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Standard for
Fire Prevention in Use of

CUTTING AND WELDING PROCESSES

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National Fire Protection Association

International

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection. Its membership includes national and regional societies and associations (list on outside back cover) and twenty thousand individuals, corporations, and organizations. Anyone interested may become a member; the annual dues are $15.00. Full membership information is available on request.

This is one of a large number of publications on fire safety issued by the Association. All NFPA standards and recommended practices, including this text, are prepared by the technical committees of the NFPA and adopted at an Annual Meeting of the Association. They are intended to prescribe reasonable measures for minimizing losses of life and property by fire.

This text and most other NFPA standards and recommended practices are published in the **National Fire Codes,** a compilation of NFPA's official technical material, issued in seven clothbound volumes. Full information on the availability of these Codes and other NFPA publications can be secured from the Association.

Official NFPA Definitions

SHALL is intended to indicate requirements.

SHOULD is intended to indicate recommendations, or that which is advised but not required.

APPROVED refers to approval by the authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The suitability of devices and materials for installation under NFPA standards is indicated by the listing of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada, the Factory Mutual Laboratories and the American Gas Association (gas equipment) test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Discount Prices on this Pamphlet

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CUTTING AND WELDING PROCESSES

NFPA No. 51B — 1962

In 1958, the NFPA Board of Directors authorized the creation of the Committee on Cutting and Welding Practices (current personnel listed below) in an effort to provide guidance in safe practices in the usage of cutting and welding equipment. The first project of the Committee was the issuance by the NFPA of an educational folder entitled "Sparks Astray" (sample copy free; $3.00 per hundred).

This fire prevention standard has been developed to guide all persons using gas or arc cutting and welding equipment in the interest of preventing loss of life and property from fire. The Standard was tentatively adopted at the 1960 NFPA Annual Meeting and was approved for final adoption at the 1962 Annual Meeting.

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Standard for Fire Protection in Use of

CUTTING AND WELDING PROCESSES

NFPA No. 51B — 1962

Foreword

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.

Approximately 6 per cent of fires in industrial properties have been caused by cutting and welding, primarily with portable equipment in areas not specifically designed or approved for such work. Cutting and 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.

A majority of industrial fires in which cutting and welding is a factor have been caused by sparks. These globules of molten metal have scattered as far as 35 feet, 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 which have reached serious proportions before being noticed.

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 had not been purged of flammable materials. In the latter case, an explosion generally resulted.

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.

Anything which 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, chemicals, and flammable liquids and gases; and combustible ground cover such as grass and brush.

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

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

2. Scope. This standard covers recommendations for the safe use of gas and arc cutting and welding equipment to prevent loss of life and property from fire.

NOTE: Details on Installation and Operation of Gas Systems for Welding and Cutting are covered in NFPA Standard No. 51.* Details on installation and operation of arc cutting and welding equipment are covered in American Standard Safety in Welding and Cutting (ASA-Z49.1).*

3. Responsibility for Cutting and Welding. Although the cutter or welder has the best opportunity to avoid fire or injury by proper control of the hot work 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 and air; or (3) the presence or nature of high oxygen concentrations in the location where hot 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. The following paragraphs outline the specific responsibilities of each.

*No. 51 is available from National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass. ASA-Z49.1 available from American Welding Society, 345 E. 47th St., New York 17, N. Y.

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

311. Based on fire potentials of plant facilities, establish approved areas for cutting and welding, and establish procedures for approving cutting and welding in other areas.

312. Designate an individual responsible for authorizing cutting and welding operations in areas not specifically designed or approved for such processes.

NOTE: He may be a welding supervisor, foreman, contractor, person responsible for fire protection, or other qualified individual aware of the fire hazards involved.

313. Insist that cutters or welders and their supervisors are suitably trained in the safe operation of their equipment and the safe use of the process.

314. Select contractors to perform hot work involving cutting or welding who have suitably trained personnel and who have an awareness of the magnitude of the risks involved.

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

32. The **Supervisor** of cutting or welding operations in areas not designed or approved for such processes may be a foreman in a large plant or a plant manager or owner in a small one. In contract operations he may be the contractor or one of his foremen or supervisors.

321. He shall be responsible for the safe handling of the cutting or welding equipment and the safe use of the cutting or welding process.

322. He shall determine the combustible materials and hazardous areas present or likely to be present in the work location.

323. He shall protect combustibles from ignition by the following:

3231. Have the work moved to a location free from dangerous combustibles.

3232. 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.

3233. See that cutting and welding are so scheduled that plant operations that might expose combustibles to ignition are not started during cutting or welding.

324. He shall secure authorization for the cutting or welding operations from the designated management representative (see 312).

325. He shall determine that the cutter or welder secures his approval that conditions are safe before going ahead.

326. He shall determine that fire protection and extinguishing equipment are properly located at the site.

327. Where fire watchers are required (see 43), he shall see that they are available at the site.

33. The **Cutter or Welder** shall handle his equipment safely and use it so as not to endanger lives and property.

331. He shall have approval by his supervisor before he starts to cut or weld.

332. He shall not cut or weld where conditions are not safe.

333. He shall continue to cut or weld only so long as conditions are unchanged from those under which approval was granted.

4. Fire Prevention Precautions. Cutting or welding shall be permitted only in areas that are or have been made fire safe. Within the confines of an operating plant or building, cutting and welding should preferably be done in a specific area designed or approved for such work, such as a maintenance shop or a detached outside location. Such areas shall be of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas. When work cannot be moved practically, as in most construction work, the area shall be made fire safe by removing combustibles or protecting combustibles from ignition sources.

41. Cutting or welding shall not be permitted in the following situations:

411. In areas not authorized by management.

412. In sprinklered buildings while such protection is impaired.

413. 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 tanks or equipment which have previously contained such materials, or that may develop in areas with an accumulation of combustible dusts. (See NFPA No. 327, Cleaning or Safeguarding Small Tanks and Containers.)*

*Available from the National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.

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

42. Before cutting or welding is permitted, the area shall be inspected by the individual responsible for authorizing cutting and welding operations. He shall designate precautions to be followed in granting authorization to proceed, preferably in the form of a written permit. (A suggested form of written permit is shown in the Appendix. It may be modified to suit local conditions.) He shall sign the permit or otherwise authorize the work, and shall assure himself of the following:

421. 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 feet. Combustible floors 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.

422. Where practicable, all combustibles shall be relocated at least 35 feet from the work site. Where relocation is impracticable, combustibles shall be protected with flame-proofed covers or otherwise shielded with metal or asbestos guards or curtains. Edges of covers at the floor should 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.

423. Wall or floor openings or cracks within 35 feet of the site shall be tightly covered to prevent the passage of sparks to adjacent areas.

424. Ducts and conveyor systems that might carry sparks to distant combustibles shall be suitably protected or shut down.

425. 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.

426. 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.

427. 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.

428. 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.

429. Portable fire extinguishers, appropriate for the type of possible fire, shall be concentrated at the work area. Where hose lines are available, they shall be connected and ready for service.

43. Fire Watchers shall be required by the individual responsible for authorizing cutting and welding 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 feet to the point of operation.

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

(c) Wall or floor openings within a 35-foot 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.

431. Fire watchers shall have fire extinguishing equipment readily available and be trained in its use.

432. Fire watchers shall be familiar with facilities for sounding an alarm in the event of a fire.

433. 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.

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

44. In "hot tapping" or other cutting or welding on a flammable gas or liquid transmission or distribution utility pipe line, safe procedures should be established.

APPENDIX

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

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.

Permit expires.....

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

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

FINAL CHECK-UP
(Where fire watch is required)

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 for at least 30 minutes after the work was completed and were found fire safe.

Signed.....
(Fire watcher)

*The back of this permit may be used to list precautions applicable to the specific industry or plant involved.