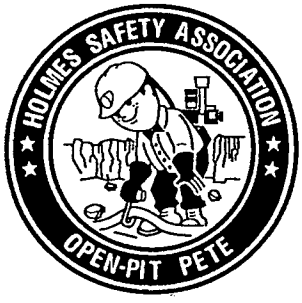
BULLETIN

October 1992



October 1992

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KEEP US IN CIRCULATION

The Holmes Safety Association Bulletin contains safety articles on a variety of subjects: fatal accident abstracts, studies, posters and other safety-related topics. This information is provided free of charge and is designed to assist in presentations to groups of mine and plant workers during on-the-job safety meetings.

Welcome new members

NAME	CHAPTER NUMBER	LOCATION
Swanton Limestone	9874	Swanton, VT
Dominion Energy	9875	Flatgap, KY
George E. Belcher	9876	Big Stone Gap, VA
El Dorado	9877	Verdunville, WV
2 M Energy, Inc.	9878	Fairmont, WV
Horizon Potash Corporation	9879	Carlsbad, NM
Mary Drinkwater Open Pit	9880	Silver Peak, NV
Wilson Decline	9881	Silver Peak, NV
16-TO-I Mill	9882	Silver Peak, NV
Mines	9883	Troy, NY
Powley Sand & Gravel	9884	E. Peoria, IL
Liggett Indust., Inc., AZ Div.	9885	Peoria, AZ
Liggett Indust., Inc., ID Div.	9886	Pocatello, ID
Low Kit	9887	Mammoth, WV
Harewood Surface	9888	Beckley, WV
Picatinny	9889	Picatinny Arsenal,NJ
Bardon Trimount Taunton	9890	Taunton, MA
M&S Fire & Safety	9891	Evansville, IN
16-to-1 Mine	9892	Silver Peak, NV
Collins Sand & Stone, Inc.	9893	Fairfax, VT
Duffield Gravel	9894	Russellville, AR
Benson & Wight Exc.	9895	Bethel, VT
Town of Royalton	9896	South Royalton, VT
Hummel Construction	9897	Gaysville, VT
Danny Ryan	9898	Longbranch, TX
Longlade County Highway Dept.	9899	Antigo, WI
C-I Crusher	9900	Harvey, ND
Gallatin County	9901	Bozeman, MT
Portable	9902	Bozeman, MT
Frank Gardecki	9903	Haverstraw, NY
Baker's Boy's	9904	Gloversville, NY
Concrete Supply Co.	9905	Shelby, NC
Portable Crusher	9906	Jamestown, ND
Johnsons' & Son Trucking Co.	9907	Hernshaw, WV
Koenig Fuel & Supply Co.	9908	Oxford, MI
Sayre Gravel	9909	East Thetford, VT
Ware Construction, Inc.	9910	East Thetford, VT
Martin's Quarry	9911	East Corinth, VT
Green Mountain Explos.	9912	Auburn, NH
Stacy Sand & Gravel	9913	East Barre, VT
Town of Barre	9914	Websterville, VT
Town of Willamstown	9915	Williamstown, VT
Pompey Farms Crushed Stone, Inc.	9916	East Thetford, VT
Grand Junction Concrete Pipe	9917	Grand Junction, CO
Abbott Ready Mix, Inc.	9918	Ridgeway, CO
Cersosimo Lumber Co.	9919	Brattleboro, VT
Greene Mountain	9920	Chester, VT
Route 5 Sand & Gravel	9921	Windsor, VT
Octad	9922	Beverly, OH
B&F Electric	9923	New Lexington, OH

Safest mines share same goals

"Our safety goal is to have the fewest accidents and fewest MSHA (Mine Safety and Health Administration) violations of any company in the industry," says Irl F. Engelhardt, President and CEO. "I envision a day when our company's name is synonymous with mine safety . . ."

Noting that Peabody Coal employees have always responded to challenges, Engelhardt said, "If our people know the goal and agree with it, they always accomplish it. Everyone can agree with our safety goals, and based on the significant improvements shown thus far in 1992, they can and will reach the goals they have set."

John E. Lushefski, Peabody Holding Vice President and Chief Financial Officer, whose responsibilities include corporate safety, says, "We are looking at a number of ways to improve our safety record. Safety is a priority with our parent company, Hanson, and the commitment is there to spend the time and money needed to make Peabody Holding subsidiaries safe places to work."

Martwick, Seneca named safest

Each year, two mines—one surface and one underground—are chosen to receive the Russell Kelce and T.C. Mullins trophies as the safest operations of Peabody Holding's mining subsidiaries. The winners of the trophies, which are named for two former Peabody presidents, are decided by using formulas that consider lost-time accidents and number of hours worked.

The 1991 winners were Seneca Mine, a surface operation in northwestern Colorado, and Martwick Mine, an underground facility in western Kentucky. Except for the obvious difference in mining methods—surface versus underground—the similarities between the two mines are striking.

Both have won awards for safety before. Seneca Mine won the Kelce trophy four times in previous years, as well as other company, state, and national awards. In 1987, Seneca was the seventh Peabody Holding operation to reach the million-hour milestone with no disabling injuries. Martwick Mine has also won company awards, and in 1986 it received the prestigious Sentinels of Safety Award from the American Mining Congress and MSHA as the safest underground mine in the United States.

Winters can be brutal

Employees at both mines face some of the most difficult operating conditions of any mine in the company. At an altitude of 8,000 feet, Seneca's coal seams follow the topography of the Rocky Mountain foothills, pitching as much as 37 percent. Actual winter temperatures of 30 below zero are common; the average annual snowfall is 160 inches, and it has ranged to more than 18 feet.

"It's harder to be safe when it's 20 or 30 below and slick," says Shooter Dennis

Bugay. "But when it's bad weather, you think more about what you are doing."

"We have to put carbide tips on the dozer grousers for traction," says equipment operator George Beatherage. "If we didn't, they would be just like skis."

Dragline operator George Temple downplays the weather effects. "When it gets too rough for the tough, that's the way we like it!"

Low coal a daily challenge

Meanwhile, about 250 feet below the gently rolling terrain in Muhlenburg County, Kentucky, Martwick miners dig coal at comfortable, constant 58 degree temperatures. But most of the time, they can't stand up straight because the average height of the Kentucky No. 9 coal seam there is only 48 inches. And roof conditions in the mine are known to be unpredictable.

"The height of the coal seam works against us as far as safety is concerned," says Superintendent Charlie Jernigan. "Just get under a table and see how easy it is to use the proper techniques for lifting."

"If we're in bad top," says roof bolter Johnny Leach, "I watch my partner put in two pins, then he'll do the same for me because it's hard to watch the roof and the controls at the same time."

"The continuous miner crew is good about cutting out loose top for us," says his fellow roof bolter Lucian Love.

Positive attitudes, experience, good communication, and watching out for

each other are common themes at both mines. Seneca employees say:

"Everyone works together, communicates, and looks out for each other," says mechanic Steve Foster. "From the corporate level, to Flagstaff, to mine management, to the people who do the work, working together is the only thing that makes it possible."

"You could have the best safety program in the world," says loader operator Marvin Bowser, "and if you don't work together and watch out for each other, it won't work. A lot of us have worked together a long time."

"The more you work with people, the more you know where they're going to be," says dragline operator Pete Whitlock.

Martwick employees echo that theme: "We have a very experienced workforce here," says Artemaus Birchwell, repairman. "You look out for everyone. People here say they'll take care of your life as well as they would their own family's."

"Operating units on both shifts have to work together," adds shuttle car operator J. C. Cook. "We tell the next shift about changes or problems—mechanical or roof conditions. You let your buddy know about the roof you're driving when he comes on shift."

Mechanic Harold West sums up: "We try to work with each other instead of against each other."

Personal safety commitment

Personal responsibility and commitment to safety is evident at both locations. At Seneca: "You've got to think about what you are doing or you're going to get hurt or hurt somebody else," says mechanic Elmer Hicks. "We've had some things that could have been real catastrophes, but somebody hollered."

"In this business, you've got to be serious about safety," dragline oiler Lupe Arroyo says. "It's your living—you've got to stay safe."

And at Martwick: "People here take it upon themselves to be responsible for their job and their actions," says miner helper Amanda Rogers. "Nobody wants to be laid up in the hospital with broken bones."

Shuttle car operator Michael Gates says, "This work is repetitious. You need to stay focused and keep your mind on your business. I try to work safe so I can return every night to my family."

At both mines, employees say the regular safety meetings are good because they are two-way. In addition to conveying new information, they offer the opportunity for employees to point out problems and concerns.

At Seneca: "If you see something that doesn't look right, you bring it up," says mechanic Rod Neumiller. "Once in awhile we bump heads with Carolyn (Carolyn Moon, Safety Supervisor), but that's good. Things get taken care of right away."

"If we see something we don't like, we let it be known—even questionable problems," says welder Wayne Tessmer. "We usually agree on the problems, even if we don't agree on the solutions."

At Martwick: "Anything that needs to come up at weekly safety talks does," says face foreman Billy Faith. "We try to talk about specific incidents and do

things like they are supposed to be done."

"If there's a problem, we discuss it. That's what meetings are for," says Leach. "Meetings and regular inspections keep us up-to-date and informed."

Positive attitude important

Even the observations of the two Superintendents are much the same. Seneca Superintendent Scott Williams says, "I've worked at mines that have good records, but the attitudes of the people here are the best I've been around." Jernigan says, "I've never worked with a group that accepted new ideas as well. Attitudes are very good here."

Two vastly different operations, 1,300 miles apart, achieving successful results, guided by the same fundamental philosophies: It's not a magic formula. Seneca and Martwick employees have a personal commitment to safety.

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Holmes Safety Association Monthly Safety Topic

Fatal fire accident

GENERAL INFORMATION: A 56-year-old mechanic with 12 years of experience died from injuries sustained in a fire at a surface coal mine.

DESCRIPTION OF ACCIDENT: The victim reported for work at his usual starting time of 3:00 p.m. His supervisor assigned him to work with another mechanic and a welder. Their task was to repair the drag scraper and primary crusher located in the truck dump facility. The truck dump was located near the preparation plant and extended from ground level to level 5—a distance of 185 feet below ground level.

The welder was working on the No. 1 feeder above the No. 1 primary crusher on Level 3. The victim and the other mechanic were working on Level 4. At about 9:58 p.m., the victim observed, through the protective curtain at the crusher level, a smoldering coal fire in the chute between the feeder and the crusher. He obtained a water hose, located on Level 4, and positioned himself on a ledge around the crusher. The other mechanic turned on the water and the victim sprayed water onto the fire. The gases (generated from spraying water onto the burning coal in a confined area) ignited and caused a flashback around the curtain and the victim's arm and hand were burned.

The victim received first aid at the mine. He was then transported to the hospital. Although the burns were treated by the physician in attendance at the hospital, the victim was taken to a regional burn center for further examination and treatment. The victim was treated at the burn center as an outpatient where he received whirlpool baths and debridement to enhance the healing process.

Approximately two weeks after the accident occurred, the treating physician decided to perform a skin graft on an area of the victim's hand that was not healing as expected. The victim was immobilized in the hospital to facilitate successful grafting. The operation was successful.

The victim died suddenly, however, four days after the operation. The cause of death was listed as a pulmonary embolism of venous thrombi caused by immobilization which was a result of the burns received in the mine fire.

CONCLUSION: The probable cause of the accident was falling material from the welder's cutting and welding operations which caused the fire in the coal chute. Physical factors contributing to the accident were as follows. The truck dump facility was idle at the time of the accident while the three-man crew performed repairs. All electrical

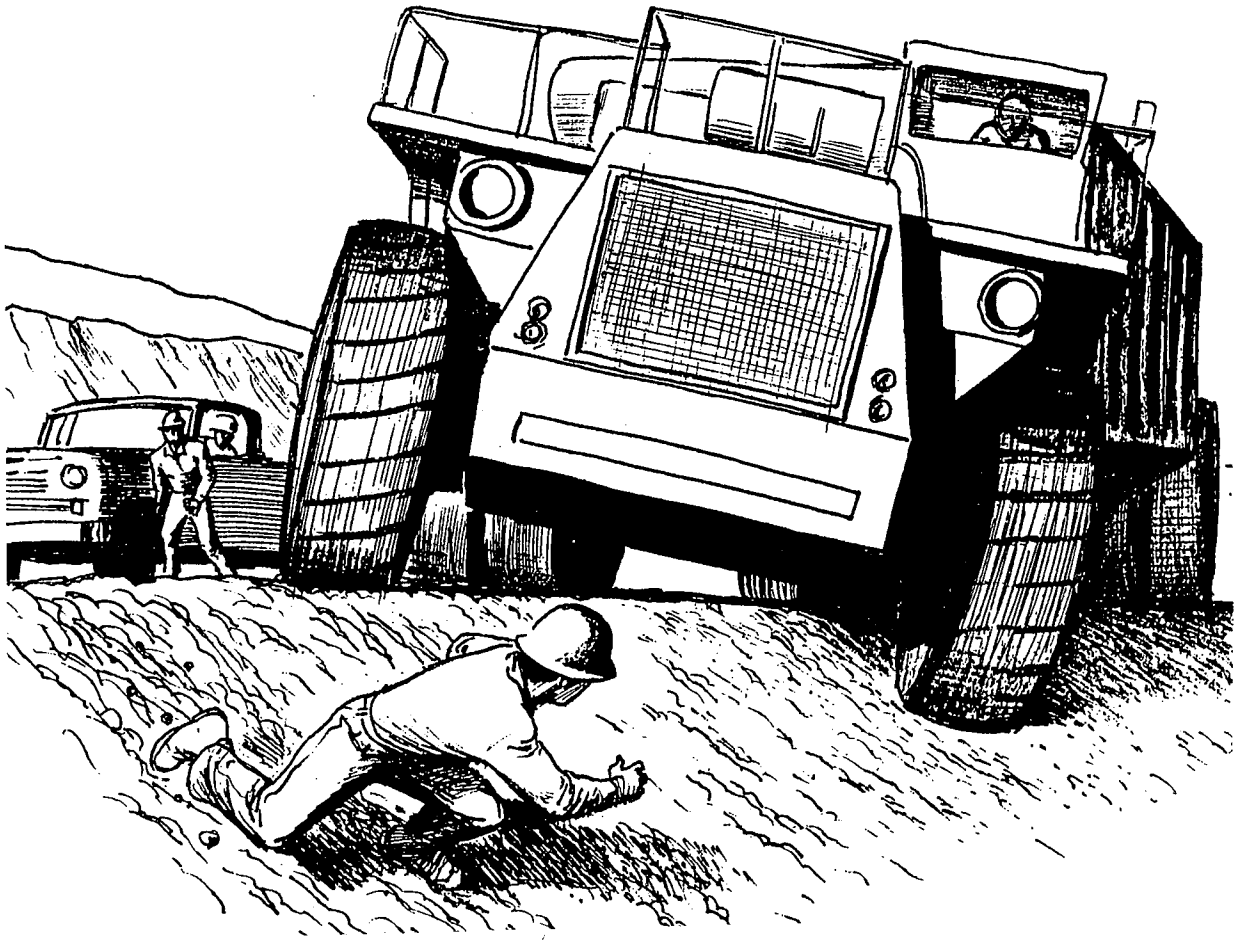
power to the feeder and crusher, located inside the facility, had been deenergized and locked out. The repairs being made by the welder to the No. 1 feeder on Level 3 entailed welding and cutting operations. The welder was working alone at this location. Finally, coal was permitted to remain in the chute connecting the No.1 feeder on Level 3 with the crusher located below on Level 4.

MEANS OF PREVENTION:

1. Firefighting should be fought from a safe location.
2. Welding and cutting operations should ensure that hot slag and sparks are confined to known safe areas.

Long Chances

SHORTEN LIVES



BE CAREFUL

BUDDY

Arc welding—some safety concerns

by

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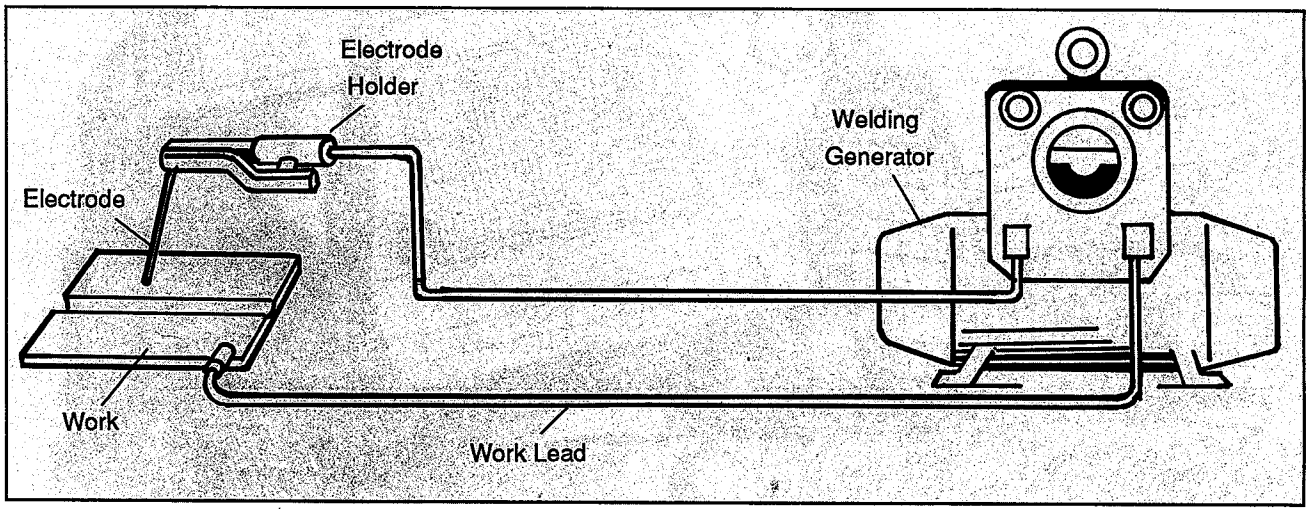
Arc welding processes

Welding is used to join together metal parts. In welding, some of the metal is melted in each part to be joined. The molten material flows together to form a single piece. Additional metal is generally added to the joint as it is welded.

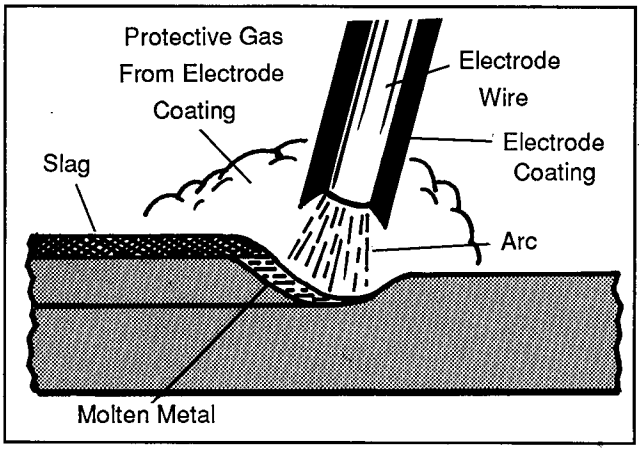
Shielded metal arc welding (SMAW) requires a minimum amount of equipment. In this process, the workpiece forms the grounded side of an electrical circuit and the welding rod forms the other side. The welder starts an arc between the rod and the workpiece. The arc melts the workpiece and the tip of the rod. As the rod's coating burns, inert gas is liberated which shields the molten metal from exposure to the air. This shielding prevents chemical reaction between the air and the molten metal.



Arc Welding Equipment

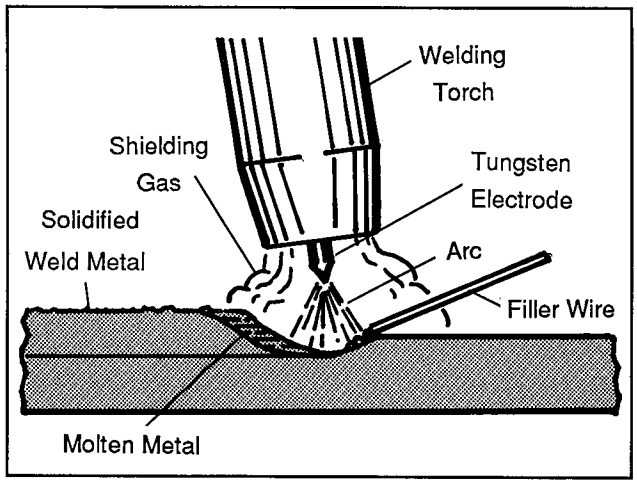
Arc welding uses an electrical lead and a work lead from the source of current to generate an electric arc. The heat needed to melt the metal comes from the arc. This article looks at some safety concerns related to arc welding.

The mining industry uses arc welding to fabricate, maintain, and repair mining equipment and structures. Most welding and cutting in mining is done in mine maintenance shops and sometimes in mills, open pits, and underground as needed. Field welding is performed with portable equipment, often under poor welding conditions. The three types of arc welding are described below.



Shielded Metal Arc Welding

Tungsten-inert gas welding (TIG) can join almost any kind of metal. In TIG welding, the electrode (torch) supplies inert gas that shields the electrode, arc, and molten metal from chemical reaction with the air. Examples of inert gases used in the process include helium, argon, and carbon dioxide. The tungsten electrode does not burn away during welding.



TIG Welding

Gas metal-arc (MIG) welding uses a regular metal electrode in the form of a wire which is fed into the torch as the wire burns away. The electrode melts in the arc and adds filler metal to the weld. Automatic welding equipment is often of the MIG type.

The welder's job

Whatever the process used, the welder's job is to control and direct the heat on the edges of metal to be joined. Welders are usually classified according to their ability and experience as beginning, semi-skilled or skilled. Beginning welders usually start on simple production jobs and gradually learn more difficult tasks as their skills improve.

Welders generally have to pass a certification test given by their employer, a government agency, or some other inspection authority before they can be assigned to work where the quality and strength of the weld are critical.

Semi-skilled welders usually do repetitive work which generally does not involve critical strength requirements. They mainly weld surfaces in only upright positions and may or may not have to be certified.

Skilled welders can plan, lay out work from various specifications, and weld all types of joints in various positions, such as flat, vertical, horizontal, or overhead. Skilled welders also have a wide range of technical knowledge involving properties of metals, effects of heat on welded structures, control of expansion and contraction forces, reading welding symbols, and recognizing welding defects. A skilled welder may be proficient in several types of gas and arc welding processes. As a rule, skilled welders are always certified for the particular welding job they are required to perform.

Arc welding equipment

Welding machines (power supplies)

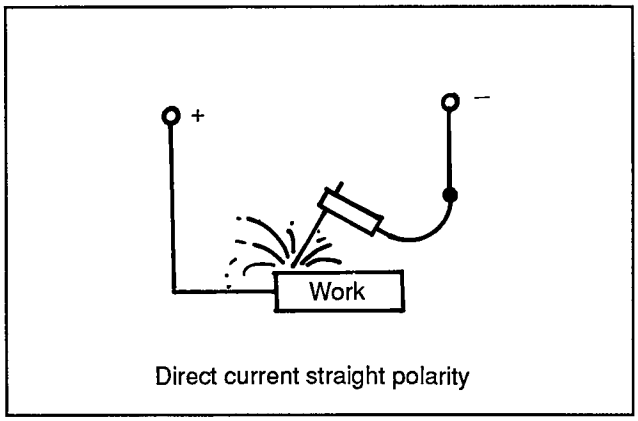
There are two different types of welding machines used in arc welding. These are AC (alternating current) and DC (direct current). Welding machines are rated by current flow (amperage). They can range in size from 25 to over 500 amps.

Welding voltages usually range from 20 to 40 volts. The AC power supply takes high voltage, low amperage power from the electric company and feeds it into a stepdown transformer which turns it into low voltage, high amperage current suitable for use in welding. The welder uses a controller on the power supply to regulate amperage. Voltage across a welding arc ranges from 15 to 40 volts, depending upon the size and type of electrode used.

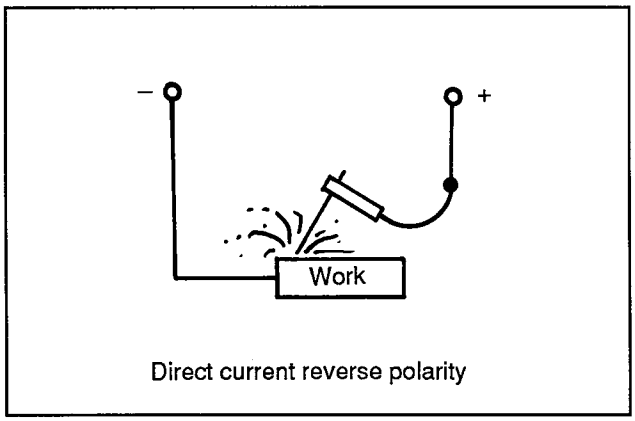
Welders should see ANSI Z49.1, *Safety in Welding and Cutting*, for additional information on safety requirements for welding machines.

DC power supplies can be driven by AC generators or self-contained generators. A rectifier in the power supply takes AC current from a transformer by means of a regulator and turns it into DC.

Shielded metal arc welding requires an electrical power supply of either AC or DC straight polarity (DCSP) or DC reverse polarity (DCRP). When the work is positive (+) and the electrode is negative (-), the current is DC straight polarity. When the work is negative (-) and the electrode is positive (+), the current is DC reversed polarity.



Direct current straight polarity



Direct current reverse polarity

Cables

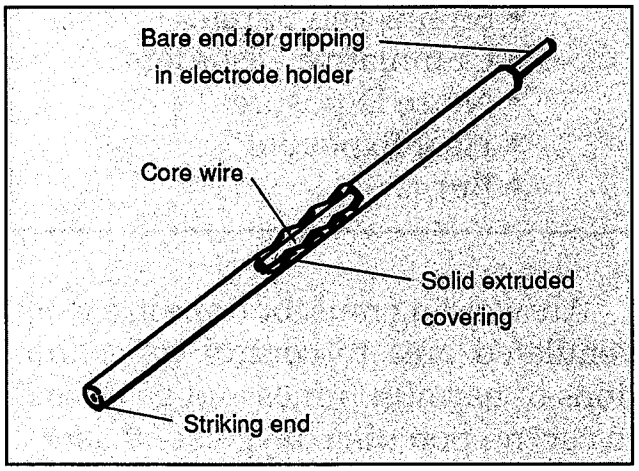
Cables carry electrical current from the welding machine to the electrodes. Several lengths of welding cable may be used in one circuit. Special cables with high quality insulation should be used.

Insulated connections used to splice or connect cables must be a capacity at least equal to the capacity of the cable on which they are used. For good electrical contact, cable lugs used for ground and machine connections should be securely fastened.

Electrodes and holders

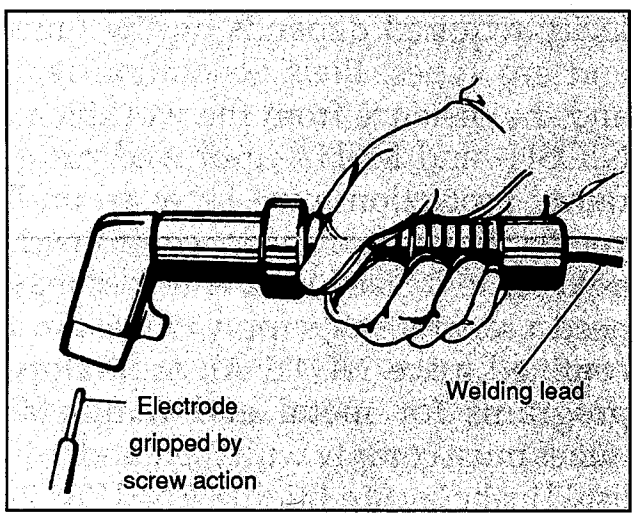
The electrode melts during arc welding to provide filler metal, to control the reaction occurring during welding, and to ensure the arc is stable. The electrode is inserted into the electrode holder.

Shielded-metal arc welding uses an electrode holder to connect the electrode to the welding cable supplying



Arc Welding Electrode

secondary current. Welders should use fully insulated electrode holders to reduce the risk of electrical shock. For light to medium applications, holders may be attached directly to the work lead from the machine. For heavy applications, a short length of cable, more flexible than the main lead, is attached to the holder to make it easier to use. Properly insulated cables and fully insulated connectors must be used.



Arc Welding Insulated Electrode Holder

Health concerns for welders

Fumes and gases

Arc welding generates several toxic gases. These fumes and gases result from the vaporization, oxidation, and condensation of materials in the consumable electrode, workpiece, and shielding gas. The exposure limits for fumes and gases are listed in the American Conference of Governmental Industrial Hygienists publication, *Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment.* For good industrial hygiene practice, the latest issue of this publication and the applicable section from *Title 30, Code of Federal Regulations (30 CFR)*, should be referred to to determine permissible exposure limits for fumes and gases. Contaminant levels can be determined by sampling for exposure to fumes and gases in the breathing zone of affected personnel.

Electric arcs form ozone which can be a problem when arc welding is done under conditions of poor ventilation. The welder's body, when exposed to too much ozone, may develop edema (swell and retain fluids). Fumes from welding on materials containing alloys of lead, zinc, cadmium, or beryllium, and surfaces coated with mercury-based rustproofing compounds, are toxic. Welders can also be exposed to oxides of nitrogen which can cause chest pain, coughing, or potentially fatal edema. High heats used in welding can liberate phosgene gas. Inhaling phosgene can cause respiratory failure or cardiac arrest. Steel rustproofed with phosphate-based compounds can pro-

duce phosphine gas when it is welded. Phosphine can irritate the eyes, nose, and skin. Carbon monoxide can also occur as a result of some types of arc welding.

Welders who inhale toxic fumes often experience symptoms such as dry metallic taste in the mouth, fatigue, nausea, and muscle aches. Inhalation of zinc, magnesium, and copper can cause "welder's chill" which has flu-like symptoms. Cadmium or metal alloy fumes, even in small amounts, can cause fatal lung irritation.

Some of the factors which affect the generation rate of fumes and gases are welding current, arc voltage (arc length), type of metal transfer or welding process, and kind of shielding gas. Gases which form photochemically, such as ozone, are affected by arc radiation. Increasing arc voltage (arc length) usually increases fume generation in all open arc processes. Oxides of nitrogen form near any open arc process. Carbon dioxide shielded arcs may form carbon monoxide. Ozone may be a by-product of argon-shielded arcs. The greatest amount of fume is produced from self-shielded flux-cored electrodes and covered electrodes. Fume generation of consumable electrodes classified by the American Welding Society (AWS) varies with each manufacturer because material compositions may be proprietary. Material Safety Data Sheets (MSDS) should be obtained from manufacturers to determine possible fume constituents. Any contaminants or coatings on the workpiece will add to the fume or gas problem.

Health concerns for welders

- Fumes and Gases
- Strains and Sprains
- Cumulative Disorders
- Noise Exposure
- Heat Exposure
- Burns

Arc welding must be done in a well-ventilated area to control concentrations of harmful fumes and gases and to control potential oxygen deficiency. Examples of ventilation methods include natural ventilation, overhead exhaust hoods, portable local exhaust fans, downdraft tables, crossdraft tables and torch-mounted exhaust systems. Natural ventilation occurs when doors or windows are left open and may be assisted by fans. Overhead exhaust, downdraft tables, and crossdraft tables are suitable for fixed welding stations. A portable local exhaust fan can control fumes anywhere in the shop. Torch-mounted exhaust systems remove the fumes at the welding site.

Remember that the ventilation velocity required depends on the fume and gas types, their generation rate, and the distance from the workpiece. NIOSH- and MSHA-approved respiratory protection must be worn until ventilation is established to control overexposure to contaminants. A welder may need a separate air supply to weld in a confined space. NOTE: All respiratory programs for metal and nonmetal mines must comply with the standards listed in the latest edition of ANSI Z88.2-1969, *Practices for Respiratory Protection*, for proper industrial hygiene practice.

Strains and sprains

Strains and sprains may occur when proper lifting techniques are not used to move equipment or workpieces. The material to be welded must be securely positioned. Welders should get help with heavy loads and use a lifting device (such as a crane) to position extremely heavy objects. Welders often must work in awkward, cramped positions to do repair work. Occasional breaks and stretching can reduce the risk of strains or sprains. All equipment and supplies should be returned to proper storage when the job is done. Welders should make additional trips or get help as needed so they don't overload themselves, or carry material so as to block their view.

Cumulative disorders

Welders may be afflicted by other cumulative disorders such as carpal tunnel syndrome, bursitis and tendinitis. Carpal tunnel syndrome can cause the victim's hand to ache, or become numb and weak. Work reassignment, changes in weld joint design, or use of a special glove with a splint may help to reduce or eliminate these types of injuries.

Noise exposure

Exposure to excessive noise causes loss of hearing. When welding operations must be performed in areas with high levels of background noise, the noise level must be reduced to a safe level. If this cannot be done (or a noisy welding process is used), proper hearing protection combined with limited noise exposure time may reduce welder's hearing loss.

Heat exposure

Exposure to excessive heat may result in heat exhaustion or heat stroke. Periodic work breaks to cooler areas and drinking ample amounts of water can prevent these afflictions from affecting welders.

Safety concerns for welders

Safety hazards that welders are exposed to include: shock from electrical equipment, burns from hot spatter and slag, ultraviolet radiation (UV) burns to the eyes and skin from the arc, fires, explosions, falls from elevated work areas, work in confined spaces, strains and sprains, cumulative trauma disorders, and noise.

Welder's safety concerns

- Electrical Hazards
- Burns
- Fire and Explosion Hazards
- Tanks and Closed Containers
- Electrodes
- Falls
- Confined Spaces

Welding safety standards are developed by the American Welding Society and are contained in ANSI Z49.1, *Safety in Welding and Cutting*. The latest edition of this publication should be used for arc welding safety information.

Electrical Hazards

Injury, severe burns, or death may result from electric shock. The precautions discussed below can minimize the dangers of electrical shock. Welders should not wear any jewelry when

welding. Welders who wear pacemakers should consult their physician or the manufacturer of the device to determine any potential hazards.

Welders must:

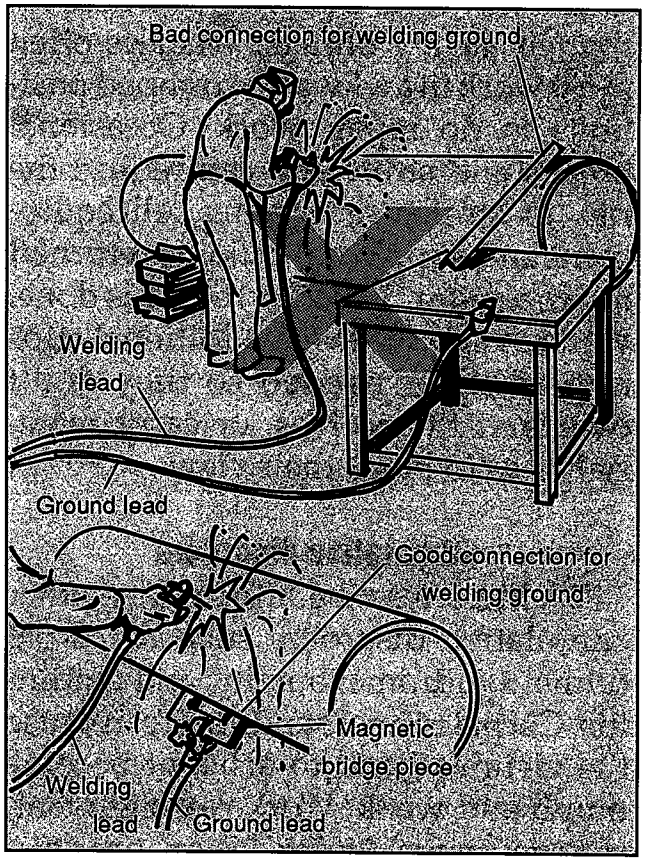
• Keep hands and clothing dry at all times and do not weld in damp areas. Never stand or lie in puddles of water, on damp ground, or against grounded metal when welding without suitable insulation. Use a dry board or rubber mat to stand on.

• Inspect the welder for proper overcurrent protection and check gauges. Examine cables for exposed conductors, nicks, or abrasions. Examine clamps and the electrode holder for defects. Inspect goggles or hood and gloves. Repair or replace damaged equipment.

• Never use electrode holders or cables that have cracked or damaged insulation. Check cable size for current rating and do not exceed this value. All electrical connections must be tight.

Open-circuit voltages are not that high on standard arc welding units. However, they are still potential shock hazards.

The workpiece must be grounded. The work lead is not a ground, but part of the welding circuit. The following should not be used for the grounding connection or part of the welding circuit: wire rope, chains, cranes, and elevators. If they are made part of the welding circuit, these and electrical pathways that contain bearings, gears, couplings, and other equipment not intended to carry current may be damaged by arcing. The ground conductor must be securely clamped to the machine or to the material to be welded. The surface to be welded should be clean and have a good tight connection. Where necessary, paint and rust should be removed from the connection point, and any power and grounds to equipment to be welded should be disconnected at the power center.



Arc Welding Grounding

The welding circuit must be deenergized before changing or adjusting electrodes or torches. When using the SMAW process, the circuit may be energized during electrode changes, but deenergizing the circuit improves safety. Dry gloves should always be worn when changing electrodes. Contact with any bare metal parts of energized welding circuits must be avoided.

Welding machines must conform to the standards specified in the latest editions of ANSI/NEMA EW-I, *Electri-*

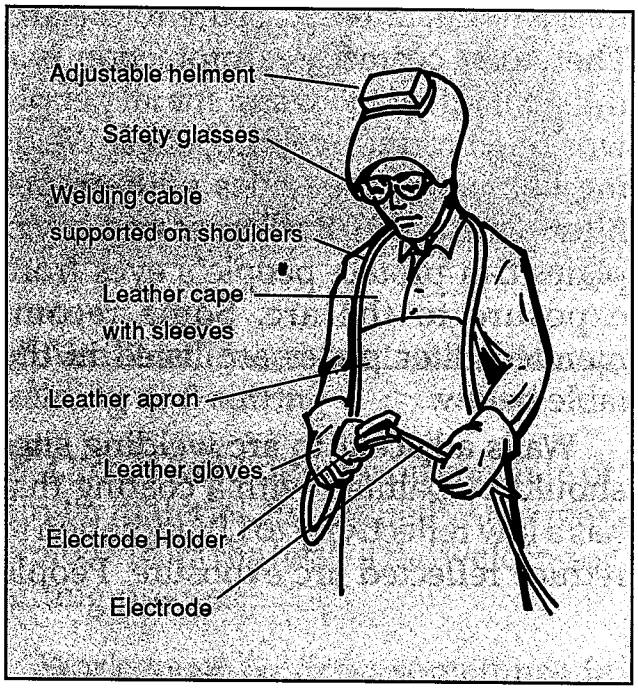
cal Arc WeldingApparatus, and ANSI/ UL 551, *Safety Standard for Transformer Type Arc Welding Machines* . Exceeding the duty cycle of the welding machine results in overheating and damage to insulation and other components. Welding machines should be installed in clean, dry places as directed in the most recent edition of the *National Electric Code* and any applicable local codes. Input power to welding machines must be disconnected before moving them. Only the rheostat control on welding machines can be adjusted during welding. All other controls must be adjusted after the arc is broken to prevent damage to the welding machine.

The maximum open circuit voltage for AC machines is 100 volts-rms, and for DC machines it is 80 volts. The polarity of DC work leads that share a common electrical conductor, e.g. metal work table, workpiece, etc. must be the same. AC-powered machines must be connected identically to the phases of the common AC power supply circuit. Failure to make the proper connections may result in open-circuit voltages that exceed the previously mentioned maximum values and a serious electrocution hazard may occur. Welders must not change the polarity switch or operate the range switch when the machine is under load, but operate only while the machine is idling and the circuit is open. If the output of one machine is AC and the other is DC, the cumulative voltage between them may be higher than normal.

Welders and other persons in the area must not contact more than one electrode holder, electrode, or welding gun at a time. When welding in hazardous conditions such as water, high humidity, or heavy perspiration, automatic controls on welding machines should be used to limit the no-load voltage to 38 VAC-rms and 50 VDC.

Burns

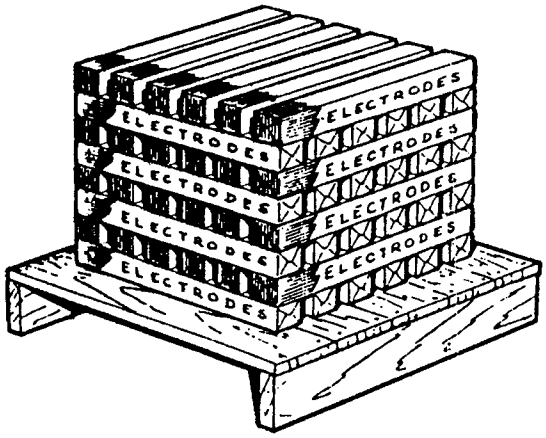
Welders can be burned by hot spatter and slag, contact with hot metal, and contact with the torch flame.



Arc Welding Protective Clothing

To protect their bodies from burns, welders should wear the following: caps; cuffless pants with covered pockets; substantial shoes or boots with the pants worn outside; dry leather gloves; flame-resistant ear plugs for out-of-position welding; leather aprons, capes, jackets, suits, and leggings as needed; woolen or cotton flame-retardant treated clothing. They should not wear clothing or shoes made of synthetic materials around welding operations as these garments may melt or easily ignite.

In addition to providing proper fire extinguishers, the work site must be checked for flammable materials and they must be moved at least 15 feet in all directions from the welding area. The work site can be isolated with nonflammable shields or barriers if flammable materials cannot be removed. Open gear cases or machine components containing lubricants at least 15 feet in all directions from the welding area must be covered with noncombustible materials. If the risk of fire is great, fire watchers must be used near the work site during and after welding and cutting to detect and control any fires which may occur before they become a problem. Fire watchers must have enough firefighting equipment and know how to use it correctly



Electrode Storage

Electrodes

Electrodes with moist coverings do not work well. Damp covers are potential sources of hydrogen in the deposited metal which can cause bad welds and excessive spatter. Some simple remedies will help to prevent this problem. Welders should store electrodes in unopened packs in a dry area which is at least 10 degrees warmer than the shade temperature outside, and store electrodes on pallets above the floor (be sure air can circulate around and through the stack). Should electrodes become moist, the manufacturer's directions should be followed for dealing with this situation.

Tanks and closed containers

Tanks and closed containers which previously held flammable substances such as fuels, lubricants, or solvents are potential bombs. No welding or cutting may be done on used drums, barrels, tanks, or other containers unless they have been thoroughly cleaned of all combustible substances that may produce flammable vapors or gases. Flammable and explosive materials include gasoline, light oil, or acids that react with metal to produce hydrogen, and nonvolatile oils or solids that release vapor when heated.

If welding is to be done on a tank or container, the welder must: determine the material stored in the container; determine safe procedures to vent, drain, or otherwise remove liquids and/or gases to render them harmless; slowly remove tank cap to bleed or remove any excess pressure; and be sure the tank or container is properly vented and rendered harmless before any heat is applied. Containers can be cleaned by flushing several times with water, chemical solutions, or with steam. Water cleaning is o.k. if the substance in the container is readily soluble in water. For less soluble substances, welders should clean containers with a strong commercial caustic cleaning

compound or blow steam into the container.

Pipelines or containers which have contained flammable, combustible, or explosive substances must either be: filled with an inert gas or water where compatible; or determined to be free of flammable gases with a gas detector prior to and at frequent intervals during the application of heat. While welding or cutting, containers must be ventilated. Welders must never cut or weld directly on concrete or similar materials because the heat generated by the process may cause entrapped water to explode.

Safety lines and belts

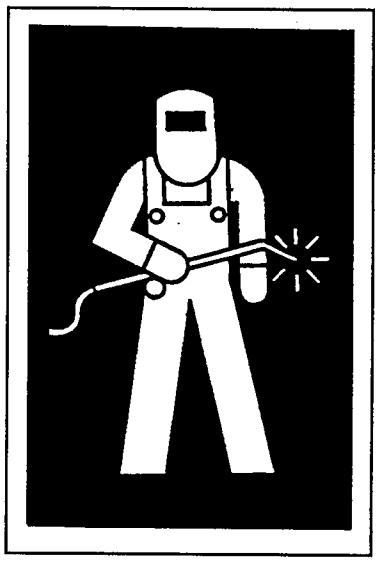
Welders must wear safety belts and lines if there is a danger of falling. Another person must tend the welder's lifeline when the welder is working in a confined space.

Housekeeping

A neat workplace in many cases goes a long way toward being a safe workplace. When finished welding, the electrode should be removed and the holder placed in a safe location. Used electrodes must not be discarded in walkways where people can fall on them. Welders should remove power from the welding machine and stop its engine; reel in positive and negative cables; store welding rods; search the work site for fire, burning cinders, or any smoldering areas; wet down the work site with water if available; and return all equipment and supplies to proper storage

Summary

No welding equipment of any kind should ever be used until exact instructions on its operation have been received. Manufacturer's recommended methods are very important and should be followed at all times. All types of welding equipment are safe to operate, providing they are used in the proper manner, but attempting to operate a piece of equipment without instruction may damage the equipment or result in a potentially serious or fatal injury.



Holmes Safety Association Monthly Safety Topic

Fatal powered haulage accident

GENERAL INFORMATION: A 43-year-old underground foreman with 20 years of experience was fatally injured at an underground platinum/palladium operation when he was struck in the chest by a 350-pound piece of material. There were no witnesses to the accident.

DESCRIPTION OF ACCIDENT: The area of mining is composed of thin layers of igneous rock. The platinum/palladium bearing zone ranges from four to twenty feet thick and it is tilted at a 70 degree angle. Ore is mined from the near vertical vein structures by conventional overhand cut-and-fill stoping. The stopes are accessed through near vertical raises which are driven from horizontal drifts.

The east 5200 transfer raise dump was used to transfer ore from the 5200 and levels above down to the 5000 level main haulage drift. The 5200 dump area was approximately 30 feet wide, 30 feet deep, and 15 feet high. The dump was approximately 8 feet long and 8 feet wide with a rail spreader in the center. The grizzly rails were about 14 inches apart and the dump area was illuminated by an overhead floodlight.

Ore was being trammed from the 5280 stope muck bay about 600 feet from the 5200 transfer raise dump. The rock involved in the accident was about 32 inches long, 22 inches wide, 16 inches thick, and weighed about 350 pounds.

A common practice for breaking the larger rocks at the 5200 level transfer raise was to raise the LHD's bucket to its highest position and roll the bucket in the dumping mode, allowing the rock to fall in the grizzly rails. The LHD was not equipped with falling object protection (FOPs) or roll-over protective structure (ROPs).

The victim arrived at work before his scheduled starting time of 4:00 p.m. He reviewed the previous day's work and gave instructions to his crew. The victim then talked with the general mine foreman and told him he had a large amount of muck to move. The victim entered the mine and met an equipment operator underground at about 4:20 p.m. The equipment operator told the victim he was going to operate the road grader until the 3 yard LHD was repaired. The victim said he would use the 2 yard LHD to help muck.

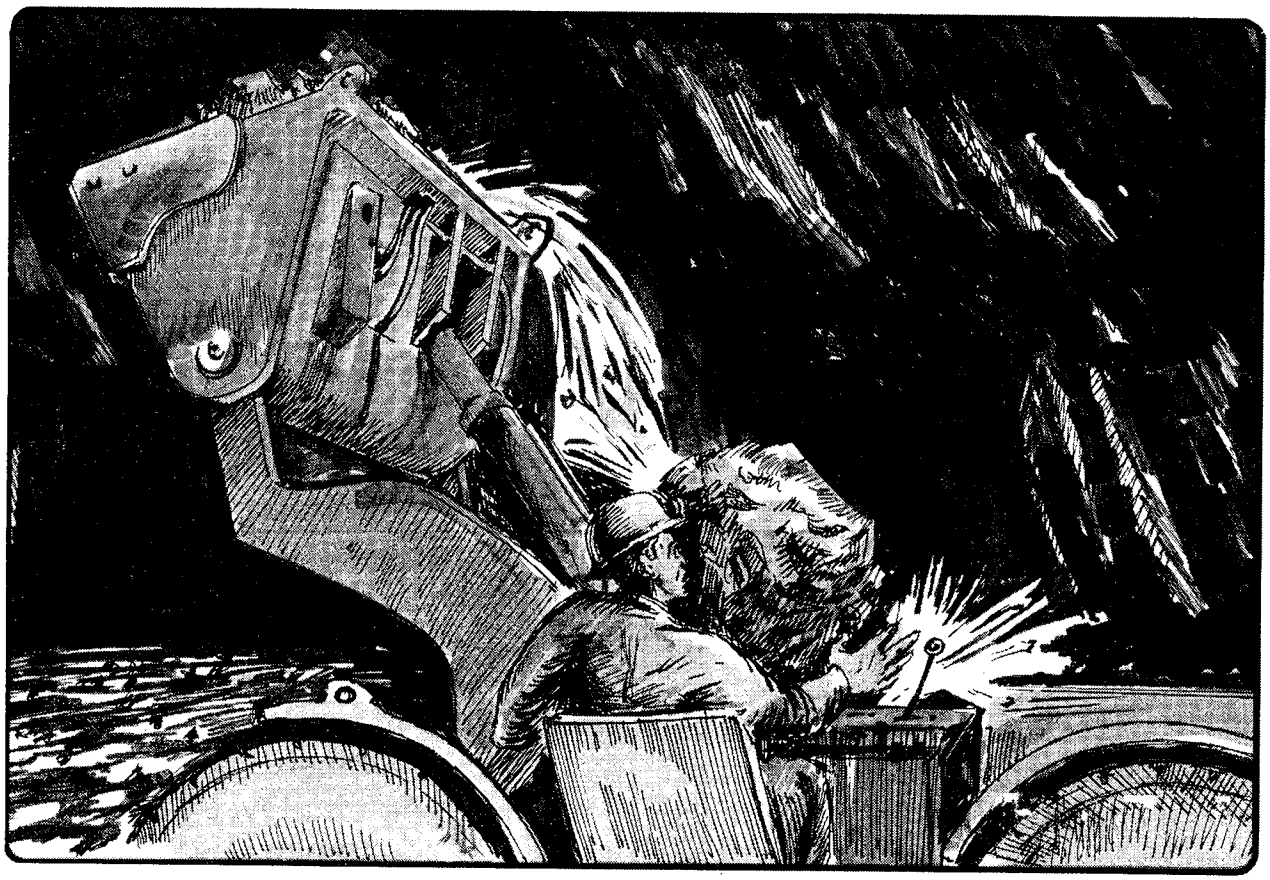
The equipment operator saw the victim pull out of the crosscut with the LHD and head toward the 5280 stope muck bay. He waited until the victim made his first trip and turned into the transfer raise dump area before he began grading the west haul road to the 5280 muck bay. After making three passes with the blade he looked

toward the dump and saw the LHD still there with its bucket hoisted. He could not see the victim on the LHD. The equipment operator shut down the grader and walked over to the LHD and found the victim lying on the ground with his feet under the LHD.

The equipment operator observed a large rock near the victim's head and could see blood above his left eye. The victim was conscious but completely disoriented. The equipment operator shut off the LHD and telephoned for help at approximately 4:45 p.m. Help arrived about fifteen minutes later. The victim was taken to the surface and airlifted to the hospital but he died on route from chest trauma.

CONCLUSION: The probable cause of the accident was that the victim was in the process of dumping a load of ore with the bucket hoisted to its maximum height and accidentally activated the bucket ejector push plate when pushing the bucket dump lever to roll the bucket in the dumping mode. This action pushed the large rock up and over the back side of the bucket, bouncing off the hoist cylinder, and striking the victim.

Contributing factors included the victim being a supervisor who only operated equipment for short periods of time, usually when a shift was shorthanded. A second factor was the work practice of using the LHD to break large rocks by hoisting the loaded bucket to its highest point and rolling the bucket in the dumping mode, allowing the ore to drop below on the grizzly rails. A third factor was overloading the bucket.



Electrical lockout accidents
A plague to the mining industry

Repairing or maintaining electrically-powered machinery which is not locked out is asking for trouble

By Robert E. Morgan, Virginia Division of Mineral Mining, Lynchburg, Virginia

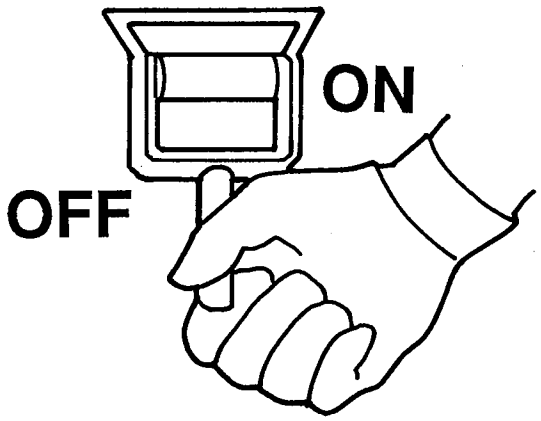
Electrical lockout accidents

Why do miners risk their lives by working on electrically-powered machinery without locking it out? Every report of a lockout-related accident reminds us anew that electricity is dangerous. According to MSHA's Metal and Nonmetal Mine Safety Division, five fatalities in 1991 occurred because the victims did not lock out equipment before working on it. Other nonfatal accidents resulted from this practice, too. The question remains, however, why don't people lock out?

Why don't people lock out?

Several factors seem to influence accident victims to make the flawed and often fatal decision not to lock out. An analysis of lockout accidents reveals that in some cases the victim did not have access to a suitable lockout device. In other situations the victim had not been trained in proper use of lockout devices. In still other cases the victim did not know about company rules requiring the use of lockout devices. Finally, some mining companies did not enforce lockout rules consistently. A combination of any one or all of these circumstances influenced the victim to commit an unsafe act.

Whatever factors influenced the victims' decision, they were still killed when somebody started machinery or equipment that an assigned worker had stopped to repair or to adjust. It is just common sense to switch off power and lock out the electrical controls to prevent someone from accidentally starting equipment.



Lockout how to's

Locking out equipment is usually enough to prevent workers from being electrocuted or injured. Let's take a look at how to do it.

Anyone exposed to machine hazards should have a lock with a single key for their exclusive use. Label each lock with the employee's name and identification number and destroy all

duplicate keys. A bolt cutter can be used to remove a lock if a key is lost or taken home by mistake.

Remember that the electrical equipment itself may not be properly designed or maintained. This means that miners can be shocked or burned while attempting to lock out the equipment. Therefore, the miner should wear appropriate personal protective equipment including a hard hat, steel-toed boots with rubber soles, safety glasses or goggles, and proper gloves. The miner should also stand on a rubber mat or dry board when operating disconnect switches.

The first step is to lock out equipment which is electrically powered. Tell the responsible supervisor that repair has begun. Move the control to "stop" the equipment which is going to be repaired. This is done because arcing may occur at the disconnect if the equipment is "on" when it is disconnected. This arcing can burn your hands or face. Find the disconnect switch (or breaker box) which controls the main (drive) power for the equipment that is to be repaired or adjusted. Standing on a nonconductive mat, move the disconnect switch (or circuit breaker handle) to the "off" position. Stand to one side of the switchbox if possible in case the switchbox cover comes off because it is loose or it flies off in case of a short circuit.

Apply a multiple lock adapter and/or lock to fix the handle in the "off" position. Make sure everyone attaches his/her own lock and that employees do not exchange or lend their locks. When two or more persons are working on the same piece of equipment at the same time, each must attach their own locks, even if one or more locks are in place. Remove keys from locks and put the key to the lock in your pocket or on your key ring.

Fill out the maintenance tag which should include the date and time of attachment, a description of the work, and your signature. Place a sign at the locked out main control or disconnect switch to warn that the equipment is being repaired. Make sure the sign can't be removed easily.

Return to the equipment and engage the "start" control to make sure that there is no power going to the equipment.

Check to see if there are other sources of electrical power which supply lights, motors, ventilation, or other service to the equipment on which you will be working. Apply the same lockout procedures to every other power switch serving the equipment.

Studies show that loaded equipment or equipment with unbalanced drives may turn without power. This hazard may not become apparent until the miner has begun to work within or under the equipment's moving parts. The miner may be caught in the moving parts or injured when the equipment moves to a balanced position. It is important to block moving parts where any possibility of nonpowered movement exists. A block of wood, iron bar, or other appropriate item can do the job here. Place the block in such a way to prevent parts from moving far enough to cause injury. Remove the block before removing the lockout. This will prevent damage to the equipment or its electrical system which will occur

Cold stress revisited

By C. Brian Malley

The industrial environment is a dynamic force that presents numerous stressors to workers. The safety professional who disregards or underestimates environmental conditions is threatened with failure. In climates of severe cold, a large percentage of man's time and energy is spent in self-preservation; consequently, his efficiency is reduced. Bulky, cold-weather clothing further decreases a person's efficiency, especially when operating equipment. Because flesh can adhere to cold metal, mittens or gloves are worn; however, these diminish the vital sense of touch. In many ways, a person must learn to cope with cold stress.

This article provides a brief description of extreme cold to help the reader understand the characteristic severity of such environments. This article shows that wind chill is only one of many cold stress considerations. Cold temperatures, taken alone, have a definite effect on the working efficiency of machinery, such as winches and engines; this is not always true of humans. Properly dressed, a worker may actually be more comfortable and more efficient in the arctic north than in parts of the southern states when those areas are windy.

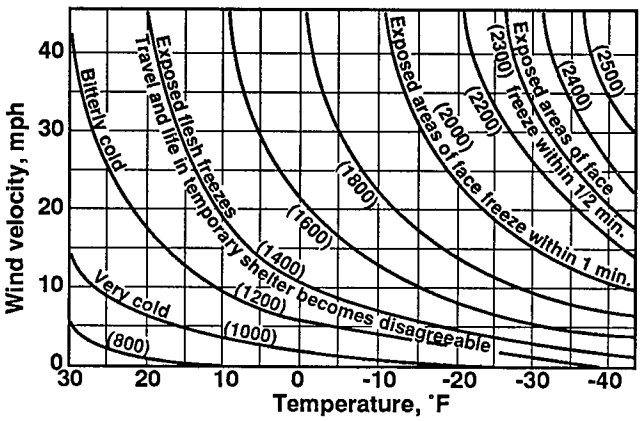
With this in mind, let us examine the effects of temperature, wind, and humidity on workers. Their combined effect is scientifically expressed as the amount of "dry shade cooling." Dry shade cooling forms a basis for estimating the efficiency of persons working outdoors in cold weather. The amount of dry shade cooling is expressed as the "windchill factor." When great, it can cause complete loss of human efficiency and suspend all outdoor activities.

Windchill factor

The windchill factor is expressed as the number of kilogram-calories the atmosphere can absorb from the body in an hour. At various temperature and wind speed combinations, certain effects may be expected. For example, when the windchill factor is 2000, the face can freeze within one minute. Due to varying factors, windchill affects individuals differently.

Table 1 provides detailed data related to windchill factor effects. However, this information is summarized in a graphic display that can easily be used in understanding windchill factors (Figure 1).

Figure 1.—Windchill effect



Metabolic heat

The effect of windchill on the human body can be (in part) offset by metabolic heat produced as a by-product of work activity. The exact amount of metabolic heat varies from worker to worker. This variation depends on numerous factors, including age, fitness, obesity, and gender. Table 2 displays the average rate of body heat production.

Solar radiation

Solar radiation—the amount of heat radiated from the sun—must also be evaluated when planning outdoor tasks. With solid overcast given a classification of 10/10 and a completely cloudless sky a classification of 0/10, heavy cloudiness (8/10) is equal to night or shade conditions. Clear, early morning skies, late afternoon sunlight, or light midday cloudiness each rate about 2/10. In high latitudes, clear midday radiation in summer compares with that of tropical early morning or late afternoon.

Clothing and solar radiation can counteract some of the heat loss, as can physical activity, because they conserve or increase body heat. A worker's ability to function efficiently in extreme cold in comfort and safety may be estimated by considering windchill, body heat production, and solar radiation.

Body heat and solar radiation combine to reduce the windchill factor because heat produced naturally reduces or counteracts heat loss.

Work efficiency

Tables 1, 2, 3, and Figure 1 are used to calculate how comfortably and safely

Table 1.—Windchill factors

Windchill factor	Effect
0	Calm conditions in darkness at 91.4°F.
100	Warm weather experienced in arctic mid-summer.
200-300	Pleasant conditions.
400-500	Snow surface becomes tacky and soft.
600-900	Workers comfortable when dressed in woolen underwear, socks, mitts, ski boots, ski headband, and thin cotton windbreaker suits.
1000-1100	Travel becomes unpleasant on foggy and overcast days.
1400-1500	Human flesh may freeze depending on degree of activity, amount of solar radiation, character of the skin, and blood circulation. Except for unusual conditions, this is about the maximum wind chill to be expected during November, December, and January. With temperature above 5°F., it requires winds approaching blizzard force to produce this condition.
1900-2200	Travel and life become extremely difficult.
	Condition reached in midwinter darkness. Exposed areas of face freeze in less than 1 minute for average individual. Travel is dangerous.
2300-2500	Exposed areas of face freeze in less than one-half minute.

The last word...

"Common sense is the knack of seeing things as they are, and doing things as they ought to be done."

"If you wait for inspiration, you'll be standing on the corner after the parade is a mile down the street."

"If you're going to do something tonight that you'll be sorry for tomorrow morning, sleep late."

"A little experience often upsets a lot of theory."

"An optimist sees an opportunity in every calamity; a pessimist sees a calamity in every opportunity."

"Truth is something you stumble into when you think you're going someplace else."

"People are not finished when they're defeated; they're finished when they quit."

"Any fool can criticize, condemn and complain—and most fools do."

"Never rise to speak till you have something to say; and when you have said it, cease."

"If you think nobody cares if you're alive, try missing a couple of car payments."

NOTICE: We welcome any materials that you submit to the Holmes Safety Association Bulletin. We cannot guarantee that they will be published, but if they are, we will list the contributor(s). Please let us know what you would like to see more of, or less of, in the Bulletin.

REMINDER: The District Council Safety Competition for 1992 is underway – please remember that if you are participating this year, you need to mail your quarterly report to:

Mine Safety & Health Administration
Educational Policy and Development
Holmes Safety Association Bulletin
P.O. Box 4187
Falls Church, Virginia 22044-0187

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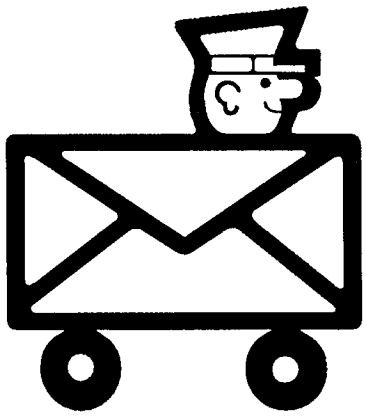

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