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NFPA 51B Cutting and Welding Processes 1989 Edition

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

Statement on NFPA Procedures

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NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 51B

Standard for

Fire Prevention in Use of Cutting and Welding Processes

1989 Edition

This edition of NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*, was prepared by the Technical Committee on Cutting and Welding Practices, and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 15-18, 1989 in Washington, DC. It was issued by the Standards Council on July 14, 1989, with an effective date of August 7, 1989, and supersedes all previous editions.

The 1989 edition of this standard has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 51B

This standard was Tentatively Adopted in the 1960 Annual Meeting and the first edition was adopted in 1962. Subsequent editions were published in 1971, 1976, 1977, and 1984.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

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Standard for

Fire Prevention in Use of Cutting and Welding Processes

1989 Edition

Information on referenced publications can be found in Appendix C.

Chapter 1 General

1-1 Introduction.

1-1.1 Cutting and welding processes using electric arcs or oxy-fuel gas flames are a necessary part of our industrial world. Too often, however, the persons who use, hire, or supervise the use of these processes do not fully appreciate that their improper use can result in loss of life and property by fire and explosion.

1-1.2 Approximately 6 percent of fires in industrial properties and many fires in other properties have been caused by cutting and welding, primarily with portable equipment in areas not specifically designed or approved for such work. Cutting and certain arc welding operations produce literally thousands of ignition sources in the form of sparks and hot slag. The electric arc or the oxy-fuel gas flame and the hot work pieces are also inherent ignition sources.

1-1.3 A majority of fires in which cutting and welding is a factor have been caused by sparks. These globules of molten metal have scattered horizontally as far as 35 ft (11 m), setting fire to all kinds of combustible materials. They have also fallen through cracks, pipe holes, or other small openings in floors and partitions starting fires that have reached serious proportions before being noticed.

1-1.4 Electric arcs or oxy-fuel gas flames, in themselves, have rarely caused fire except where they have overheated combustibles in the vicinity of the work or where they have been used on containers that have held combustibles and that have not been cleaned and purged. In the latter case, an explosion generally resulted.

1-1.5 The heat of the metal being welded or cut has caused fires where the hot pieces were permitted to rest or fall upon combustible materials. Fires and explosions have also been caused where this heat was transmitted, as in the case of a container, through the metal to a flammable atmosphere or to combustibles within the container.

1-1.6 Anything that is combustible or flammable is susceptible to ignition by the cutting and welding. The most common materials likely to become involved in fire are combustible building construction such as floors, partitions, and roofs; combustible contents such as wood, paper, textiles, plastics, chemicals, and flammable liquids and gases; and combustible ground cover such as grass and brush.

1-1.7 Preventing cutting and welding fires can best be achieved by separating the combustibles from ignition sources or by shielding the combustibles.

1-2 Purpose. This standard has been prepared for the guidance of cutters and welders (including persons doing cutting and welding), fire watchers, their supervisors (including outside contractors), and those in management on whose property cutting and welding is to be performed.

1-3 Scope. This standard covers provisions to prevent loss of life and property from fire in the use of oxy-fuel gas and electric arc cutting and welding equipment when such equipment is used for cutting and welding.

NOTE: Details on design and installation of gas cutting and welding equipment are covered in NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*. Details on installation and operation of arc cutting and welding equipment and operation of gas cutting and welding equipment are covered in ANSI Z49.1, *American National Standard Safety in Welding and Cutting*.

Chapter 2 Responsibility for Cutting and Welding

2-1 General. Although the cutter or welder has the best opportunity to avoid fire or injury by proper control of the equipment he is using, there are many circumstances where fires, explosions, or severe injuries would be inevitable if the oxy-fuel gas torch or the electrode were to be used. Such circumstances can arise where the cutter or welder may not be aware of (1) the proximity or the flammable nature of nearby combustible solids, liquids, or dusts; (2) the presence or development of possibly explosive mixtures of flammable gases or vapors and air; or (3) the presence or nature of an oxygen-enriched atmosphere in the location where the work is to be performed. The precautions taken by a cutter or welder will often be governed by the desire of others for speed or economy in his work or by the failure of management to emphasize the possible extent or seriousness of a fire in the work area. Therefore, all three, the cutter or welder, his supervisor, and management share full responsibility for the safe use of cutting or welding equipment. Specific responsibilities of each are cited in Sections 2-2, 2-3, and 2-4.

2-2 Management. Management shall recognize its responsibility for the safe usage of cutting and welding equipment on its property and:

(a) Based on fire potentials, establish approved areas for cutting and welding or establish procedures for approving cutting and welding.

(b) Designate an individual responsible for authorizing cutting and welding operations in areas not specifically designed or approved for such processes. The individual shall be aware of the fire hazards involved and familiar with the provisions of this standard, and may delegate this responsibility to the supervisors in Section 2-3.

(c) Insist that only approved apparatus, such as torches, manifolds, regulators or pressure reducing valves, and acetylene generators, be used.

(d) Insist that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment, the safe use of the process, and emergency procedures in the event of a fire.

(e) Select contractors to perform cutting or welding who have suitably trained personnel and who have an awareness of the magnitude of the risks involved.

(f) Advise all contractors about flammable materials or hazardous conditions of which they may not be aware.

2-3 The Supervisor. The supervisor of cutting or welding operations in areas not designed or approved for such processes may be a foreman or a plant manager or a property owner or other qualified individual. In contract operations he may be the contractor or one of the foremen or supervisors.

2-3.1 The supervisor shall be responsible for the safe handling of the cutting or welding equipment and for the safe use of the cutting or welding process.

2-3.2 The supervisor shall determine the combustible materials and hazardous areas present or likely to be present in the work location.

2-3.3 The supervisor shall protect combustibles from ignition by the following:

(a) Have the work moved to a location free from dangerous combustibles.

(b) If the work cannot be moved, have the combustibles moved to a safe distance from the work or have the combustibles properly shielded against ignition.

(c) See that cutting and welding are so scheduled that operations that might expose combustibles to ignition are not started during cutting or welding.

2-3.4 The supervisor shall secure authorization for the cutting or welding operations from the designated management representative [*see Section 2-2(b)*].

2-3.5 The supervisor shall determine that the cutter or welder secures approval that conditions are safe before going ahead.

2-3.6 The supervisor shall determine that fire protection and extinguishing equipment are properly located at the site.

2-3.7 Where fire watchers are required (*see Section 3-3*), the supervisor shall see that they are available at the site.

2-3.8 Where a fire watcher is not required, a final check-up shall be made by the supervisor one-half hour after the completion of cutting or welding operations to detect and extinguish possible smoldering fires.

2-4 The Cutter or Welder. The cutter or welder shall handle the equipment safely and use it so as not to endanger lives and property, as follows:

(a) Have approval by the supervisor before starting to cut or weld.

(b) Cut or weld only where conditions are safe.

(c) Continue to cut or weld only so long as conditions are unchanged from those under which approval was granted.

Chapter 3 Fire Prevention Precautions

3-1 Permissible Areas. Cutting or welding shall be permitted only in areas that are or have been made firesafe (*see Section 3-2*). Within the confines of an operating plant or building, cutting and welding shall be done in either (1) a specific area designed or approved for such work, such as a maintenance shop or a detached outside location that shall be of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas; or (2) when work cannot be moved practically, as in most construction work, the area shall be made firesafe by removing combustibles or protecting combustibles from ignition sources.

3-1.1 Cutting or welding shall not be permitted in the following situations:

(a) In areas not authorized by management.

(b) In sprinklered buildings while such protection is impaired.

(c) In the presence of explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air) or explosive atmospheres that may develop inside uncleaned or improperly prepared drums, tanks, or other containers and equipment that have previously contained such materials or that may develop in areas with an accumulation of combustible dusts.

NOTE: See NFPA 327, *Standard Procedures for Cleaning or Safeguarding Small Tanks and Containers*, and *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping that have held Hazardous Substances*, AWS F-4.1.

(d) In areas near the storage of large quantities of exposed, readily ignitible materials such as bulk sulfur, baled paper, or cotton.

3-2 Permit. Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing cutting and welding operations [*see Section 2-2(b)*] to ensure that it is a firesafe area. This individual shall designate precautions to be followed in granting authorization to proceed in the form of a written permit or other equivalent means. (A suggested form of written permit is shown in Appendix A. It may be modified to suit conditions.) This individual shall sign the permit or otherwise authorize the work, and shall verify the following:

3-2.1 Cutting and welding equipment to be used shall be in satisfactory operating condition and in good repair.

3-2.2 Where combustible materials such as paper clippings, wood shavings, or textile fibers are on the floor, the floor shall be swept clean for a radius of 35 ft (11 m). Combustible floors (except wood on concrete) shall be kept wet,

covered with damp sand, or protected by fire-resistant shields. Where floors have been wet down, personnel operating arc welding or cutting equipment shall be protected from possible shock.

3-2.3 Where practical, all combustibles shall be relocated at least 35 ft (11 m) horizontally from the work site. Where relocation is impracticable, combustibles shall be protected with flameproofed covers or otherwise shielded with metal or fire-resistant guards or curtains. Edges of covers at the floor shall be tight to prevent sparks from going under them. This precaution is also important at overlaps where several covers are used to protect a large pile.

3-2.4 Openings or cracks in walls, floors, or ducts within 35 ft (11 m) of the site shall be tightly covered to prevent the passage of sparks to adjacent areas.

3-2.5 Conveyor systems that might carry sparks to distant combustibles shall be suitably protected.

3-2.6 Where cutting or welding is done near walls, partitions, ceiling, or roof of combustible construction, fire-resistant shields or guards shall be provided to prevent ignition. If welding is to be done on a metal wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles. Where combustibles are not relocated, a fire watch on the opposite side from the work shall be provided. Welding shall not be attempted on a metal partition, wall, ceiling, or roof having a combustible covering, nor on walls or partitions of combustible sandwich-type panel construction.

3-2.7 Cutting or welding on pipes or other metal in contact with combustible walls, partitions, ceilings, or roofs shall not be undertaken if the work is close enough to cause ignition by conduction.

3-2.8 Fully charged and operable fire extinguishers, appropriate for the type of possible fire, shall be available at the work area. Where hose lines are available, they shall be connected and ready for service.

3-2.9 When welding or cutting is done in close proximity to a sprinkler head, a wet rag shall be laid over the head and then removed at the conclusion of the welding or cutting operation. Special precautions shall be taken to avoid accidental operation of automatic fire detection or suppression systems — e.g., special extinguishing systems.

3-2.10 Nearby personnel shall be suitably protected against heat, sparks, slag, etc.

3-3 Fire Watchers. Fire watchers shall be required by the individual responsible for authorizing cutting and welding [*see Section 2-2(b)*] whenever cutting or welding is performed in locations where other than a minor fire might develop, or any of the following conditions exist:

(a) Appreciable combustible material in building construction or contents closer than 35 ft (11 m) to the point of operation.

(b) Appreciable combustibles are more than 35 ft (11 m) away but are easily ignited by sparks.

(c) Wall or floor openings within a 35-ft (11-m) radius expose combustible material in adjacent areas including concealed spaces in walls or floors.

(d) Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation.

3-3.1 Fire watchers shall have fire extinguishing equipment readily available and be trained in its use, including practice on test fires.

3-3.2 Fire watchers shall be familiar with facilities and procedures for sounding an alarm in the event of a fire.

3-3.3 Fire watchers shall watch for fires in all exposed areas, and try to extinguish them first only when obviously within the capacity of the equipment available, or otherwise sound the alarm immediately.

3-3.4 A fire watch shall be maintained for at least a half hour after completion of cutting or welding operations to detect and extinguish smoldering fires.

3-4 Hot Tapping. "Hot tapping" or other cutting and welding on a flammable gas or liquid transmission or distribution utility pipeline shall be performed by a crew qualified to make hot taps.

NOTE: For a gas pipeline, see 841.27 in *Gas Transmission and Distribution Piping Systems*, ANSI/ASME B31.8.

Chapter 4 Public Exhibitions and Demonstrations

4-1 Scope. The following provisions apply to oxy-fuel gas welding and cutting operations at public exhibitions, demonstrations, displays, and trade shows (referred to hereinafter as the "site") in order to promote the safe usage of compressed gases in public gatherings.

4-2 Supervision. Installation and operation of welding, cutting, and related equipment shall be done by, or under the supervision of, a competent operator to ensure the personal protection of viewers and demonstrators as well as the protection from fire of materials in and around the site and the building itself.

4-3 Site.

4-3.1 Site Location. Sites involving the use and storage of compressed gases shall be located so as not to interfere with the egress of people during an emergency.

4-3.2 Site Design. The site shall be constructed, equipped, and operated in such a manner that the demonstration will be carried out so as to minimize the possibility of injury to viewers.

4-4 Fire Protection.

4-4.1 Fire Extinguishers. Each site shall be provided with a portable fire extinguisher of appropriate size and type and with a pail of water.

4-4.2 Shielding. The public, combustible materials, and compressed gas cylinders at the site shall be protected from flames, sparks, and molten metal.

4-4.3 Fire Department Notification. The fire department shall be notified in advance of such use of the site.

4-5 Cylinders.

4-5.1 Gas Capacity Limitation. Cylinders containing compressed gases for use at the site shall not be charged in excess of one-half their maximum permissible content. Cylinders of nonliquefied gases and acetylene shall be charged to not more than one-half their maximum permissible charged gauge pressure (psi or kPa). Cylinders of liquefied gases shall be charged to not more than one-half the maximum permissible capacity in pounds (kilograms).

4-5.2 Storage. Cylinders located at the site shall be connected for use except that enough additional cylinders may be stored at the site to furnish approximately one day's consumption of each as used. Other cylinders shall be stored in an approved storage area, preferably outdoors, but not near a building exit.

4-5.3 Transporting Cylinders. Cylinders in excess of 40 lb (18 kg) total weight being transported to or from the site shall be carried on a hand or motorized truck.

4-5.4 Process Hoses. Hoses shall be located and protected so that they will not be physically damaged.

4-5.5 Cylinder Valves. Cylinder valves shall be closed when equipment is unattended.

4-5.6 Valve Caps. Where caps are provided for valve protection, such caps shall be in place except when the cylinders are in service or connected ready for service.

4-5.7 Cylinder Protection. Cylinders shall be secured so that they cannot be knocked over.

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

A Suggested Form of Written Cutting and Welding Permit (may be modified to suit local conditions)

(Front)

PERMIT
FOR CUTTING AND WELDING
WITH PORTABLE GAS OR ARC EQUIPMENT

Date .....

Building .....

Dept. ..... Floor .....

Work to be done .....

.....

Special Precautions .....

.....

Is fire watch required? .....

The location where this work is to be done has been examined, necessary precautions taken, and permission is granted for this work. (See other side)

Permit expires .....

Signed .....
(Individual responsible for authorizing welding and cutting)

Time started ..... Completed .....

FINAL CHECK-UP

Work area and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite sides of walls) were inspected 30 minutes after the work was completed and were found firesafe.

Signed .....
(Supervisor or Fire Watcher)

(Rear)

ATTENTION

Before approving any cutting and welding permit, the fire safety supervisor or his appointee shall inspect the work area and confirm that precautions have been taken to prevent fire in accordance with NFPA 51B.

PRECAUTIONS

- ☐ Sprinklers in service
- ☐ Cutting and welding equipment in good repair

WITHIN 35 FT. OF WORK

- ☐ Floors swept clean of combustibles
- ☐ Combustible floors wet down, covered with damp sand, metal or other shields
- ☐ No combustible material or flammable liquids
- ☐ Combustibles and flammable liquids protected with covers, guards or metal shields
- ☐ All wall and floor openings covered
- ☐ Covers suspended beneath work to collect sparks

WORK ON WALLS OR CEILINGS

- ☐ Construction noncombustible and without combustible covering
- ☐ Combustibles moved away from opposite side of wall

WORK ON ENCLOSED EQUIPMENT
(Tanks, containers, ducts, dust collectors, etc.)

- ☐ Equipment cleaned of all combustibles
- ☐ Containers purged of flammable vapors

FIRE WATCH

- ☐ To be provided during and 30 minutes after operation
- ☐ Supplied with extinguisher and small hose
- ☐ Trained in use of equipment and in sounding fire alarm

FINAL CHECK-UP

- ☐ To be made 30 minutes after completion of any operation unless fire watch is provided.

Signed .....
(Supervisor)

Appendix B

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

Appendix B is a collection of fires and explosions caused by improper use of cutting and welding equipment drawn from NFPA fire records. Its sole purpose is to illustrate how such incidents occur and to emphasize the provisions of this standard.

B-1 Kaukauna, WI, Warehouse

While an arc welder was being used on the second floor, sparks dropped through an opening to cardboard boxes below, and the boxes ignited. There was no fire watch on the first floor, and when the fire was discovered 15 minutes later, employees could not put it out. They finally called the fire department, but too late to save the 2-story building of ordinary construction. Loss was $1,600,000.

B-2 Winnipeg, Manitoba, Food-Processing Plant

While an employee was using an oxyacetylene cutting torch to modify a bracket in the boiler room, hot slag ignited canvas and plywood that were being used as a temporary covering over a hole in the wall between the fire-resistive boiler room and the storage room. Fire then spread to waxed cartons and plastic bags in the storage room. Fire fighting was impeded by the windowless walls and thick black smoke. Loss was $650,000.

B-3 Halsey, OR, Rolled Paper Storage

A bracket was being welded on a column adjacent to an aisle, with rolled paper storage not more than 5 ft away. A welding permit was reportedly issued for the work, but the standard permit form clearly stated that combustibles within 35 ft of the work should be removed or shielded. The permit also required the signature of the supervisor certifying that a check of the area had been made. In this case there was no protection for the combustibles and no signature.

The fire quickly spread into the interior of the storage pile, but sprinklers operated, roof vents were opened, and hose streams were brought into play as the smoke cleared a little. About 300 rolls were burned beyond salvage and other rolls wet. Loss was $250,000.

B-4 Atlanta, GA, Poultry Processing

An employee using an electric arc welder was working in an area above a refrigerated room, which was insulated with polyurethane foam sandwiched between sheets of aluminum. Sparks fell on the exposed ends of the insulation, causing a severe fire. The heat was sufficient to bring about collapse of exposed metal bar joist roof framing, and the total loss was $250,000.

B-5 Ontario, OR, Food Processing

An oxyacetylene cutting torch was being used in a metal-lined freezing tunnel, with some pipes passing through the walls of the tunnel and making a loose fit with these walls. Sparks evidently passed through a crack to ignite polystyrene foam insulation. This event happened at a rest period and was not discovered until the rest period was over. Further time was lost during a fruitless effort to extinguish the fire with extinguishers and a small hose. The fire department, when finally called, was confronted with a tough task in the heavy smoke and with the fire spreading to the concealed and undivided attic space. Loss was $2,300,000.

B-6 San Pedro, CA, Wharf

Workmen were using a gasoline-powered chain saw and cutting torch to repair pilings on a 3,700-ft-long wharf. While some of the men were refueling the chain saw from a two-gallon can, another man was using a cutting torch far too close. Gasoline vapors ignited, and during efforts to extinguish the fire, the can was kicked into the water. Burning gas in the water ignited the pilings and flames spread 370 ft along the underside of the wharf before firemen could control the fire.

B-7 Portland, OR, Lumber Mill

Workmen had shut down one of several sprinkler systems in the plant to remove branch lines to facilitate removal of a conveyor. While workmen were cutting bolts from the converyor with welding equipment, some of the sparks went through cracks in the floor to land in sawdust accumulations below. There smoldering occurred for three hours without being noticed by the maintenance employees, who were the only people in the plant. In the meantime the area in the region of the cutting operations, but not the floor below, had been washed down and visited regularly at half-hour intervals.

When the fire was finally noticed, some time was spent in trying to extinguish it before the fire department was called. By the time the fire department arrived, it was too late to save the lumber storage and stacker buildings. Destruction caused loss of $1,250,000.

B-8 Austin, TX, University Library

Workmen were using an acetylene torch to remove old heating ducts in a utility shaft between the twentieth and twenty-first stories of the tower of a 27-story university library building. Flying sparks fell through a vent and ignited papers stacked against the vent in a twenty-story storage room. Apparently the fire burned for 20 to 30 minutes before discovery.

There was no fire protection in the upper stories besides portable fire extinguishers, and firemen had to connect to the standpipes in the third and fourth stories and pull hose lines up the enclosed stairways to the twentieth and twenty-first stories. They finally controlled the fire in 2½ hours, but damage extended to four stories when fire spread by way of nonfirestopped utility shafts and elevator shafts.

The work here was being done by two air conditioning installation workmen, on contract, and they were obviously more interested in speed than in safety. They had not investigated the possibility of combustible material being in contact with the old heating duct on which they were working.

B-9 Atlanta, GA, Wire and Nail Mill

A small fire started on the built-up wood roof by repairmen using an acetylene torch for welding. The repairmen believed that they had extinguished the fire, but 3½ hours later the fire broke out again and spread on an accumula-

tion of metal dust on overhead beams thoughout the unsprinklered, undivided single-story structure. The loss was $2,300,000.

B-10 Provo, UT, Hardware Warehouse

An employee was welding a broken metal roof beam in the attic of a 1-story brick, wood-joisted, wholesale hardware building. A spark fell through a crack in the attic floor and ignited cardboard boxes in the shelving below. No precautions had been taken to guard against fire, and the welder did not realize that there was a fire until he felt the heat coming up from below. Loss was $131,000.

B-11 Thomson, NY, Paper Mill

Productions lines were shut down in a tissue paper mill so that maintenance men could use a cutting torch to remove a drive roll for repairs. The area where the cutting was to be done was cleaned up and wet down as a precaution against flying sparks. Also an employee with a portable extinguisher acted as fire guard during the cutting operation.

A stray spark ignited paper dust on the floor at the adjacent machine. When the fire watch attempted to extinguish the small blaze, he found that his portable extinguisher was empty. The blaze spread to paper dust and lint atop an unused overhead heating duct which was from 2 to 5 ft in diameter. It took fire fighters about three hours to extinguish the blaze in the unsprinklered duct. The damage to tissue paper by fire fighting operations amounted to $25,000.

B-12 Jacksonville, IL, Pavement Manufacturing

After partially unloading a tanker of MC 800 road oil at a temperature of about 290 °F, two employees went to the top of the asphalt tank to straighten a pipe through which they measured the oil level. In this repair work they were using an acetylene torch. The torch so heated the top of the tank that flammable vapors within the tank exploded and tore up a large part of the top. Both men were thrown long distances, and both were killed.

B-13 Toledo, OH, Tar Manufacturing

Welders were repairing a leak in an odor scrubbing system when an explosion occurred in a tank connected with the system and containing naphthalene vapors above the hot tar level. It is believed that heat from the torch ignited flammable vapors within the pipe, and that the flame was propagated to the tank. Spread of hot tar when the tank ruptured handicapped firemen in gaining quick access to the area. Three workmen were killed and property damage was $110,000.

B-14 New Orleans, LA, Office Building

An outside contractor, installing new elevator equipment in a seven-story office building with plank floors, set a number of fires as a result of cutting and welding operations, but the contractor's employees extinguished all but one. This one occurred towards the end of the day's work, and the four employees, without discovering it, went home. Later in the evening the night porter noticed the old elevator penthouse, partly of wooden construction, ablaze as he was summoning the elevator to perform his normal duties. Two hours later the fire department, using many large hose lines, brought the fire under control. The loss was $530,000, mainly to the top story from fire and to lower stories from water.

There was no formal fire watch nor, following the last use of the welder, was there any inspeciton of the area during a set period after the welding.

B-15 Hatboro, PA, Chemical Plant

Workmen were welding some additional fill-line supports on a 6,000-gal vertical tank containing 3,000 gal of alcohol. Heat transmitted through the metal of the tank ignited alcohol vapors inside, and the tank was blown into the air. Alcohol was dumped into two diked areas containing eight tanks of high-flash-point liquid, but heavy use of hose streams kept other tanks from rupturing. Loss was $100,000.

B-16 New Orleans, LA, Candy Storage

The outside of the walls of this sprinklered metal-frame warehouse were lined with combustible laminated paper-asphalt vapor barrier and a 1½-inch layer of foamed polystyrene insulation. A workman was welding metal plates to the base of the structural member when the combustible vapor barrier ignited. While the welder ran to turn in an alarm and to get a portable extinguisher, seven sprinklers operated to control the fire.

B-17 Billings, MT, Auditorium

In the remodeling of the auditorium at the Fairgrounds, workmen were welding straps on channel iron which had been placed on each side of 12-in. by 12-in. wooden uprights to give more strength to these columns. Heat from the torch apparently caused some smoldering in the columns. Some five hours later the caretaker noticed that the roof was ablaze. It was too late then to save the building, which was of ordinary construction and unsprinklered. Loss was $266,000.

B-18 Sorel, P.Q., Passenger Ship Under Construction

A shipyard worker was welding a steel bracket beneath the steel deck of a stateroom when the hot deck plate ignited paper on the floor of the stateroom. Flames then spread to wooden paneling and other combustibles and soon reached synthetic rubber insulation on electrical cables and also resin-impregnated glass fiber ducts carrying 3,000 cfm of warm air. Although a workman discovered the fire within a few minutes and the fans for the air ducts were quickly shut off, the heat and dense smoke from the burning resin and synthetic rubber prevented control. The fire spread from the promenade deck to three other decks. Damage to the vessel was $4,000,000.

B-19 San Francisco, Calif., Marine Terminal

The reinforced concrete dock had a tarpaper vapor barrier beneath the concrete and a wooden fenderline around the outside of the apron. Workmen had a 30-day "blanket" welding and cutting permit, but had not notified the Port Authority Fire Marshal that they planned to do cutting in the known dangerous area. They had also failed to take a portable extinguisher to the job with them. The two workmen, in a boat, were cutting a reinforcing rod beneath the apron when flame or sparks from the torch ignited the tarpaper, and the fire spread overhead so fast that the two

men had to jump into the water to save themselves. The loss was estimated at $200,000.

B-20 Searcy, AR, Missile Silo

A welder in a missile silo under repair inadvertently included a temporarily installed steel-braided hose containing hydraulic oil under 500 psi pressure in the range of the electric arc, and caused rupture of the steel braid and of the Teflon® inner tube. The escaping oil ignited at the arc, and a very severe fire resulted in the confined underground space, fatally trapping 53 workmen. The hose was only 14 inches away from the work being done, and working conditions were crowded and cramped.

After the accident, conditions were duplicated as nearly as possible at another site, with of course, proper protection of personnel; and the time from the beginning of the arc at the hose to rupture was 0.69 second, and from rupture to ignition 0.02 second.

B-21 River Rouge, MI, Metal Working

A workman was cutting an object with a torch, using as a workbench the top of a drum containing kerosine, when the torch cut into the drum and caused an explosion in the partially full interior. The workman was fatally burned over 75 percent of his body.

B-22 Port Maitland, Ontario, Fertilizer Manufacturing

Workmen had been welding on a rubber-lined steel separator vessel. Reportedly, the rubber lining inside the vessel had been stripped from the metal tank wall where welding was to be done; however, workmen a short time later noticed smoke and discovered that the lining was burning. The fire spread from the vessel through several feet of rubber-lined duct connected to the vessel, and employees were unable to extinguish the fire on the vessel until after about 45 minutes. The process equipment affected remained out of service for two weeks.

B-23 El Centro, CA, Hospital

During construction of a new wing, sparks from a cutting torch, being used to cut a steel beam in an existing wall, ignited cellulose insulation in the attic of the existing single-story building. Although workman extinguished the fire before the fire department arrived (limiting fire spread to a 20 ft × 4 ft area of insulation), it took two hours to remove smoke from the maternity ward.

The cellulose insulation was treated with a fire retardant when installed 7 years prior to the fire. However, tests showed that much of its fire retardant property had been lost.

B-24 Texas, Building Under Construction

During a late stage of construction of an apartment complex consisting of twenty-three 2-story wooden buildings, heat from a plumber's torch ignited exterior low-density fiberboard sheathing on one of the buildings. The plumber had left the site approximately one hour before the fire was discovered and had not noticed fire or smoke in the area at that time. There was no fire watch procedure in effect.

A watchman and a construction worker made an unsuccessful attempt to extinguish the fire before notifying the fire department. This delay and fire department operational problems with the new hydrant and yard main system resulted in extensive fire spread, injuries to four firemen and damage estimated at $400,000.

B-25 Montana, Lumber Mill

A fire in this lumber mill started when sparks from a welding torch ignited a smoldering fire in a pile of sawdust. The night watchman who discovered the fire at 6:10 am in the sawdust pile attempted to extinguish it using one of the hose lines, but due to lack of maintenance, the hose burst. The watchman ran to another section of the building to get another hose. When he returned, the fire had spread and was out of control. He telephoned the fire department at 6:15 am. Officials stated that repair work, using a welding torch, was being done in the area of fire origin and had been completed approximately one hour prior to the discovery of the fire.

Contributing to the mill's destruction was the high concentration of unfinished lumber and sawdust, which helped increase the fire's spread. Fire officials stated that, if the occupant fire hose had been maintained, the loss, which was estimated at $500,000 might have been minimized.

B-26 Tennessee, Building Under Construction

A welder on the third floor of this construction project unknowingly started a fire on the floor below, which threatened other workmen as well as the entire complex. He did not realize how far the globules of molten metal from his operation were traveling until another construction worker spotted a fire in some combustible material on the second floor at 1:44 pm. The wind had carried the molten metal to the lower east wing and ignited one of four cardboard and wood crates, each of which contained a 100-gallon water heater. The workmen tried to control the fire with portable extinguishers, but winds gusting up to 40 miles per hour ended that prospect quickly. Luckily, someone on the site telephoned the fire department, and fire fighters had the situation stabilized soon after they arrived.

No one was injured, and the building's contents were the only things damaged. The loss was estimated at $10,000.

Appendix C Referenced Publications

C-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

C-1.1 NFPA Publications. National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 51-1987, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*

NFPA 327-1987, *Cleaning or Safeguarding Small Tanks and Containers.*

C-1.2 Other Publications.

ANSI Z49.1-1988, *Safety in Welding and Cutting*, American Welding Society, PO Box 351040, Miami, FL 33135.

ANSI/ASME B31.8-1986, *Gas Transmission and Distribution Piping Systems*, American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017.

AWS F-4.1-1988, *Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping that have held Hazardous Substances*, American Welding Society, PO Box 351040, Miami, FL 33135.

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

1. For each document on which you are proposing amendment indicate:
   (a) The number and title of the document
   (b) The specific section or paragraph.

2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269

Date 5/18/85 **Name** John B. Smith **Tel. No.** 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) **Document Title:** Protective Signaling Systems **NFPA No. & Year** NFPA 72D

   b) **Section/Paragraph:** 2-7.1 (Exception)

2. **Proposal recommends: (Check one)**
   - ☐ new text
   - ☐ revised text
   - ☒ deleted text.

3. **Proposal (include proposed new or revised wording, or identification of wording to be deleted):**

   Delete exception.

4. **Statement of Problem and Substantiation for Proposal:**

   A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ **This Proposal is original material.**
   ☐ **This Proposal is not original material; its source (if known) is as follows:** _____

(Note: Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

I agree to give NFPA all and full rights, including rights of copyright, in this Proposal and I understand that I acquire no rights in any publication of NFPA in which this Proposal in this or another similar or analogous form is used.

John B. Smith

Signature

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
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Date _____ Name _____ Tel. No. _____

Address _____

Representing (Please indicate organization, company or self) _____

1. a) Document Title: _____ NFPA No. & Year _____

   b) Section/Paragraph: _____

2. Proposal recommends: (Check one) ☐ new text
   ☐ revised text
   ☐ deleted text.

3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

Cut Here

4. Statement of Problem and Substantiation for Proposal:

5. ☐ This Proposal is original material.
   ☐ This Proposal is not original material; its source (if known) is as follows: _____

(Note: Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

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