

**INDEPENDENT REGULATORY  
REVIEW COMMISSION**

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# Regulatory Analysis Form

(Completed by Promulgating Agency)

(All Comments submitted on this regulation will appear on IRRC's website)

(1) Agency  
Department of Environmental Protection

(2) Agency Number:  
Identification Number: 7-527

IRRC Number: **3165**

(3) PA Code Cite: 25 Pa Code Chapter 208 Underground Coal Mine Safety

(4) Short Title: Sensitive Ground Fault

(5) Agency Contacts (List Telephone Number and Email Address):  
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(6) Type of Rulemaking (check applicable box):

- Proposed Regulation
- Final Regulation
- Final Omitted Regulation

- Emergency Certification Regulation;
- Certification by the Governor
- Certification by the Attorney General

(7) Briefly explain the regulation in clear and nontechnical language. (100 words or less)

This proposed rulemaking will add a provision to 25 Pa. Code Chapter 208, and four definitions. The proposed regulation will add Section 208.600 (relating to sensitive ground fault) and related definitions to § 208.1, to read as set forth in Annex A.

Specifically, this proposed regulation adds a provision requiring operators to equip certain electrical circuits at the mine with sensitive ground fault protection – a protection scheme that will shut off electrical power through the circuit when it detects that a current is flowing along an unintended path – which will reduce risk of injury or death from electrocution.

(8) State the statutory authority for the regulation. Include specific statutory citation.

Section 106.1 of The Bituminous Coal Mine Safety Act (BCMSA) (52 P.S. § 690-106.1) authorizes the Board of Coal Mine Safety (Board) to adopt regulations to implement BCMSA and to protect the health, safety, and welfare of miners and other individuals in and about mines.

Further, Section 334(c) of the BCMSA (52 P.S. § 690-334(c)) directed the mining industry to initiate studies into possible means of enhancing safety of underground cables, including through, among other things, “more sensitive ground fault limiting and detection.” The statute further required both laboratory and underground testing of such systems, and that the Board will take action on the industry’s reports and recommendations. To that end, the Pennsylvania Coal Alliance (PCA) (representing the coal mining industry) formed a committee with representatives from several coal mine operators to convene, manage the studies, and ultimately produce a report and recommendations to the

Board. The committee produced a report in March of 2012, titled "Pennsylvania Coal Association Bituminous Coal Mine Safety Act Section 334 Industry Studies Final Report" (Final Report). This proposed rulemaking is the product of the Final Report, which was followed by extensive deliberations by the Board.

(9) Is the regulation mandated by any federal or state law or court order, or federal regulation? Are there any relevant state or federal court decisions? If yes, cite the specific law, case or regulation as well as, any deadlines for action.

This regulation is not mandated by any federal or state law, court order, or federal regulation.

(10) State why the regulation is needed. Explain the compelling public interest that justifies the regulation. Describe who will benefit from the regulation. Quantify the benefits as completely as possible and approximate the number of people who will benefit.

This proposed rulemaking enhances miner safety from electrocution by improving the sensitive ground fault mechanisms on certain electrical circuits powering machinery within the mines. This proposed rulemaking will require operators to ensure that certain new and rebuilt power centers are equipped with this more sensitive ground fault protection devices (these including sensing relays, limiting resistors, and interrupting devices) thus enhancing the safety of persons working with or around the electric cables supplying power to certain machinery. Moreover, there is a compelling public interest in ensuring that miners are safe in the workplace. While estimating an exact number of individuals who will benefit from this rulemaking is difficult, miners, their families, mining companies, and others will benefit from electrical safety in underground mines. As a result of this proposed rulemaking, the risk of workplace injuries and deaths related to these electric cables will decline.

(11) Are there any provisions that are more stringent than federal standards? If yes, identify the specific provisions and the compelling Pennsylvania interest that demands stronger regulations.

In order to improve miner safety, per the BCMSA, the proposed rulemaking is more stringent than federal regulations in certain regards.

The federal Mine Safety and Health Administration (MSHA) regulation at 30 CFR 75.901(a) requires a ground fault current limit (trip setting) of 25 Amperes or less, and an MSHA policy manual recommends that the device be adjusted to operate at not more than 50 percent of the current rating of the grounding resistor.

The proposed rulemaking requires a trip setting of 300 milli-amperes or less nominally, except in the case of circuits powering equipment using variable speed drives, in which case, if nuisance tripping occurs at 300 milli-amperes, the operator may adjust the setting no greater than the lower value of 500 milli-amperes or one half of the neutral ground resistor's current rating. The need for improved miner safety from electrical hazards and that a practical and commercially available means of providing improved safety exists present a compelling Pennsylvania interest that calls for stronger regulation.

(12) How does this regulation compare with those of the other states? How will this affect Pennsylvania's ability to compete with other states?

The proposed rulemaking is industry-leading regulation that is more stringent than those of other states. Regardless, the industry-lead Final Report concluded that more sensitive ground fault relays, with the settings that this proposed rulemaking would require are, "practical, commercially available, and provides a significant enhancement to the safety of miners...."

(13) Will the regulation affect any other regulations of the promulgating agency or other state agencies? If yes, explain and provide specific citations.

No. The proposed regulation does not affect any other regulations of the promulgating agency or other state agencies.

(14) Describe the communications with and solicitation of input from the public, any advisory council/group, small businesses and groups representing small businesses in the development and drafting of the regulation. List the specific persons and/or groups who were involved. ("Small business" is defined in Section 3 of the Regulatory Review Act, Act 76 of 2012.)

This proposed rulemaking was prepared at the direction of the Board and pursuant to Section 334(c) of the BCMSA. Section 334(c) required the industry to study certain means of enhancing cable safety and create a report and recommendations, on which the Board must act. The seven-member Board is chaired by the Secretary of the Department of Environmental Protection and consists of three members who represent mine workers and three members who represent coal mine operators. Three of the members of the Board were nominated by the United Mine Workers of America (UMWA) to represent miners, and three were nominated by the Pennsylvania Coal Alliance (PCA) to represent coal mine operators.

The development and drafting of this proposed rulemaking was aided by input from the Board which received recommendations and advice on the rulemaking from its constituents. The three members of the Board nominated by the UMWA provided input on the regulations on behalf of mine workers. Likewise, the three representatives on the Board nominated by PCA made recommendations on the regulation on behalf of the nine underground bituminous mining companies and affiliates that currently operate in Pennsylvania. As such, both UMWA and PCA participated in the decision of the Board to prepare this regulation. The comment, review, and deliberation process extended for approximately three years after production of the 2012 report.

The Board has determined that three small businesses, as that term is defined under Section 3 of the Regulatory Review Act, will be affected by this proposed rulemaking. According to the Small Business Size Regulations under 13 CFR Part 121, for NAICS Code 212112 (bituminous coal underground mining), a small business is one that employs fewer than 500 persons. The Board determined that this rulemaking would apply to the nine underground bituminous mining companies currently operating in Pennsylvania, three of which employ fewer than 500 persons. The Board made this determination by reviewing its own internal data and publicly available data from the companies.

(15) Identify the types and number of persons, businesses, small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012) and organizations which will be affected by the regulation. How are they affected?

There are approximately 40 bituminous underground mines operating in Pennsylvania that are owned by nine underground bituminous mining companies. Three of these nine companies are small businesses. This proposed rulemaking will require these operators to ensure that any new or rebuilt load centers that operate in by the last open crosscut of the mine must include sensitive ground fault protective devices. For such load centers in operation at the time of the effective date of the regulation, operators must ensure that these load centers have sensitive ground fault protective devices within 60 months.

(16) List the persons, groups or entities, including small businesses that will be required to comply with the regulation. Approximate the number that will be required to comply.

There are approximately 40 underground bituminous coal mines operating in Pennsylvania that are owned by nine underground bituminous mining companies. These companies collectively employ approximately 5,300 persons. Three of these nine companies are small businesses. All of these entities will be required to comply with the regulation.

(17) Identify the financial, economic and social impact of the regulation on individuals, small businesses, businesses and labor communities and other public and private organizations. Evaluate the benefits expected as a result of the regulation.

This proposed rulemaking will have a financial impact on the operators related to the cost of acquiring and installing the sensitive ground fault devices. The potential benefits of the proposed rulemaking include the continued prevention of bodily harm and loss of life at underground mine sites.

(18) Explain how the benefits of the regulation outweigh any cost and adverse effects.

Although the benefit of reducing the risk of bodily harm and loss of life or property is difficult to quantify, the Final Report prepared pursuant to the BCMSA concluded that employing the devices required by this proposed rulemaking "is practical, commercially available, and provides a significant enhancement to the safety of miners working in a section power center, the equipment powered from it, and handling the trail cable." Moreover, the BCMSA explicitly noted the issue of cable safety with the expectation that this issue would be addressed after study and Board deliberation.

(19) Provide a specific estimate of the costs and/or savings to the **regulated community** associated with compliance, including any legal, accounting or consulting procedures which may be required. Explain how the dollar estimates were derived.

The Board anticipates that this rulemaking will cost the industry approximately \$500,000.00 over the next five years. As with any reduction of potentially hazardous risks, there are possible savings to the regulated industry as a result of enhancing worker safety.

This proposed rulemaking does not directly require additional accounting or consulting procedures, recordkeeping, or other paperwork. There may be indirect accounting or paperwork costs, but the Board anticipates that these costs will be minimal because most of the accounting or other paperwork is that which is already being performed on a routine basis when new equipment is purchased, or existing equipment is replaced or rebuilt. The proposed rulemaking includes no reporting requirement.

(20) Provide a specific estimate of the costs and/or savings to the **local governments** associated with compliance, including any legal, accounting or consulting procedures which may be required. Explain how the dollar estimates were derived.

This question does not apply because local governments do not engage in underground bituminous coal mining.

(21) Provide a specific estimate of the costs and/or savings to the **state government** associated with the implementation of the regulation, including any legal, accounting, or consulting procedures which may be required. Explain how the dollar estimates were derived.

The costs incurred by the state government as a result of this proposed rulemaking are expected to be negligible, as the Commonwealth already conducts mine safety inspections. Nothing in this proposed rulemaking will alter current state government practices or costs.

(22) For each of the groups and entities identified in items (19)-(21) above, submit a statement of legal, accounting or consulting procedures and additional reporting, recordkeeping or other paperwork, including copies of forms or reports, which will be required for implementation of the regulation and an explanation of measures which have been taken to minimize these requirements.

This proposed rulemaking requires minimal additional accounting or consulting procedures, recordkeeping, or other paperwork because most of the paperwork required is that which is already being performed on a routine basis when new equipment is purchased or existing equipment is replaced or rebuilt. The proposed rulemaking includes no reporting requirement.

(22a) Are forms required for implementation of the regulation?

No forms are required for the implementation of the proposed rulemaking.

(22b) If forms are required for implementation of the regulation, **attach copies of the forms here**. If your agency uses electronic forms, provide links to each form or a detailed description of the information required to be reported. **Failure to attach forms, provide links, or provide a detailed description of the information to be reported will constitute a faulty delivery of the regulation.**

N/A because no forms are required for the implementation of the proposed rulemaking.

(23) In the table below, provide an estimate of the fiscal savings and costs associated with implementation and compliance for the regulated community, local government, and state government for the current year and five subsequent years.

	<b>Current FY 2015/16</b>	<b>FY +1 2016/17</b>	<b>FY +2 2017/18</b>	<b>FY +3 2018/19</b>	<b>FY +4 2019/20</b>	<b>FY +5 2020/21</b>
<b>SAVINGS:</b>	\$	\$	\$	\$	\$	\$
<b>Regulated Community</b>	\$0	\$0	\$0	\$0	\$0	\$0
<b>Local Government</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>State Government</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>Total Savings</b>	\$0	\$0	\$0	\$0	\$0	\$0
<b>COSTS:</b>	\$	\$	\$	\$	\$	\$
<b>Regulated Community</b>	\$0	\$50,625	\$75,938	\$101,250	\$126,563	\$151,875
<b>Local Government</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>State Government</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>Total Costs</b>	\$0	\$50,625	\$75,938	\$101,250	\$126,563	\$151,875
<b>REVENUE LOSSES:</b>	\$	\$	\$	\$	\$	\$
<b>Regulated Community</b>	\$0	\$0	\$0	\$0	\$0	\$0
<b>Local Government</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>State Government</b>	N/A	N/A	N/A	N/A	N/A	N/A
<b>Total Revenue Losses</b>	\$0	\$0	\$0	\$0	\$0	\$0

(23a) Provide the past three-year expenditure history for programs affected by the regulation.

<b>Program</b>	<b>FY-3 2013-14</b>	<b>FY-2 2014-15</b>	<b>FY-1 2015-16</b>	<b>FY 2016-17</b>
<b>Environmental Protection Operations (#160-10381)</b>	\$75,184,000	\$84,438,000	\$87,172,000	\$89,066,000
<b>Environmental Program Management (#161-10382)</b>	\$25,733,000	\$28,517,000	\$28,277,000	\$30,025,000

(24) For any regulation that may have an adverse impact on small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012), provide an economic impact statement that includes the following:

(a) An identification and estimate of the number of small businesses subject to the regulation.

Three small businesses operate underground bituminous coal mines in Pennsylvania. The Board does not anticipate that the proposed rulemaking will have an adverse impact on these businesses.

- (b) The projected reporting, recordkeeping and other administrative costs required for compliance with the proposed regulation, including the type of professional skills necessary for preparation of the report or record.

There will be no additional costs incurred with respect to reporting, recordkeeping, and other administrative costs required for compliance with the rulemaking.

- (c) A statement of probable effect on impacted small businesses.

This proposed rulemaking is not expected to have a great effect on the three small businesses subject to this regulation. According to the Small Business Size Regulations under 13 CFR Part 121, for NAICS Code 212112 (bituminous coal underground mining) a small business is one that employs fewer than 500 persons. Three of the nine underground bituminous coal mining companies currently operating in Pennsylvania employ fewer than 500 persons. The three small businesses will be somewhat impacted, but these businesses were represented on the committee that undertook the study and created the Final Report that concluded that the devices required by this proposed rulemaking are practical and commercially available. The three small businesses are also represented on the Board that deliberated on this proposed rulemaking.

- (d) A description of any less intrusive or less costly alternative methods of achieving the purpose of the proposed regulation.

Section 334(b)-(c) requires that the industry study various means of achieving greater cable safety. Implementation of sensitive ground fault devices is the first product of these studies.

- (25) List any special provisions which have been developed to meet the particular needs of affected groups or persons including, but not limited to, minorities, the elderly, small businesses, and farmers.

No special provisions were developed to meet the particular needs of affected groups or persons as no groups were identified to be impacted. Three small businesses will be somewhat impacted, but these businesses were represented on the committee that undertook the study and created the Final Report that concluded that the devices required by this proposed rulemaking are practical and commercially available. The three small businesses are also represented on the Board that deliberated on this proposed rulemaking.

- (26) Include a description of any alternative regulatory provisions which have been considered and rejected and a statement that the least burdensome acceptable alternative has been selected.

The Board considered various adjusted settings of the ground fault detection devices and determined that on most systems, a setting of 300 milli-amperes is the lowest value that could be maintained without frequent nuisance tripping. For equipment utilizing variable-speed drives, which are more prone to nuisance tripping, operators may adjust the setting up to the lesser of 500 milli-amperes or one half of the neutral ground resistor's current rating.

In determining the setting that would work best for industry in Pennsylvania, the Board considered both state and federal requirements. The Board reviewed and considered all available information along with industry feedback.

Section 334(b)-(c) requires that the industry study various means of achieving greater cable safety. Implementation of sensitive ground fault devices is the first product of these studies.

(27) In conducting a regulatory flexibility analysis, explain whether regulatory methods were considered that will minimize any adverse impact on small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012), including:

- a) The establishment of less stringent compliance or reporting requirements for small businesses;
- b) The establishment of less stringent schedules or deadlines for compliance or reporting requirements for small businesses;
- c) The consolidation or simplification of compliance or reporting requirements for small businesses;
- d) The establishment of performing standards for small businesses to replace design or operational standards required in the regulation; and
- e) The exemption of small businesses from all or any part of the requirements contained in the regulation.

According to the Small Business Size Regulations under 13 CFR Part 121, for NAICS Code 212112 (bituminous coal underground mining) a small business is one that employs fewer than 500 persons. Three of the nine underground bituminous coal mining companies currently operating in Pennsylvania employ fewer than 500 persons. This proposed rulemaking is not expected to have a significant effect on the three small businesses subject to this regulation.

- a) Less stringent compliance requirements for small businesses were not considered because the industry-led study required by Sections 334(c) of the BCMSA into various means of enhancing cable safety (in which the relevant small businesses were represented) resulted in a Final Report that concluded - "more sensitive ground fault relays is practical, commercially available, and provides a significant enhancement to the safety of miners." This proposed rulemaking includes no reporting requirement.
- b) Less stringent schedules or deadlines for compliance were considered and ultimately adopted in the proposed rulemaking in the form of a 60-month phase-in requirement for all operators based on the logistics of maintaining operations while equipment rebuilding/replacing takes place. This proposed rulemaking includes no reporting requirement.
- c) The consolidation or simplification of compliance requirements for small business was not considered because this proposed rulemaking encompasses one rule regarding specific mining equipment. This proposed rulemaking includes no reporting requirement.
- d) The establishment of performing standards for small businesses to replace design or operational standards required in the regulation was not considered because the industry-led study required by Sections 334(c) of the BCMSA into various means of enhancing cable safety (in which the relevant small businesses were represented) resulted in a Final Report that concluded - "more sensitive ground fault relays is practical, commercially available, and provides a significant enhancement to the safety of miners." This rulemaking is a product of that study.
- e) The exemption of small businesses from all or any part of the requirements contained in the regulation was not considered because the industry-led study required by Sections 334(c) of the BCMSA into various means of enhancing cable safety (in which the relevant small businesses were represented) resulted in a Final Report that concluded - "more sensitive ground fault relays is practical, commercially available, and provides a significant enhancement to the safety of miners."

(28) If data is the basis for this regulation, please provide a description of the data, explain in detail how the data was obtained, and how it meets the acceptability standard for empirical, replicable and testable data that is supported by documentation, statistics, reports, studies or research. Please submit data or supporting materials with the regulatory package. If the material exceeds 50 pages, please provide it in a searchable electronic format or provide a list of citations and internet links that, where possible, can be accessed in a searchable format in lieu of the actual material. If other data was considered but not used, please explain why that data was determined not to be acceptable.

Section 334(c) of the BCMSA (52 P.S. § 690-334(b)-(c)) direct the mining industry to initiate studies into means of enhancing safety of underground cables. The statute further required both laboratory and underground testing of various equipment. To that end, PCA formed a committee with representatives from several operators to convene, manage the studies, and ultimately produce a report. The committee produced a report in March of 2012, titled "Pennsylvania Coal Association Bituminous Coal Mine Safety Act Section 334 Industry Studies Final Report" (attached). The Final Report concluded, among other things, that the lowest setting at which sensitive ground fault devices could be reliably employed without nuisance tripping was 300 milli-amperes.

Moreover, Department staff presented to the Board at its June 2015 meeting information that indicated that the ground fault device setting that would ensure the lowest risk of fatality from electrocution is 125 milli-amperes.

29) Include a schedule for review of the regulation including:

- |                                                                                               |                        |
|-----------------------------------------------------------------------------------------------|------------------------|
| A. The length of the public comment period:                                                   | <u>30 days</u>         |
| B. The date or dates on which any public meetings or hearings will be held:                   | <u>Not Applicable</u>  |
| C. The expected date of delivery of the final-form regulation:                                | <u>Quarter 4, 2017</u> |
| D. The expected effective date of the final-form regulation:                                  | <u>Quarter 1, 2018</u> |
| E. The expected date by which compliance with the final-form regulation will be required:     | <u>Quarter 1, 2018</u> |
| F. The expected date by which required permits, licenses or other approvals must be obtained: | <u>N/A</u>             |

(30) Describe the plan developed for evaluating the continuing effectiveness of the regulations after its implementation.

The Board is committed to ensuring the health and safety of all persons in the underground bituminous coal mine industry. As a result, the Board periodically reviews all regulations within this industry to ensure their continued effectiveness. This periodic review occurs at all Board meetings. The Board meets a minimum of four times each calendar year.



Pennsylvania Coal Association  
Bituminous Coal Mine Safety Act  
Section 334 Industry Studies  
Final Report  
March, 2012

Sections 334 (b) and (c) of the Pennsylvania Bituminous Coal Mine Safety Act (BCMSA), 52 P.S. § 690.334(b) and (c), contain provisions concerning certain studies that were to be performed pertaining to electrical issues. These include studies related to the potential use shielded cables in certain applications, more sensitive ground fault detection and studies related to enhancing the safety of underground direct-current machine cables.

The Pennsylvania Coal Association (PCA) formed a committee with representatives of a number of operators, including representatives from higher seam longwall mines, and mines that rely on continuous miners in thinner seams and larger and smaller operations. That Committee met several times and also communicated through email and telephone discussions. The committee initiated inquiries in the following areas:

- Higher resistance grounding with more sensitive ground fault detection for section power centers.
- Shielded cables for use with section power centers to supply 600 Volt AC power to permissible and non-permissible equipment that moves with the section.
- Ground wire monitors to monitor the grounding connection between a battery and off-board portable equipment that moves with the section, i.e. direct current equipment. .

**HIGHER RESISTANCE GROUNDING WITH MORE SENSITIVE GROUND FAULT DETECTION FOR SECTION POWER CENTERS.**

The Pennsylvania Bituminous Coal Mine Safety Act, Section 332(4) requires that the power center grounding resistor limit ground fault current to 25 Amperes or less. A similar MSHA standard, 30 CFR 75.901(a), also requires the grounding resistor limit ground fault current to 25 Amperes or less. The MSHA Program Policy Manual for 30 CFR 75.900 recommends that the ground fault detection device be adjusted to operate at not more than 50 percent of the current rating of the grounding resistor. At the present time, standard mining industry power centers are equipped with a grounding resistor(s) that limit ground fault current to 15 Amperes. The ground fault detection devices are commonly adjusted to operate at approximately 5 Amperes.

The PCA committee agreed that increasing the resistance rating (decreasing the current rating) of the grounding resistor would offer a significant increase in the safety of the power system. This change would limit the amount of energy available in all ground faults that could occur in the power system. Any decrease in the current rating of the resistor would also require a decrease in the setting of the ground fault detection relays. This enhancement to underground section power centers offers the potential to increase the safety of the power center, the equipment powered from it as well as the trailing cable. The committee was concerned that lowering the setting of the ground fault detection relays would result in nuisance tripping.

The committee investigated manufacturers of ground fault relays and section power centers. They found the following original equipment manufacturers to be suitable sources for this equipment:

**Ground Fault Relays**

Bender  
700 Fox Chase  
Coatesville PA 19320  
304-255-7438

Littelfuse, Inc.  
8755 West Higgins Road  
Chicago, IL, 60631  
773-628-1000

Bender-SMC Electrical Products  
P.O. Box 880  
Barboursville WV 25504  
304-736-8933

**Section Power Centers**

Intermountain Electronics  
12005-1/2 Virginia Blvd.  
Ashland, KY 41102  
877.543.9199

Line Power Manufacturing  
P.O. Box 8200  
Bristol VA 24203  
276-466-8200

Bender-SMC Electrical Products  
P.O. Box 880  
Barboursville WV 25504  
304-736-8933

**The above lists are not the only possible sources for this equipment**

Testing was initiated in two underground longwall mines. This proved successful in that it did not appear to generate unacceptable nuisance tripping of the equipment. Testing was then initiated in two underground non-longwall mines, which was also was successful. At this point larger scale testing was begun. Full power centers were ordered with current limiting grounding resistors rated at three, one and/or 0.6 Amperes. The setting of the ground trip relays was varied and the lowest value that could be reliably maintained without nuisance tripping was determined to be 0.300 Amperes. As of this date there are 15 safety enhanced section power centers in service in Pennsylvania underground coal mines. The ground fault detection relays in all of these power centers are currently set to trip at 0.300 Amperes.

This testing program has demonstrated that higher resistance rated (lower current rated) grounding resistors with more sensitive ground fault relays is practical, commercially available and provides a significant enhancement to the safety of miners, working in a section power center, the equipment powered from it and handling the trailing cable.

**SHIELDED CABLES FOR USE WITH SECTION POWER CENTERS TO SUPPLY 600 VOLT AC POWER TO PERMISSIBLE AND NON-PERMISSIBLE EQUIPMENT THAT MOVES WITH THE SECTION.**

PCA invited the major suppliers of underground mining cable, AmerCable and General Cable, and the two leading cable repair shops located in the state, Global Mine Services and RC Kadyk to participate in this portion of the study.

There was extensive discussion of the type of laboratory testing that was necessary to determine if the use of shielded cables was feasible on underground mine equipment with cable reels. Such discussions focused, in part, on the tests that would involve bending and manipulating shielded cables. The cables other jurisdictions such as the United Kingdom of Great Britain, Australia and Canada were discussed, as well as American shielded cable. A testing protocol was developed, including identification of the types and sizes of cables to be tested, as well as the potential availability of cable to be tested.

One of the manufacturers, General Cable, had testing equipment that appeared suitable for the testing, although that equipment had not been used for several years. They offered to rehabilitate the equipment and perform the testing at one of their out of state manufacturing plants. The test cables were identified and obtained from both cable manufacturers, General Cable and AmerCable. Some of those cables were built to specifications used in other countries. The upgraded test equipment was thought to be suitable and the testing began.

Unfortunately there was a problem regarding plant visitation privileges which delayed the testing. Initially it was believed that the technical representatives of the competing cable companies would be given access to the other manufacturer to witness and participate in the testing, but this was ultimately not permitted by the cable manufacturer because of concerns over the protection of proprietary information and trade secrets. As a result, both companies agreed to

do independent testing. AmerCable had to build its own test equipment. While this issue caused a delay, it resulted in a more comprehensive laboratory test program. The focus of the testing was to simulate the use of the cables on reeled equipment. The test equipment was developed to perform multiple flexing of the cable until failure was reached. The concern is that the use of reeled cables, under tension, with the occurrence of continual flexing of the shielded cable would damage the shielding. This damage results in unshielded sections of the cable and ground faults.

## AmerCable Inc. Tiger®brand Shielded Shuttle Car Cable Testing

### Test Objective:

To determine what shielded shuttle car cable(s) designs could be used in Pennsylvania mines as acceptable substitutes for the current non-shielded cables being used.

### Design Criteria:

Cable must be capable of withstanding approximately 25,000 cycles on a machine designed to represent reeling and de-reeling of cables on shuttle cars (Shuttle Car Simulator). This was estimated to be approximately equal to 3 months of flexure in the mine.

### Test Parameters:

The sheaves were 8" outside diameter and the tension was maintained at 100 lbs +/- 10%. These values were based on the practical experiences of the PCA committee members and AmerCable technical staff. The conductor temperature was approximately 75°C in a 25°C ambient. Seventy-five degrees Celsius was used instead of 90°C since this is the approximate temperature of shuttle car cable in free air, as opposed to temperatures down in the reel. The power conductors were wired in series to apply current. The machine was set to shut down when a power conductor experienced fatigue failure, or when the ground check or a grounding conductor broke. Also, a ground fault monitor was used to determine if/when a braid shield wire broke and penetrated the insulation. This too was set to shut down the machine at that moment.

### Background on Test Cables:

The cables selected by the PCA committee were representative of shielded cables being used in the U.S., shielded shuttle car cables being successfully used in other countries; and a control sample of both non-shielded Type GGC and copper braid shielded Type SHD-GC.

The following cables were tested:

- **Tiger® brand standard #2AWG 3/C Round Type GGC**

This was selected to establish base line data for what is probably the most commonly used shuttle car cable in the U.S.

- **Australian Type 275 CPE**

This sample was labeled TR1069 and uses the standard #2 3/C Round GGC assembly, but with semi-conductive rubber insulated grounds and a semi-conductive rubber inner jacket layer. It had an AmerCable standard Extra-Heavy-Duty (EHD) Chlorinated Polyethylene Rubber (CPE) outer jacket layer.

- **Australian Type 275 TPU**

This sample was labeled TR1067 and has the same design of the cable assembly, but with a Thermoplastic Polyurethane (TPU) semi-conductive inner jacket layer; and an EHD TPU outer jacket material.

- **British Standard BS 6708 Type 11.**

This cable had three copper/nylon individually braided shielded power conductors, and one individually shielded pilot (ground check) conductor equal in size to the power conductors. This cable had no bare copper grounding conductors in the interstices. The copper braid shielding over all four conductors is made to the British requirement and has enough mass to carry any fault current that might occur during a failure. The specification BS 6708 contains dc resistance requirements for the braid shields in parallel.

- **Tiger® brand standard #2AWG 3/C Type SHD-GC**

This sample was a standard commercially available American design.

- **South African Type RSA 41.5**

This cable had two 35mm<sup>2</sup> conductors in a Flat Type GGC construction a Hypalon rubber jacket. It was a brand new style of semi-conductive shielded flat DC shuttle car cable designed by AmerCable for coal mines in the Republic of South Africa.

Laboratory test results for each of these cables are shown below. The performance is recorded in cycles to failure or, if no phase to ground failure occurred, the target was approximately 25,000 cycles. Each cycle consists of a full traverse (down and back) of the Shuttle Car Simulator trolley.

Diagrams of the above cables and pictures of the test equipment and cable samples are in Appendix A of this report.

**AmerCable Inc. Test Results**

<b>Cable Description</b>	<b>Cycles</b>	<b>Comment</b>
#2AWG 3/C Round Type GGC	25,565	no failure
Australian Type 275 CPE	11,250	cable became kinked and had to be taken off of the machine
Australian Type 275 CPE	25,000	no failure
Australian Type 275 TPU	272	semi-conductive TPU cracked
British Standard BS 6708 Type 11	25,000	no failure
#2AWG 3/C Type SHD-GC	3,512	braid wire broke and penetrated the insulation
South African Type RSA 41.5	10,800	phase conductor wire broke and penetrated ground

**Discussion:**

Of the shielded cables, the British spec BS-6708 metallic shielded cable and the Australian Type 275 clearly performed the best on this test. They both performed equally to the most common shuttle car cable in the U.S., that being the #2 AWG 3/C Round Type G-GC non-shielded cable built to the Insulated Cable Engineers Association (ICEA) S-75-381. The ICEA spec SHD-GC was the second worst on this test, and hence will in all probability be a very poor performer in very small radius reeling applications at the mines. When used on larger diameter reels and guider sheave wheels, it should perform better.

A brand new style of semi-conductive shielded flat shuttle car cable for DC was designed by

AmerCable for coal mines in the Republic of South Africa. The first sample did quite well. Changes to the construction have been made, but no additional samples were tested on the Shuttle Car Simulator. While a work in progress this construction is considered to have good potential, even at 10,800 cycles to failure. The semi-conductive shielding performed its task and tripped the circuit breaker when one of the individual wires of the power conductor broke and penetrated the insulation.

### **General Cable Shielded Shuttle Car Cable Testing**

After extensive technical discussion between the PCA committee and General Cable technical staff a laboratory test protocol was developed. General Cable had previously built testing equipment and this equipment was in line with the needs of the PCA to test cable; however the equipment had not been used for testing for several years. General Cable offered to rehabilitate the test equipment and perform the testing at their Marion, Indiana cable factory.

The testing equipment consisted of two apparatus to test cables – each subjecting the cables to different forces. The first tester, the “Flex Testing” apparatus, held a cable sample under tension and flexed the cable through an angle of 180°. Cables are periodically checked for shorts and opens in the various conductors. The test is performed for 10,000 cycles on round cables and for 20,000 cycles on flat cables. After the test is completed the test cable is dissected and the cores and shields are examined for individual wire breakage.

The second test simulated the operation of a mine shuttle car. This test used a stationary piece of cable on a traversing carriage. Four sheaves create a double “S” bend in the cable as it cycles over a 15 foot distance and the cable is tensioned with air pressure of 100psi (±10 psi). Round cables are cycled to a count of 7,500 and flat cables to 8,000. Again the samples are periodically checked for shorts and opens and upon test completion, the test cable is dissected and the cores and shields are examined for individual wire breakage.

The suitable candidate cables for test were identified and obtained. Those cables were #2 AWG, three conductor, 2 kV cables as described below:

- Round G-GC (non-shielded)
- Round G-GC (with a semi-conductive rubber inner jacket)
- Round SHD-CG (with a nylon and copper braid shield)

- Flat G-GC (non-shielded)
- Flat G (with a semi-conductive rubber inner jacket)

The test equipment was upgraded and thought to be suitable to perform the testing and the testing was begun. General Cable developed the cable designs, created the manufacturing work instructions and then manufactured sample cables for testing and the testing commenced. A problem was discovered late in the testing of the General Cable sample cables. A wear issue was discovered late in the process when certain test results were simply unbelievable. This wear issue invalidated all previous tested samples. The test equipment had to be redesigned, in some cases new cable samples had to be produced, and the testing restarted.

By March of 2010 General Cable had tested four of the five cable candidates that they had agreed to test. While the last sample cable was being manufactured an issue was discovered with the shuttle car simulator's gear box. In order to extend the life of the gearbox to complete the testing, it was agreed to reduce the cycle time of the shuttle tester. This caused a delay as the testing that had occurred there had taken place at much slower cycle speeds than expected because of this gear box issue. This continued until it was realized that the gearbox had to be changed as it was pending a catastrophic failure. Testing of the last sample was delayed until the gear box could be replaced. Once the gear box was replaced the final cable sample was tested. To provide comparable data, the last cable was tested at the same "slower" cycle speed as the other cables.

Once this final cable sample was tested, data from the cable tests were evaluated, analyzed and presented to the PCA.

- Ground conductors in metallic shielded cables performed poorly in the flex test.

- Ground conductors with a semi-conductive shield performed poorly in the shuttle car simulator test.
- Wire breakage in both power and ground check conductors was approximately equal in all 3 round cables tested.
- Metallic shield wire breakage (discovered in the shuttle car simulator test) would likely lead to premature phase-to-ground shorts.

Two flat cables were tested, a #2 AWG, four conductor, type W and a #2 AWG, three conductor, type G with a semi-conductive inner jacket acting as a shield. The tests on these cables revealed:

- Little difference was found between the two cables with respect to power conductor wire breakage.
- Ground conductors in the type G with the semi-conductive shield surrounding did not hold up well.

Following a meeting with PCA, General Cable determined that the laboratory tests needed to be performed again to validate the data presented and alleviate questions raised about the testing by the PCA. General Cable was tasked with retesting the following cables:

- #2 AWG, three conductor round 2 kV Anaconda cable (type G-GC)
- #2 AWG, three conductor round 2 kV Anaconda cable with a semi-conductive inner jacket shield (type G-GC).
- #2 AWG, three conductor flat 2 kV Anaconda cable with a semi-conductive inner jacket shield (type G).

At this time, General Cable had developed two new cable designs. The General Cable designs were modifications to standard cable designs, a round 2 kV #2 AWG three conductor type G-GC Anaconda cable with an inner jacket layer of semi-conductive rubber and a flat 2 kV #2 AWG

three conductor type G Anaconda cable also with an inner jacket layer of semi-conductive rubber.

After the retesting, PCA advised that there was little benefit in further laboratory testing and CONSOL has agreed to test both of the new cable designs in a mine.

Representatives from CONSOL, R.C. Kadyk, and General Cable met to discuss the in mine testing. CONSOL agreed to field test the new round type G-GC and flat type G General Cable designs with the semi conductive inner jacket (from here on referred to as "safety enhanced" cable). R.C. Kadyk requested a quote for 4,000 feet of the round cable so that adequate quantity of the cable would be available for a meaningful test. CONSOL did offer to look into modifying equipment using round cable to accommodate flat cable to facilitate the testing of the flat cable. Both the BMX and Enlow Fork mines use a "CONSOL Spec" type W cable (a standard type W cable with a semi-conductive layer over the ground wire) shuttle car cable. BMX Mine agreed to install a length of the new safety enhanced round cable on a shuttle car. When this cable was to be removed from service, BMX Mine agreed to test the new flat safety enhanced cable.

BMX Mine tested the round safety enhanced cable in their mine. The cable operated for three weeks. When the cable was taken out of service it had 5 splices/taped spots on it. Reports stated that on the first day of operation the cable was pulled around the rib and torn in two. Mine personnel spliced the cable and reported that the cable appeared to be more difficult to splice than a standard cable. The cable was returned to R.C. Kadyk's shop for inspection.

In September CONSOL requested that General Cable provide splicing recommendations and procedures for the enhanced cables. General Cable, working in conjunction with TE Connectivity was tasked to develop procedures for splicing three cables: three conductor flat

type G (2 kV); three conductor round type G-GC (2 kV); and four conductor round type W cable (also 2 kV).

General Cable's new enhanced #2 AWG four conductor round type W cable was placed in service on a shuttle car at CONSOL's Enlow Fork Mine. Service life of the cable was typical of shuttle car cable life at the mine. The cable had one splice in it, the remainder of the jacket was in good condition. Delving deeper, the splice was well made but mine personal noted that splicing the cable took longer than normal to complete due to the jacket being difficult to strip. The cable performed as designed; a failure in the cable generated enough fault current to trip the breaker. From a safety point of view, the cable met the expected goals. From a cable repair point of view, the cable under performed. General Cable was contacted and asked to start a root cause investigation as to why the cable was so difficult to strip.

Investigation by General Cable revealed that the stripping problem was caused by inconsistent application of talc between the conductor insulation and the inner semi-conductive jacket.

Sections of the cable that had adequate talc applied were significantly easier to strip than sections lacking enough talc. Without a proper amount of talc applied to the core, the inner jacket bonds to the phase insulation during the curing process making the cable difficult to strip.

Several measures were taken by the Marion plant to ensure proper manufacture of this new product. An audible alarm was tied to a visual alarm on the equipment applying the talc; A visual aid showing proper talc application was placed at the operator work station; and a refresher training course was conducted for all operators.

At this time, in mine testing is still being conducted. CONSOL wishes to continue to test the #2 AWG four conductor type W safety enhanced cable. The cable is on order

Additional information is included in Appendix B.

### **Illinois Mines using Shielded Cable**

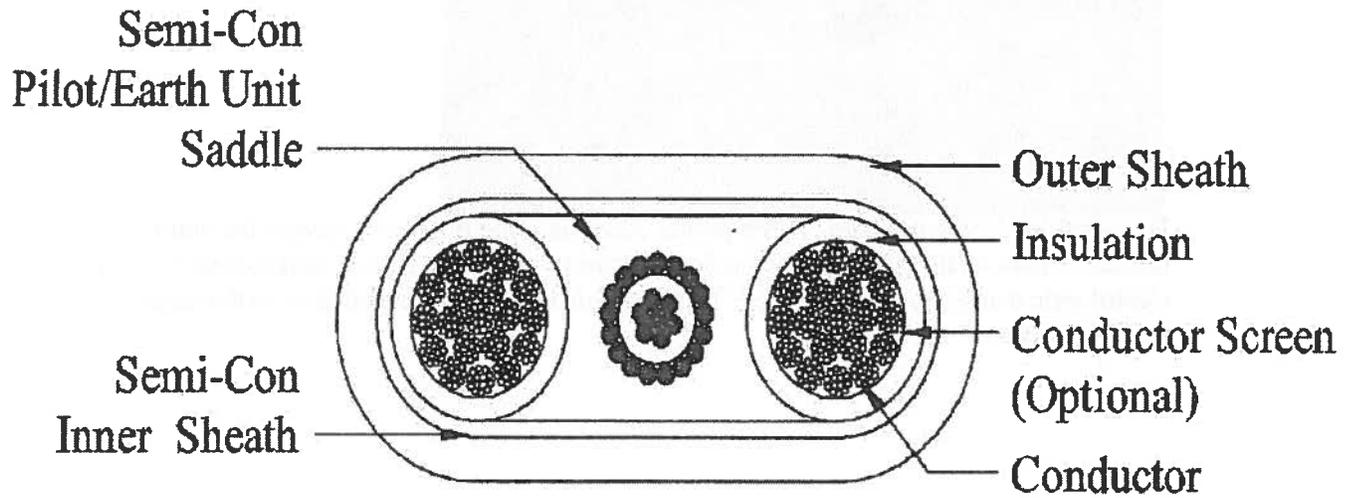
It was brought to the attention of the PCA committee that there are operating coal mines in Illinois using shielded cable for all face equipment powered from their section power centers. The committee was able to confirm that five mines are using shielded cable for all face equipment. Each of these mines is operating all face equipment at 995 VAC. Only one mine is operating cable reel shuttle cars. The committee was unable to gain any specific knowledge regarding cable life, splicing issues or shield deterioration. The lack of concrete information on the use of shielded cables in Illinois, prevents any meaningful comparison or analysis for the purpose of this report.

### **Finding**

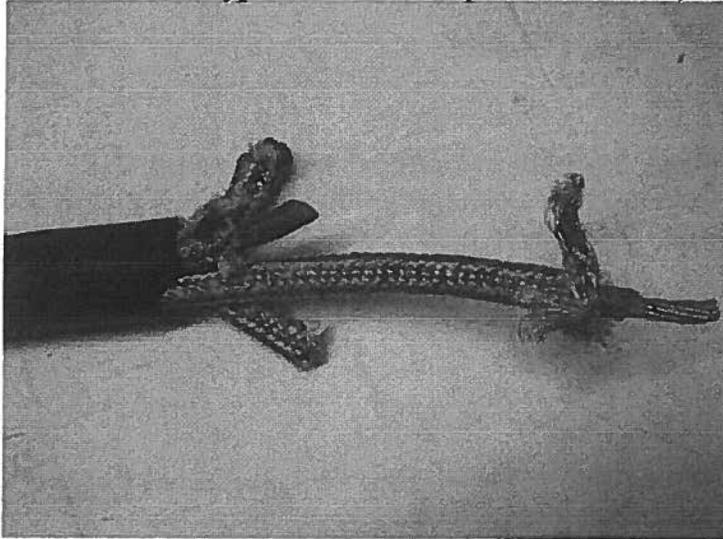
As a result of all the above information, at this time, the PCA committee finds that shielded cables available for use in Pennsylvania underground coal mines could not be expected to provide reasonable service.

## Appendix A AmerCable

**Flat DC Shuttle Car Cable for Republic of South Africa DC Shuttle Cars**  
**Pilot is the small central conductor and the earth (grounding conductor) is stranded around the insulated pilot wire.**



**British BS 6708 Type 11: 3 screened power conductor, 1 screened pilot**



**Description: 3-phase 4-core. Three power cores and one pilot core having the same nominal cross-sectional area, each having a protective metallic screen, laid around an elastomeric centre, sheathed overall. The combined screens shall function as the cable earth conductor**



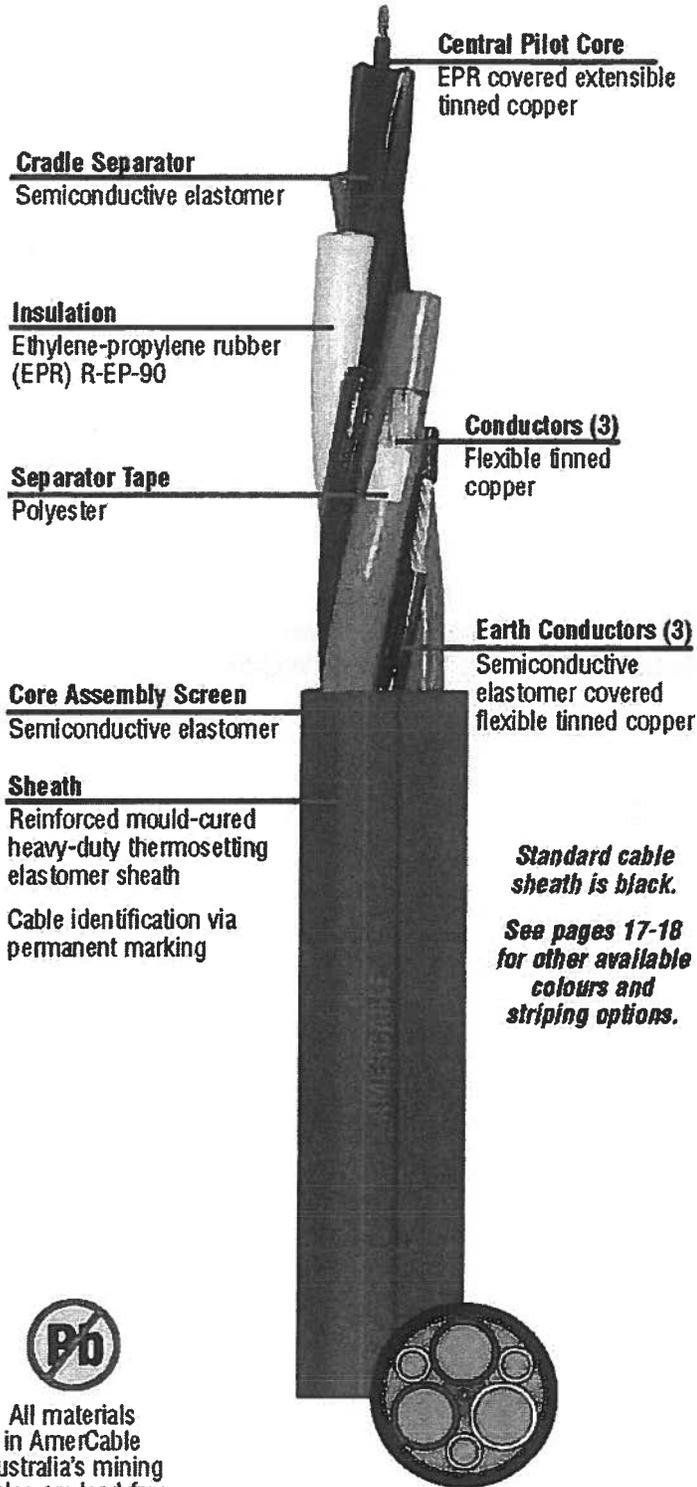
**U.S. Type G-GC: 3 non-screened power conductors, 2 earthing conductors, and one pilot per Insulated Cable Engineers Association S-75-381/NEMA WC-58**



**U.S. Type SHD-GC 2kV: 3 copper/nylon braid screened power conductors, 2 earthing conductors, and one pilot wire per ICEA S-75-381/NEMA WC-58.**

# Type 275

## Mould-cured CPE Sheath • 1.1kV

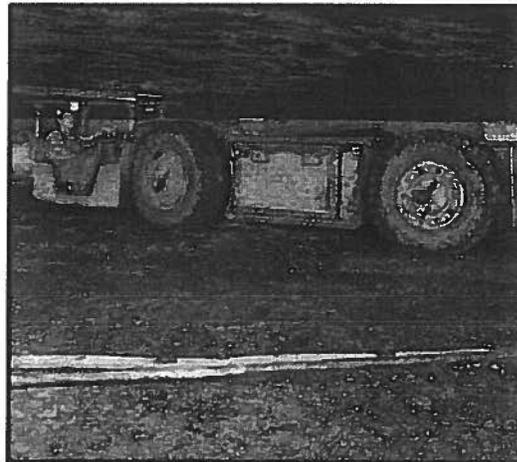


### Summary

Used for shuttle cars or other equipment with cable reels.

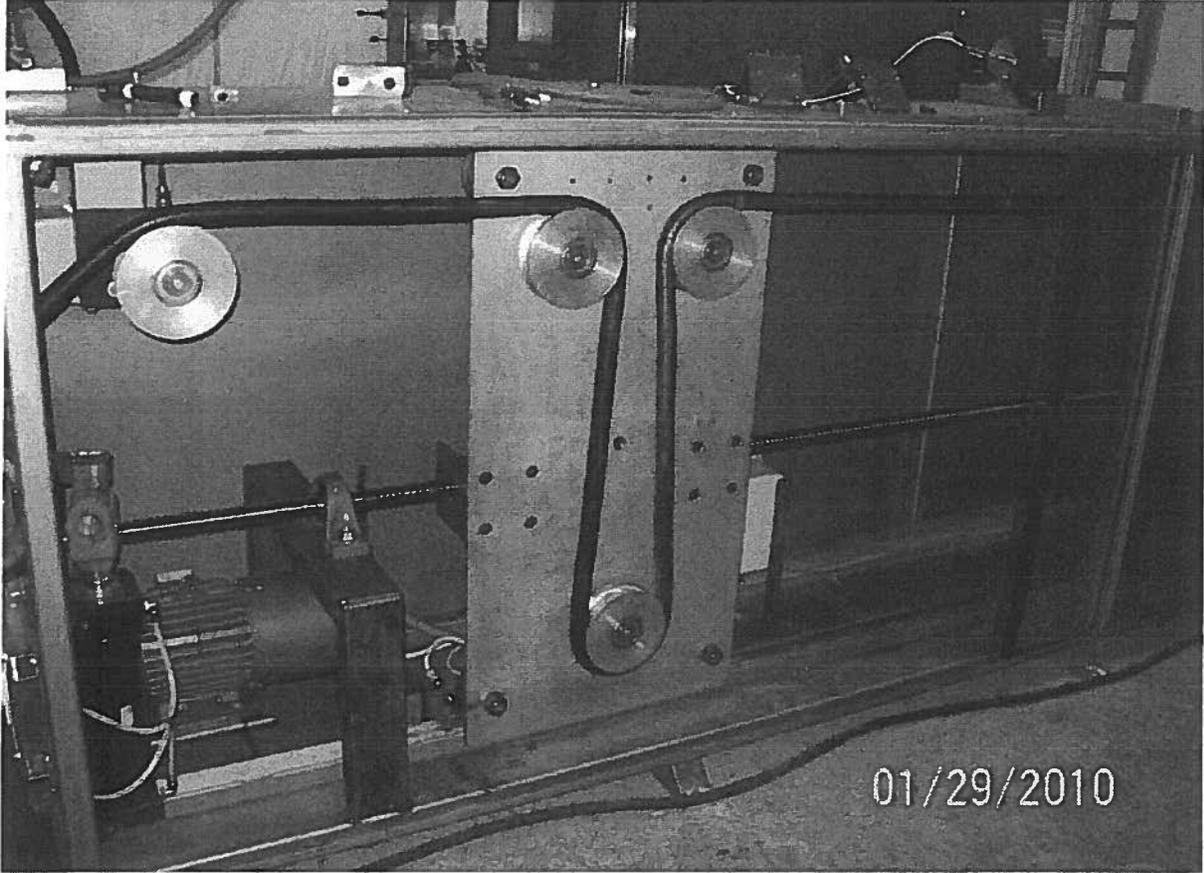
AmerCable Mining Cable meets or exceeds AS/NZS 1802 Standards.

Highly flexible construction with abrasion resistant CPE sheath.  
Available in colours and stripes.

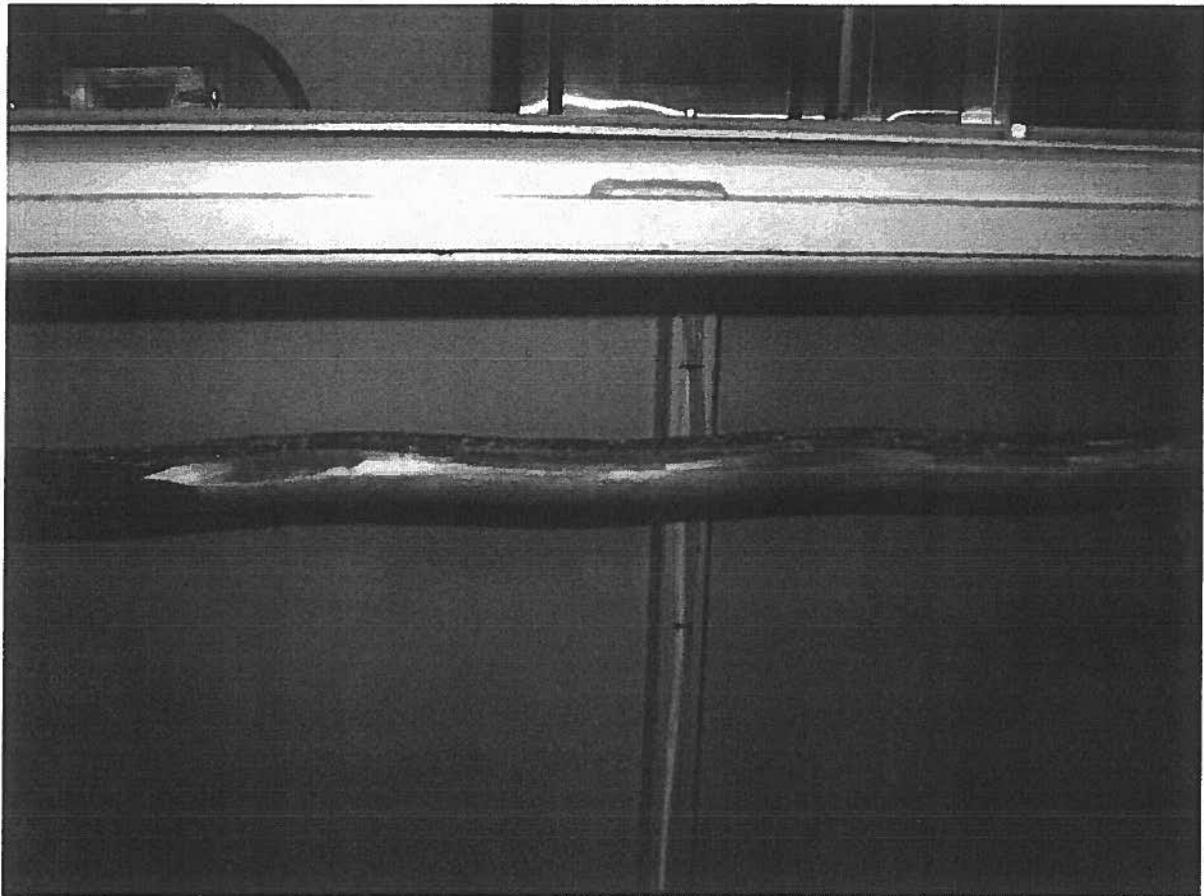


All materials in AmerCable Australia's mining cables are lead free.

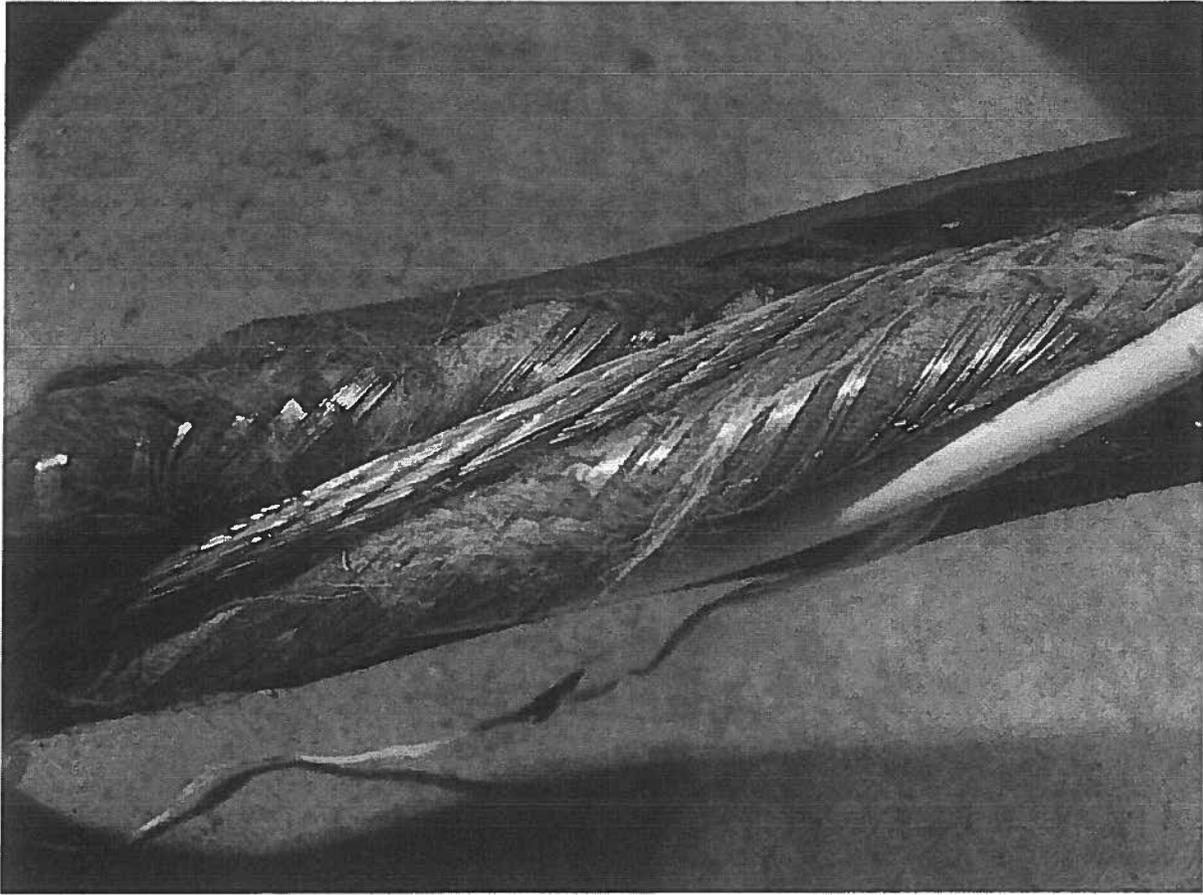
**Put the Power of AmerCable in your Mine**



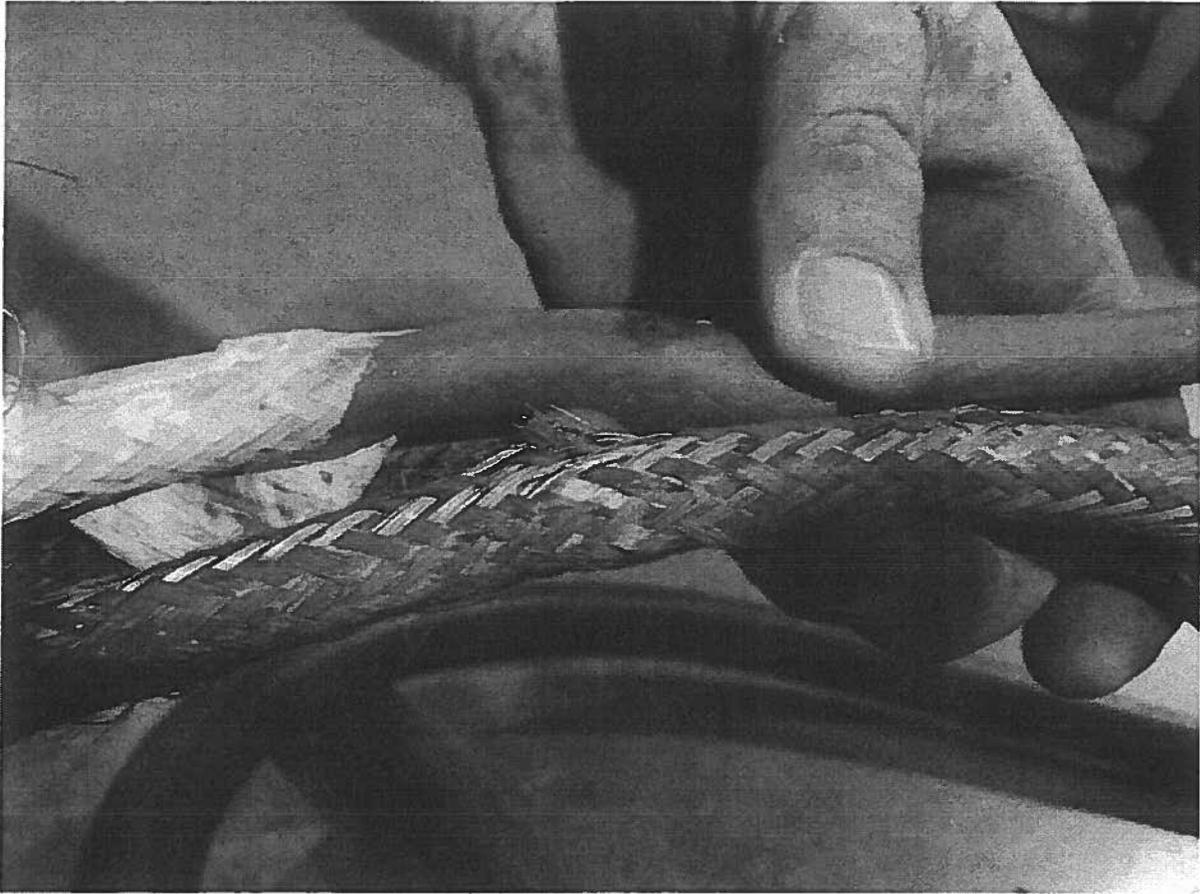
Shuttle Car Simulator



Australian Type 275, first sample kinked

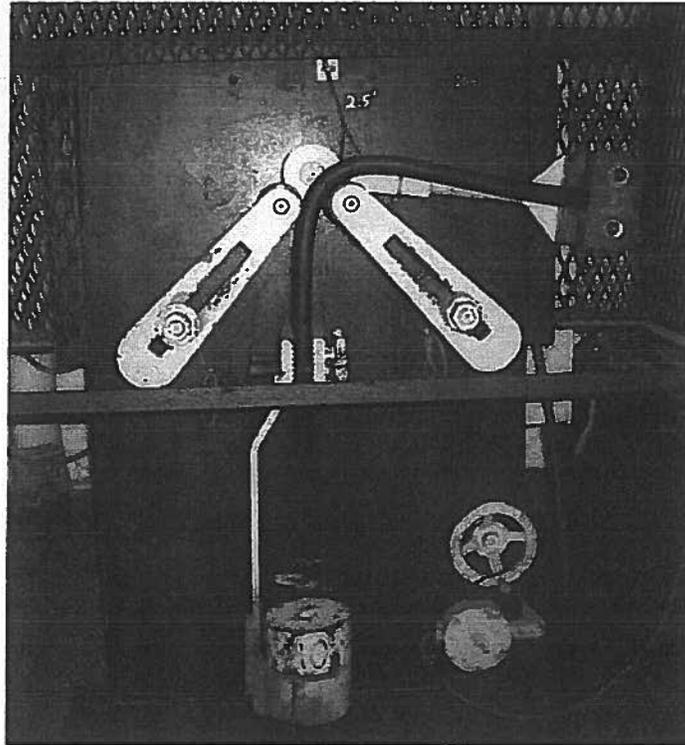


Standard SHDGC with broken shield wires. Also, note the wide spacing of the braid wires after only 3,512 cycles.



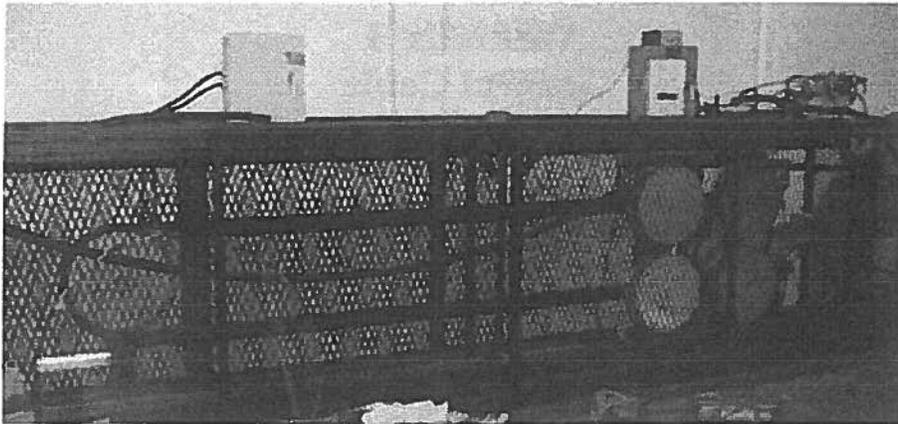
**SHDGC shield wires penetrated the insulation causing the trip.**

## Appendix B General Cable



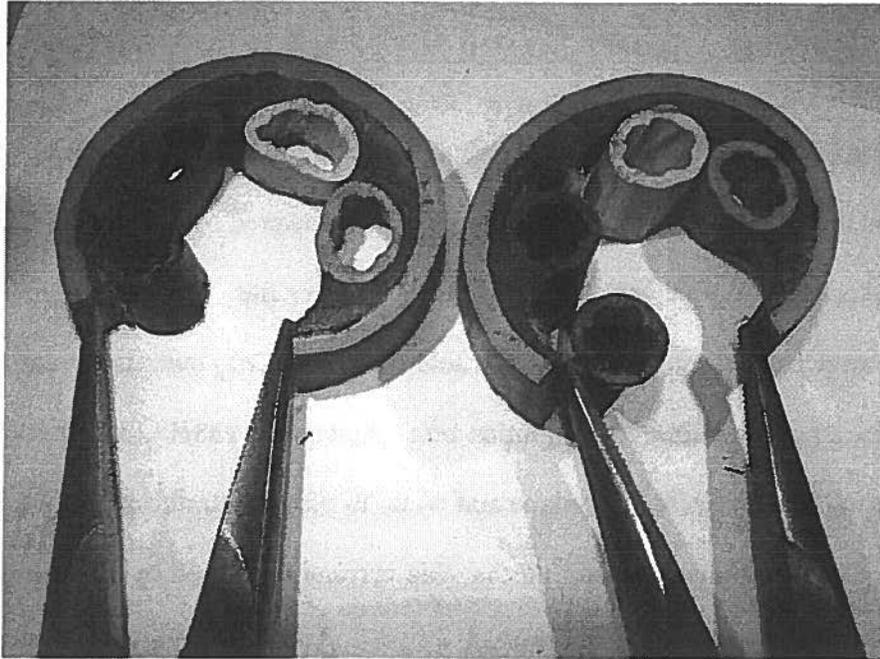
### Flex Testing

- Cable is flexed under tension through an angle of 180°
- 10,000 cycles for round cables
- 20,000 cycles for flat cables
- Samples periodically checked for shorts & opens
- Dissection for the examination of wire breaks



### **Shuttle Car Simulator Testing**

- 7,500 cycles for round cable and 8,000 cycles for flat cables
- Samples periodically checked for shorts and opens
- Dissection for the examination of wire breaks
- Test utilizes a stationary piece of cable on a traversing carriage
- Four sheaves create a double "S" bend of the cable as it cycles over a 15' distance
- Cable tension air pressure: 100 PSI  $\pm$  10PSI



From the photo it can be seen that the cut cross sections of two cable samples behave very differently when they are spread apart with the pliers. The “without talc” section on the left, shows that the phase insulation is bonded to the semi-conductive jacket

**GROUND WIRE MONITORS TO MONITOR THE GROUNDING CONNECTION BETWEEN A BATTERY AND OFF-BOARD PORTABLE EQUIPMENT THAT MOVES WITH THE SECTION.**

The Pennsylvania mining industry evaluated ground wire monitors for use on direct current (DC) equipment. The use of portable and/or mobile equipment powered by DC cable is not common but a few mines occasionally power equipment through DC cables. There are a limited number of mines that power equipment through a DC cable where the DC power is developed from an AC power source in a power center/distribution box. A standard MSHA accepted ground wire monitor can be powered from the AC source and wired to provide monitoring of the DC ground connection. In fact it is our understanding that this is currently required by the Bureau of Mine Safety through their equipment approval process.

A second method is to power equipment through a DC cable where the DC power is developed from an ungrounded battery. An example is a power take off (PTO) that provides power to a power center carrier. The carrier is powered by DC motors. The cable connecting the carrier to the PTO includes a conductor that is connected to the battery case at one end and the power center carrier frame at the other. The circuit breaker protecting this cable is interlocked to trip the circuit breaker if any plug is opened. The circuit is also protected against overload and short circuit. The power center carrier is only energized to relocate the unit after high voltage AC power is removed from the power center. A second example is powering a longwall monorail cable handling system after longwall cables have been de-energized as part of a longwall section power move.

We obtained the following list of companies that offer MSHA accepted ground wire monitors for use in underground coal mines.

American Electric, Inc.  
P.O. Box 710  
Beckley WV 25802  
304-255-7438

Mining Controls Incorporated  
P.O. Box 1141  
Beckley WV 25802  
304-252-6243

American Mine Research, Inc.  
12187 North Scenic Highway  
Rocky Gap VA 24366  
276-928-1712

Pemco Corporation  
P.O. Box 1319  
Bluefield VA 24605  
276-326-2611

Gai-Tronics Corporation  
400 East Wyomissing Avenue  
Mohntown PA 19540  
800-492-1212

Bender-SMC Electrical Products  
P.O. Box 880  
Barboursville WV 25504  
304-736-8933

Line Power Manufacturing Corporation  
P.O. Box 8200  
Bristol VA 24203  
276-466-8200

None of these manufacturers have an approved ground wire monitor that is rated for use on battery powered equipment. There are no MSHA-approved direct current powered ground wire monitors. A DC powered monitor would be required as the AC power is de-energized in the above examples.

American Electric, Inc. was the only manufacturer that was willing to work with us to develop a DC ground wire monitor. We set up a test area at Marion Engineering in Fairmont, West Virginia. Several prototype units were tested and each one failed. Attempts to modify existing MSHA accepted monitors by Marion Engineering also resulted in failure.

Caterpillar (Bucyrus) initiated a project to develop an MSHA accepted DC ground wire monitor. After several months they determined that a plug interlock circuit extended to the load is the current state of the art in this area.

The technical difficulty associated with developing such a monitor, the need to avoid grounding the battery and a limited market for this type of equipment are significant reasons that no such monitor is commercially available.

Our finding is that a DC ground wire monitor is not practical at this time.

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**(Pursuant to Commonwealth Documents Law)**

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Copy below is hereby approved as to form and legality.  
Attorney General

*Angela M. Elliott*

By: (Deputy Attorney General)

**NOV 16 2016**

DATE OF APPROVAL

Check if applicable  
Copy not approved. Objections attached.

Copy below is hereby certified to be true and  
correct copy of a document issued, prescribed or  
promulgated by:

DEPARTMENT OF ENVIRONMENTAL  
PROTECTION  
BOARD OF COAL MINE SAFETY

(AGENCY)

DOCUMENT/FISCAL NOTE NO. 7-527

DATE OF ADOPTION September 13, 2016

BY *Patrick McDonnell*

TITLE **PATRICK MCDONNELL  
ACTING CHAIRMAN**

EXECUTIVE OFFICER CHAIRMAN OR SECRETARY

Copy below is hereby approved as to form and legality  
Executive or Independent Agencies

BY *Marisa H. Z. Lehr*

**OCT 25 2016**

DATE OF APPROVAL

(Deputy General Counsel)  
(~~Chief Counsel - Independent Agency~~)  
(Strike inapplicable title)

Check if applicable. No Attorney General Approval  
or objection within 30 days after submission.

**NOTICE OF PROPOSED RULEMAKING**

**DEPARTMENT OF ENVIRONMENTAL PROTECTION  
BOARD OF COAL MINE SAFETY**

**Sensitive Ground Fault**

**25 Pa. Code Chapter 208**



**PROPOSED RULEMAKING  
BOARD OF COAL MINE SAFETY  
25 PA. CODE CH. 208  
SENSITIVE GROUND FAULT**

The Board of Coal Mine Safety (Board) amends Chapter 208 (relating to underground coal mine safety) to read as set forth in Annex A. The proposed rulemaking adds a provision to require operators to equip certain circuits with sensitive ground fault protection, as well as related definitions. This protection will enhance miner safety with respect to electric cables.

This proposed rulemaking was adopted by the Board at its meeting of September 13, 2016.

*A. Effective Date*

This proposed rulemaking will be effective upon final-form publication in the *Pennsylvania Bulletin*.

*B. Contact Persons*

For further information, contact Craig Carson, Director, Bureau of Mine Safety, 131 Broadview Road, New Stanton, PA 15672, (724) 404-3154, or by e-mail to cocarson@pa.gov; or Joseph Iole, Assistant Counsel, Bureau of Regulatory Counsel, Rachel Carson State Office Building, P. O. Box 8464, Harrisburg, PA 17105-8464, (717) 787-9376, or by email to jirole@pa.gov. Information regarding submitting comments on this proposed rulemaking appears in Section J of this preamble. Persons with a disability may use the Pennsylvania AT&T Relay Service, (800) 654-5984 (TDD users) or (800) 654-5988 (voice users). This proposed rulemaking is available on the Department of Environmental Protection's (Department) web site at [www.dep.pa.gov](http://www.dep.pa.gov).

*C. Statutory Authority*

Sections 106 and 106.1 of the Bituminous Coal Mine Safety Act (BCMSA) (52 P. S. §§ 690-106 and 690-106.1) authorize the adoption of regulations to implement the BCMSA. The BCMSA further authorizes the Board to promulgate necessary or appropriate regulations to implement the requirements of the BCMSA and to protect the health, safety and welfare of miners and other individuals in and about mines.

*D. Background and Purpose*

On July 7, 2008, the General Assembly enacted the BCMSA, which was the first significant update of the Commonwealth's underground bituminous coal mine safety laws since 1961. See 52 P. S. § 690-103(a). The BCMSA provides broad authority to promulgate regulations that are necessary or appropriate to implement the BCMSA and to protect the health, safety and welfare of miners and other individuals in and about mines. See 52 P. S. § 690-106.1(a). Under section 106 of the BCMSA, the Board consists of three members representing mine workers, three

members representing underground bituminous coal mine operators and the Secretary of the Department of Environmental Protection (Department) who serves as the Board's chairperson.

This proposed rulemaking adds a provision to Chapter 208 to enhance cable safety. Specifically, Section 334(c) of the BCMSA (52 P.S. § 690-334(c)) directed the mining industry to initiate studies into possible means of enhancing safety of underground cables, including through, among other things, “more sensitive ground fault limiting and detection.” The statute further required both laboratory and underground testing of such systems, and that the Board will take action on the industry’s reports and recommendations.

To that end, the Pennsylvania Coal Alliance (PCA) formed a committee with representatives from several coal mine operators to convene, manage the studies, and ultimately produce a report and recommendations to the Board. The committee produced a report in March of 2012, titled “Pennsylvania Coal Association Bituminous Coal Mine Safety Act Section 334 Industry Studies Final Report” (Final Report). This proposed rulemaking is the product of the Final Report, which was followed by extensive deliberations by the Board over the course of three years.

This proposed rulemaking enhances miner safety from electrocution by improving the sensitive ground fault mechanisms on certain electrical circuits powering machinery within the mines. This proposed rulemaking will require operators to ensure that certain new and rebuilt power centers are equipped with this more sensitive ground fault protection devices (these including sensing relays, limiting resistors, and interrupting devices) thus enhancing the safety of persons working with or around the electric cables supplying power to certain machinery.

In order to improve miner safety, per the BCMSA, the proposed rulemaking is more stringent than federal regulations in certain regards. The federal Mine Safety and Health Administration (MSHA) regulation at 30 CFR 75.901(a) requires a ground fault current limit (trip setting) of 25 Amperes or less, and an MSHA policy manual recommends that the device be adjusted to operate at not more than 50 percent of the current rating of the grounding resistor.

In light of the Final Report, which indicated that a setting of 125 milli-amperes would be too low to functionally operate equipment at the mine, but that 300 milli-amperes was more protective than the current regulatory requirement of 25 Amperes, the proposed rulemaking requires a trip setting of 300 milli-amperes or less nominally, except in the case of circuits powering equipment using variable speed drives, in which case, if nuisance tripping occurs at 300 milli-amperes, the operator may adjust the setting no greater than the lower value of 500 milli-amperes or one half of the neutral ground resistor’s current rating. These settings improve safety while maintaining mining operations.

There is a compelling public interest in ensuring that miners are safe in the workplace. Miners, their families, mining companies, and others will benefit from electrical safety in underground mines. As a result of this proposed rulemaking, the risk of workplace injuries and deaths related to these electric cables will decline. Adopting this regulation ensures that operations at underground bituminous coal mine sites are safely conducted and maintained.

## *E. Summary of Proposed Regulatory Requirements*

### *§ 208.1. Definitions*

This section adds definitions of the terms “crosscut”, “inby”, and “working section”, which appear in the proposed § 208.600. *Sensitive Ground Fault*, and a definition of the term “working face”, which appears in the proposed definition of “inby”.

### *§ 208.600. Sensitive Ground Fault*

This section requires that operators utilize sensitive ground fault devices on circuits that operate three-phase electrically operated equipment operated on a working section inby the last open crosscut; specifies the settings of the sensitive ground fault devices powering various machines; and sets an implementation schedule for utilizing these devices on new, rebuilt, and existing power centers.

## *F. Benefits, Costs and Compliance*

### *Benefits*

The proposed rulemaking enhances cable safety by requiring on certain circuits a sensitive ground fault protective device. Sensitive ground fault protective devices improve cable safety by shutting off electrical power through the circuit when it detects that a current is flowing along an unintended path, thereby reducing the risk of bodily harm from electrocution.

### *Compliance costs*

The proposed rulemaking will cost the nine operators approximately \$500,000.00 over five years. This cost reflects the purchase of new power centers equipped with the sensitive ground fault devices and the rebuilding of existing machines to include such devices.

### *Paperwork requirements*

The proposed rulemaking does not generate additional paperwork.

## *G. Pollution Prevention*

The Federal Pollution Prevention Act of 1990 (42 U.S.C.A. §§ 13101—13109) establishes a National policy that promotes pollution prevention as the preferred means for achieving state environmental protection goals. The Department encourages pollution prevention, which is the reduction or elimination of pollution at its source, through the substitution of environmentally friendly materials, more efficient use of raw materials and the incorporation of energy efficiency strategies. Pollution prevention practices can provide greater environmental protection with greater efficiency because they can result in significant cost savings to facilities that permanently achieve or move beyond compliance. This proposed rulemaking has minimal impact on pollution prevention since it is focused on mine safety.

## H. *Sunset Review*

The Board is not establishing a sunset date for these regulations, since they are needed for the Department to carry out its statutory authority. The Department will continue to closely monitor these regulations for their effectiveness and recommend updates to the Board as necessary

## I. *Regulatory Review*

Under section 5(a) of the Regulatory Review Act (71 P.S. § 745.5(a)), on March 3, 2017, the Department submitted a copy of this proposed rulemaking and a copy of a Regulatory Analysis Form to the Independent Regulatory Review Commission (IRRC) and to the Chairpersons of the House and Senate Environmental Resources and Energy Committees. A copy of this material is available to the public upon request.

Under section 5(g) of the Regulatory Review Act, IRRC may convey any comments, recommendations or objections to the proposed rulemaking within 30 days of the close of the public comment period. The comments, recommendations or objections must specify the regulatory review criteria in section 5.2 of the Regulatory Review Act (71 P.S. § 745.5b) which have not been met. The Regulatory Review Act specifies detailed procedures for review, prior to final publication of the rulemaking, by the Department, the General Assembly and the Governor.

## J. *Public Comments*

Interested persons are invited to submit to the Board written comments, suggestions, support or objections regarding the proposed rulemaking. Comments, suggestions, support or objections must be received by the Board by April 17, 2017. In addition to the submission of comments, interested persons may also submit a summary of their comments to the Board. The summary may not exceed one page in length and must also be received by the Board by April 17, 2017. The one-page summary will be distributed to the Board and available publicly prior to the meeting when the final-form rulemaking will be considered.

Comments including the submission of a one-page summary of comments may be submitted to the Board online, by e-mail, by mail or express mail as follows.

Comments may be submitted to the Board by accessing eComment at <http://www.ahs.dep.pa.gov/eComment>.

Comments may be submitted to the Board by e-mail at [RegComments@pa.gov](mailto:RegComments@pa.gov). A subject heading of the proposed rulemaking and a return name and address must be included in each transmission.

If an acknowledgement of comments submitted online or by e-mail is not received by the sender within 2 working days, the comments should be retransmitted to the Board to ensure receipt. Comments submitted by facsimile will not be accepted.

Written comments should be mailed to the Board of Coal Mine Safety, P. O. Box 8477, Harrisburg, PA 17105-8477. Express mail should be sent to the Board of Coal Mine Safety, Rachel Carson State Office Building, 16th Floor, 400 Market Street, Harrisburg, PA 17101-2301.

Patrick McDonnell  
Acting Chairman,  
Board of Coal Mine Safety



Annex A  
TITLE 25. ENVIRONMENTAL PROTECTION  
PART I. DEPARTMENT OF ENVIRONMENTAL PROTECTION  
Subpart D. ENVIRONMENTAL HEALTH  
AND SAFETY  
ARTICLE IV. OCCUPATIONAL HEALTH  
AND SAFETY  
CHAPTER 208. UNDERGROUND COAL  
MINE SAFETY

**§ 208.1. Definitions.**

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise:

*AED—Automated external defibrillator*—A portable device that uses electric shock to restore a stable heart rhythm to an individual in cardiac arrest.

*Act*—The Bituminous Coal Mine Safety Act (52 P. S. § § 690-101—690-708).

*Approval or approved*—The term as defined in section 104 of the act (52 P. S. § 690-104).

*Barricaded*—To obstruct passage of persons, vehicles or flying materials.

*Berm*—A pile or mound of material capable of restraining a vehicle.

*Certified or registered*—A person certified or registered by the state in which the coal mine is located to perform duties prescribed by 30 CFR Part 77 (relating to mandatory safety standards, surface coal mines and surface work areas of underground coal mines), except that, in a state where a program of certification or registration is not provided or when the program does not meet at least minimum Federal standards established by the Secretary of the United States Department of Labor, the certification or registration shall be by the Secretary of the United States Department of Labor.

**Crosscut—A passageway driven between the entry and its parallel air course or air courses for ventilation purposes.**

*Flash point*—The minimum temperature at which sufficient vapor is released by a liquid or solid to form a flammable vapor-air mixture at atmospheric pressure.

**Inby—In the direction of the working face.**

*MSHA*—The term as defined in section 104 of the act.

*Miner*—The term as defined in section 104 of the act.

*NIOSH*—The term as defined in section 104 of the act.

*Operator*—The term as defined in section 104 of the act.

*Overpressure*—The pressure over the background atmospheric pressure that could result from an explosion, which includes the impact of the pressure wave on an object.

*psi*—Pounds per square inch.

*Qualified person*—The term means either of the following as determined by the context of the regulation:

(i) An individual deemed qualified by the Secretary of the United States Department of Labor and designated by the operator to make tests and examinations required under 30 CFR Part 77.

(ii) An individual deemed, in accordance with the minimum requirements to be established by the Secretary of the United States Department of Labor, qualified by training, education and experience to perform electrical work, to maintain electrical equipment, and to conduct examinations and make tests of all electrical equipment.

*Representative of the miners*—The term as defined in section 104 of the act.

*Roll protection*—A framework, safety canopy or similar protection for the operator when equipment overturns.

*SCSR—Self-contained self-rescue device*—A type of closed-circuit, self-contained breathing apparatus approved by MSHA and NIOSH under 42 CFR Part 84 (relating to approval of respiratory protective devices) for escape only from underground mines.

*Safety can*—An approved container, of not over 5 gallons capacity, having a spring-closing lid and spout cover.

*Trailing cable*—The cable connecting portable and mobile equipment to a power source. A cable is not considered a trailing cable if it connects to equipment which is installed in a stationary location and is permanently wired.

*Underground bituminous coal mine or mine*—The term as defined in section 104 of the act.

**Working face**—Any place in a mine where coal is extracted during a mining cycle.

**Working section**—The area in a mine from the face extending back 1,000 feet.

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## CABLE SAFETY

### § 208.600. Sensitive Ground Fault.

(a) All three-phase electrically operated equipment operated on a working section inby the last open crosscut shall receive power from a circuit equipped with a sensitive ground fault protection as specified herein:

#### (1) Sensitive Ground Fault.

(i) A sensitive ground fault protective device shall be connected so that the associated circuit will be instantaneously interrupted upon the occurrence of a ground fault which shall not exceed 300 milli-amperes nominally.

(ii) A sensitive ground fault protective device on such circuits on equipment utilizing variable speed drives shall be connected so that the associated circuit will be instantaneously interrupted upon the occurrence of a ground fault which shall not exceed 300 milli-amperes nominally; provided that if nuisance tripping occurs on such circuits, such devices shall be permitted to be adjusted to the minimum setting necessary to prevent nuisance tripping. In no case shall the device(s) be adjusted greater than the lower value of 500 milli-amperes or one half of the neutral ground resistor's current rating.

(iii) The secondary main circuit breaker protecting any sensitive ground fault circuit subject to this regulation shall also provide backup sensitive ground fault protection. Relay settings may include a short time delay (250mS) and/or a higher current setting to provide coordination. In no case shall the device(s) be adjusted greater than the lower value of 500 milli-amperes or one half of the neutral ground resistor's current rating.

#### (2) Implementation Schedule.

These regulations are effective immediately upon enactment for all load centers that power equipment that operates inby the last open crosscut and that is purchased after the effective date of the regulations and such load centers that are rebuilt after the effective date of these regulations at new mines. For any load centers that power equipment that operates inby the last open crosscut that are located in or at a mine on the effective date of the regulations, sensitive ground fault protection shall be installed within 60 months after the effective date of this regulation.



March 3, 2017

David Sumner  
Executive Director  
Independent Regulatory Review Commission  
333 Market Street, 14th Floor  
Harrisburg, PA 17120

Re: Proposed Rulemaking: Sensitive Ground Fault (#7-527)

Dear Mr. Sumner:

Pursuant to Section 5(a) of the Regulatory Review Act, please find enclosed a copy of a proposed regulation for review and comment by the Independent Regulatory Review Commission (Commission). This proposal is scheduled for publication in the *Pennsylvania Bulletin* on March 18, 2017 with a 30-day public comment period. The Board of Coal Mine Safety (Board) adopted this proposal on September 13, 2016.

The enclosed rulemaking proposes adding a regulatory provision to Chapter 208 to address the safety of cables powering certain machines at underground bituminous coal mine sites. This addition, § 208.600 (relating to cable safety) and related definitions added to § 208.1, will read as set forth in Annex A, and will require operators to utilize sensitive ground fault protection devices on certain power centers.

The Bituminous Coal Mine Safety Act directs the mining industry to undertake studies regarding possible means of enhancing safety of underground cables, including through, among other things, “more sensitive ground fault limiting and detection.” The statute requires both laboratory and underground testing of such systems, and requires that the Board take action on the industry’s reports and recommendations. This proposed rulemaking is the product of those statutory requirements. This proposed rulemaking will ensure the enhancement of cable safety, reducing the risk of accidents and injuries resulting from electrocution. Such regulations benefit persons in and about mine sites and mine operators. There are nine operators of underground bituminous coal mines in Pennsylvania that will be subject to this proposed rulemaking, and three of those operators are small businesses.

The development and drafting of this rulemaking was aided by input from the Board which received recommendations and advice on the rulemaking from its constituents. The Board is chaired by the Secretary of the Department of Environmental Protection and consists of three members representing the interests of mine workers and three members representing the interests of underground bituminous coal mine operators.



The Department will provide the Commission with the assistance required to facilitate a thorough review of this proposal. Section 5(g) of the Regulatory Review Act provides that the Commission may, within 30 days of the close of the comment period, convey to the agency its comments, recommendations and objections to the proposed regulation. The Department will consider any comments, recommendations or suggestions made by the Commission, as well as the Committees and public commentators, prior to final adoption of this rulemaking.

Please contact me by e-mail at [ledinger@pa.gov](mailto:ledinger@pa.gov) or by telephone at 717.783.8727 if you have any questions or need additional information.

Sincerely,

A handwritten signature in blue ink that reads "Laura Edinger". The signature is written in a cursive style with a large initial "L".

Laura Edinger  
Regulatory Coordinator

Enclosures



**TRANSMITTAL SHEET FOR REGULATIONS SUBJECT TO  
 THE REGULATORY REVIEW ACT**

I.D. NUMBER: 7-527  
 SUBJECT: Sensitive Ground Fault  
 AGENCY: DEPARTMENT OF ENVIRONMENTAL PROTECTION

**TYPE OF REGULATION**

- Proposed Regulation
- Final Regulation
- Final Regulation with Notice of Proposed Rulemaking Omitted
- 120-day Emergency Certification of the Attorney General
- 120-day Emergency Certification of the Governor
- Delivery of Tolerated Regulation
  - a.  With Revisions
  - b.  Without Revisions

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**FILING OF REGULATION**

DATE	SIGNATURE	DESIGNATION
3/3	<i>Shelly K. Kleener</i>	Majority Chair, HOUSE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Representative John Maher
3/3	<i>Bill M...</i>	Minority Chair, HOUSE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Representative Mike Carroll
3/3	<i>J. Willard</i>	Majority Chair, SENATE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Senator Gene Yaw
3/3	<i>Nayla...</i>	Minority Chair, SENATE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY Senator John Yudichak
3/3/17	<i>K. Cooper</i>	INDEPENDENT REGULATORY REVIEW COMMISSION David Sumner
		ATTORNEY GENERAL (for Final Omitted only)
3/3	<i>Courne Inant</i>	LEGISLATIVE REFERENCE BUREAU (for Proposed only)

