXEMPT RULE
BOARD OF COAL MINE HEALTH AND SAFETY

SERIES 12
~~RULES AND REGULATIONS~~ GOVERNING ELECTRICAL
PROVISIONS FOR UNDERGROUND MINING

§36-12-1. General.

- 1.1. Scope. -- ~~Rules and regulations~~ governing electrical provisions for underground mining.
- 1.2. Authority. -- W. Va. Code ~~§22-6-4~~ §§22A-6-4 and 22A-6-5.
- 1.3. Filing Date. -- ~~August 14, 1995~~ _____.
- 1.4. Effective Date. -- ~~January 15, 1996~~ _____.

§36-12-2. Effect of Regulations.

2.1. ~~These rules and regulations shall have the effect of law and violations shall be deemed a violation of law and so cited with the same effect as law. All provisions of Article 1A, Chapter 22A of the Code relative to enforcement are applicable to the enforcement of the rules and regulations. This Series shall have the effect of law and violations shall be deemed a violation of law and so cited with the same effect as law. All provisions of W. Va. Code §22A-1-1 et seq. relative to enforcement are applicable to the enforcement of this Series.~~

§36-12-3. Definitions.

3.1. ~~All terms in these rules and regulations~~ this Series, not defined herein, shall have the meanings set forth in ~~§1-1A-22A of the Code~~ W. Va. Code §22A-1-2.

3.1.1. (a) ~~Permanent Underground Battery Charging Station~~ -- The term “~~p~~Permanent underground battery charging station” shall mean a battery charging station that has been located in one specific location for a period of time exceeding one (1) year.

3.1.2. (b) ~~Ground Fault Circuit Interrupting Devices~~ -- ~~A~~ The term “ground fault circuit interrupting devices” shall mean a device for the protection of personnel that functions to deenergize a circuit or portions thereof within an established period of time when a circuit to ground exceeds some predetermined value that is less than required to operate the over current protective device of the supply circuit.

3.1.3. (c) ~~Wet Location (as referred to in 4.45 of this regulation)~~ -- ~~installations~~ The term “wet location” shall mean installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, such as vehicle washing areas, and locations exposed to weather and unprotected.

3.1.4. Electrical Troubleshooting or Testing -- The term “electrical troubleshooting or testing” shall mean the process of locating an electrical problem in the electric circuits on an energized machine. This process can include the following: taking voltage and current measurements, simulating a fault to activate a device, and observing diagnostic indicators/readouts or the operational sequence of relays and contactors.

3.1.5. Hot Stick -- The term "hot stick" shall mean an approved and insulated pole usually made of fiberglass used when performing work on high-voltage circuits to protect from electric shock.

§36-12-4. General Provisions.

4.1. Operators of coal mines in which electricity is used as a means of power shall comply with the following provisions:

4.1.1. ~~4.1.~~ All surface transformers, unless of a construction which will eliminate shock hazards, or unless installed at least eight (8) feet above ground, shall be enclosed in a house or surrounded by a fence at least six (6) feet high. If the enclosure is of metal, it shall be grounded effectively. The gate or door to the enclosure shall be kept locked at all times, unless authorized persons are present.

4.1.2. ~~4.2.~~ Underground transformers shall be air cooled or cooled with ~~noninflammable~~ nonflammable liquid or inert gas.

4.1.3. ~~4.3.~~ Underground stations containing circuit breakers filled with inflammable liquids shall be put on a separate split of air or ventilated to the return air, and shall be of fireproof construction.

4.1.4. ~~4.4.~~ Transformers shall be provided with adequate overload protection.

4.1.5. ~~4.5.~~ "Danger -- High Voltage" signs with the voltage indicated shall be posted conspicuously on all transformer enclosures, high-potential switchboards and other high-potential installations.

4.1.6. ~~4.6.~~ Dry insulating platforms of rubber or other suitable nonconductive material shall be kept in place at each switchboard and at stationary machinery where shock hazards exist.

4.1.7. ~~4.7.~~ Capacitors used for power factor ~~connection~~ correction shall be ~~noninflammable~~ nonflammable liquid filled. Suitable drain-off resistors or other means to protect workmen against electric shock following removal of power shall be provided.

4.1.8. ~~4.8.~~ All unattended underground loading points where electric driven hydraulic systems are used shall utilize a fireproof oil or emulsion.

4.1.9. ~~4.9.~~ Before electrical changes are made to permissible equipment for use in a mine, they shall be approved by the Director of the Office of Miners' Health, Safety and Training.

4.1.10. ~~4.10.~~ Reverse current protection shall be provided at storage battery charging stations to prevent the storage batteries from energizing the power circuits in the event of a power failure.

4.1.11. ~~4.11.~~ In all mines all junction or distribution boxes used for making multiple power connection in by the last open crosscut shall be permissible.

4.1.12. ~~4.12.~~ All hand-held electric drills, blower and exhaust fans, electric pumps, and such other low horsepower electric face equipment which are taken into or used in by the last open crosscut of any coal mine shall be permissible.

4.1.13. ~~4.13.~~ All electric face equipment which is taken into or used in by the last open crosscut of any coal mine is permissible.

4.1.14. ~~4.14.~~ In mines operated in coal seams which are located at elevations above the water table, the phrase “coal seams above the water table” means coal seams in a mine which are located at the elevation above a river or the tributary of a river into which a local surface water system naturally drains.

4.1.15. ~~4.15.~~ The operator of each coal mine shall maintain in permissible condition all electric face equipment, which is taken into or used in by the last open crosscut of any mine.

4.1.16. ~~4.16.~~ Except where permissible power connection units are used, all power-connection points out by the last open crosscut shall be in intake air.

4.1.17. ~~4.17.~~ All power circuits and electric equipment shall be deenergized and locked or suitably tagged where locking out is not possible before work is done on such circuits and equipment, except when necessary for trouble shooting or testing. When performing electrical troubleshooting or testing ~~or troubleshooting~~ an energized electrical circuit, gloves rated for the maximum voltage of the circuit shall be worn when handling electrical testing equipment or once the plane of the electrical enclosure is broken.

4.1.17.a. No electrical troubleshooting or testing shall be performed on low-, medium-, or high-voltage distribution circuits or equipment except by a qualified person or by a person trained to perform electrical work and to maintain electrical equipment under the immediate supervision of a qualified person.

4.1.17.b. Before electrical troubleshooting or testing a low- or medium-voltage circuit contained in a compartment with a high-voltage circuit, the high-voltage circuit must be deenergized, disconnected, grounded, locked out and tagged.

4.1.17.c. While electrical troubleshooting or testing is being done on equipment with energized circuits exposed, other repairs or maintenance shall not be performed on the equipment with the exposed circuit.

4.1.17.d. All test instruments and their accessories shall be rated and designed for the environment to which they will be exposed and for the manner in which they will be utilized.

4.1.17.e. Insulated gloves and other insulated personal protective equipment must:

4.1.17.e.1. Have a voltage rating that meets or exceeds ASTM F496-97 “Standard Specification for In-Service Care of Insulating Gloves and Sleeves” (1997).

4.1.17.e.2. Be examined before each use for visible signs of damage.

4.1.17.e.3. Leather protectors must always be worn with insulated rubber gloves.

4.1.17.e.4. Be removed from service or destroyed when damaged or defective.

4.1.17.e.5. Class 0 gloves used at 1000 volts or less must be electrically tested every six (6) months when in use and every year when not in use and properly stored. A record of these gloves must be kept in a book prescribed by the Director and made available for authorized representatives of the Office of Miners’ Health, Safety and Training upon request.

4.1.17.e.6. Gloves used in conjunction with a hot stick and with high-voltage fault finders must be electrically tested six (6) months after initial use and every year when properly stored and not in use. A record of these gloves must be kept in a book prescribed by the Director and made available for

authorized representatives of the Office of Miners' Health, Safety and Training upon request. Requirements for gloves and personal protective equipment used to handle energized cables on longwalls are specified in Title 36-47-7 and on high-voltage continuous miner trailing cables are specified in Title 36-48-14.

4.1.17.e.7. Hot sticks are required to be electrically tested every twelve (12) months. A record of the tests must be kept in a book prescribed by the Director and made available for authorized representatives of the Office of Miner's Health, Safety and Training upon request.

4.1.17.e.8. Be provided by the employer.

4.1.18. 4.18. Energized trolley wires may be repaired only by a person trained to perform electrical work and to maintain electrical equipment and the operator of a mine shall require that such persons wear approved and tested insulated shoes and wireman's gloves.

4.1.19. 4.19. No electrical work shall be performed on low-, medium-, or high-voltage distribution circuits or equipment, except by a qualified person or by a person trained to perform electrical work and to maintain electrical equipment under the direct supervision of a qualified person. Disconnecting devices shall be locked out and suitably tagged by ~~the persons who perform~~ each person who performs such work, except that in cases where locking out is not possible, such devices shall be opened and suitably tagged by ~~such each~~ each person. Locks or tags shall only be removed by the persons who installed them, or, if such persons are unavailable, by qualified persons authorized by the operator or his/her agent.

4.1.20. 4.20. All electric equipment shall be examined weekly, tested ~~monthly~~, and properly maintained by a qualified person to assure safe operating conditions. When a potentially dangerous condition is found on electric equipment, such equipment shall be removed from service until such conditions are corrected. A record of such examinations shall be kept and made available to an authorized representative of the Director of the Office of Miners' Health, Safety and Training and to the miners in such mine.

4.1.21. 4.21. All electric conductors shall be sufficient in size and have adequate current-carrying capacity and be of such construction that a rise in temperature resulting from normal operation will not damage the insulating material.

4.1.22. 4.22. All electrical connection or splices in conductors shall be mechanically and electrically efficient, and suitable connectors shall be used. All electrical connections or splices in insulated wire shall be reinsulated at least to the same degree of protection as the remainder of the wire.

4.1.23. 4.23. Cables shall enter metal frames of motors, splice boxes, and electric compartment only through proper fittings. When insulated wire, other than cables pass through metal frames, the holes shall be substantially bushed with insulated bushings.

4.1.24. 4.24. All power wire (except trailing cables on mobile equipment, specially designed cables conducting high-voltage power to underground rectifying equipment or transformers, or bare insulated ground and return wires) shall be supported on well-installed insulators and shall not contact combustible material, ~~coal~~ roof or ribs.

4.1.25. 4.25. Power wires and cables, including but not limited to phone communications and control wires, except trolley wires, trolley feeder wires and bare signal wires, shall be insulated adequately and fully protected.

4.1.26. ~~4.26.~~ Automatic circuit-breaking devices or fuses of the correct type and capacity shall be installed so as to protect all electric equipment and circuits against short circuit and overloads. Three-phase motors ~~an~~ on all electric equipment shall be provided with overload protection that will deenergize all three phases in the event that any phase is overloaded.

4.1.27. ~~4.27.~~ Incandescent lamps installed along haulageways and at other locations shall not contact combustible material, and if powered from trolley or direct current feeder circuits, need not be provided with separate short circuits or overload protection, if the lamp is not more than eight (8) feet in distance from such circuits.

4.1.28. ~~4.28.~~ In all main power circuits, disconnecting switches shall be installed underground within five hundred (500) feet of the bottoms of shafts and boreholes through which main power circuits enter the underground area of the mine and within five hundred (500) feet of all other places where main power circuits enter the underground area of the mine.

4.1.29. ~~4.29.~~ All electric equipment shall be provided with switches or other controls that are safely designed, constructed and installed.

4.1.30. ~~4.30.~~ Each ~~underground, ungrounded~~ exposed power conductor that leads underground shall be equipped with suitable lightning arresters of approved type within one hundred (100) feet of the point where the circuit enters the mine. Lightning arresters shall be connected to a low-resistance grounding medium on the surface which shall be separated from neutral grounds by a distance of not less than twenty-five (25) feet.

4.1.31. ~~4.31.~~ Except for areas of a coal mine inby the last open crosscut, incandescent lamps may be used to illuminate underground areas. When incandescent lamps are used in a track entry or belt entry or near track entries to illuminate special areas other than structures, the lamps shall be installed in weatherproof sockets located in positions such that the lamps will not come in contact with any combustible material. Lamps used in all other places must be of substantial construction and be fitted with a glass enclosure.

4.1.32. ~~4.32.~~ An authorized representative may require in any mine that electric face equipment be provided with devices that will permit the equipment to be deenergized quickly in the event of an emergency.

4.1.33. ~~4.33.~~ An authorized representative of the Director shall require manually operated emergency stop switches, designed to deenergize the traction motor circuit when the contractors or controller fail to open, to be installed on all battery powered tractors, taken into or used inby the last open crosscut of any entry or room.

4.1.34. ~~4.34.~~ Trailing cables used in coal mines shall meet the requirements for flame-resistant cables.

4.1.35. ~~4.35.~~ Short circuit protection for trailing cables shall be provided by an automatic circuit breaker or other no less effective device approved by the Director of the Office of Miners' Health, Safety and Training of adequate current-interrupting capacity in each ~~underground~~ ungrounded conductor. Disconnecting devices used to disconnect power from trailing cables shall be plainly marked and identified and such devices shall be equipped or designed in such a manner that it can be determined by visual observation that the power is disconnected.

4.1.36. ~~4.36.~~ When two (2) or more trailing cables junction to the same distribution center, means shall be provided to assure against connecting a trailing cable to the wrong size circuit breaker.

4.1.37. ~~4.37.~~ One (1) temporary splice may be made in any trailing cable. Such trailing cable may only be used for the next twenty-four (24) hour period. No temporary splice shall be made in a trailing cable within twenty-five (25) feet of the machine, except cable reel equipment. Temporary splices in trailing cables shall be made in a workmanlike manner and shall be mechanically strong and well insulated. Trailing cables or hand cables which have exposed wires or which have splices that heat or spark under load shall not be used. As used in this section, the term "splice" means a mechanical joining of one (1) or more conductors that have been severed.

4.1.38. ~~4.38.~~ When (permanent) splices in trailing cables are made, they shall be:

4.1.38.a. ~~a)~~ Mechanically strong with adequate electrical conductivity and flexibility,

4.1.38.b. ~~b)~~ Effectively insulated and sealed so as exclude moisture, and

4.1.38.c. ~~c)~~ Vulcanized or otherwise treated with suitable materials to provide flame-resistant qualities and good bonding to the outer jacket.

4.1.39. ~~4.39.~~ Trailing cables shall be clamped to machines in a manner to protect the cables from damage and to prevent strain on the electrical connections. No cables will be hung in manner which will damage the insulation or conductors.

4.1.40. ~~4.40.~~ Trailing cables shall be adequately protected to prevent damage by mobile equipment.

4.1.41. ~~4.41.~~ Trailing cable and power cable connections to junction boxes and to electrical equipment shall not be made or broken under load.

4.1.42. ~~4.42.~~ All metallic sheaths, armors and conduits enclosing power conductors shall be electrically continuous throughout and shall be grounded by methods approved by an authorized representative of the Director of the Office of Miners' Health, Safety and Training. Where grounding wires are used to ground metallic shields, armors, conduits, frames, casings, and other metallic enclosures, such grounding wires will be approved if:

4.1.42.a. Where the conductor used is #6 AWG or larger, the cross sectional area of the grounding wire is at least one-half (1/2) the cross sectional area of the power conductor.

4.1.42.b. Where the power conductor used is less than #6 AWG, the cross sectional area of the grounding wire is equal to the cross sectional area of the power conductor.

4.1.43. ~~4.43.~~ Except where waived by the Director, metallic frames, casings and other enclosures of electric equipment that can become alive through failure of insulation or by contact with energized parts shall be grounded, and on or before the first day of January, 1978, shall have a ground monitoring system.

4.1.44. ~~4.44.~~ In instances where single-phase 110-220 volt circuits are used to feed electrical equipment, the only method of grounding that will be approved is the connection of all metallic frames, casing and other enclosures of such equipment to a separate grounding conductor which establishes a continuous connection to a grounded center tap of the transformer. In the case of 120 volt single winding transformers used to feed electrical equipment, the only method of grounding that will be approved is the

connection of all metallic frames, casings and other enclosures of such equipment to a separate grounding conductor which establishes a continuous connection to a grounded center tap or a grounded leg of the transformer.

~~4.1.45. 4.45.~~ ~~At preparation plants, surface areas of underground mines and shop areas all~~ All 120 volt AC 15-20 amp circuits used to power portable hand tools ~~used in wet locations~~ shall be protected with ground fault circuit interrupting devices.

~~4.1.46. 4.46.~~ The attachment of grounding wires to a mine ~~tract~~ track or other grounded power conductor will be approved if separate clamps, suitable for such purpose, are used and installed to provide a solid connection.

~~4.1.47. 4.47.~~ The frames of all offtrack direct-current machines and the enclosures of related detached components shall be effectively grounded or otherwise maintained at no less safe voltages.

~~4.1.48. 4.48.~~ Installation of silicon diodes shall be restricted to electric equipment receiving power from a direct current system with one polarity grounded. Where such diodes are used on circuits having a nominal voltage rating of two hundred fifty (250), they must have a forward current rating of four hundred (400) amperes or more, and have a peak inverse voltage rating of four hundred (400) or more. Where such diodes are used on circuits having nominal voltage rating of five hundred and fifty (550), they must have a forward current rating of two hundred and fifty (250) amperes or more, and have a peak inverse voltage rating of eight hundred (800) or more.

~~4.1.49. 4.49.~~ In addition to the grounded diode, a polarizing diode must be installed in the machine control circuit to prevent operation of the machine when the polarity of a trailing cable is reversed.

~~4.1.50. 4.50.~~ When installed on permissible equipment, all grounding diodes, over-current devices, and polarizing diodes must be placed in explosion-proof compartments.

~~4.1.51. 4.51.~~ High-voltage lines, both on the surface and underground, shall be deenergized and grounded before work is performed on them, except that repairs may be permitted, in the case of energized surface high-voltage lines, if such repairs are made by a qualified person in accordance with procedures and safeguards, including, but not limited to, a requirement that the operator of such mine provide, test and maintain protective devices in making such repairs.

~~4.1.52. 4.52.~~ 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 persons shall not be allowed to work on different phases on equipment with different potentials.

~~4.1.53. 4.53.~~ All persons performing work on energized high-voltage surface lines shall wear protective rubber gloves, sleeves, and climber guards if climbers are worn. Protective rubber gloves shall not be worn wrong side out or without protective leather gloves. Protective devices worn by a person assigned to preform repairs on high-voltage surface lines shall be worn continuously from the time he leaves the ground until he returns to the ground, and, if such devices are employed for extended periods, such persons shall visually inspect the equipment assigned him for defects before each use, and, in no case, less than twice each day.

~~4.1.54. 4.54.~~ Disconnecting or cutout switches on energized high-voltage surface lines shall 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 operating such devices shall wear protective rubber gloves.

4.1.55. ~~4.55.~~ Solely for purposes of grounding ~~underground~~ ungrounded high-voltage power systems, grounded messenger wires used to suspend the cables of such systems may be used as a grounding medium.

4.1.56. ~~4.56.~~ When not in use, power circuits ungrounded shall be deenergized on idle days and idle shifts, except that rectifiers and transformers may remain energized.

4.1.57. ~~4.57.~~ High-voltage circuits entering the underground area of any coal mine shall be protected by suitable circuit breakers of adequate interrupting capacity. Such breakers shall be equipped with devices to provide protection against undervoltage, grounded phase, short circuit and overcurrent.

4.1.57.a. Testing, examination, and maintenance of high-voltage circuit breakers; procedures.

4.1.57.a.1. Circuit breakers and their auxiliary devices protecting underground high-voltage circuits shall be tested and examined at least once each month by a qualified person.

4.1.57.a.2. Tests shall include:

4.1.57.a.2.A. Breaking continuity of the ground check conductor where ground check monitoring is used; and

4.1.57.a.2.B. Actuating at least two (2) of the auxiliary protective relays.

4.1.57.a.2.C. Examination shall include visual observation of all components of the circuit breaker and its auxiliary devices, and such repairs or adjustments as are indicated by such tests and examinations shall be carried out immediately.

4.1.57.b. Testing, examination, and maintenance of high-voltage circuit breakers; records.

4.1.57.b.1. Recordkeeping. The operator shall make a record of each test, examination, repair, or adjustment of all circuit breakers protecting high-voltage circuits which enter any underground area of the mine.

4.1.57.b.2. Such record shall be kept in a book prescribed by the Director and made available for authorized representatives of the Office of Miner's Health, Safety and Training.

4.1.58. ~~4.58.~~ Circuit breakers protecting high-voltage circuits entering an underground area of any coal mine shall be located on the surface and in no case installed either underground or within a drift.

4.1.59. ~~4.59.~~ One (1) circuit breaker may be used to protect two (2) or more branch circuits, if the circuit breaker is adjusted to afford overcurrent protection for the smallest conductor.

4.1.60. ~~4.60.~~ The grounding resistor, where required, shall 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 fault condition. 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.

4.1.61. ~~4.61.~~ High-voltage circuits extending underground and supplying portable mobile or

stationary high-voltage equipment shall contain either a direct or derived neutral which shall be grounded through a suitable resistor at the source transformers, and a grounding circuit, originating at the grounded side of the grounding resistor, shall extend along with the power conductors and serve as a grounding conductor for the frames of all high-voltage equipment supplied power from the circuit, except that the Director or his authorized representative may permit ungrounded high-voltage circuits to be extended underground to feed stationary electrical equipment if such circuits are either steel armored or installed in grounded, rigid steel conduit throughout their entire length, and upon his finding that such exception does not pose a hazard to the miners. Within one hundred (100) feet of the point on the surface where high-voltage circuits enter the underground portion of the mine, disconnecting devices shall be installed and so equipped or designed in such manner that it can be determined by visual observation that the power is disconnected, except that the Director or his authorized representative may permit such devices to be installed at a greater distance from such area of the mine if he determines, based on existing physical conditions, that such installation will be more accessible at a greater distance and will not pose any hazard to the miners.

4.1.62. ~~4.62.~~ High-voltage resistance grounded systems serving portable or mobile equipment shall include a fail-safe ground check circuit to monitor continuously the grounding circuit to assure continuity, and the fail-safe ground check circuit breaker to open when either the ground or pilot check wire is broken, or other no less effective device approved by the Director or his authorized representative to assure such continuity.

4.1.63. ~~4.63.~~ Underground high-voltage cables used in resistance grounded systems shall be equipped with metallic shields around each power conductor with one (1) or more ground conductors having a total cross-sectional area of not less than one half the power conductor, and with an insulated internal or external conductor not smaller than No. 10 (A.W.G.) for the ground continuity check circuit.

4.1.64. ~~4.64.~~ All such cables shall be adequate for the intended current and voltage. Splices made in such cables shall provide continuity of all components.

4.1.65. ~~4.65.~~ Single-phase loads, such as transformer primaries, shall be connected phase-to-phase when utilized on resistance grounded or ungrounded power systems.

4.1.66. ~~4.66.~~ All underground high-voltage transmission cables shall be installed only in regularly inspected air courses and haulageways, and shall be covered, buried, or placed so as to afford protection against damage, guarded where men regularly work or pass under them unless they are six and one-half feet or more above the floor or rail, securely anchored, properly insulated, guarded at ends, and covered, insulated, or placed to prevent contact with trolley wires and other low-voltage circuits.

4.1.67. ~~4.67.~~ Disconnecting devices shall be installed at the beginning of branch lines in underground high-voltage circuits and equipped or designed in such a manner that it can be determined by visual observation that the circuit is deenergized when the switches are open.

4.1.68. ~~4.68.~~ Circuit breakers and disconnecting switches underground shall be marked for identification.

4.1.69. ~~4.69.~~ In case of high-voltage cables used as trailing cables, temporary splices shall not be used and all permanent splices shall be made in accordance with the manufacturer's specifications.

4.1.70. ~~4.70.~~ Frames, supporting structures and enclosures of stationary, portable or mobile underground high-voltage equipment supplying power to such equipment receiving power from resistance

grounded systems shall be effectively grounded to the high-voltage ground.

4.1.71. 4.71. Low- and medium-voltage power circuits serving three-phase alternating current equipment serving portable or mobile equipment shall be protected by suitable circuit breakers of adequate interrupting capacity which are properly tested and maintained as prescribed by the Director. Such breakers shall be equipped with devices to provide protection against under-voltage, grounded phase, short circuit and overcurrent.

4.1.71.a. Testing, examination, and maintenance of low- and medium-voltage circuit breakers; procedures.

4.1.71.a.1. Circuit breakers protecting low- and medium-voltage alternating current circuits service three-phase alternating current equipment and their auxiliary devices shall be tested and examined at least once each month by a qualified person.

4.1.71.a.2. In performing such tests, actuating all of the circuit breaker auxiliaries or control circuits in any manner which causes the circuit breaker to open shall be considered a proper test.

4.1.71.a.3. All components of the circuit breaker and its auxiliary devices shall be visually examined and such repairs or adjustments as are indicated by such tests and examinations shall be carried out immediately.

4.1.71.b. Testing, examination, and maintenance of low- and medium-voltage circuit breakers; records.

4.1.71.b.1. Recordkeeping. The operator of any coal mine shall make a written record of each test, examination, repair, or adjustment of all circuit breakers protecting low- and medium-voltage circuits service three-phase alternating current equipment used in the mine.

4.1.71.b.2. Such record shall be kept in a book prescribed by the Director and made available for authorized representatives of the Office of Miners' Health, Safety and Training upon request.

4.1.72. 4.72. Power centers and portable transformers shall be deenergized before they are moved from one location to another, except that, when equipment powered by sources other than such centers or transformers is not available, the Director may permit such centers and transformers to be moved while energized if he determines that another equivalent or greater hazard may otherwise be created, and if they are moved under the supervision of a qualified person, and if such centers and transformers are examined prior to such movement by such person and found to be grounded by methods approved by an authorized representative of the Director and otherwise protected from hazards to the miner. A record shall be kept of such examinations. High-voltage cables, other than trailing cables, shall not be moved or handled at any time while energized except that when such centers and transformers are moved while energized as permitted under this section, energized high-voltage cables attached to such centers and transformers may be moved only by a qualified person and the operator of such mine shall require that such person wear approved and tested insulated wireman's gloves.

4.1.73. 4.73. Low-and medium-voltage three-phase alternating-current circuits used underground shall contain either a direct or derived neutral which shall be grounded through a suitable resistor at the power center, and a grounding circuit, originating at the grounded side of the grounding resistor, shall extend along with the power conductors and serve as a grounding conductor for the frames of all electrical equipment supplied power from the circuit, except that the Director or his authorized representative may

permit underground low-and medium-voltage circuits to be used underground to feed such stationary electrical equipment if such circuits are either steel armored or installed in grounded rigid steel conduit throughout their entire length. The grounding resistor, where required, shall be of the proper ohmic value to limit the ground fault current to twenty-five (25) amperes. 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.

4.1.74. ~~4.74.~~—Low-and medium-voltage resistance grounded systems serving portable or mobile equipment shall include a fail-safe ground check circuit to monitor continuously the grounding circuit to assure continuity which ground check circuit shall cause the circuit breaker to open when either the ground or pilot check wire is broken, or other not less effective device approved by the Director or his authorized representative to assure such continuity, except that an extension of time, not in excess of twelve months, may be permitted by the Director on a mine-to-mine basis if he determines that such equipment is not available. Cable couplers shall be constructed so that the ground continuity conductor shall be broken first and the ground conductors shall be broken last when the coupler is being uncoupled.

4.1.75. ~~4.75.~~—Disconnecting devices shall be installed in conjunction with circuit breakers serving portable or mobile equipment to provide visual evidence that the power is connected.

4.1.76. ~~4.76.~~—Circuit breakers shall be marked for identification.

4.1.77. ~~4.77.~~—Single-phase loads shall be connected phase-to-phase when utilized on resistance grounded or ungrounded power systems.

4.1.78. ~~4.78.~~—Trailing cables for medium-voltage circuits shall include grounding conductors, a ground check conductor, and grounded metallic shields around each power conductor or a ground metallic shield over the assembly, except that on equipment employing cable reels, cables without shields may be used if the insulation is rated two thousand (2000) volts or more.

4.1.79. ~~4.79.~~—Trolley wires and trolley feeder wires shall be provided with cutout switches at intervals of not more than two thousand (2000) feet and near the beginning of all branches.

4.1.80. ~~4.80.~~—Trolley wire and trolley feeder wires shall be provided with overcurrent protection.

4.1.81. ~~4.81.~~—Trolley wires and trolley feeder wires, high-voltage cables, and transformers shall not be located within fifteen (15) feet of the last open crosscut and shall be kept at least one hundred and fifty (150) feet from pillar workings.

4.1.82. ~~4.82.~~—Trolley wires and trolley feeder wires, and bare signal wires shall be insulated adequately where they pass through doors and stoppings and where they cross over power wires and cables. Trolley wires and trolley feeder wires shall be guarded adequately:

4.1.82.a. ~~a)~~ At all points where men are required to work or pass regularly under the wires.

4.1.82.b. ~~b)~~ On both sides of all doors and stoppings.

4.1.82.c. ~~c)~~ At man-trip stations.

4.1.83. ~~4.83.~~—Temporary guards shall be provided where trackmen and other persons work in proximity to trolley wires and trolley feeder wires.

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4.1.84. ~~4.84.~~ Adequate precaution shall be taken to ensure that equipment being moved along haulageways will not come in contact with trolley wires or trolley feeder wires.

4.1.85. ~~4.85.~~ Trolley and feeder wires shall be installed as follows: Where installed on permanent haulage, they shall be:

4.1.85.a. ~~a)~~ At least six (6) inches outside the track gauge line.

4.1.85.b. ~~b)~~ Kept taut and not permitted to touch the roof, rib or crossbars. Particular care shall be taken where they pass through door openings to preclude bare wires from coming in contact with combustible material.

4.1.85.c. ~~c)~~ Installations of trolley wire hangers shall be provided within three (3) feet of each splice in a trolley wire.