ANSI/NFPA 214 An American National Standard August 14, 1992

NFPA 214 Water-Cooling Towers 1992 Edition

NFPA

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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

This material has been developed under the published procedures of the National Fire Protection Association, which are designed to assure the appointment of technically competent Committees having balanced representation. While these procedures assure the highest degree of care, neither the National Fire Protection Association, its members, nor those participating in its activities accepts any liability resulting from compliance or noncompliance with the provisions given herein, for any restrictions imposed on materials or processes, or for the completeness of the text.

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NFPA 214

Standard on

Water-Cooling Towers

1992 Edition

This edition of NFPA 214, *Standard on Water-Cooling Towers*, was prepared by the Technical Committee on Water Cooling Towers and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 18-21, 1992 in New Orleans, LA. It was issued by the Standards Council on July 17, 1992, with an effective date of August 14, 1992, and supersedes all previous editions.

The 1992 edition of this document 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 214

The subject of the protection of water-cooling towers was first considered by the NFPA Committee on Building Construction in 1957, and a progress report on that subject was published in the Advance Reports of that year. In 1958, a new Committee on Water Cooling Towers was appointed and a Tentative Standard on Fire Protection of Water Cooling Towers proposed by the Committee was adopted by the Association in that year. Final adoption was secured in 1959. Revised editions were published in 1961, 1966, 1968, 1971, 1976, 1977, 1983, and 1988. This latest edition incorporates a variety of technical and editorial revisions.

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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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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph in Appendix A.

Information on referenced publications can be found in Chapter 7 and Appendix C.

Foreword

The fire record of water-cooling towers indicates the failure to recognize the extent or seriousness of the potential fire hazard of these structures both while in operation or when temporarily shut down. Cooling towers of combustible construction, especially those of the induced draft type, present a potential fire hazard even when in full operation because of the existence of relatively dry areas within the towers.

A significant percentage of fires in water-cooling towers of combustible construction are caused by ignition from outside sources such as incinerators, smokestacks, or exposure fires. Fires in cooling towers may create an exposure hazard to adjacent buildings and processing units. Therefore, distance separation from buildings and sources of ignition or the use of noncombustible construction are primary considerations in preventing these fires.

Ignition within these structures can be caused by welding or cutting operations, smoking, overheated bearings, electrical failures, and other heat- or spark-producing sources.

Fires have also occurred during the construction of cooling towers. Measures must be taken during construction to prevent the accumulation of combustible waste materials such as wood borings, shavings, scrap lumber, or other easily ignited materials. "No Smoking" regulations and strict control of welding and other heat- or spark-producing operations must be enforced. Wetting down combustible portions of the tower during idle periods of construction is a good fire prevention practice.

Cooling water supplied to heat exchangers used for cooling flammable gases or liquids or combustible liquids where the cooling water pressure is less than that of the material being cooled may constitute an unusual hazard to the cooling tower by the return of the flammables or combustibles to the cooling tower water distribution system.

Chapter 1 General

1-1 Scope.

1-1.1 This standard applies to fire protection for field-erected water-cooling towers of combustible construction or those in which the fill is of combustible material. It does not apply to small factory-assembled towers, the main structures of which have a volume of 2,000 cu ft (56.6 m^3) or less.

1-1.2 No standard can be promulgated that will guarantee the elimination of fires in water-cooling towers. Technology in this area is under constant development, and will be reflected in revisions to this standard. The user of this standard must recognize the complexity of fire protection requirements for water-cooling towers. Therefore, the designer is cautioned that the standard is not a design handbook. The standard does not do away with the need for the engineer or competent engineering judgment. It is intended that a designer capable of applying more complete and rigorous analysis to special or unusual problems shall have latitude in the development of such designs. In such cases, the designer is responsible for demonstrating the validity of the approach.

1-2 Definitions.

Air Travel. The horizontal distance through the fill measured just below the distribution basin.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

Cell. The smallest tower subdivision that can function as an independent unit with regard to air and water flow. Each cell may have one or more fans or stacks and one or more distribution systems. For the purposes of this standard, a cell within a hyperbolic tower is considered the area bounded by fire-resistant partitions.

Combustible. Material other than noncombustible material.

Cooling Tower Classifications. (*See Figures B-1 through B-5, Appendix B.*)

Counterflow. A cooling tower in which the water flows counter-current to the airflow.

Crossflow. A cooling tower in which the airflow is essentially perpendicular to the flow of water.

Film Fill. Water-cooling media made of formed plastic sheets, placed parallel to tower air travel at evenly spaced intervals.

Fire-Resistant Partition.* A tight, continuous partition suitable for use in a cooling tower environment having a fire-resistance rating of 20 minutes or more when tested in accordance with NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*. The partition shall extend from the bottom of the collection basin to the underside of the fan deck (for counterflow towers) or distribution basin (for crossflow towers).

Labeled. Equipment or materials to which has been attached a label, symbol or other identifying mark of an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Mechanical Draft. A cooling tower in which air movement depends on fans or blowers. When the fans or blowers are at the air inlet, the tower is considered forced-draft. When the fans or blowers are at the air exit, the tower is considered induced-draft.

Natural Draft. A cooling tower in which air movement depends on the difference in densities of the heated air inside the tower and the cooler air outside. Natural-draft towers contain no fans or blowers.

Noncombustible. A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat. Examples of noncombustible materials are concrete, masonry, tile, and metal.

Shall. Indicates a mandatory requirement.

Should. Indicates a recommendation or that which is advised but not required.

Chapter 2 Location of Cooling Towers

2-1 Cooling towers with combustible exterior surfaces, including the deck, distribution basins, etc., shall be located at least 100 ft (30.5 m) from the following hazards:

(a) Structures or processes that emit sparks or flying brands under ordinary circumstances, such as chimneys, incinerators, flare stacks, or cob burners.

(b) Materials or processes of severe fire hazard, such as petroleum-processing and storage tanks, explosives manufacturing or storage, and petroleum product pipelines and pumping stations.

2-2 Towers with combustible exterior surfaces and provided with fixed exposure protection in accordance with 5-2.10 of this standard may be located closer than 100 ft (30.5 m) from the hazards listed in Section 2-1(a) and (b).

2-3 Towers with noncombustible exterior surfaces shall be located 40 ft (12.2 m) or more from the hazards listed in Section 2-1(a) and (b).

2-4 Towers with noncombustible exterior surfaces and provided with fixed interior fire protection installed in accordance with Chapter 5 of this standard may be located closer than 40 ft (12.2 m) from the hazards listed in Section 2-1(a) and (b).

2-5 Combustible cooling towers located on building roofs or other locations to which access for manual fire fighting is restricted or difficult shall be provided with a protection system in accordance with Chapter 5 of this standard.

2-6 Open areas or space between a combustible cold water basin and the ground or roof of a building upon which it is located shall be effectively screened to prevent the accumulation of waste combustible material under the tower, or to prevent the use of such areas or space under the tower for the storage of combustible material. Fire protection shall be permitted to be installed in lieu of screening.

Chapter 3 Electrical Equipment and Wiring

3-1 Installation of all electrical equipment and wiring pertaining to water-cooling towers shall be in accordance with NFPA 70, *National Electrical Code®*.

3-2* Electric motors driving fans shall be provided with overcurrent protective devices as mandated by NFPA 70, *National Electrical Code*.

3-3 A remote fan motor switch shall be provided to stop the fan in case of fire.

3-4 When a fire protection system is installed, provision shall be made to interlock the fan motors with the sprinkler system (*see Chapter 5*).

3-5 An automatic vibration-controlled switch shall be provided to automatically shut down fan motors.

Chapter 4 Internal Combustion Engine Driven Fans

4-1 Electric motors or steam turbines are the preferred drives to operate fans on cooling towers. When neither is available, internal combustion engines may be used, provided they are installed, used, and maintained in accordance with NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*.

Chapter 5 Fire Protection

5-1 General.

5-1.1* The following are some of the factors that shall be considered in determining the extent and method of fire protection of induced-draft and natural-draft cooling towers:

(a) Importance to continuity of operation.

(b)* Size and construction of tower.

(c) Type of tower.

(d) Location of tower.

(e) Water supply.

(f) Value of tower.

(g) Climate.

(h)* Water delivery time.

(i) Environment.

(j) Rooftop towers.

(k) Limited access.

5-1.2 Construction Materials of Cooling Towers. When the cooling tower structure, fan and distribution decks, louvers, and fill materials are all of noncombustible materials, no fire protection is required. If any of these are combustible materials and the factors in 5-1.1 necessitate it, fire protection shall be provided as identified in the following sections.

5-1.3* Depending on factors indicated above where a fire protection system is required, one of the following general types of systems shall be used:

(a) Open-head deluge system.

(b) Closed-head dry-pipe system.

(c) Wet-pipe automatic sprinkler system.

(d) Closed-head preaction system.

5-1.4 Complete Plans and Data Required. A complete plan showing piping arrangement, location of sprinklers, fixed detectors, and operating equipment such as valves, deluge valves, etc., together with hydraulic calculations, water requirements, and water supply information, shall be submitted to the authority having jurisdiction for approval before installation. Plans shall be drawn to scale and include the details necessary to indicate clearly all of the equipment and its arrangement. Plans shall show location of new work with relation to existing structures, cooling towers, and water supplies. Plans shall include a note listing the types of materials used in the system.

5-2 Fire Protection System Design.

5-2.1 Fire protection systems shall be designed, installed, and tested in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, except as modified by this standard.

5-2.2 Types of Systems.

5-2.2.1 The counterflow tower design lends itself to either closed- or open-head systems. Therefore, wet-pipe, dry-pipe, preaction, or deluge systems shall be permitted to be used. A deluge system provides a higher degree of protection where water supplies are adequate. In climates that are subject to freezing temperatures, a deluge system minimizes the possibility of failure due to pipes freezing.

5-2.2.2 The crossflow design is such that it is difficult to locate sprinklers in the most desirable spots for both water distribution and heat detection. This situation can be solved by separating these two functions and using separate water discharge and detection systems. The open-head deluge system does this and, therefore, shall be used in crossflow towers.

5-2.3 Minimum Rate of Application.

5-2.3.1 Under the fan decks of counterflow towers, the rate of application of water shall be 0.5 gpm/sq ft (20.4 L/min:m^2) (including fan opening).

5-2.3.2 Under the fan decks of crossflow towers, the rate of application of water shall be 0.33 gpm/sq ft (13.45 L/min:m^2) (including fan opening).

5-2.3.3 Over the fill areas of crossflow towers, the rate of application of water shall be 0.5 gpm/sq ft (20.4 L/min:m^2).

5-2.4 Types and Locations of Discharge Outlets.

5-2.4.1* Counterflow Towers.

5-2.4.1.1 The discharge outlets shall be located under the fan deck and fan opening.

5-2.4.1.2 Except under the fan opening, all discharge outlets shall have deflector distances installed in accordance with NFPA 13, *Installation of Sprinkler Systems*.

5-2.4.1.3 Closed-head discharge outlets for dry-pipe and preaction systems shall be installed in the upright position only.

5-2.4.2* Crossflow Towers.

5-2.4.2.1 The discharge outlets protecting the plenum area shall be located under the fan deck and in the fan opening.

5-2.4.2.2 Discharge outlets protecting the fill shall be located under the distribution basin on either the louver or drift eliminator side, discharging horizontally through the joist channels.

5-2.4.2.3 Towers with a fill area longer than the maximum allowable for the discharge device being used shall have discharge devices placed on both sides of the fill area, in each joist channel. The pressure at each discharge device shall be adequate to provide protection for one-half the length of the fill area.

5-2.4.2.4 Where joist channels are wider than 2 ft (0.6 m), more than one discharge device shall be required per joist channel.

Exception: If the discharge device being used is listed for the width of the joist channel being protected.

5-2.4.3* On towers having extended fan decks that completely enclose the distribution basin, the discharge outlets protecting the fill area shall be located over the basin, under the extension of the fan deck. These discharge outlets shall be open directional spray nozzles or other approved spray devices arranged to discharge 0.35 gpm/sq ft (14.26 L/min:m^2) directly on the distribution basin, and 0.15 gpm/sq ft (6.11 L/min:m^2) on the underside of the fan deck extension. On towers having extended fan decks that do not completely enclose the hot water basin, outlets protecting the fill shall be located under the distribution basin as set out in 5-2.4.2 of this standard.

5-2.4.4 For deluge systems using directional spray nozzles in the pendant position, provisions shall be made to protect the underside of a combustible fan deck at a minimum of 0.15 gpm/sq ft (6.11 L/min:m^2), which shall be included as part of the application rate specified in 5-2.3.

5-2.4.5* On film-filled towers that have solid hot water basin covers over the complete basin, the discharge outlets protecting the fill area shall be permitted to be located under the basin covers. These discharge outlets shall be open directional spray nozzles or other approved devices arranged to discharge 0.35 gpm/sq ft (14.26 L/min:m^2) directly on the distribution basin, and 0.15 gpm/sq ft (6.11 L/min:m^2) on the underside of the water basin covers. On towers having basin covers that do not completely enclose the hot water basin, outlets protecting the fill shall be located under the distribution basin as set out in 5-2.4.2 of this standard.

5-2.5 Pipe, Fittings, and Hangers.

5-2.5.1* Piping shall be installed in accordance with the requirements of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

5-2.5.2* Piping or tubing used within the cooling tower shall be metallic and approved for fire protection use.

Exception: Piping or tubing used for pneumatic detection systems shall be permitted to be of other materials suitable for use in a cooling tower environment.

5-2.5.3 Hydraulic calculations shall be made in accordance with Chapter 6 of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

5-2.5.4 All fittings shall be of a type specifically approved for fire protection use. In dry sections of the system piping, which may be exposed to possible fire conditions, ferrous fittings shall be of steel, malleable iron, or ductile iron.

Exception: Cast-iron fittings shall be permitted to be used in pneumatic detection piping.

5-2.5.5 Approved gasketed groove-type fittings are acceptable to connect pipe in fire-exposed areas where the fire protection system is automatically operated.

5-2.5.6 Where piping is supported from structural members of a cooling tower, the attachment shall be made so that the structural member is not split or otherwise damaged.

5-2.6 Valves.

5-2.6.1 General. Valves shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, where applicable. Shutoff valves, and automatically operated water control valves, if provided, shall be located:

(a) Outside the fire-exposed area;

(b) As close to the cooling tower as possible to minimize the amount of pipe to the discharge device; and

(c) Where they will be accessible during a fire emergency.

5-2.6.2 Manual Release Valve. Remote manual release valves, where required, shall be conspicuously located and readily accessible during a fire emergency. If remote manual release valves are not required, an inspector's test valve shall be provided for each pilot-head-operated system.

5-2.7 Strainers. Strainers are required for systems utilizing discharge devices with waterways of less than 0.375-in. (9.5-mm) diameter. (*See NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection, for further details.*)

5-2.8* Heat Detectors.

5-2.8.1 Where deluge or preaction systems are used, heat detectors shall be installed in accordance with the applicable sections of NFPA 72E, *Standard on Automatic Fire Detectors.*

5-2.8.2 In mechanical induced-draft towers, heat detectors shall be located under the fan deck at the circumference of the fan opening and under the fan opening where necessary to comply with the following spacing requirements. (*For extended fan decks, see 5-2.8.3.*)

5-2.8.2.1 Fixed-temperature detectors shall be spaced not more than 8 ft (2.4 m) apart in any direction including the fan opening. Temperature ratings shall be selected in accordance with operating conditions, but shall be no less than intermediate.

5-2.8.2.2 Rate-of-rise detectors shall be spaced not more than 15 ft (4.6 m) apart in any direction. In pneumatic-type systems, for detectors inside the tower, there shall be no more than one detector for each mercury check in towers operating in cold climates, and two detectors for each mercury check in towers used during the warm months only or year-round in warm climates. There shall be no more than four detectors for each mercury check where the detectors are located outside the tower.

5-2.8.3 On towers having extended fan decks that completely enclose the distribution basin, detectors shall be located under the fan deck extension in accordance with standard indoor spacing rules for the type detectors used (*see NFPA 72E, Standard on Automatic Fire Detectors*).

Exception: Where the fan deck extension is 16 ft (4.9 m) or less and this dimension is the length of the joist channel, then only one row of detectors centered on and at right angles to the joist channels shall be required. Spacing between detectors shall be in accordance with NFPA 72E, Standard on Automatic Fire Detectors.

On towers having extended fan decks that do not completely enclose the hot water basin, detectors shall not be required under the fan deck extension.

5-2.8.4* Heat barriers shall be installed under the extended fan deck to separate deluge systems where the total number of systems exceeds the number for which the water supply was designed. Heat barriers shall extend from the fan deck structure to the distribution basin dividers.

5-2.8.5 Where heat detectors are inaccessible during tower operation, an accessible test detector shall be provided for each detection zone.

5-2.8.6 Heat detector components exposed to corrosive vapors or liquids shall be protected by materials of suitable construction or by suitable protective coatings applied by the equipment manufacturer.

5-2.9 Protection for Fan Drive Motor.

5-2.9.1 A heat detector and water discharge outlet shall be provided over each fan drive motor when the motor is located so that it is not within the protected area of the tower.

5-2.9.2 Provision shall be made to interlock the fan motors with the fire protection system so that the cooling tower fan motors will be stopped in the cell(s) for which the system is actuated. Where the continued operation of the fans is vital to the process, a manual override switch may be provided to reactivate the fan when it is determined that there is no fire.

5-2.10 Exposure Protection.

5-2.10.1 Where any combustible exterior surfaces of a tower, including the fan deck, distribution basins, etc., are less than 100 ft (30.5 m) from significant concentrations of combustibles such as structures, piled material, etc., the combustible exposed surfaces of the tower shall be protected by an automatic water spray system.

5-2.10.2 Systems for exterior protection shall be designed with the same attention and care as interior systems. Pipe sizing shall be based on hydraulic calculations. Water supply and discharge rate shall be based on a minimum 0.15 gpm/sq ft (6.11 L/min:m^2) for all surfaces being protected.

5-2.11 The design and installations shall comply with the applicable sections of NFPA 13, *Standard for the Installation of Sprinkler Systems.*

5-3 Corrosion Protection.

5-3.1 Piping, fittings, hangers, braces, and attachment hardware including fasteners shall be hot dip galvanized steel per ASTM A153, *Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware*, for fittings, hangers, braces, and hardware. Exposed pipe threads shall be protected against corrosion. All other components shall be corrosion resistant or protected against corrosion by a suitable coating.

5-3.2 Approved discharge devices are made of nonferrous material and are corrosion resistant to normal atmospheres. Some atmospheres require special coatings on the discharge devices. Wax-type coatings shall not be used on devices without fusible elements.

5-3.3 Special care shall be taken in the handling and installation of wax-coated or similar sprinklers to avoid damaging the coating. Corrosion-resistant coatings shall not be applied to the sprinklers by anyone other than the manufacturer of the sprinklers, except that in all cases any damage to the protective coating occurring at the time of installation shall be repaired at once using only the coating of the manufacturer of the sprinkler in an approved manner so that no part of the sprinkler will be exposed after the installation has been completed. Otherwise, corrosion will attack the exposed metal and will, in time, creep under the wax coating.

5-4* Hydrant Protection. Hydrants shall not be located closer than 40 ft (12.2 m) from towers.

5-5* Standpipe Protection. Towers with any combustible construction located on a building 50 ft (15.3 m) or more in height shall be provided with Class III standpipe protection (as defined in NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*) with hose connections within 200 ft (61.0 m) of all parts of the tower. Sufficient hose shall be provided to reach all parts of the tower. Provision shall be made for completely draining all exposed standpipe lines during winter. Hose equipment at each standpipe hose connection on the roof shall be protected from the weather in a suitable cabinet or enclosure. (*See NFPA 14, Standard for the Installation of Standpipe and Hose Systems, for further details.*)

5-6 Water Supply.

5-6.1 Deluge Systems.

5-6.1.1* Where all cells of a cooling tower are protected by a single deluge system, the water supply shall be adequate to supply all discharge outlets on that system.

5-6.1.2 Where two or more deluge systems are used to protect a cooling tower and fire-resistant partitions are not provided between the deluge systems, the water supply shall be adequate to supply all discharge outlets in the two most hydraulically demanding adjacent systems.

5-6.1.3* Where two or more deluge systems are separated by fire-resistant partitions, the water supply shall be adequate to supply all discharge outlets in the single most hydraulically demanding system.

5-6.2 Wet, Dry, and Preaction Systems.

5-6.2.1* Where each cell of the cooling tower is separated by a fire-resistant partition, the water supply shall be adequate to supply all discharge outlets in the hydraulically most demanding single cell.

5-6.2.2* Where fire-resistant partitions are not provided between each cell of a cooling tower, the water supply shall be adequate to supply all discharge outlets in the two most hydraulically demanding adjoining cells.

5-6.3 Hose Streams. Water supplies shall be sufficient to include a minimum of 500 gpm (1892.5 L/min) for hose streams in addition to the sprinkler requirements.

5-6.4 Duration. An adequate water supply of at least 2-hour duration shall be provided for the combination of the water supply specified in 5-6.1 or 5-6.2, plus the hose stream demand specified in 5-6.3.

5-7* Lightning Protection. Lightning protection, where provided, shall be installed in accordance with the provisions of NFPA 780, *Lightning Protection Code*.

5-8 Earthquake Protection. Where provided, earthquake-resistant construction shall be in accordance with applicable sections of NFPA 13, *Standard for the Installation of Sprinkler Systems*.

Chapter 6 Maintenance

6-1 Areas around towers located on the ground shall be kept free of grass, weeds, brush, or combustible waste materials.

6-2 Smoking shall not be permitted on or adjacent to any cooling tower of combustible construction. Signs to this effect shall be posted and maintained and this regulation strictly enforced.

6-3 Forced- and induced-draft towers in continuous operation shall be checked frequently for excessive heating in motors and for excessive fan vibration.

6-4 At least semiannually, the fan assemblies, including the motors and speed reducers, shall be checked, both during operation and when shut down, for excessive wear or vibration, improper lubrication, corrosion, or other features that could result in failure and, where conditions require, corrective action shall be taken.

6-5 Where work on the tower requires welding or cutting, it shall be done in accordance with NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*.

6-6* Combustible cooling towers are particularly susceptible to ignition when they are shut down for repairs or other reasons and the wood becomes dried out. During these periods, all automatic fire protection on the tower shall be operable, or if the tower is not so protected, special protection shall be provided until the tower is back in service.

6-7 Access to the tops of water-cooling towers for fire fighting and maintenance shall be provided by an approved stairway or ladder. Towers in excess of 120 ft (36.6 m) in any dimension shall be provided with not less than two means of access remote from each other.

6-8 Motors, speed reduction units, and drive shafts shall be accessible for servicing and maintenance. Provisions shall be made for lockout or tagout of electric motors when maintenance work is being performed in the area of fans.

6-9 After maintenance work is completed, all scaffolding, boards, temporary supports, and other temporary materials shall be removed from the tower.

6-10 For proper maintenance of fire protection systems see NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

Chapter 7 Referenced Publications

7-1 The following documents or portions thereof are referenced within this standard and shall be 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.

7-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1991 edition

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 1990 edition

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 1990 edition

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 1992 edition

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 1990 edition

NFPA 51B, *Standard for Fire Prevention in Use of Cutting and Welding Processes*, 1989 edition

NFPA 70, *National Electrical Code*, 1993 edition

NFPA 72E, *Standard on Automatic Fire Detectors*, 1990 edition

NFPA 251, *Standard Methods of Fire Tests of Building Construction and Materials*, 1990 edition

NFPA 780, *Lightning Protection Code*, 1992 edition.

7-1.2 Other Publications.

7-1.2.1 ASTM Publication. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM A153-82, *Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware*.

Appendix A

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

A-1-2 Fire-Resistant Partition. Types of construction that meet this requirement are ½-in. (12.7-mm) asbestos cement board, ½-in. (12.7-mm) plywood, or ¾-in. (19.1-mm) tongue and groove boarding when installed on both sides of wood studs.

A-3-2 Motors should be totally enclosed to protect them from dirt or moisture and to prevent sparks from reaching adjacent combustible construction.

A-5-1.1 Fire experience for mechanical forced-draft towers does not indicate the general need for automatic fire protection systems. However, exposure protection may be necessary as provided in 5-2.10.

A-5-1.1(b) There are several fire tests that can be used to evaluate the fire risk related to water-cooling tower materials. The most suitable tests are those that demonstrate low fire risk when tested in a configuration that approximates that large scale of the installation. Tests such as ASTM E136 and ASTM E84 have limitations. The test methods do not duplicate the larger extent of the hazard in its final installation and are not necessarily suitable or generally satisfactory for materials that soften, flow, or melt under fire conditions.

A-5-1.1(h) Where applicable, piping arrangements, system capacities, and supervisory air pressures should be designed such that the time for water delivery to the most remote discharge device is minimized. For all water suppression systems using detection, the detection system should be designed to cause actuation of the special water control valve within 20 seconds under expected exposure conditions (*see NFPA 15, Section 8-6*).

A-5-1.3 Antifreeze Sprinkler Systems. The use of antifreeze sprinkler systems in cooling towers is not recommended. While in theory this type of system would function, the use of antifreeze systems in cooling towers presents problems not encountered in usual antifreeze applications.

Due to the inaccessibility of the piping during normal operation of the cooling tower, it is practically impossible to do any maintenance work or to make routine inspections. The corrosion problem can be quite serious in cooling towers, and leaks in the system will not readily become apparent. This would result in loss of the antifreeze solution and could result in freezing of the system.

Local ordinances in many areas prohibit the use of these systems.

A-5-2.4.1 See Figures A-5-2.4.1(a)-(d).

A-5-2.4.2 See Figures A-5-2.4.2(a)-(d).

A-5-2.4.3 Location of the nozzle relative to surfaces to be protected shall be determined by the particular nozzle's discharge characteristics. Care should also be taken in the selection of nozzles to obtain waterways not easily obstructed by debris, sediment, sand, etc., in the water. Refer to Figures A-5-2.4.3(a) and (b).

A-5-2.4.5 See Figure A-5-2.4.5.

A-5-2.5.1 In towers where sufficient vibration is anticipated that will cause movement of the fire protection system resulting in wear of water or detection piping or tubing at the hangers, it may be necessary to install vibration absorbers between the hangers and the pipe.

Special consideration should be given to the support of detection piping or tubing due to its small diameter. Thin-wall or nonmetallic pipe or tubing usually requires closer spacing of hangers for adequate support.

A-5-2.5.2 Where plastic piping or tubing is used for pneumatic detection systems, consideration should be given to the effects of ultraviolet radiation.

A-5-2.8 Due to the extremely humid atmosphere and potentially corrosive conditions in cooling towers, it is very difficult to maintain electrical detection equipment. Experience has shown that even with weatherproof equipment and wiring practices an electrical system will malfunction frequently. Therefore, the information in the subparagraphs of this section is based on the use of detectors operating on pneumatic or hydraulic principles.

A-5-2.8.4 Acceptable materials are ⅜-in. (9.5-mm) plywood or $^{3}/_{16}$-in. (4.8-mm) asbestos cement board on one side of studs.

A-5-4 Hydrant protection should be provided within 200 ft (61.0 m) of all parts of towers having combustible construction located on the ground or on buildings less than 50 ft (15.3 m) in height. A hose house and standard hose house equipment should be provided at each hydrant. (*See NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, for further details.*)

A-5-5 Standpipes should preferably be located in stair towers. If located on an open roof, they should not be closer than 40 ft (12.2 m) to the cooling tower.

A-5-6.1.1 Where a single deluge system protects an entire water-cooling tower, regardless of the number of cells, the water supply needs to be based on the entire deluge system coverage. Refer to Figure A-5-6.1.1.

A-5-6.1.3 Deluge systems separated by fire-resistant partitions can be treated independently as worst-case water supply situations. Refer to Figure A-5-6.1.3.

A-5-6.2.1 Water-cooling towers with each cell separated by a fire-resistant partition and protected by wet, dry, or preaction system(s) should have the water supply based on the most demanding individual cell. Refer to Figure A-5-6.2.1.

A-5-6.2.2 Without fire-resistant partitions between cells, the worst-case situation involves the most demanding adjoining cells. Refer to Figure A-5-6.2.2.

A-5-7 Towers located on roofs of buildings in certain geographical locations may be particularly susceptible to lightning damage.

A-6-6 Examples of special protection are watch service or intermittent wetting, or both.

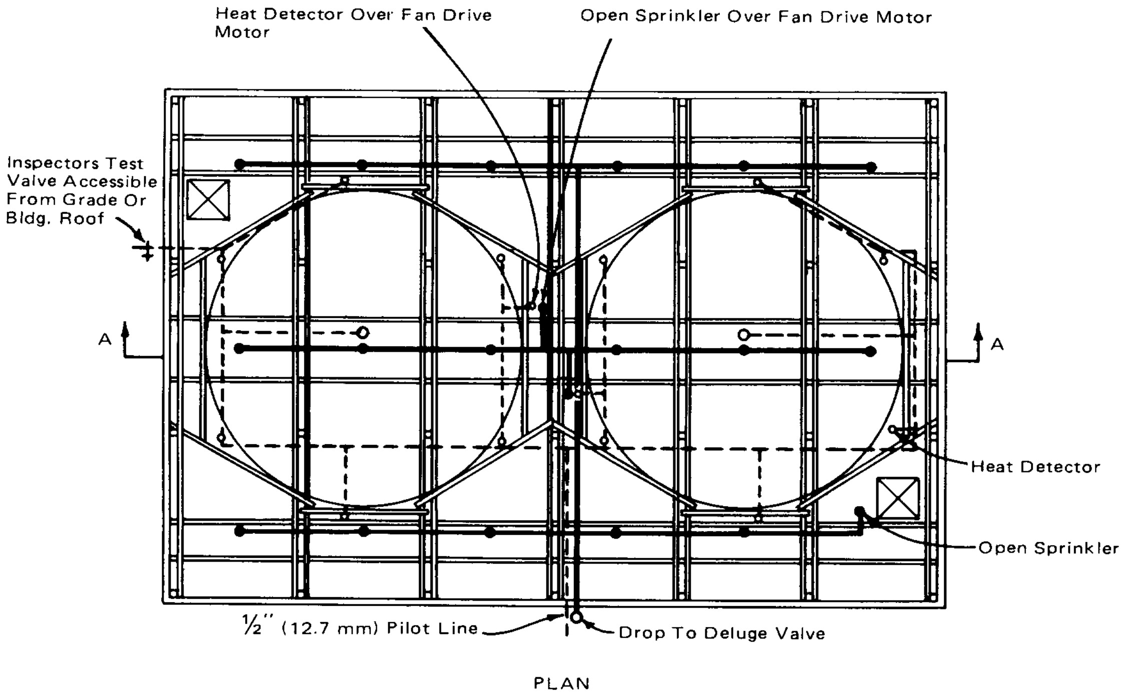

Figure A-5-2.4.1(a) Typical deluge fire protection arrangement for counterflow towers.

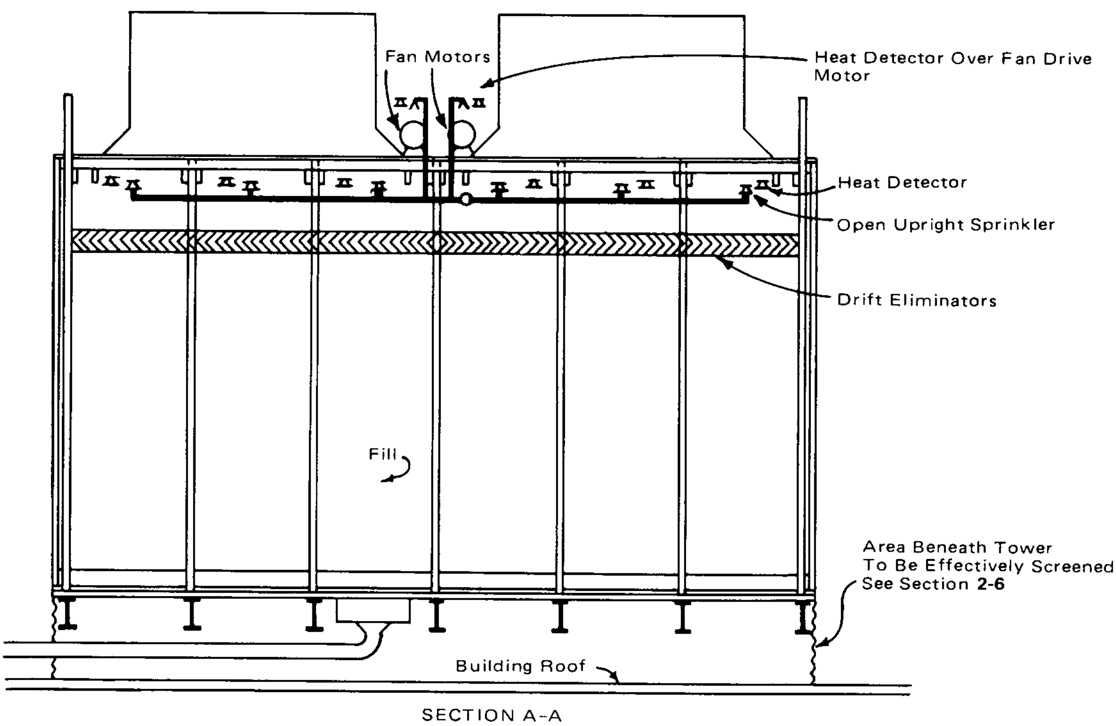

Figure A-5-2.4.1(b) Typical deluge fire protection arrangement for counterflow towers.

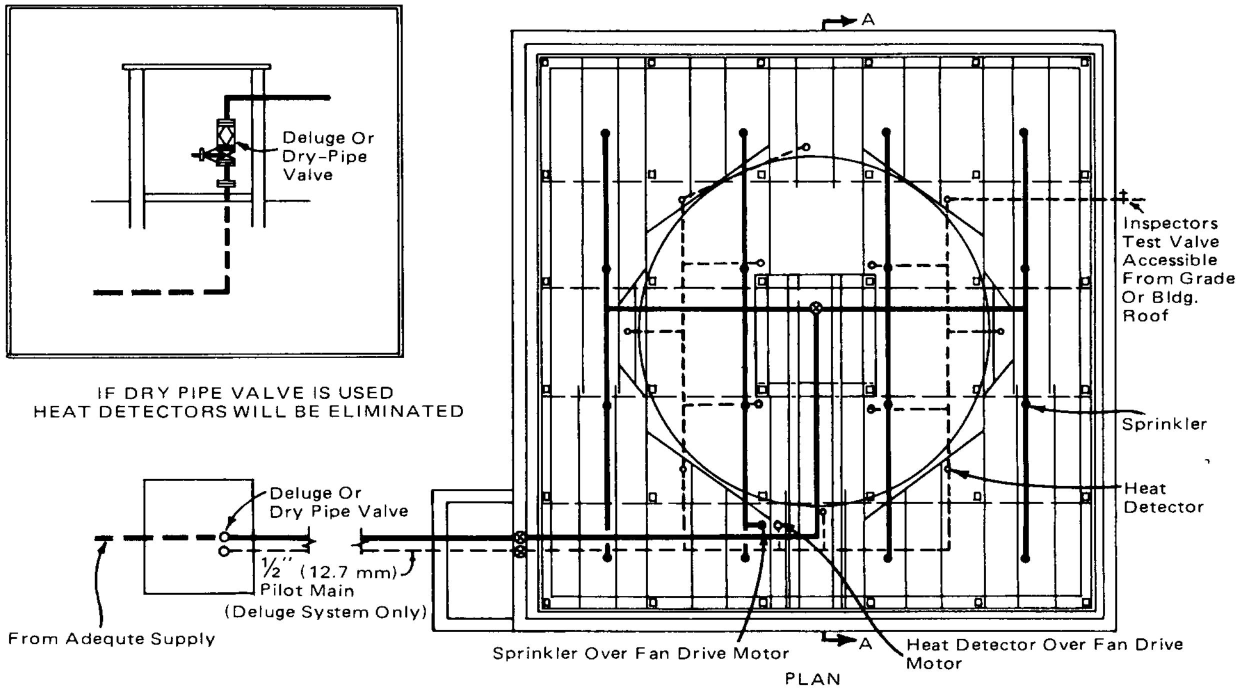

Figure A-5-2.4.1(c) Typical deluge or dry-pipe fire protection arrangement for counterflow towers.

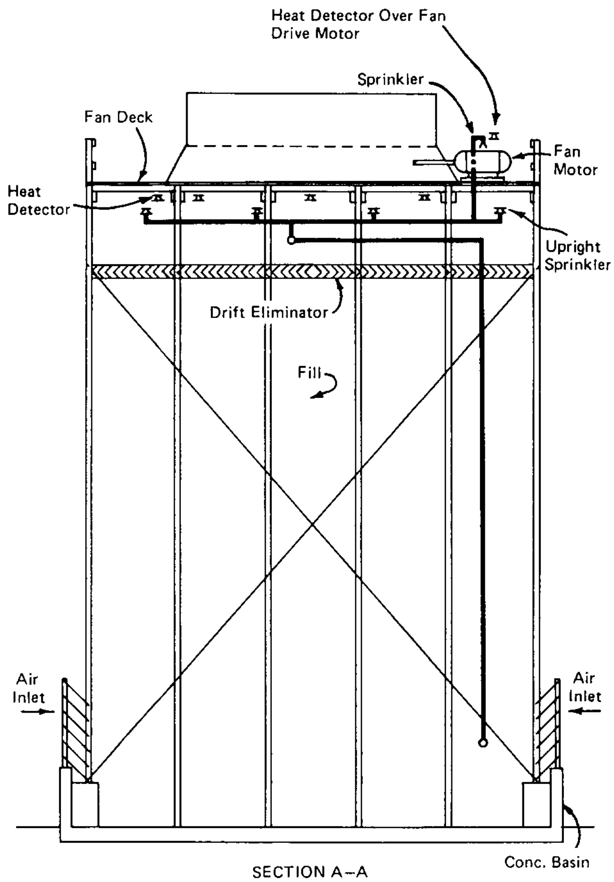

Figure A-5-2.4.1(d) Typical deluge or dry-pipe fire protection arrangement for counterflow towers.

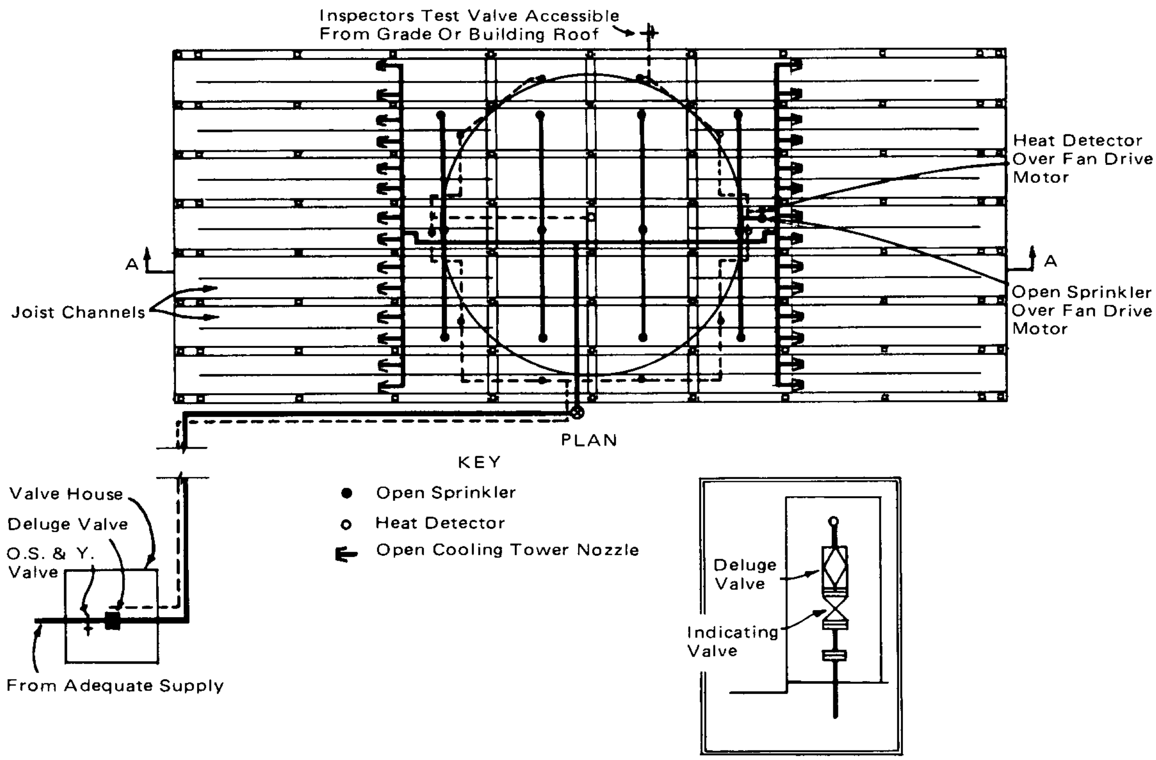

Figure A-5-2.4.2(a) Typical deluge fire protection arrangement for crossflow towers.

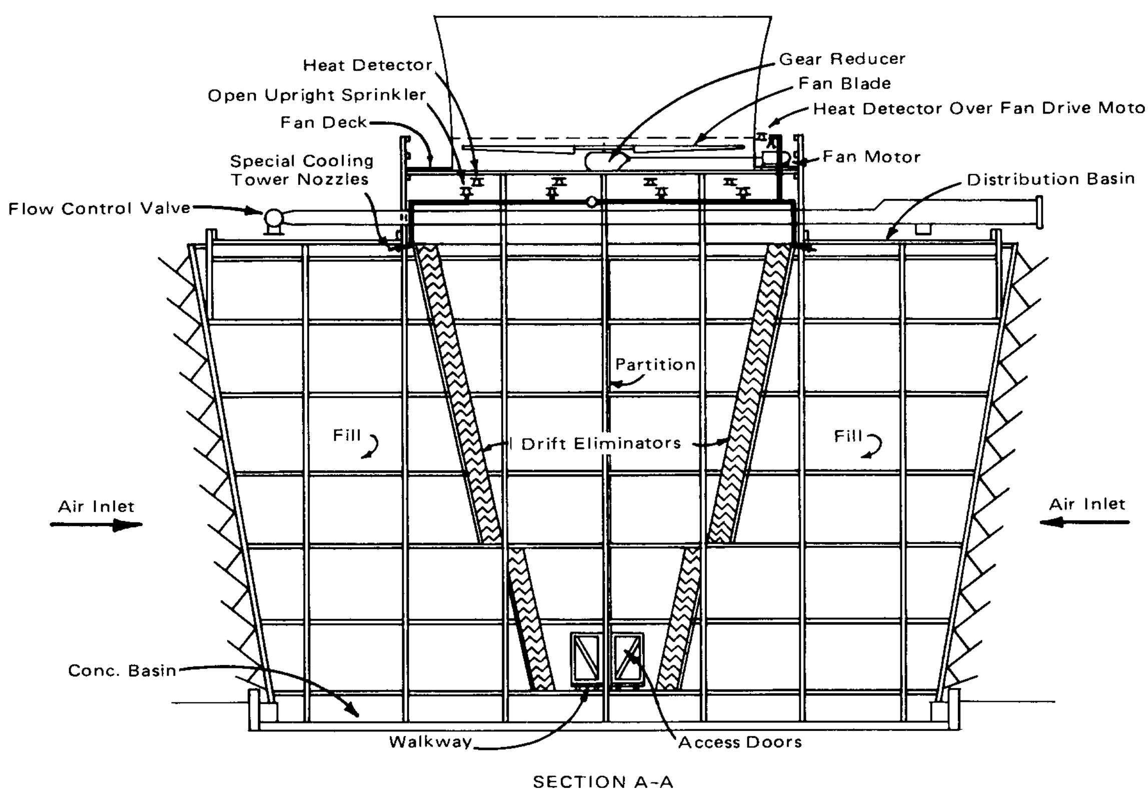

Figure A-5-2.4.2(b) Typical deluge fire protection arrangement for crossflow towers.

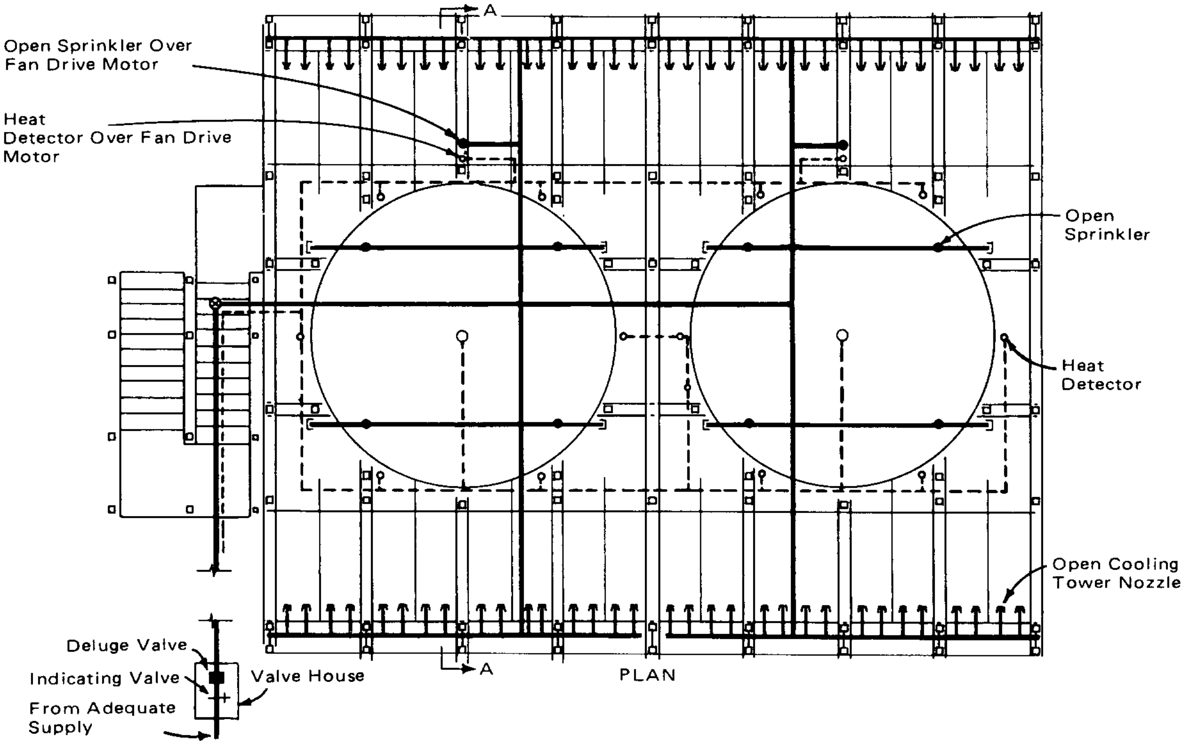

Figure A-5-2.4.2(c) Typical deluge fire protection arrangement for crossflow towers. [*See Note following caption of Figure A-5-2.4.2(d).*]

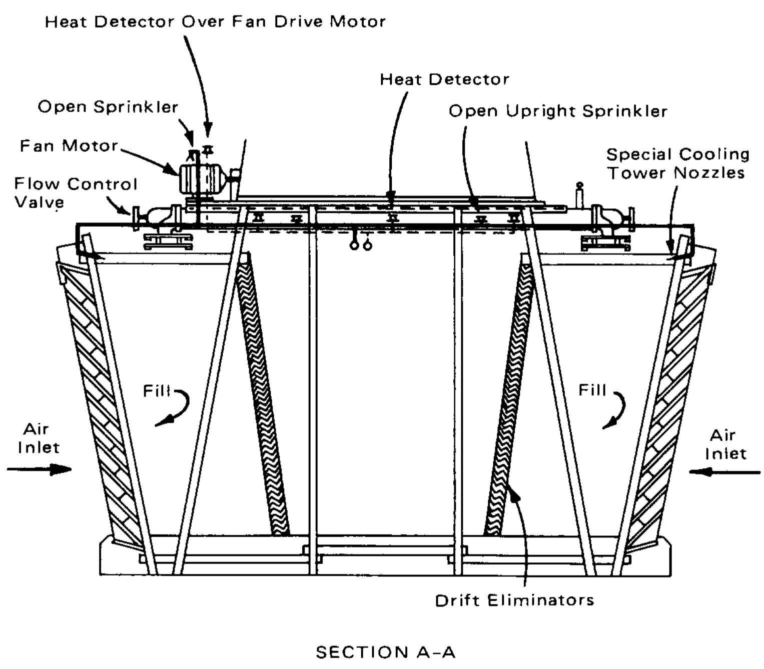

Figure A-5-2.4.2(d) Typical deluge fire protection arrangement for crossflow towers.

NOTE: Where air seal boards prevent installation of cooling tower nozzles on drift eliminator side of fill, this nozzle location should be used.

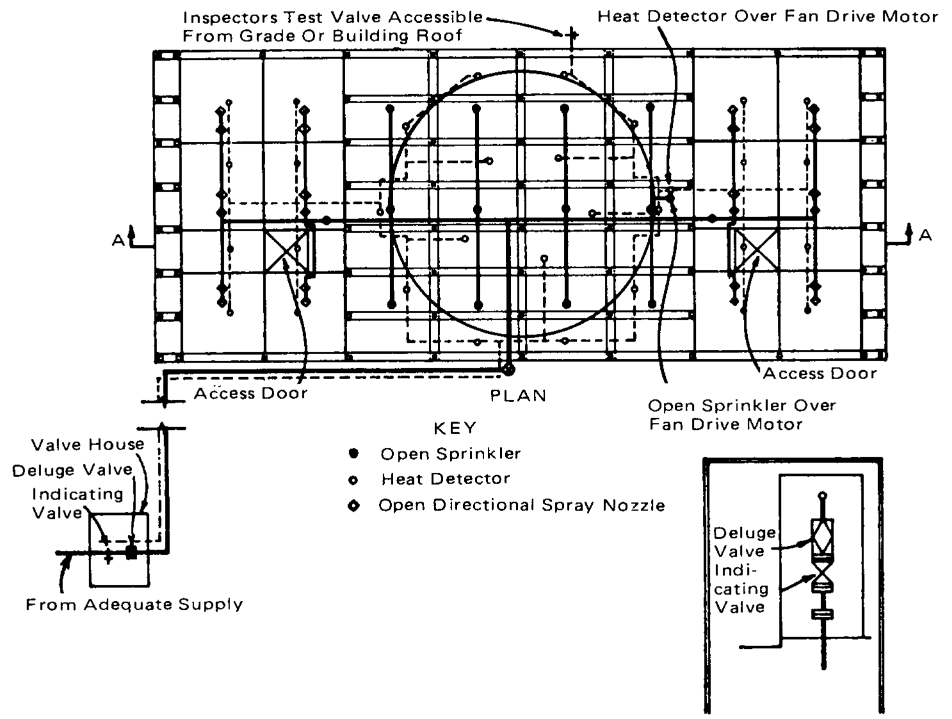

Figure A-5-2.4.3(a) Typical deluge fire protection arrangement for crossflow towers with completely enclosed distribution basins.

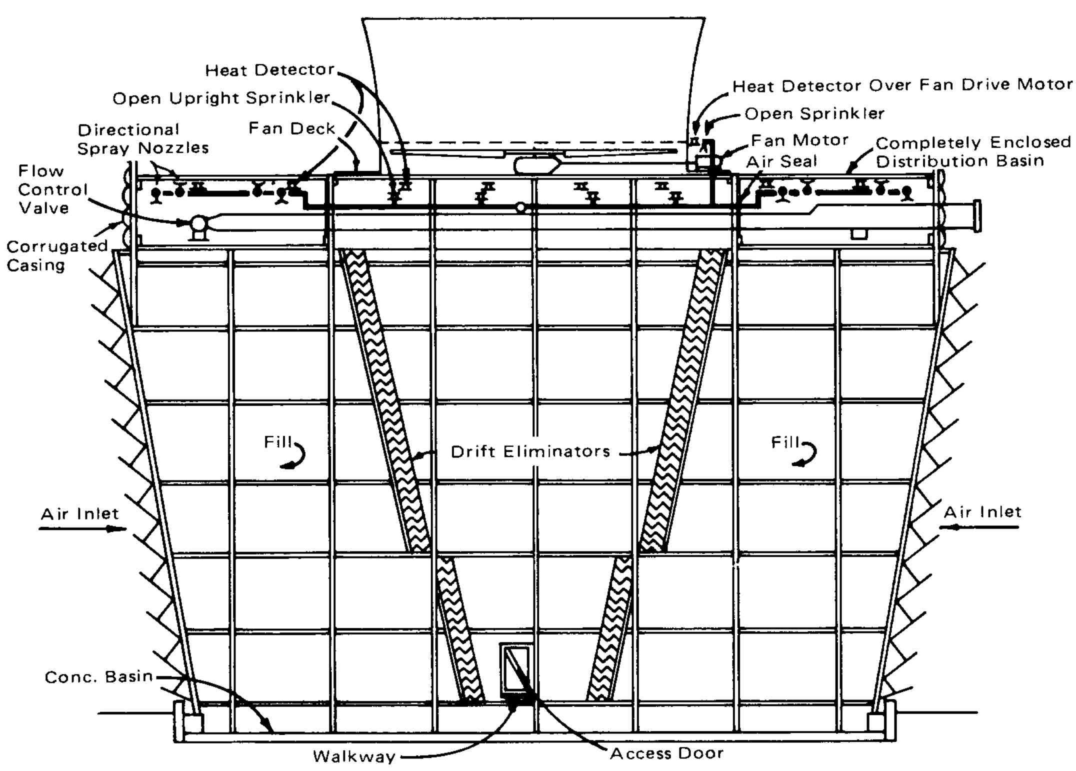

Figure A-5-2.4.3(b) Typical deluge fire protection arrangement for crossflow towers with completely enclosed distribution basins.

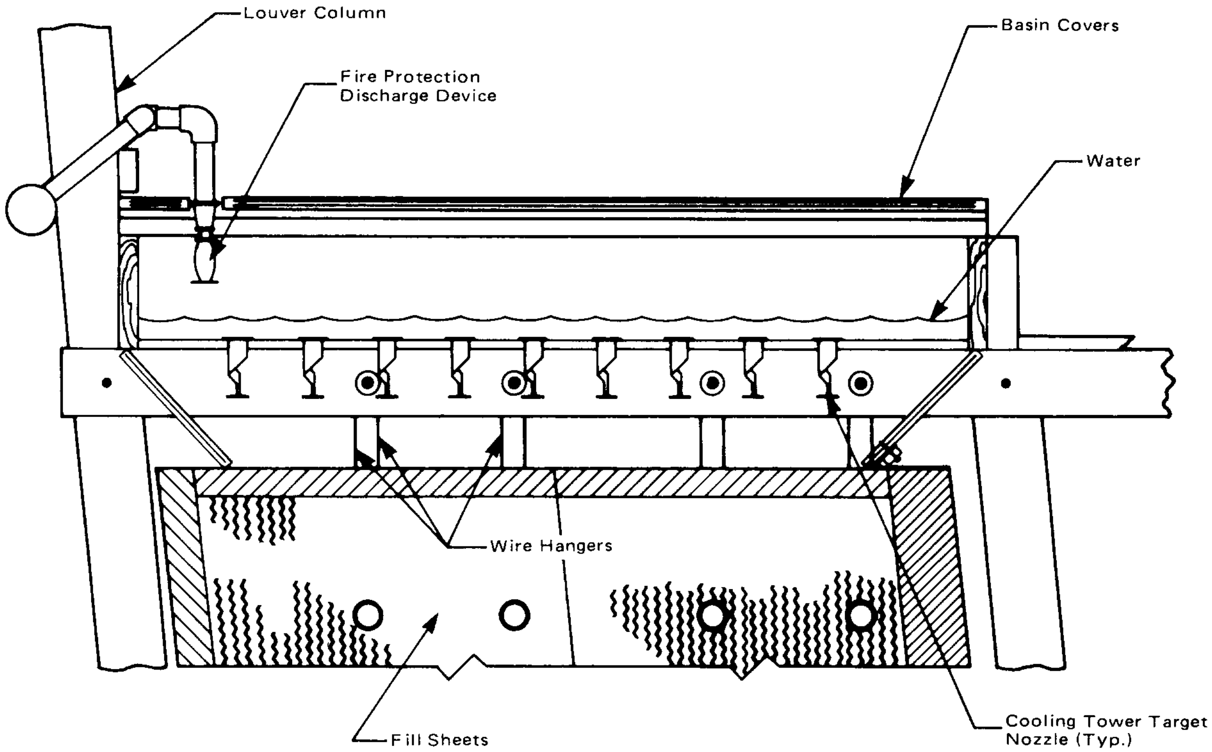

Figure A-5-2.4.5 Typical deluge fire protection arrangement for crossflow towers with covers completely enclosing distribution basins.

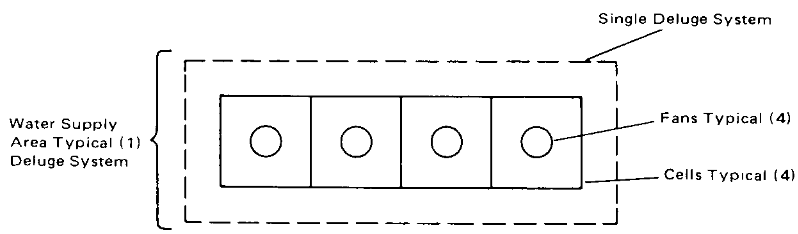

Figure A-5-6.1.1

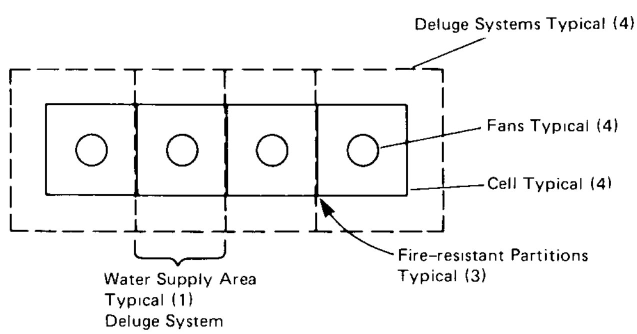

Figure A-5-6.1.3

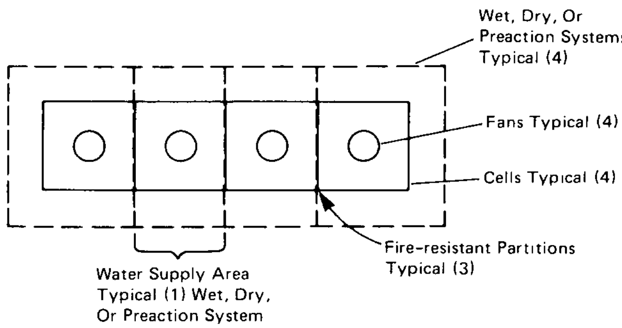

Figure A-5-6.2.1

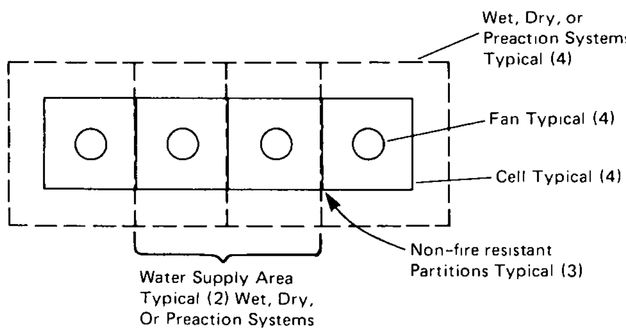

Figure A-5-6.2.2

Appendix B

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

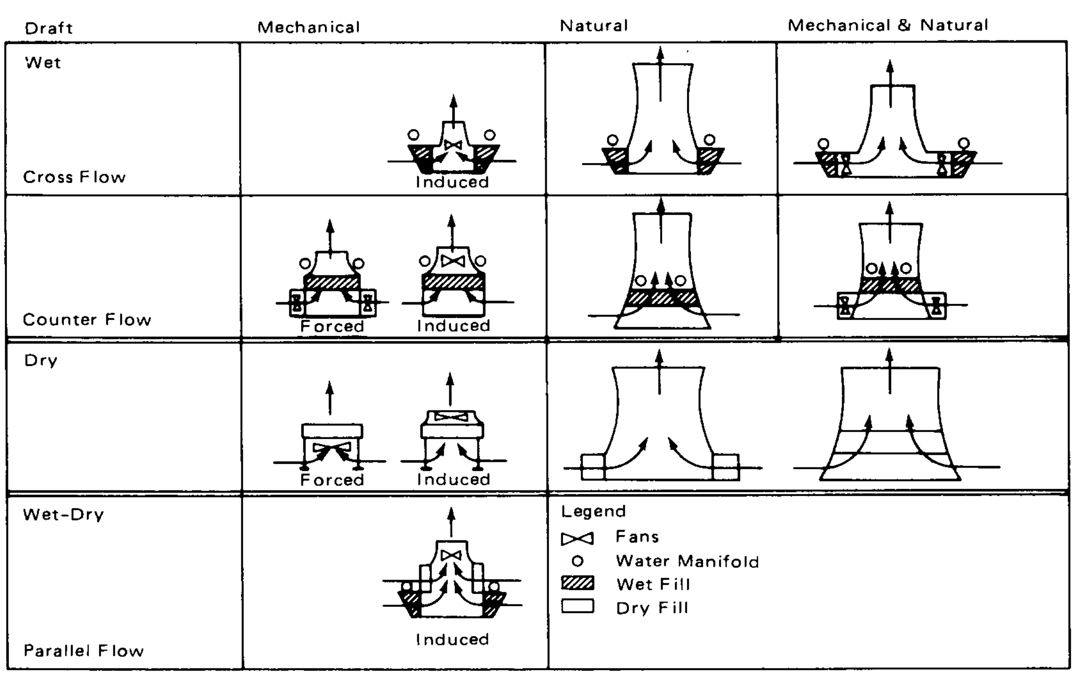

Figure B-1 Summary of typical cooling towers.

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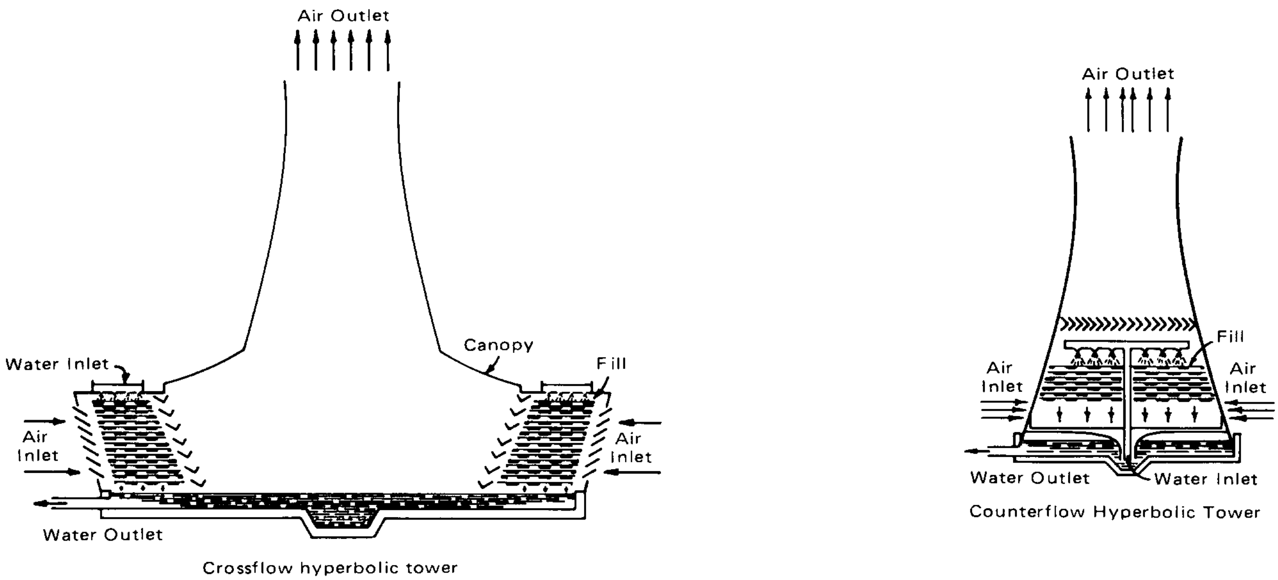

Figure B-2 Types of natural-draft towers.

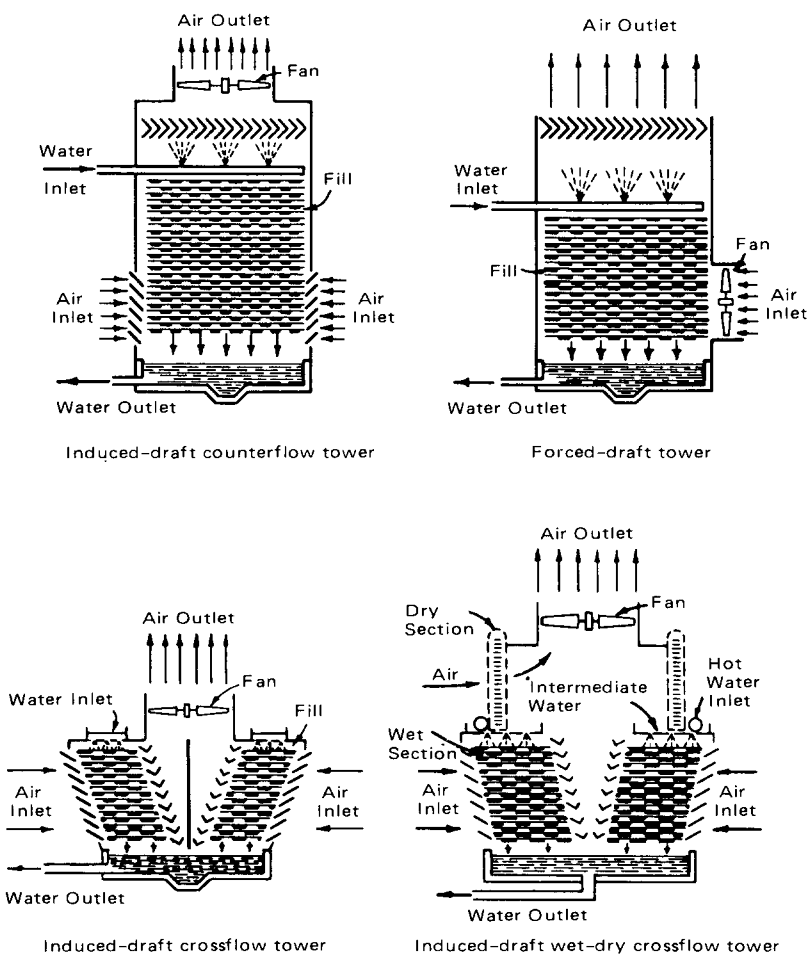

Figure B-3 Types of mechanical-draft towers.

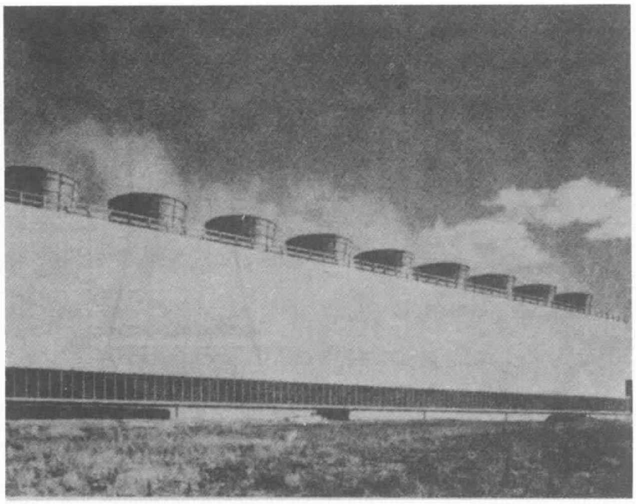

Figure B-4 Typical induced-draft counterflow water-cooling tower.

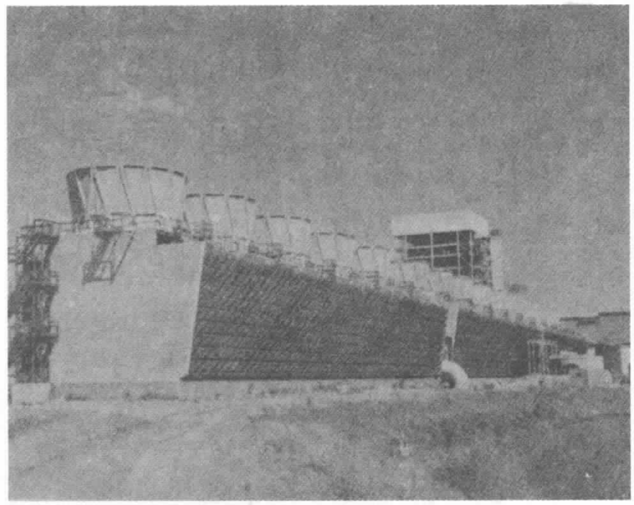

Figure B-5 Typical induced-draft crossflow water-cooling tower.

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, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 1990 edition

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 1992 edition.

C-1.2 Other Publications.

C-1.2.1 ASTM Publications. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E84-91, *Standard Test Method for Surface Burning Characteristics of Building Materials*

ASTM E136-82, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.*

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