

NFPA No.

241

**SAFEGUARDING**

**BUILDING  
CONSTRUCTION  
AND DEMOLITION  
OPERATIONS  
1973**



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## Standard for Safeguarding Building Construction and Demolition Operations

NFPA No. 241 — 1973

This edition, adopted by the National Fire Protection Association Annual Meeting on May 17, 1973, supersedes all previous editions of this Standard. It is a complete revision of the last previous edition issued in 1968.

Work on this subject commenced in 1930 when the NFPA Committee on Construction Operations developed *Recommended Good Practice Requirements for Building Construction Operations*. This text was adopted by the National Fire Protection Association with revisions in 1933. In 1942 a tentative revision was submitted and while no official action was taken, the revision was published subsequently for information in the printing of the text in Volume III of the *National Fire Codes* published by the NFPA.

The NFPA Committee on Building Construction now has jurisdiction over this Standard. A tentative text prepared by that Committee was adopted at the 1957 NFPA Annual Meeting and that text was unanimously approved by the NFPA in 1958. A complete revision was adopted by the NFPA in 1968.

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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.*

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## NFPA No. 241 — 1973

**Introduction**

**0.1** Fires during construction, major alteration or demolition of buildings are preventable or controllable. The fire potential is usually greater during these operations than in completed buildings. Opportunities for serious fires are present during these operations because of accumulations of materials or debris and the presence of potential sources of ignition.

A study of a number of losses to buildings which were under construction shows that 60 percent of those where the cause could be ascertained originated from these three causes:

- (a) Salamanders or portable heating equipment (25 percent)
- (b) Cutting and welding operations (20 percent)
- (c) Matches and smoking (15 percent).

**0.2** Early planning and appropriate scheduling of fire preventative measures, fire protection facilities and rapid communication are vitally important in avoiding a major fire in a construction or demolition project. All too often such fires can be attributed simply to "too little or too late" attention to the threat of fire.

**0.3** This standard is intended to indicate the measures which, with preplanning, will prevent fire or at least minimize damage when fire occurs. The public fire department and other fire protection authorities should also be consulted for their guidance. The importance of pre-fire planning cannot be overemphasized. The unique and dangerous situations which may confront fire fighters during construction or demolition operations dictate that a complete exchange of pertinent information continue from the beginning to the end of operation.

**0.4** Contracts should specify the fire safety program which is to be observed and establish the owner's right to administration and enforcement, even though the building may otherwise be entirely under the jurisdiction of the builder or the wrecking company. Correction of unnecessary fire hazards should not be subject to delay which frequently accompanies usual contractual negotiations.

**0.5** Contracts for provision of fire protection facilities should be awarded as early as possible, as there is inherent delay in supplying some fire protection equipment which is specialized and fabricated on order only.

**Standard for**  
**Safeguarding Building Construction and**  
**Demolition Operations**

**NFPA No. 241 — 1973**

**Chapter 1 Scope**

This standard is intended to apply to buildings in the course of erection, major alteration, or demolition.

**Chapter 2 Temporary Construction and Equipment**

**2-1 Construction Offices and Sheds**

**2-1.1** Construction offices, trailers, sheds and other facilities for the storage of tools and materials, when located within the building, on the sidewalk bridging or within 30 feet of the building shall be of noncombustible construction.<sup>1</sup>

**2-1.2** Only safely installed approved heating devices shall be used in construction offices and sheds. Ample clearance shall be provided around stoves and heaters and all chimney and vent connectors to prevent ignition of adjacent combustible materials. When temporary heating equipment is used, see Section 3-2.

**2-2 Temporary Enclosures**

**2-2.1** Only flame resistant tarpaulins or materials of equivalent fire retardant characteristics shall be used.

**2-2.2** When used to enclose buildings temporarily, the enclosing material shall be fastened securely or guarded by construction so it cannot be blown against heaters or other sources of ignition by the wind.

**2-3 Scaffolding, Shoring, and Forms<sup>2</sup>**

**2-3.1** Unnecessary accumulation of combustible forms or form lumber shall be avoided. Those portions of the building where combustible forms are present shall not be used for the storage of other combustible building supplies.

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<sup>1</sup>When located 30 feet or more from the building and constructed of combustible materials, it is desirable to separate them into small detached units.

<sup>2</sup>Steel scaffolding or approved fire retardant treated lumber and planking should be used on both the outside and the inside of the building.

**2-3.2** Fire extinguishing equipment shall be provided during forming and stripping. Charged hose lines will meet this requirement.<sup>1</sup>

## **2-4 Construction Equipment**

**2-4.1** Internal combustion engine-powered air compressors, hoists, derricks, pumps, etc., shall be so located that the exhausts discharge well away from combustible materials. When the exhausts are piped to outside the building under construction, a clearance of at least 6 inches shall be maintained between such piping and combustible material.

**2-4.2** Internal combustion equipment shall be shut down prior to refueling.<sup>2</sup>

**2-4.3** Service areas for construction equipment shall not be located within buildings.

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<sup>1</sup>The local fire authority should be contacted regarding adequacy of water supply for hose lines.

<sup>2</sup>Suitable fire extinguishers should be provided on manned construction equipment utilizing liquid fuel.

## Chapter 3 Construction Processes and Hazards

### 3-1 Cutting and Welding Operations

**3-1.1** A permit system shall be used for cutting and welding operations on the job site under the supervision of the person in charge of fire protection. A permit shall not be issued until (1) it has been determined cutting and welding can be safely conducted at the desired location, (2) combustibles have been moved away or safely covered, and (3) a fire watchman with extinguisher is posted for the duration of the work, and for 30 minutes thereafter, to see that sparks or drops of hot metal do not start fires.<sup>1</sup>

**3-1.2** All gas-operated cutting and welding equipment and operations shall be in accordance with the *Standard for the Installation and Operation of Oxygen-Fuel Gas Systems for Welding and Cutting* (NFPA 51 — 1973).

### 3-2 Temporary Heating Equipment

**3-2.1** The permanent heating equipment for a new building shall be installed and put into operation as soon as practicable. In cold weather demolition operations, building heat shall be maintained to permit sprinklers, hose, and extinguishers to be maintained on lower floors, or within enclosed areas without danger of freezing.

**3-2.2** Only steam heaters, approved electric heaters, approved gas- and oil-fired space heaters, or indirect-fired gasoline heaters located outside the building shall be used.

**3-2.3** Chimney or vent connectors, where required from direct-fired heaters, shall be maintained at least 18 inches from combustibles.

**3-2.4** Oil-fired heaters shall comply in design and installation features with the *Standard for the Installation of Oil Burning Equipment* (NFPA 31 — 1972).

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<sup>1</sup>Additional fire watchmen should be provided during welding or cutting operations where sparks or molten metal may drop several floors.

If welding operations have been conducted during the day, the oncoming watchman (see Section 5-6) should be alerted to check the location where welding was done as a part of his regular rounds. Where watchman service is not provided, use of gas-operated welding or cutting equipment should be discontinued a minimum of one hour before quitting time.

If the structure has a wooden floor, the floor should be wetted down before and after welding or cutting operations are conducted. Adequate precautions must be taken so that wetting down will not introduce a personnel safety hazard.



**3-2.5** Fuel supplies for liquefied petroleum gas-fired heaters shall comply with the *Standard for the Storage and Handling of Liquefied Petroleum Gases* (NFPA 58 — 1972), and the *Standard for the Installation of Gas Appliances and Gas Piping* (NFPA 54 — 1969).

**3-2.6** Refueling operations for oil burning equipment and liquefied petroleum gas burning equipment shall be safely conducted, removing the heater to a safe location and waiting for it to cool prior to refueling.

**3-2.7** Heating devices shall be situated so they are not likely to overturn and shall be otherwise installed in accordance with their listing, including clearance to combustible material, equipment, or construction.

**3-2.8** Temporary heating equipment, when utilized, shall be attended and maintained by competent personnel.

### **3-3 Smoking**

**3-3.1** Smoking shall be prohibited at or in the vicinity of hazardous operations or materials.

**3-3.2** Where smoking is permitted, safe receptacles shall be provided for smoking materials.

### **3-4 Trash Disposal**

**3-4.1** Combustible waste material and rubbish shall not be stored or allowed to accumulate within the building or in the immediate vicinity, but shall be removed from the premises as rapidly as practicable.

**3-4.2** Rubbish shall not be burned on the premises without first obtaining a permit from the local fire department.<sup>1</sup>

### **3-5 Flammable Liquids**

**3-5.1** Flammable liquid storage shall be in accordance with the *Flammable and Combustible Liquids Code* (NFPA 30 — 1973).

**3-5.2** Ventilation shall be provided for operations involving the application of materials containing flammable solvents.

<sup>1</sup>If a chute is employed for removal of demolition debris, it should be erected on the outside of the building.

**3-5.3** Potential sources of ignition shall be identified and safeguarded whenever such operations are being conducted.

**3-5.4** Asphalt and tar kettles shall be located in a safe place outside of the building or on a noncombustible roof at a point where they avoid danger of ignition of combustible material below. Continuous supervision shall be maintained while kettles are in operation, and metal covers shall be provided for all kettles to smother out flames in case of fire. Suitable fire extinguishers shall be provided.

**3-5.5** Used roofing mops shall be stored away from the building and combustible materials.

**3-5.6** For demolition projects the following precaution shall be taken:

| Drain flammable liquids and combustible oils from tanks and machinery reservoirs in a safe manner, with particular attention to removal of residue and sludge accumulations. Remove from the building immediately.<sup>1</sup>

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<sup>1</sup>Tanks and piping formerly containing flammable liquids are likely to contain flammable vapors and preferably should be removed prior to demolition of the building. If this is not feasible, these hazards should be placarded or otherwise identified for careful removal. Purging with inert materials should be done as early as possible in the demolition operation in order to minimize the possibility of explosion. Remaining residue or sludge may constitute a fire or explosion hazard.

## Chapter 4 Utilities

### 4-1 Electrical

**4-1.1** Electrical wiring and equipment for light, heat, or power purposes shall be installed in compliance with the requirements of the *National Electrical Code* (NFPA 70 — 1971).

**4-1.2** In demolition projects electric service shall be reduced to a minimum and identified to leave no uncertainty as to which circuits are energized.

**4-2 Gas.** Prior to demolition, gas supplies shall be turned off at a point outside the building.

## Chapter 5 Fire Protection

### 5-1 Fire Cutoffs

**5-1.1** Fire walls and exit stairways, if required for the completed building, shall be given construction priority. Fire doors, with approved closing devices and hardware shall be hung on openings as soon as practicable and before any significant quantity of combustible material is introduced. Fire doors, after installation, shall not be obstructed from closing.<sup>1</sup>

**5-1.2** For demolition projects fire cutoffs shall be retained as such until razing operations necessitate their removal.

### 5-2 Access for Fire Fighting

**5-2.1** A suitable location at the site shall be designated as a command post and provided with plans, emergency information, keys, communication, and equipment, as needed. The person in charge of fire protection shall respond to the location whenever fire occurs.

**5-2.2** Access for use of heavy fire fighting equipment shall be provided to the immediate job site at the start of construction and maintained until all construction is completed.<sup>2</sup>

<sup>1</sup>It is recommended that fire doors be closed at the end of each working day.

<sup>2</sup>The local fire authority should be contacted to establish access ways of sufficient dimension to allow maneuvering of fire equipment.

**5-2.3** Free access from the street to fire hydrants and to outside connections for standpipes, sprinklers, or other fire extinguishing equipment, whether permanent or temporary, shall be provided and maintained at all times. Protective pedestrian walkways shall not be so constructed as to impede ready access to hydrants. No material or construction shall interfere with access to hydrants or connections.

**5-2.4** During construction or demolition operations, free access to permanent, temporary, or portable first aid fire equipment shall be maintained at all times.

**5-2.5** In all buildings over 50 feet in height, at least one stairway shall be provided in usable condition at all times. This stairway shall be extended upward as each floor is installed in new construction. This stairway shall be lighted and enclosed if the building exterior walls are in place.<sup>1</sup>

**5-2.6** Arrangements shall be made so that firemen will have immediate access to the premises when called.

### **5-3 Water Supply**

**5-3.1** Water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates. There shall be no delay in the installation of fire protection equipment.<sup>2</sup>

**5-3.2** Where underground water mains are to be provided, they shall be installed, completed and in service with hydrants or standpipes located as directed by the local fire authority, but not later than the time when combustible materials are delivered to the construction site.

### **5-4 Standpipes**

**5-4.1** In all new buildings in which standpipes are required or where existing in buildings being altered or demolished, such standpipes shall be maintained in conformity with the progress of building activity in such a manner that they are always ready for fire department use.

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<sup>1</sup>Hoists and elevators provide the only efficient means of transporting hose and other cumbersome fire fighting equipment to upper floors in tall construction or demolition projects. They should be available to the fire department whenever necessary.

<sup>2</sup>No minimum water supply is specified due to the wide range of construction types, sites, sizes, etc. However, unless combustibles are essentially nonexistent in the completed structure and occupancy, a minimum of 500 gpm should be provided. In most instances the required supply will be higher.

5-4.2 The standpipes shall be provided with conspicuously marked siamese fire department connections on the outside of the building at the street level and shall have at least one standard hose outlet at each floor.

5-4.3 Pipe sizes, hose valves, hose, water supply, and other details for new construction shall be in accordance with the *Standard for the Installation of Standpipe and Hose Systems* (NFPA 14 1973).<sup>1</sup>

## 5-5 Sprinkler Protection

5-5.1 If automatic sprinkler protection is to be provided, the installation shall be placed in service as soon as possible. Details of installation shall be in accordance with the *Standard for the Installation of Sprinkler Systems* (NFPA 13 — 1973).<sup>2</sup>

5-5.2 Where sprinklers are required for safety to life, the building shall not be occupied until the sprinkler installation has been entirely completed and tested such that the protection is not susceptible to frequent impairment attributable to testing and corrections.

*Exception: This provision shall not preclude the occupancy of the lower floors of a building, even though the upper floors may be in various stages of construction or protection, providing the following conditions are satisfied:*

- (a) *The sprinkler protection of the lower occupied floors is completed and tested in accordance with the above criteria.*
- (b) *The sprinkler protection of the upper floors will be supplied by entirely separate systems and separate control valves such that its absence or incompleteness will in no way impair the sprinkler protection of the occupied lower floors.*

<sup>1</sup>An entire chapter in NFPA 14 deals directly with buildings under construction.

<sup>2</sup>With good scheduling and contracting, it is possible for the sprinkler installation to progressively and closely follow the building construction. This common good practice provides sprinklered areas for the storage of interior finish materials and building mechanical equipment, much of which may be received in combustible packaging and which cannot be stored outside because of absence of exterior space, weather or security. Even when construction combustibles are not a factor, sprinkler protection would be available for unanticipated early delivery of combustible contents planned for the permanent occupancy. It is not unusual, when needed, to temporarily plug the extremity of a partially installed sprinkler system so that a portion may be placed in automatic service. This is frequently done in multiple-storied buildings to facilitate protection on the lower floors before the upper floors have been built.

**5-5.3** When a building, equipped with sprinklers by requirement, is to be demolished, the sprinkler protection shall be retained in service as long as the condition requiring sprinklers continues to exist.<sup>1</sup>

**5-5.4** Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked daily at close of work to ascertain that protection is in service.

## **5-6 Supervision and Watch Service**

**5-6.1** A capable person having the necessary authority shall be placed in charge of fire protection. His responsibilities shall include maintenance and location of fire protective equipment, general supervision of safeguards and location of salamanders or portable heating equipment, and the establishment and maintenance of safe cutting and welding operations. Where watch service is provided, he shall acquaint the watchman with developments during the day and pass along any special instructions on the status of fire protection equipment and emergency procedures.<sup>2</sup>

**5-6.2** There shall be a readily available public fire alarm box near the premises, telephone service to the responding fire department, or equivalent facilities. Instructions shall be issued to immediately notify the fire department in case of fire. When telephone service is employed, the local fire department number shall be conspicuously posted near the telephone.

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<sup>1</sup>If the building to be demolished presents a serious fire exposure threat to neighboring property, the existing sprinklers should be retained in service as long as reasonable by cutting off and capping the system at the floor or area being razed. Modification of the sprinkler systems to permit alterations or additional demolition should be done under direction of the local fire authority and should be expedited so automatic protection may be restored as quickly as possible.

<sup>2</sup>It is recommended that areas and buildings should be patrolled at all times when construction operations are not in progress by a competent watchman registering on an approved watchman's clock from stations covering all parts of the building in accordance with the *Standard for Guard Operations* (NFPA 601 \ — 1968).

## 5-7 First-Aid Fire Equipment

5-7.1 Hose and nozzles shall be provided and made ready for use as soon as either the temporary or permanent water supply is available on new construction.<sup>1</sup>

5-7.2 In every building operation, wherever a toolhouse, a storeroom, or other shanty is placed, or a room or space is used for storage, dressing room, or workshop, at least one approved extinguisher shall be provided and maintained in an accessible location.

*Exception: This requirement may be waived if structures do not exceed 150 sq. ft. floor area and are equipped with automatic sprinklers or other approved protection.*

5-7.3 At least one approved fire extinguisher shall also be provided on each floor at each usable stairway in plain sight as soon as combustible material accumulates.

5-7.4 During demolition, portable fire extinguishers shall be available.<sup>2</sup>

5-7.5 The suitability, distribution and maintenance of extinguishers shall be in accordance with the *Standard for the Installation of Portable Fire Extinguishers* (NFPA 10 — 1973) and *Recommended Good Practice for the Maintenance and Use of Portable Fire Extinguishers* (NFPA 10A — 1973).

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<sup>1</sup>Signs or distinctive markings, as may be required to designate the location of first aid fire equipment and standpipe connections, should be conspicuously displayed. During demolition operations, charged hose lines supplied by hydrants or sprinkler-riser adapters should be available.

<sup>2</sup>Fifty-five gallon water-filled drums with buckets should be provided on each floor and protected from freezing in winter.

## Appendix A

*This Appendix is not a part of this NFPA Standard 241 but is included for information purposes only.*

### Principles of Safeguarding Building Construction and Demolition Operations

**A-1** Buildings under construction, alteration, or demolition are particularly susceptible to fire damage. Construction activities inevitably bring large quantities of combustible materials together with numerous sources of ignition at a time when the building is most vulnerable to a fire, as fire protection facilities generally have not been completed and unprotected steel work may exist throughout the structure.

**A-2** Wooden forms and form supports, often constituting sufficient fuel to completely destroy the structure in the early stages of construction, give way in the later stages to vast quantities of combustible crating, boxes, cartons, bags, excelsior and straw accompanying the installation of finishing materials and new equipment. Welding and cutting operations, plumbing torches, tar kettles, temporary heating equipment, and wiring, all may serve as ignition sources of this combustible accumulation and create a rapidly developing fire situation. Too frequently, automatic sprinkler protection, yard hydrant systems, and standpipe and hose facilities have not yet been finished, thereby severely hampering fire fighters. The need for proper steps to safeguard these conditions is obvious, and conformance with the provisions of this standard will materially assist in reducing the loss potential in structures undergoing construction and alteration or being razed.

**A-3** Consideration should also be given to several other items associated with the construction work that are not so readily apparent.

**A-4** Attention should be focused on possible fire exposure hazards created by the construction work. Fire damage may not be confined to the building of origin and may spread to adjacent property. If the fire threat to adjoining or nearby buildings is severe, provision for fire doors, temporary barriers or sprinkler water curtains should be evaluated. For example, construction of a new addition to a hospital may constitute such a life hazard that fire doors or temporary bricking up of existing openings may be indicated. A similar situation may exist when facilities housing a process vital to continued plant production are undergoing expansion.



**A-5** Windstorm damage, while not necessarily related directly to loss by fire may, in fact, contribute directly to an increase in the fire hazard. Open structures are particularly susceptible to damage from high winds that may cause skewing and misalignment of the structure which may disrupt existing water supplies for fire protection. Not only may water supplies be affected from this cause, but they may also freeze in cold weather if temporary doors or window closures are blown away. Roof construction may also be damaged to the extent that freezing of equipment may occur. Entry of wind into a building may also blow debris, lumber scraps, or tarpaulins against heating devices thereby causing ignition of these materials. Consequently, proper care should be given to eliminating both direct loss from wind and the attendant possibility of resultant fire damage.

**A-6** The provisions and advisory guidance set forth in this Standard are applicable in principle to very tall buildings, commonly referred to as high-rise buildings. Consideration was given to preparation of a separate section dealing only with high-rise buildings. However, although their specialized fire problems are becoming increasingly recognized, the technology of adequate fire protection and life-safety measures is not yet fully developed, and there are varying definitions of high-rise buildings, some as low as 8 stories, for which this standard is adequate for safeguarding construction activities.

**A-7** For ultra-high buildings which may have completely established occupancies on the lower floors while construction continues on the upper floors, it is quite obvious that life-sustaining measures necessary for occupants of completed buildings should be expedited for the life-safety of the hundreds of people engaged in the construction activity. At this time, it appears most appropriate to indicate that the selected measures — smoke control, safe refuge areas, etc. — should be engineered such that they can be made available for the security of construction workers as needed, in accordance with construction progress. Special attention must be given to the unique problems presented by varying stages of construction, logistics of movement, etc.

## **A-8 Illustration**

**A-8.1** The following suggestion is outlined as an illustration of imaginative engineering which might be suitable under certain conditions by utilizing the special equipment, know-how and disciplined organization of the construction industry: