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Aircraft Hangars

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NATIONAL FIRE PROTECTION ASSOCIATION
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National Fire Protection Association

International

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes two hundred national and regional societies and associations (list on outside back cover) and seventeen thousand individuals, corporations, and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association including periodicals, books, posters and other publications; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in six volumes of the **National Fire Codes** which are re-issued annually and which are available on an annual subscription basis. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire safety.

Definitions

The official NFPA definitions of shall, should and approved are:

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.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings 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 and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Standard on Aircraft Hangars

No. 409—May 1958

This edition prepared by the Committee on Aircraft Hangars, approved by the Committee on Aviation and Airport Fire Protection and adopted by the National Fire Protection Association May 19–23, 1958, supersedes all previous editions and incorporates the following changes from the last previous edition (1957).

Changes in 1958 Edition

In 1958 changes were made in Paragraph 1002 covering the depth of draft stops and in Paragraphs 1609 and 1614.c. on foam-water sprinkler system design. Two new paragraphs were added in Chapter 16 (Nos. 1614.f. and 1616.c.) covering foam tank outlets and flushing of foam-water sprinkler systems. Changes were also made, largely editorial in nature, in Part G, Appendix, Paragraphs A-1002 and A-1509. The change in the latter paragraph affected only the NFPA edition of No. 409. Editorial changes have been made in Paragraphs 105., 1101.b., 1102.a., 1103.b., the fine print note following 1301., 1501.a., 1504.c., 1505.a., 1507.a., 1509.a., 1513.c.(2)., 1513.d., 1514.a., 1702.a.(1)., 1703.a., 1704.a., 1705.a., 1802., 1902., 2001., 2101., 2102.b., 3001.a. and b. and A-1103.

History

The original fire protection recommendations for the construction and protection of airplane hangars were published by the National Board of Fire Underwriters in 1930. Revisions were issued by the NBFU in 1931, 1943, 1945, and 1950. During the period 1943 until 1954, these recommendations were published as NBFU Pamphlet No. 85.

In 1951, the National Fire Protection Association organized a Committee on Aircraft Hangars to which the National Board of Fire Underwriters and other interested groups (see Committee listing, page 409-4) lent their support. The NFPA's first standard was adopted in 1954 and the NBFU adopted the same text, rescinding their earlier 1950 Standard. A revision was made in 1957 (largely in connection with Chapter 16) and this 1958 edition incorporates the changes noted above.

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PART A

INTRODUCTION

Chapter 1. Scope and Purpose

101. GENERAL. The adequacy and usefulness of aircraft hangars depends, to a large extent, upon the fire resistance of their construction and the fire protection provided within the buildings. These standards have been drafted to provide guidance as to the proper construction and protection of aircraft hangars and are intended to provide good practice recommendations for the guidance of airport authorities, aircraft owners and operators, building and fire officials and insurance underwriters.

102. SUBDIVISIONS OF THIS STANDARD. This standard is divided into seven subdivisions as follows:

a. PART A. INTRODUCTION.

b. PART B. CONSTRUCTION OF AIRCRAFT HANGARS. This Part and Part C give recommendations for the conventional aircraft hangar used for the storage and servicing of aircraft of the types commonly used by airline operators, the military and a large number of fixed based operators at private, municipal and state owned airports. The recommendations are predicated on the assumption that these hangars will be used for both the storage and servicing of aircraft.

c. PART C. PROTECTION OF AIRCRAFT HANGARS. See remarks under Paragraph 102. b.

d. PART D. WING OR NOSE HANGARS. Wing or nose hangars are buildings which provide shelter for the servicing of aircraft without housing the aircraft aft of the trailing edge of the wings. Wing or nose hangars may have extensive service shops and offices incorporated within the structures.

e. PART E. NONPORTABLE AIRCRAFT DOCKS. Nonportable aircraft docks are shelters or covers for the servicing of aircraft engines. Such docks do not house the wings nor contain service shops or offices.

f. PART F. UNIT TYPE HANGARS FOR SMALL AIRCRAFT. These hangars are used for the storage of personal, executive or other small aircraft. Such unit type hangars may be single units for an individual aircraft or joined to form a row of hangars.

g. PART G. APPENDIX. Diagrams and text designed to assist in implementing this Standard.

103. FIRE RECORD OF HANGARS. The fire record of aircraft hangars indicates that unusual precautions must be taken to assure continuity of use. Aircraft maintenance activities and the special hazards associated with aircraft storage and shop work account for approximately 64% of the known fire causes. The average losses for hangars over a period of 20 years reveals that the average per-square-foot loss to the building is $2.72 while the average per-square-foot loss to the contents is approximately $7.00. An average of six aircraft are destroyed in each hangar fire according to the fire record studies conducted by the National Fire Protection Association.* In approximately 71% of all the hangars which sustained fires during the period studied, roof collapse resulted. One of the principal reasons for heavy fire losses in aircraft hangars is revealed in the statistics which show that in 60% of the cases, airports at which these fires occurred were located "outside city or town limits, beyond established fire protection zones." In an additional 10% of the cases, the airports were located in communities having less than 10,000 population, in which communities fully staffed public fire protection services are not ordinarily found.

104. APPLICATION OF STANDARDS. It is urged that airport operators follow these recommended standards in the construction and protection of aircraft hangars in the absence of adequate local building laws and fire prevention ordinances. It should be clearly understood, however, that these recommendations are not proposed for legal adoption nor are they intended to apply on a retroactive basis to existing hangars except as such recommendations may be found useful in furthering the fire safety of any structure and its contents.

105. SUBJECTS NOT COVERED.

a. AIRCRAFT MAINTENANCE AND STORAGE. This standard does not deal with aircraft storage and maintenance procedures and hazards. The National Fire Protection Association has established a separate Committee on Aircraft Maintenance and Storage to deal with these subjects and currently this Committee is developing detailed recommendations on safeguarding such operations. The National Board of Fire Underwriters has published Recommended Safeguards for the Control of Operational Hazards in Aircraft Hangars (NBFU No. 410). The recommendations

*See "An Analysis of Aircraft Hangar Fire Experience" (NFPA AH-4) available from the Association for $5.00 per copy.

contained herein do, however, comtemplate the hazards existing in aircraft maintenance and storage operations as well as the hazards occasioned by the construction of the building and the utilities supplied for the comfort and convenience of the occupants.

b. AIRCRAFT RESCUE AND FIRE FIGHTING. This standard does not deal with aircraft rescue and fire fighting equipment or manpower. Reference is made to the recommendations of the National Fire Protection Association entitled "Suggestions for Aircraft Rescue and Fire Fighting Services for Airports" (NFPA No. 403) and "Standard Operating Procedures, Aircraft Rescue and Fire Fighting" (NFPA No. 402) for data and correlation with the hangar fire protection specified herein. Particular reference is made to Paragraph 111 of NFPA No. 403. Preplanning is recommended for maximum efficiency in the use of this equipment in combatting hangar and apron fires (see Paragraph 2103).

106. OTHER APPLICABLE AIRPORT STANDARDS. Applicable national or international standards should be followed with regard to the clearance distance for hangars in relation to the center line of airport runways. In the United States the minimum distances for such clearances have been established by the Civil Aeronautics Administration.† The International Civil Aviation Organization has also prepared recommended practices as to the clearance of buildings to approach and landing surfaces.††

107. LOCAL FIRE REGULATIONS. It is recommended that every airport develop fire protection and prevention regulations in addition to those provided herein as a guide to meet local conditions and to implement these standards on a local basis.

108. USE OF TERMS. The following definitions apply throughout the standard:

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.

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†See pamphlet "Airport Design" available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

††See "Annex 14 Aerodromes", issued by the International Civil Aviation Organization. Copies available from ICAO, International Aviation Building, 1080 University St., Montreal, Canada.

PART B
CONSTRUCTION OF AIRCRAFT HANGARS.

Chapter 2. Definitions.

201. A HANGAR is defined as a building or other structure in any part of which aircraft are housed or stored, or in which aircraft may be undergoing servicing, repairs or alterations. (See Paragraphs 2201, 2501 and 2801 for special types.)

202. A SINGLE HANGAR BUILDING is a building which contains one aircraft storage or servicing area and any adjoining structure (e.g., "lean-to") not separated as specified in Paragraph 503.

203. A HANGAR BUILDING GROUP is a building or group of buildings containing more than one aircraft storage or servicing area and all structures attached thereto not separated as specified in Paragraph 504.

Chapter 3.
General Recommendations on Hangar Design.

301. PREFERENTIAL CONSTRUCTION. Single hangar buildings, separated by space are preferable to two or more adjoining hangars separated by fire walls.

302. COMMUNICATING SECTIONS. Shop, office and storage areas should be in separate detached buildings wherever possible. Where such areas communicate (as in lean-tos) with an aircraft storage or servicing area and possess inherent hazards, contain valuable records or store concentrations of critical or highly valued materials, they shall be cut-off in the manner specified in Paragraph 502. Separate shops, offices and storage areas having their own roof coverings and built within aircraft storage or servicing areas, shall have water-tight roof deck coverings.

Chapter 4.
Classification of Hangars by Construction Types.

401. FIRE RESISTIVE CONSTRUCTION. Hangars of this type shall have structural members of noncombustible materials having fire resistance ratings of not less than three hours for bearing walls or bearing portions of walls (exterior or interior) and wall supporting members and columns, and not less than two hours for floors, roofs decks and supports thereof. Exterior and interior bearing walls shall be of approved masonry or reinforced concrete construction. Nonbearing walls or portions of walls shall be noncombustible and fire resistance may be required depending upon conditions of occupancy or exposure. Bearing walls and bearing partitions shall have adequate stability under fire conditions

in addition to the specified fire resistance rating. (See NFPA Standard No. 220 for further details on Fire Resistive Construction.)

402. HEAVY TIMBER CONSTRUCTION. Hangars of this type shall have columns, beams, girders and roofs of heavy timber or of approved glued laminated construction of not less than the following nominal dimensions for individual members:

Columns . . . . . 8 inches
Trusses . . . . . 4 inches by 6 inches*
Beams and Girders . . . 6 inches by 10 inches
Roof Decks . . . . . 2 inches (plank), 3 inches (laminated)

*Spaced members may be composed of two or more pieces not less than 3 inches, nominal, in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate of not less than 2 inches, nominal, thickness secured to the underside of members. Splice scabs shall be not less than 3 inches, nominal, thickness. When the building is protected with an approved automatic sprinkler or foam-water sprinkler system (see Chapters 15 and 16) the framing members may be reduced to not less than 3 inches, nominal, thickness.

Bearing walls or bearing portions of walls of masonry or other noncombustible construction shall have a minimum fire resistance rating of not less than two hours and stability under fire conditions. Nonbearing exterior walls shall be noncombustible and fire resistance may be required depending upon conditions of occupancy or exposure. Interior structural members, columns, beams, girders or trusses of materials other than wood may be substituted for heavy timber members (as specified above) provided they have a fire resistance rating of not less than one hour. (See NFPA Standard No. 220 for further details on Heavy Timber Construction.)

403. NONCOMBUSTIBLE CONSTRUCTION. Hangars of this type shall have walls, partitions and structural members of noncombustible materials which, as assembled, do not qualify as Fire Resistive (see Paragraph 401). Materials considered noncombustible do not ignite and burn when subject to fire and include such materials as steel, iron, brick, tile, concrete, slate, asbestos, glass or plasters. In hangar construction there are commonly two types of noncombustible buildings which may be described as follows:

a. PROTECTED NONCOMBUSTIBLE. Protected noncombustible hangars shall have bearing walls or portions of bearing walls (exterior or interior) of noncombustible materials having a fire resistance rating of not less than two hours and roof decks and supports of noncombustible materials having a fire resistance rating

of not less than one hour. A one hour fire resistant ceiling beneath the roof construction may be used in lieu of the specified fire resistance of the roof construction. Nonbearing walls or portions of walls shall be noncombustible and fire resistance may be required depending upon conditions of occupancy or exposure. Bearing walls and bearing partitions shall have adequate stability under fire conditions in addition to the specified fire resistance rating. (See NFPA Standard No. 220 for further details on Protected Noncombustible Construction.)

b. UNPROTECTED NONCOMBUSTIBLE. Unprotected noncombustible hangars shall be constructed of noncombustible materials for walls, columns, girders, trusses, floor, roof and partitions of unspecified fire resistance.

404. ORDINARY CONSTRUCTION.

a. Hangars of this type shall have exterior bearing walls or bearing portions of exterior walls of noncombustible construction having a minimum fire resistance rating of two hours and stability under fire conditions. Nonbearing exterior walls shall likewise be of noncombustible construction and fire resistance may be required depending upon conditions of occupancy or exposure. Roofs, floors (except as specified in Paragraph 802), and interior framing are normally wholly or partly of wood (or other combustible material) of smaller dimensions than required for Heavy Timber Construction (see Paragraph 402). (See NFPA Standard No. 220 for further details on Ordinary Construction.)

b. Ordinary construction shall be designated Protected Ordinary Construction when the roof and floor construction and their supports have a one hour fire resistance rating. (See NFPA Standard No. 220 for further details on Protected Ordinary Construction.)

405. WOOD FRAME.

a. Hangars in which exterior walls, bearing walls and partitions and roof construction and its supports are of wood or other combustible material not qualifying as Heavy Timber Construction (Paragraph 402) or Ordinary Construction (Paragraph 404). Hollow spaces between inner and outer sheathing shall be firestopped at each eight feet of height. (See NFPA Standard No. 220 for further details on Wood Frame Construction.)

b. This type construction shall be designated Protected Wood Frame Construction when the roof and floor construction and its supports have a one hour fire resistance rating. (See NFPA Standard No. 220 for further details on Protected Wood Frame Construction.)

Chapter 5.
Internal Subdivisions and Separation.

501. GENERAL. The nature of fires in aircraft hangars indicates that more than ordinary precautions should be taken to insure ready access to such buildings from all sides and adequate separation should be provided to reduce fire exposure between buildings. The clear spaces specified in Tables I and II of Paragraphs 503 and 504 should not be used for the storage of aircraft or concentrations of combustible materials nor should buildings of any type be erected therein.

502. INTERNAL SUBDIVISIONS. When two or more aircraft storage or servicing areas adjoin or are connected by lean-tos or other intervening construction, they shall be separated by an approved fire wall. Openings in such fire walls communicating directly between two aircraft storage or servicing areas shall be provided with approved Class A fire doors on both sides of the wall. Single approved Class A fire doors may be used at fire wall openings where the openings are not direct to another aircraft storage or servicing area, except where, in the judgment of the authority having jurisdiction, double doors are required. Partitions and ceilings separating aircraft storage and servicing areas from other areas (e.g. shop, office and parts storage areas) should have at least a one-hour fire resistance rating with openings protected by approved Class C fire doors (see Paragraph 302). Curbs, ramps or drains shall be provided at all openings from aircraft storage or servicing areas to prevent the flow of liquids through the openings (see Paragraph 902.c. and d.).

503. SEPARATION BETWEEN SINGLE HANGAR BUILDINGS. Clear space distances specified in Table I shall be maintained on all sides of single hangar buildings (areas not in excess of provisions of Table III, Paragraph 701). Where mixed types of construction are involved the predominating type of construction shall be used as a guide, subject to the approval of the authority having jurisdiction.

TABLE I

TYPE OF CONSTRUCTION	SEPARATION REQUIRED*
Fire Resistive	50 ft.
Protected Noncombustible	50 ft.
Heavy Timber or Protected Ordinary	50 ft.
Unprotected Noncombustible	50 ft.
Ordinary	50 ft.
Protected Wood Frame and Wood Frame	75 ft.

*See Paragraph 501 for Limitations in Use of Space and Paragraph 505 for Exceptions.

504. SEPARATION BETWEEN HANGAR BUILDING GROUPS. The clear space distances specified in Table II shall be maintained on all sides of hangar building groups (areas not in excess of provisions of Table IV, Paragraph 702). Where mixed types of construction are involved, the predominating type of construction shall be used as a guide, subject to the approval of the authority having jurisdiction.

TABLE II

TYPE OF CONSTRUCTION	SEPARATION REQUIRED*
Fire Resistive	75 ft.
Protected Noncombustible	75 ft.
Heavy Timber	75 ft.
Protected Ordinary	100 ft.
Unprotected Noncombustible	100 ft.
Ordinary	100 ft.
Protected Wood Frame and Wood Frame	125 ft.

*See Paragraph 501 for Limitations in Use of Space and Paragraph 505 for Exceptions.

505. EXCEPTIONS TO SEPARATION REQUIREMENTS.

a. If both exposing walls of adjacent single hangar buildings are stable under fire conditions and both walls are unpierced and have a fire resistance rating of at least three hours, no distance separation shall be required, in which case the buildings shall be considered a hangar building group and subject to the area provisions of Paragraph 702.

b. If one hangar has as its exposing wall a stable, unpierced wall having a fire resistance rating of two hours or longer, the distance separation may be reduced to not less than 25 feet for single hangar buildings and 50 feet for hangar building groups.

c. If the exposing walls of both buildings are stable under fire conditions, have a fire resistance rating of two hours or longer with all windows protected by wired glass in fixed steel sash (approved Class E type) with outside sprinkler protection, and each doorway is protected with one automatically operated approved Class D fire door, the clear space may be reduced to not less than 25 feet for single hangar buildings and 50 feet for hangar building groups. Glass area in the exposing walls under such conditions shall not be more than 25% of the wall area. The requirement for approved Class E windows and outside sprinkler protection for lean-to portions of hangars may be modified subject to the approval of the authority having jurisdiction.

Chapter 6. Height Limitations.

601. The height of aircraft storage or servicing areas should be limited to one story regardless of type of construction. This should not be interpreted to prohibit a roof space (see Paragraph 804.d.) nor to prohibit multiple story adjoining or communicating structures suitably cut-off by fire division walls from aircraft storage or servicing areas.

Chapter 7. Area Limitations.

701. MAXIMUM AREAS FOR SINGLE HANGAR BUILDINGS. Areas permitted for single hangar buildings without fire wall subdivisions all openings in which are protected by approved double Class A fire doors, should be limited as specified in Table III. Where mixed types of construction are involved, the predominating type of construction shall be used as a guide, subject to the approval of the authority having jurisdiction. (For clear space distances required see Table I, Paragraph 503.)

TABLE III
MAXIMUM RECOMMENDED AREAS
SINGLE HANGAR BUILDINGS

TYPE OF CONSTRUCTION	MAXIMUM AREA NONSPRINKLERED SQUARE FEET	MAXIMUM AREA SPRINKLERED SQUARE FEET
Fire Resistive	30,000	100,000
Protected Noncombustible	20,000	80,000
Heavy Timber or Protected Ordinary	15,000	65,000
Unprotected Noncombustible	12,000	65,000
Ordinary	12,000	40,000
Protected Wood Frame	8,000	30,000
Wood Frame	5,000	20,000

702. MAXIMUM AREAS FOR HANGAR BUILDING GROUPS. Areas permitted for hangar building groups should be limited in length to 1,200 feet and in area as specified in Table IV, including all lean-tos and enclosed spaces attached or adjoining. No single aircraft storage or servicing area should exceed the limits of a single hangar building as specified in Table III, Paragraph 701. Where mixed types of construction are involved, the predominating type of construction shall be used as a guide, subject to the approval of the authority having jurisdiction. (For clear space distances required see Table II, Paragraph 504.)

TABLE IV
MAXIMUM RECOMMENDED AREAS
HANGAR BUILDING GROUPS

TYPE OF CONSTRUCTION	MAXIMUM AREA NONSPRINKLERED SQUARE FEET	MAXIMUM AREA SPRINKLERED SQUARE FEET
Fire Resistive	60,000	300,000
Protected Noncombustible	40,000	240,000
Heavy Timber or Protected Ordinary	30,000	195,000
Unprotected Noncombustible	24,000	195,000
Ordinary	24,000	120,000
Protected Wood Frame	16,000	90,000
Wood Frame	10,000	60,000

Chapter 8. Structural Requirements Common To All Types of Hangars.

801. MEZZANINES, TOOL ROOMS, ETC. Mezzanine floors, tool rooms, and other enclosures within aircraft storage and servicing areas shall be of noncombustible construction in all but wood frame hangars (see Paragraph 405). Preference should be given to the use of noncombustible materials in wood frame hangars. Separate shops, offices and storage areas shall comply with the provisions of Paragraphs 302 and 502.

802. FLOORS.

a. The surface of the grade floor of aircraft storage or servicing areas, regardless of type of hangar construction, shall be noncombustible and above the grade of the approach or apron at the entrance to the hangar. The floor shall be laid on ground without air space underneath and without basement. Tunnels beneath the floor should be avoided but where used in no case shall openings be made in the floor of the aircraft storage or servicing areas to such tunnels. (For floor drainage, see Paragraph 902; for static protection, see Paragraph 1302; for floor openings, see Paragraph 803.)

b. The floors of adjoining and communicating areas, regardless of type of hangar construction, should be as specified in Paragraph 802.a. wherever the occupancy conditions present special hazards (as in spray painting or doping areas, flammable liquid storage or mixing rooms, cutting and welding areas, etc.). In other sections, floors may be combustible or earth, subject to the approval of the authority having jurisdiction.

803. FLOOR OPENINGS. Floor openings in multi-storied sections of hangars (see Paragraph 601) should be enclosed with partitions or protected with construction having a fire resistance rating not less than that required for the floor construction in which the opening is made.

804. ROOFS.

a. ROOF COVERINGS. Roof coverings shall be of an approved type of tile, slate, metal, asbestos, asphalt shingles or of built-up roofing finished with asphalt, slag or gravel or other approved material. Roof coverings which are listed by Underwriters' Laboratories, Inc. as Class "A" or "B" shall be accepted as meeting the requirements of this paragraph. Underwriters' Laboratories approved Class "C" roof coverings may be used on Wood Frame Hangars (see Paragraph 405).

b. ROOF DECKS. Except where roof coverings are of a character permitting attachment direct to framework, roof decks shall be solid or close fitting. (See Paragraphs 401, 402, 403, 404 or 405 for materials used and desired fire resistance ratings.)

c. ROOF INSULATION. Approved types of insulation may be used on top of the roof deck provided such insulation is covered with an approved type of roof covering applied directly thereto.

d. ROOF SPACES. When suspended ceilings are provided in aircraft storage or servicing areas, the roof space shall be cut-off from the area below so that the roof space cannot be used for storage or other occupancy. The roof space shall be provided with ventilation louvres to assure air circulation therein.

e. LADDERS TO ROOFS. Unless enclosed stairs leading directly to the roof of aircraft storage or servicing areas are available from the exterior of the hangar, adequate permanent exterior ladders to hangar roofs should be provided on all hangars exceeding 25,000 square feet in area, or exceeding 40 feet in height, or exceeding 100 feet in the smallest dimension to assure access in case of fire emergencies (see also Paragraph 1702.b.).

805. DOORS AND CURTAINS.

a. DOORS TO ACCOMMODATE AIRCRAFT.

(1). Hangar doors to accommodate aircraft shall be of noncombustible construction when hangar walls are of fire resistive or noncombustible construction. (see Paragraphs 401, 402, 403 and 404.)

(2). Adequate door operating provisions should be made to permit removal of aircraft from a hangar in case a fire occurs when doors are closed. The primary power supply to power-

operated doors shall be reliable and shall have an independent circuit supplying power to the doors, with wiring run in rigid conduit directly from the main electrical distribution panel of the hangar to the door controls. If a secondary source of power is not available in case of primary power failure, an auxiliary power source should be provided to operate the doors.

(3). Vertical acting doors shall be so counter-balanced, and horizontal slide or accordion type doors shall be so arranged, that manual or auxiliary operation (as with winches or tractors) is feasible. Pre-planning should assure availability of necessary auxiliary equipment (such as tractors, cables, grapnels, etc.) where manual operation is either not possible or too slow to allow prompt aircraft removal. (See also Paragraph 1512.b.)

(4). In areas where freezing temperatures may occur, door tracks or the bottom edges of doors shall be protected (by heating coils or equivalent means) to prevent ice formation which might prevent or delay operation.

b. OTHER EXTERIOR DOORS. See Paragraph 505 for exposure protection for exterior doors in certain locations and Chapter 14 with regard to exit doors.

c. CURTAINS ENCLOSING WORK AREAS. Where curtains are used to enclose a work area they shall be of an approved flame resistant type.

Chapter 9. Drainage of Aprons and Hangar Floors.

901. APRON DRAINAGE. The apron or approach at the entrance to the hangar shall slope away from the hangar sufficiently to prevent the flow of liquids from the apron into the hangar. Drainage of the apron shall be so arranged that the flow of flammable liquids thereon will not endanger adjoining or nearby buildings. In establishing locations for nearby aircraft parking, consideration should be given to the drainage pattern of the apron slopes.

902. HANGAR (AIRCRAFT STORAGE OR SERVICING AREAS) FLOOR DRAINAGE.

a. GENERAL. Floor drains are needed in aircraft storage or servicing areas to dispose of water used for cleaning of aircraft, washing of floors and for similar "utility" purposes, and, to carry away any spilled flammable liquids and water discharged from operating sprinklers or fire hose streams during a fire emergency. In addition, adequate drainage to dispose of surface liquids on the hangar floor is desired to restrict the spread of fire

or area of hazard within a hangar resulting from the spillage of flammable liquids, and, to prevent extension of the fire or hazard zone to aprons on which aircraft may be parked. While it is recognized that totally effective drainage to accomplish these purposes may not be practically or economically feasible, the drainage facilities recommended herein should be incorporated. (See Paragraph 1601.c. for advantages of foam-water sprinkler systems.)

b. "UTILITY" FLOOR DRAINS. Drains to serve for "utility" purposes should be incorporated in the aircraft storage or servicing areas of all hangars. These "utility" drains should be designed to be of sufficient capacity to also provide effective drainage facilities for interior standpipe hose streams. (See Paragraphs 1702 and 1705.) Drain pipes for "utility" drains should be not less than six (6) inches in diameter and it is recommended that the maximum flow distance on the floor from any point to the nearest drain be not greater than 40 feet. Such drains should be equipped with oil separators (see Paragraphs 902.f. and g.).

c. DRAINS AT DOORS ACCOMMODATING AIRCRAFT. Drains should be provided at these doors to dispose of as much as possible of the water flow resulting from the operation of interior water sprinklers and the use in the hangar of fire hose streams. They should consist of grated drainage trenches at each such door, extending approximately the full width of the opening but should not pass fire walls. Each trench should be an independent unit to prevent the flow of liquids from one hangar door trench to another and should discharge to a safe location where pollution is not a factor. Grating over such trenches should be at least 8 inches in width and openings or voids in the grating should be designed to trap the maximum practicable amount of water flowing from the hangar floor. Door trenches may be located inside or outside the door but if outside special precautions will be necessary in cold climates to keep them clear of ice and snow. Door tracks should not interfere with efficient drainage. To aid in disposing of excess water, apron drainage trenches may supplement door trenches if the former are within about 15 feet of the doors and run parallel to the openings.

d. DRAINS AT OTHER OPENINGS FROM AIRCRAFT STORAGE OR SERVICING AREAS. Other openings from aircraft storage or servicing areas (e.g., to shops, offices, etc. in lean-tos), not curbed or ramped, should be provided with a drainage trench and grating the width of the opening and at least 8 inches in depth.

e. PIT DRAINAGE. Pits for service facilities (e.g., for compressed air, electrical outlets, etc.) should drain into the utility floor drainage system and should be so designed or provided with a "back-water" valve or sump-pump, or both, so that they will not become flooded by back-flow from other drains.

f. OIL SEPARATORS FOR DRAINS. Oil separators should be provided to take care of the normal use of floor drainage systems unless the entire system discharges to a remote location where pollution is not a factor. Sprinkler discharge need not be considered in determining oil separator size. A by-pass should be provided around the separator to take care of fire flow water disposal. Oil discharge from separators should drain to a safely located tank, cistern or sump.

g. DRAIN AND SEPARATOR MAINTENANCE. Periodic maintenance checks (not less than monthly) and flushing shall be conducted on all drains and oil separators to assure that they are clear of obstructions and function in the manner for which they were designed. To discourage disposal of waste oil and flammable liquids in floor drains, portable oil waste disposal cans of approved design shall be provided.

h. GRATES AND DRAIN COVERS. Grates and drain covers shall be of sufficient strength to take the point loading of the heaviest type aircraft which the hangar serves. Grates and covers should be removable to facilitate cleaning and flushing.

Chapter 10. Draft Stops In Sprinklered Hangars.

1001. MATERIALS. Draft stops installed in accordance with the provisions of Paragraph 1510 shall be constructed of noncombustible materials not subject to disintegration or fusion during the early stages of a fire and shall be tightly fitted to the underside of the roof or ceiling. Any opening in draft stops shall be provided with self-closing doors of materials equivalent in fire resistance to the draft stop itself.

1002. DEPTH. Draft stops should extend down from the roof or ceiling of aircraft storage or servicing areas not less than one-eighth of the height from floor to roof or ceiling. Under curved or sloping roofs extending to grade level or close to grade level, draft stops need not be continued below 16 feet from the floor.

(NOTE: See Part G, Par. A-1002, for Sketches.)

1003. INSTALLATION. Draft stops should be installed preferably at right angles to the hangar doors forming roof pockets that are rectangular in shape. Hangars that are long and narrow, however, may best be subdivided by a "grid" system of draft stops that are both at right angles and parallel to the doors. In arch type hangars, draft stops may be hung on exposed interior roof supports running parallel to the doors. The method of installation selected shall be based on securing maximum operational efficiency from the sprinkler protection taking into consideration mean wind conditions, the floor drains, the floor pitch and details of occupancy usage.

1004. ROOF SECTIONS AS DRAFT STOPS. Structural features of a building which accomplish the purpose of draft stops (such as roof monitors, saw tooth roofs, etc.) may be accepted in lieu of specially constructed draft stops.

Chapter 11. Hangar Services and Utilities.

1101. HEATING.*

a. No heater employing an open flame or glowing element shall be installed in aircraft storage or servicing areas or sections communicating therewith, except as authorized in subparagraphs **b** or **c** below.

b. GENERAL.

1. Heating equipment shall be installed to conform with Article XI of the National Building Code issued by the National Board of Fire Underwriters, the Standard on "Installation of Air Conditioning and Ventilating Systems of Other than Residence Type" (No. 90A), the "Installation of Oil Burning Equipment" (No. 31) and the "Installation of Gas Piping and Gas Appliances in Buildings" (No. 54), except as hereinafter specifically provided.

2. It is recommended that hangar heating plants fired with gas, liquid or solid fuels be located in a fire resistive or noncombustible detached building wherever possible.

3. Hangar heating plants fired with gas, liquid or solid fuels (not covered under subparagraph c below) which are not lo-

*CAUTION: It should be noted that fire protection equipment in aircraft hangars is frequently of a type which depends on rate-of-temperature-rise at the ceiling and that the sudden input of large quantities of heated air at any point may endanger the correct operation of automatic fire extinguishing and alarm equipment.

cated in a detached building, shall be located in a room separated from other parts of the hangar by construction having at least a one-hour fire resistance rating. This separated room shall not be used for any other hazardous purpose or combustible storage and should have no direct access from the aircraft storage or servicing area. Openings in the walls of such rooms communicating with other portions of the hangar shall be restricted to those necessary for ducts or pipes and such ducts shall be protected with approved type automatic fire dampers or doors. All air for combustion purposes entering such separated rooms shall be drawn from outside of the building.

4. Fan furnace heating systems employing recirculation of air within aircraft storage or servicing areas shall have **return** air openings not less than 10 feet above the floor. **Supply** air openings shall not be installed in the floor and shall be at least 6 inches from the floor, measured to the bottom of the opening. It is recommended that the fans for such systems be arranged to shut down automatically by the operation of the interior automatic fire protection system. One or more manual fan shut-off switches should also be provided. Shut-off switches shall be accessible and clearly placarded. Personnel should be fully instructed that in event of a serious gasoline or similar flammable liquid spill on the hangar floor, the fans should be shut-off.

c. SUSPENDED OR ELEVATED HEATERS.

1. Electric, gas or oil heaters, approved as suitable for use in aircraft hangars, may be used if installed as specified in subparagraphs 2, 3 and 4 below.

2. In aircraft storage or servicing areas, they shall be installed at least 10 feet above the upper surface of wings or of engine enclosures of the highest aircraft which may be housed in the hangar. (The measure should be made from the wing or engine enclosure, whichever is higher from the floor, to the bottom of the heater.)

3. In shops, offices and other sections of aircraft hangars, communicating with aircraft storage or servicing areas, they shall be installed not less than 8 feet above the floor.

4. Suspended or elevated heaters shall be so located in all spaces of aircraft hangars that they shall not be subject to injury by aircraft, cranes, movable scaffolding or other objects. WARNING. Provision should be made to assure accessibility to suspended heaters for recurrent maintenance purposes.

1102. VENTILATION AND BLOWER AND EXHAUST SYSTEMS.

a. When a mechanical ventilating system is employed in hangars or shops, the ventilating system shall be installed in accordance with the Standard for the "Installation of Air Conditioning and Ventilating Systems of Other than Residence Type" (No. 90A) and in accordance with the provisions of Paragraph 1101. When blower and exhaust systems are installed for vapor removal, the systems shall be installed in accordance with the "Standards for the Installation of Blower and Exhaust Systems" (No. 91).

1103. LIGHT.

a. Artificial lighting shall be restricted to electricity.

b. Electrical services shall be installed in compliance with the provisions for aircraft hangars contained in Article 510 of the National Electrical Code (No. 70). (See Part G, Appendix for excerpts from 1956 National Electrical Code, Article 510, Section 5115 and Paragraph 805.a.(2) on power supply to doors accommodating aircraft.)

c. It is recommended that main distribution panels, metering equipment, etc. be located in a suitable enclosure provided therefor and for no other hazardous purpose. This room should be vented to the outside atmosphere and shall be separated from the aircraft storage or servicing area by a solid, unpierced partition having at least a one-hour fire resistance rating.

Chapter 12. Lightning Protection.

1201. All aircraft hangars should be surveyed to determine the need for approved lightning protection. When installed, such systems should bear the Master Label of Underwriters' Laboratories, Inc. (See National Fire Protection Association Code for Protection Against Lightning, NFPA No. 78.)

Chapter 13. Grounding Facilities for Static Electricity.

1301. GENERAL. Grounding facilities shall be provided for removal and control of static electrical accumulations on aircraft while aircraft are stored or undergoing servicing in a hangar, except that aircraft which have never been fueled or are in dead storage with fuel tanks removed or drained and purged need not be grounded.

NOTE: For the purposes of this standard, a "drained and purged tank" is one from which the flammable liquid has been drained and the flammable vapor atmosphere or any residue capable of producing flammable vapors has been removed so that subsequent airing or ventilation will not result in the reinstatement of a flammable atmosphere unless or until a flammable liquid is again introduced. (See Suggested Procedures for Safeguarding Aircraft Fuel Tank Atmospheres, Ground Handling, NFPA No. 405.)

1302. INSTALLATION METHODS. An adequate number of floor ground receptacles shall be provided. The receptacles should be grounded through individual driven electrodes or may be electrically bonded together in a grid system and the entire system grounded to underground metal piping (e.g. cold water or sprinkler piping) or driven electrodes. Where driven electrodes are used they shall consist of 5/8 inch diameter or larger metal rods driven at least 5 feet into the ground. Floor grounding receptacles should be designed so as to minimize the tripping hazard.

1303. RESISTANCE MAXIMUM. As low a resistance as possible should be secured and maintained. 10,000 ohms is a practical recommended maximum when determined by standard procedures. Static grounding facilities should be tested periodically for electrical resistance.

1304. GROUNDING WIRES. Grounding wires shall be bare and of a gauge which will be satisfactory from the durability standpoint as influenced by mechanical strains and usage (speedometer, preformed steel or equivalent cable will minimize danger of employee hand injury).

1305. REFERENCES. For further details on this subject, see "Static Electricity in Aircraft Operations and Maintenance" (NFPA No. 404) and "Fueling Aircraft on the Ground" (NFPA No. 407).

Chapter 14. Exit* and Access Requirements.

1401. EXITS FROM AIRCRAFT STORAGE OR SERVICING AREAS. In general, exits from aircraft storage or servicing areas shall be provided at intervals of not more than 150 feet on all exterior walls and be so located as to secure minimum interior travel distance for occupants. There shall be a minimum of two exits serving each aircraft storage or servicing area. Exits along interior fire walls shall be provided at intervals of not more than 100 feet positioned so as to secure minimum interior travel dis-

*See NFPA Building Exits Code (NFPA No. 101), particularly Section 28, for further information.

tance for occupants. Dwarf or "smash" doors in doors accommodating aircraft may be used to comply with these requirements. All doors designated as exits (except sliding doors) shall swing in the direction of exit travel and shall be kept unlocked in the direction of exit travel while area is occupied. They shall be not less than 36 inches wide.

1402. EXITS FROM MEZZANINE FLOORS LOCATED IN AIRCRAFT STORAGE OR SERVICING AREAS. Exits from mezzanine floors in aircraft storage or servicing areas shall be so arranged that the maximum travel to reach the nearest exit from any point on the mezzanine shall not exceed 75 feet. Such exits shall lead directly to a properly enclosed stairwell discharging directly to the exterior or to a suitably cut-off area or to outside fire escape stairs.

1403. EXIT SIGNS. Exit signs shall be provided over doors and exitways. They shall be so located as to be readily observed. Except where otherwise required by law, exit signs shall have white letters on a red field, or, for internally illuminated types, shall have red letters of translucent material in an opaque field.

1404. ACCESS AISLES TO FIRE FIGHTING EQUIPMENT. Aisles and clear space shall be maintained to assure access to sprinkler control valves, standpipe hose, fire extinguishers and similar equipment.

1405. MARKING AND IDENTIFICATION OF EXIT AND ACCESS AISLES. Exit and access aisles shall be conspicuously and permanently marked on floors where required by the authority having jurisdiction.

PART C

PROTECTION OF AIRCRAFT HANGARS.

Chapter 15. Sprinkler Systems.

1501. GENERAL.

a. Sprinkler systems shall be installed in accordance with the "Standard for the Installation of Sprinkler Systems" (No. 13) except as otherwise specified in this Chapter. It is recommended that all hangars of the type covered by this Part (see Paragraph 102.b.), regardless of size or construction, be equipped with approved automatic sprinkler systems, foam-water sprinkler systems (see Chapter 16) and/or automatic detection systems (see Chapter 19).

1502. PLANS AND SPECIFICATIONS. The designing and installation of sprinkler systems should be entrusted to none but fully experienced and responsible persons. Before such systems are installed preliminary and working plans and specifications shall be submitted for approval to the authority having jurisdiction. Working plans shall be drawn to scale, show all essential details and be so made that they can be easily reproduced to provide the necessary copies. Information required includes the designed purpose of the system, sprinkler discharge and friction loss calculations, details and tests of available water supply, detailed layout of the piping and of heat-responsive equipment, type of sprinklers to be installed, location and spacing of sprinklers, pipe hanger installation details, locations of draft curtains, and an accurate and complete layout of the buildings or hazards to be protected.

1503. APPROVAL. Before requesting final approval of sprinkler and standpipe installations by the authority having jurisdiction, the installing company should furnish a written statement to the effect that the work has been completed and tested in accordance with the approved plans and specifications.

1504. ACCEPTANCE TESTS. Whenever possible, flushing, flowing and hydrostatic tests should be made in the presence of a representative of the authority having jurisdiction.

a. FLUSHING.

(1). UNDERGROUND MAINS. Underground mains supplying water for sprinkler systems shall be flushed out thoroughly before the sprinkler system risers are connected to the mains. A flow equal to or greater than the maximum required to supply sprinklers and hydrants simultaneously as calculated in accordance with Paragraph 1513 should be flowed through these mains with

a velocity of at least 7½ feet per second and for a sufficient time to give at least two changes of water in the mains between the source and the sprinkler lead-in pipes, or until there is no evidence of discharge of foreign material. (See Par. 1513.b.(7).)

(2). SPRINKLER LEAD-IN PIPING. Sprinkler lead-in piping shall be flushed out with a flow of at least the maximum quantity that would be discharged by the sprinkler system. (For example, if the lead-in pipe supplies 150 sprinklers, a minimum flow of 2250 gallons-per-minute would be required for flushing purposes.)

b. FLOWING. When practicable, full flowing tests should be made on all open head sprinkler systems, as a means of checking the sprinkler layout and to insure against clogging of the smaller piping and the sprinklers by foreign matter carried by the water. The maximum number of systems that may be expected to operate in case of fire (see Paragraph 1513.b.) should be in full operation simultaneously to give a check as to adequacy and condition of water supply.

c. HYDROSTATIC. Hydrostatic pressure tests shall be conducted on all sprinkler systems after completion, as specified in the "Standard for the Installation of Sprinkler Systems" (No. 13).

1505. TYPES OF SPRINKLER SYSTEMS.*

(See Chapter 16 for Foam-Water Sprinkler Systems)

a. Automatic sprinkler systems may employ open sprinklers, sealed sprinklers, or a combination of sealed and open sprinklers, as specified in the "Standard for the Installation of Sprinkler Systems" (No. 13), Paragraph 102.

b. Deluge sprinkler systems are preferable in aircraft storage or servicing areas of hangars. Deluge sprinkler systems shall be installed in such areas having a maximum roof or ceiling height of 35 feet or more. In aircraft storage or servicing areas of lesser height, wet, dry pipe or pre-action sprinkler systems may be installed, to be supplemented by water curtains collinear with the draft stops when the floor area exceeds 12,000 square feet. (See Paragraph 1511.) In other portions of hangars, not over 35 feet in height, wet or dry pipe sprinkler systems are normally adequate except that in certain extra-hazardous areas, water spray, carbon dioxide, dry chemical or foam systems may be desirable.

c. Where weather conditions permit, wet pipe systems are preferable to dry pipe systems.

*See footnote to Paragraph 1101.

1506. SIZE OF SYSTEMS.

a. In aircraft storage or servicing areas, the maximum number of sprinklers supplied through one riser shall not exceed 150. Small additional areas (e.g., lean-tos, offices, etc.) may be supplied from a system of sealed sprinklers which also protect an aircraft storage or servicing area, providing the operation of the sealed sprinklers does not automatically trip deluge valves in the aircraft storage or servicing area.

1507. PIPE SIZES.

a. Pipe sizes for sprinkler systems installed in aircraft storage or servicing areas shall be in accordance with the requirements as given in the "Standard for the Installation of Sprinkler Systems" (No. 13), Paragraphs 415 "Schedule for Extra Hazard Occupancies" and 1043 "Pipe Schedule for Deluge Systems" except as modified herein.

b. In designing the piping system for aircraft storage or servicing areas of hangars, adjustment in pipe sizes to provide uniform sprinkler discharge should be based on a maximum variation per sprinkler of 15 per cent from the required discharge of 15 gallons-per-minute per sprinkler. When steel piping is installed the coefficient C in the Hazen & Williams formula shall be taken as 120 in the calculations.

c. To obtain uniform distribution of water from sprinklers under sloping roofs, cross mains should be located near the high end of the branch lines and fed centrally.

d. Trapped ends of branch lines on wet pipe systems shall be equipped with nipples not less than 6 inches long to collect sediment and on dry pipe systems trapped ends shall be equipped with valves and plugs.

1508. TYPE OF SPRINKLERS.

a. Sprinklers with nominal ½ inch orifices should be used. All sprinklers shall be of approved make and type.

1509. SPACING OF SPRINKLERS.

a. Sprinkler spacing in aircraft storage or servicing areas shall be in accordance with the requirements for extra-hazard occupancies as given in the "Standard for the Installation of Sprinkler Systems" (No. 13). The protection area for fire resistive construction shall be considered the floor area. For all other types of construction, the spacing as projected on the floor shall be not wider than required for extra-hazard occupancies, but in no case shall the spacing on the roof or ceiling be wider than required

for ordinary-hazard occupancies. In other portions of hangars supplied with sprinklers, the spacing shall be in accordance with the hazard requirements of the areas involved.

(NOTE: Sketches showing sprinkler spacing are included in Paragraph A-1509 in Part G. Appendix.)

1510. DRAFT STOPS. (See also Chapter 10.)

a. In aircraft storage or servicing areas of hangars equipped with systems of open sprinklers, draft stops shall effectively surround each individual system, except, in any individual case, the number of draft stops may be reduced by the authority having jurisdiction when the water supply is adequate to supply all sprinklers in the aircraft storage or servicing area at one time.

b. In aircraft storage or servicing areas of hangars equipped with systems of sealed sprinklers, draft stops shall be installed to limit the area between effective draft stops to not over 12,000 square feet. The locations of draft stops need not follow the outlines of the individual systems where sealed sprinklers are used.

1511. WATER CURTAINS.

a. Where water curtains are used in conformance with 1505.b., open spray sprinklers may be used for water curtains spaced not to exceed 8 feet apart and installed directly beneath the lower edge of draft stops. Where open regular sprinklers are used, they should be spaced not to exceed 6 feet apart and should be installed directly beneath the lower edge of draft stops. Other types of sprinklers and other types of arrangements may be used subject to approval of the authority having jurisdiction.

b. Water curtains shall be controlled by thermostatically operated valves. The location and spacing of heat responsive devices shall be in accordance with their listing by Underwriters' Laboratories, Inc.* These devices shall be installed on each side of the draft stops.

c. Interconnection of individual water curtain systems, using approved check valves, is permissible.

1512. SPRINKLERS AT SPECIAL LOCATIONS.

a. SUSPENDED CEILINGS. (Refer to Paragraph 804.d.) Where the roof is of noncombustible construction and an approved ceiling of noncombustible construction is installed below the roof trusses, sprinklers are not required in the roof space. Where the roof is of combustible construction, the roof space shall be protected by sealed sprinklers on the basis of ordinary hazard classification. If the suspended ceiling has less than one-hour

*See footnote to Paragraph 1101.

fire resistance, the area above and below the ceiling shall be considered as one area as regards sprinkler pipe sizes.

b. Adequate sprinkler protection shall be provided for hangar doors accommodating aircraft to insure their operation during fire emergencies. (See also Paragraph 805.a.). Operating controls and mechanisms of such doors may need shielding to prevent water damage. These sprinkler systems may be supplied independently of the main hangar systems. Where operation of hangar doors accommodating aircraft may result in interference with distribution of water from the hangar sprinkler systems, auxiliary sprinklers shall be added to insure effective floor coverage.

c. Where aircraft storage or servicing areas are protected by automatic sprinklers, adjoining and communicating areas should be protected with automatic sprinklers or by other types of automatic fire extinguishing equipment approved by the authority having jurisdiction.

1513. WATER SUPPLY.

a. GENERAL.

(1). Supply for sprinklers shall be capable of furnishing water for the largest number of sprinklers which may be expected to operate from one fire starting at any point in the largest aircraft storage or servicing area. It shall be acceptable to the authority having jurisdiction.

(2). Where the water supply for sprinklers also serves as a supply for standpipes or hydrant hose streams, the total supply should be increased in accordance with the largest number of hose streams likely to be used in case of fire in the hangars. In most cases 500 to 1,000 gallons-per-minute to supply hose streams should be added to the fire flow requirements.

b. SPECIFIC REQUIREMENTS. Supply for sprinklers shall be capable of furnishing water at a rate of not less than 15 gallons-per-minute for not less than the number of sprinklers specified in the following Subparagraphs. Minimum water supply requirements are specified to avoid unduly small draft-curtained areas being advocated as a basis for inadequate supplies.

(1). Aircraft storage or servicing areas not over 35 feet in height having draft stops conforming to Paragraph 1510, or of such size as not to require draft stops, shall have water supplies sufficient for the operation of the largest number of sprinklers, excluding open sprinklers along draft stops, obtained by assuming that a fire at any point will operate all the sprinklers in every draft-curtained area that is wholly or partially within 50 feet of that point (measured horizontally).

(2). Aircraft storage or servicing areas over 35 feet in height having draft stops conforming to Paragraph 1510, or of such size as not to require draft stops, shall have water supplies sufficient for the operation of the largest number of sprinklers, obtained by assuming that a fire at any point will operate all the sprinklers in every draft-curtained area that is wholly or partially within 75 feet of that point (measured horizontally).

(3). When draft stops are not provided as specified in Paragraph 1510, water supply requirements should be calculated on the assumption that all sprinklers in the aircraft storage or servicing area not subdivided by fire division walls will open.

(4). Aircraft storage or servicing areas with large doors on both ends may present special draft problems affecting the efficient operation of the installed sprinklers. The authority having jurisdiction may require additional sprinklers to be included in the calculation of water supply demand in such cases.

(5). The supply shall be capable of delivering water at the rate specified, at a pressure sufficient to discharge this amount through any group of the specified number of sprinklers.

(6). With systems designed in accordance with Paragraph 1507.c., the pressure at which the required quantity is available should be not less than 15 pounds plus the pressure equivalent of the elevation to the top line of sprinklers plus the friction loss up to the risers and in the risers and feed mains (not the cross mains or branch lines).

(7). The supply shall be so arranged that the required pressure is maintained at all times. Underground water supply mains shall be designed to deliver water at a velocity not exceeding 16 feet per second.

(8). The supply shall be available at the rate specified, for a period of at least 45 minutes.

c. FIRE PUMPS.

(1). To reduce friction losses and maintenance costs and to increase reliability and adequacy, fire pumps and water tanks should be located close to hangar areas. Pump houses and rooms should be of fire resistive construction (see Paragraph 401). Where pump rooms adjoin hangars, they shall be cut off from aircraft storage or servicing areas by walls or partitions having a fire resistance of not less than one hour. Pump rooms connected to hangars shall have no direct access from the aircraft storage or servicing areas and pumping equipment shall be adequately safeguarded against interruption of service through damage by fire, windstorm or flood.

(2). Fire pumps shall be started automatically by a drop in water pressure. In addition they should be started automatically by operation of the sprinkler system (dry pipe valve, deluge valve, etc.). Where two or more electrically driven fire pumps are used, the automatic operation should be arranged so that pumps start successively. (See "Standard for Installation of Centrifugal Fire Pumps", No. 20.)

(3). Frequent operation of fire pumps such as might result from leakage from underground pipe shall be avoided by the installation of a small auxiliary pressure maintenance pump or other suitable means to maintain normal system pressures.

(4). Once started, fire pumps should be arranged to run continuously until they are stopped manually, in which case there should be audible alarm provided.

d. SOURCES OF SUPPLY. The development of satisfactory water supplies is a matter requiring careful analysis of local conditions and engineering judgment. Subparagraphs (1) and (2) below outline general suggestions of an advisory nature. The authority having jurisdiction should be consulted for recommendations applicable to specific situations. (See "Standard for the Construction and Installation of Water Tanks for Private Fire Protection Service", No. 22, and "Standard for the Installation of Centrifugal Fire Pumps", No. 20.)

(1). Acceptable types of water supplies may consist of one or more of the following: (a) Connections to reliable water works systems including automatic booster pumps where required; (b) Automatic fire pumps taking suction under a head from storage reservoirs or other suitable supply; (c) Gravity tanks. Combinations of these supplies may be used to advantage. It is desirable to have two independent water supplies. Where reliance is placed upon automatic fire pumps special consideration should be given to the use of multiple pumps in preference to single pumps and the use of multiple sources of power in order to increase the reliability of such water supply. Water supplies should be guarded against entry of foreign material which would clog sprinklers or piping. (See also Paragraph 2101.)

(2). Water works connections, when used as an independent supply, should be capable of delivering water at the specified rate and pressure, as determined by flow tests, due consideration being given to any conditions which may have an effect on the supply or pressure. Investigation should be conducted as to the normal and emergency operation of the water works system

(including domestic consumption and operation of water works pumps at time of test), pressure reducing valves or other factors affecting adequacy of a public water supply. Automatic fire pumps may be used to provide effective pressure from water works connections.

1514. MAINTENANCE OF SPRINKLER EQUIPMENT.

a. Sprinkler equipment requires competent and continuous care and maintenance to effectively perform its purpose at time of fire. Sprinkler equipment should be serviced, tested and operated periodically by men experienced in this work. An inspection contract with the installer of the equipment for service, test and operation at regular intervals is recommended and may be required by the authority having jurisdiction. Authorities having jurisdiction should require reports giving details of such service. (See the pamphlet "Care and Maintenance of Sprinkler Systems", No. 13A.)

Chapter 16. Foam-Water Sprinkler Systems.

1601. GENERAL.

a. Foam-water sprinkler systems are intended to provide an extra margin of protection over standard deluge sprinkler systems covered by Chapter 15. The foam discharge tends to cover the floor area regardless of intervening obstructions and should be capable of blanketing and smothering flammable liquid spill fires of the types likely to be encountered in aircraft hangars.

b. Foam-water sprinkler systems are for operation with foam of the type known as air foam (or mechanical foam) produced by aerating a solution formed by adding air foam liquid to water in equipment approved for this liquid.

c. Where adequate floor drainage cannot be provided, that is drainage capacity adequate for removal of possible discharge from fuel tanks, plus the maximum anticipated discharge of sprinkler systems and hose streams without permitting liquids to accumulate on the floor, a foam-water sprinkler system has a definite advantage over a deluge sprinkler system. (See Chapter 9.)

d. In the event of fuel spillage, foam-water sprinkler systems may be operated manually to quickly blanket the area of spill whether or not ignition has occurred.

e. In addition to the provisions of this Chapter foam-water sprinkler systems shall conform to all the provisions for standard deluge type water sprinkler systems as covered by Chapter 15, Sprinkler Systems. The system shall be arranged to continue automatically as a deluge type water sprinkler system after foam injection is completed.

1602. PLANS AND SPECIFICATIONS. In addition to the items specified in Section 1502, plans and specifications shall indicate the quantity of air foam liquid (stabilizer) to be stored, the type of foam liquid to be used including specific gravity, and percentage of foam liquid to water-foam solution (such as 3% or 6%).

1603. ACCEPTANCE TESTS.

a. HYDROSTATIC. Foam liquid piping shall receive the same hydrostatic test required in Section 1504.

b. FOAM DISCHARGE TEST.

(1). Acceptance test should include (1) the discharge, using foam liquid, of a single system and (2) the simultaneous discharge (with foam) of the maximum number of systems expected to operate with the single system tested. The tests should be run for sufficient time to obtain stabilized discharge. Three-minute operation of systems is recommended.

(2). During the test the pressure at the foam-water sprinklers should be at least equal to the minimum designed operating pressure for the system or systems tested. Percentage of foam liquid injected into the water should be at the nominal rate indicated under Paragraph 1602 with allowance for minor variation. The amount of variation shall be within limits established by the approval authority for effective operation of foam-water sprinklers.

1604. LOCATION OF FOAM LIQUID APPARATUS. Apparatus furnishing the foam liquid supply should not be located in the same fire area containing the hazard which it protects, and shall not be subject to an exposure fire in the hazard which it protects.

1605. FOAM LIQUID INJECTION. Foam liquid injection shall be activated automatically by or concurrently with activation of the main water deluge valve, and shall also be arranged for manual control as fire conditions warrant.

1606. PIPE. Sprinkler piping beyond the deluge valve shall be of a material to satisfactorily protect against atmospheric corrosion and any deleterious effects of the foam solution.

1607. TYPE OF SPRINKLERS. Foam-water sprinklers shall be of makes and types for the application of both air foam and water, approved for this class of service.

1608. STRAINERS.

a. Approved strainers shall be installed in the main water supply lines feeding orifices (or water passages) smaller than 3/8-inch. Strainers should be installed on systems having larger orifices where water supply conditions warrant.

b. Strainers should be installed in foam liquid lines at the entrance to metering orifices or proportioning devices.

c. A strainer is required in the foam liquid pump suction line from the foam liquid storage tank by Section 1614. e.

1609. SYSTEM DESIGN. Devices shall be so spaced and the system hydraulically engineered to provide a water discharge rate averaging not less than 0.17 gallons per minute per square foot of protected floor area with a maximum allowable variation per sprinkler of 15 per cent.

1610. WATER SUPPLY. Water supply for foam-water sprinklers shall be of capacity and pressure capable of maintaining foam discharge at a water rate of not less than the specified minimum discharge density as indicated in Section 1609 for the required period of foam discharge over the entire area protected by systems expected to operate as described in Paragraphs 1513. b. (1). and (2). The total water supply furnished shall conform with the standard requirements for deluge sprinkler systems in Section 1513.

WARNING: If water supply is dependent on public water sources attention must be given to the pollution hazard and any cross connections cleared with the public health agencies concerned.

1611. FOAM LIQUID PUMPS. Foam liquid pumps and their power supplies shall provide reliability equivalent to that of an

approved fire pump. The pump shall be suitable for the foam liquid used.

1612. PRESSURE ON FOAM LIQUID LINES. Where foam liquid lines are run underground, or aboveground for more than 50 feet, foam liquid should be maintained in these lines under pressure to assure prompt foam application and to provide a means of checking on the tightness of the system. Pressure may be maintained by the installation of a small auxiliary pump or other suitable means. Means shall be provided to cause a signal in the event of any loss of foam liquid.

1613. FOAM LIQUID SUPPLY.

a. Foam liquid shall be of the same type and characteristics as that used in laboratory tests for approval listing of the particular foam-water sprinkler used. Foam liquid shall be stored in sufficient quantity to supply all systems expected to operate [see Paragraphs 1513. b. (1). and (2).] in the prescribed proportion and at the minimum water discharge rate specified in Section 1609 for a period of 10 minutes. Where the designed water discharge rate exceeds that specified in Section 1609, foam discharge time may be reduced porportionately but to not less than seven minutes.

b. In addition there should be an equal reserve supply of foam liquid directly connected to the foam liquid pump. This supply shall normally be shut off from the foam liquid pump by an indicating type valve. This additional supply is to enable the immediate return to normal operating condition after the fire.

c. Temperatures maintained in foam liquid storage shall be within limits to assure proper functioning of the system.

1614. FOAM LIQUID STORAGE TANK.

a. Storage tanks for air foam liquid shall be of construction suitable for the liquid, solidly mounted and permanently located.

NOTE: The liquid is heavier than water.

b. The primary and reserve supplies of foam liquid shall be stored separately in individual tanks or in one compartmented tank. In order to minimize interior tank and foam liquid surfaces in contact with air, the size of each tank or compartment shall be only large enough to accommodate the foam liquid required

with adequate space for outage, the latter to be preferably accomplished by means of a vertical riser.

c. Tanks shall be equipped with suitable conservation type vents of adequate capacity; access handholes or manholes located to provide for visual inspection of interior tank surfaces; connections for pump suction, relief and testing lines; protected sight gauges; liquid level devices; and adequate filling and draining connections.

d. Tanks shall be so located as to furnish a positive head on the pump suction.

e. The foam liquid pump suction shall be provided with a strainer so installed that the strainer can be cleaned.

f. The foam outlet from the tank should be raised above the bottom of the tank to provide an adequate sediment pocket.

1615. TESTING OF FOAM LIQUID SYSTEM. The foam liquid injection system shall be so arranged that periodic testing may be made of foam liquid pump injection equipment. Proportioning devices and strainers shall be checked and cleaned at the time of inspection. The system should be so arranged that test can be performed with as little loss of foam liquid as practicable.

1616. MAINTENANCE.

a. Foam-water sprinkler systems because of their unusual nature require competent and continuous care and maintenance to assure that they will perform their purpose effectively in time of fire. They should be serviced, tested and operated periodically (not less than semiannually) by men experienced in this work. These tests should include a qualitative test of the foam liquid. An inspection contract with the installer of the equipment for service, test and operation at regular intervals is recommended and may be required by the authority having jurisdiction.

b. Copies of inspection reports, including test of foam liquid, should be submitted to the authority having jurisdiction.

c. Systems shall be thoroughly flushed with water after operation with foam except those portions normally containing foam liquid when the system is not operating. Particular attention should be given to strainers or other small openings.

Chapter 17. Fixed Standpipe and Hose Systems (All Types).

1701. GENERAL.

a. Facilities shall be provided within every hangar to supply water hand hose lines (see Paragraph 1705.b.). Foam, carbon dioxide and dry chemical types of standpipe and hose systems are recommended for combating flammable liquid fires. Carbon dioxide and dry chemical types are also suitable for electrical fires.

b. At least one station of each type of fixed standpipe system installed in the aircraft storage or servicing area shall be located near the hangar door equipped with at least 150 feet of hose to provide protection on hangar apron areas.

1702. WATER STANDPIPE AND HOSE SYSTEMS.

a. INTERIOR.

(1). (See Paragraph 1701.) Interior water standpipes for hose systems installed in aircraft storage or servicing areas shall be not less than 2 inches in diameter and should be so located that with not more than 100 feet of hose connected to each, any part of the hangar or an aircraft therein may be effectively reached. (In very large hangars, additional hose may be required at each standpipe to accomplish the range specified.) The installation of such systems shall be in compliance with the "Standard for the Installation of Standpipe and Hose Systems" (No. 14) and "Standard for Water Spray Systems" (No. 15).

(2). The water supply for hose streams preferably should be from an independent connection to the underground water supply system. Small hose may be supplied from sealed head wet pipe sprinkler systems if connected to not less than 2½-inch pipes.

(3). The 1½-inch fire hose supplied for use inside hangars shall be equipped with suitable nozzles of the adjustable straight stream and spray type with the solid stream orifice not to exceed ½-inch nominal.

b. ROOF CONNECTIONS.

(1). Hose connections and hose should be installed on roofs of hangars having combustible roof coverings, regardless of roof deck construction, when such roofs exceed 25,000 square feet in area, or 50 feet in height, or 100 feet in smallest dimension.

(2). Roof hose connections should be spaced to cover all points of the roof not readily covered from the ground. They may be supplied from 2½-inch or larger wet pipe sprinkler mains. 1½-inch hose connections should be spaced not over 200 feet apart and not over 75 feet of 1½-inch hose with ½-inch nozzle should be supplied from each hose connection.

(3). Roof hose connections for hangars having deluge or dry pipe systems should be supplied from the standpipe riser for hose systems but may be supplied through a connection to the sprinkler system located below the sprinkler riser control valve with a cold weather valve located in the heated sprinkler valve house.

(4). In unheated, unsprinklered hangars, roof hose connections should be supplied through a cold weather valve in a heated valve house. In cold weather, the lines to roof hose connections should be kept shut off and should be properly drained. They should be maintained wet during warm weather months.

(5). Usual consideration should be given to the design of supply mains to roof hose connections in regard to length of piping and water supplies available. Mains should be capable of supplying at least 2 lines of hose being discharged simultaneously.

(6). Hose connection houses should be properly heated and constructed to serve the purpose.

(7). For ladders to roofs, see Paragraph 804.e.

1703. CARBON DIOXIDE STANDPIPE AND HOSE SYSTEMS (WHEN INSTALLED).

a. (See Paragraph 1701 and the Standard on "Carbon Dioxide Extinguishing Systems", No. 12.) Carbon dioxide hose stations shall be located so that all the floor area in the aircraft storage or servicing area (or other areas requiring this special protection) can be effectively reached with at least two lines.

b. Controls shall be arranged so that each hose line can be put into operation by one man at the hose reel station. A manual discharge control valve shall be provided at the nozzle.

c. The supply pipe and length of hose shall be designed to provide an effective discharge of carbon dioxide in not more than 30 seconds. In addition, the supply piping shall be adequate to permit the effective use of at least any two hose lines at the same time.

d. Hose lines suitable for this use can be secured to provide a discharge rate of from 200 pounds-per-minute to 600

pounds-per-minute and the selection of equipment will depend on the nature of the protection requirements. Lower discharge rates may be used for protection of localized special hazards. Hose used shall be of a type that will permit discharge without complete removal from reel or rack.

e. The carbon dioxide supply shall be at least sufficient for any hose line or group of hose lines which may be used at one time to provide continuous operation for 2½ minutes.

1704. DRY CHEMICAL STANDPIPE AND HOSE SYSTEMS (WHEN INSTALLED).

a. (See Paragraph 1701 and the Standard on Dry Chemical Extinguishing Systems, No. 17.) Dry chemical hose stations shall be so located that all floor area in the aircraft storage or servicing area (or other area requiring this special protection) can be effectively reached with at least two lines.

b. Controls shall be arranged so that each hose line can be put into operation by one man at the hose reel station. A manual discharge control valve shall be provided at the nozzle.

c. The supply pipe and length of hose shall be designed to provide an effective discharge of dry chemical in not more than 30 seconds. In addition, the supply piping shall be adequate to permit the effective use of at least any two hose lines at the same time.

d. Hose lines suitable for this use can be secured to provide a discharge rate of from 200 pounds-per-minute to 500 pounds-per-minute and the selection of equipment will depend on the nature of the protection requirements. Lower discharge rates may be used for protection of localized special hazards. Hose used shall be of type that will permit discharge without complete removal from reel or rack.

e. The dry chemical supply shall be at least sufficient for any hose line or group of hose lines which may be used at one time to provide continuous operation for 2½ minutes.

1705. FOAM STANDPIPE AND HOSE SYSTEMS (WHEN INSTALLED).

a. (See Paragraph 1701 and the Standards for "Foam Extinguishing Systems", No. 11.) Air (mechanical) foam should be used in these systems because of its stability should water be subsequently discharged in the same area.

b. Where aircraft storage or servicing areas are protected by foam-water sprinkler systems as specified in Chapter 16, fixed foam standpipe and hose systems supplied by such foam-water sprinkler systems may be used in lieu of water standpipe and hose systems (see Paragraph 1701.a.).

c. Where aircraft storage or servicing areas are protected by standard automatic sprinkler systems, foam from fixed standpipe systems may also be used, if backed up with water. Foam nozzles in such cases should be of such design as to permit discharging a satisfactory stream of water alone, after foam discharge ceases. Foam-water hand hose lines should be installed in accordance with the provisions of Paragraph 1702.a.

d. When used in unheated hangars, air foam mixing equipment shall be located in enclosures heated (where required) to 50-75 degress F. so as to prevent freezing and to obtain the optimum chemical mixture of stabilizer and water.

e. Foam standpipe extinguishing systems shall be designed to provide for the simultaneous use of two streams of 50 gallons-per-minute of water (including foam liquid) each for a period of 10 minutes in sprinklered hangars and 20 minutes in nonsprinklered hangars. A full recharge for an equivalent amount (two standpipes) of foam producing material shall be maintained in reserve.

Chapter 18. First Aid Appliances.

1801. WHEELED EXTINGUISHERS. Every aircraft storage or servicing area shall be provided with at least one (1) approved wheeled extinguisher for each 25,000 square feet of floor area or greater part thereof. These wheeled units shall have minimum capacities of at least 33 gallons foam, 75 lbs. of dry chemical, or 100 lbs. of carbon dioxide. Where carbon dioxide, dry chemical or foam standpipe and hose systems, as described in Paragraphs 1703, 1704, and 1705 respectively are provided, portable wheeled units are not required.

1802. PORTABLE HAND EXTINGUISHERS. In every hangar, the fixed standpipe and hose systems or wheeled units shall be supplemented by approved portable fire extinguishers on the basis of one unit for each 2,500 square feet or greater portion thereof. (See Standard for Portable Fire Extinguishers, No. 10.)

Chapter 19.

Sprinkler Alarms and Fire Detection Systems.

1901. SPRINKLER ALARMS. In addition to local alarm service, waterflow alarms should be transmitted to the airport fire department headquarters (if any), to the airport control tower (if any), and to the public fire alarm headquarters or central station. If the control tower or airport fire department is manned 24 hours a day and is provided with a direct fire alarm box connection to the public fire alarm headquarters or central station, the direct waterflow connection to public fire alarm headquarters or central station may be omitted.

1902. FIRE DETECTION SYSTEMS.* Nonsprinklered hangars should be equipped with an approved automatic fire detection system. Alarms from it should be transmitted to the airport fire department headquarters (if any), to the airport control tower (if any), and to the public fire alarm headquarters or central station. If the control tower or airport fire department is manned 24 hours a day and is provided with a direct fire alarm box connection to the public fire alarm headquarters or central station, the direct connection from the automatic fire detection system to the public fire alarm headquarters or central station may be omitted. (See Standards for Protective Signalling Systems, Nos. 71, 72.)

Chapter 20. Employee Organization for Fire Safety.

2001. All personnel in and about the hangar should be trained in the operation of all fixed and portable fire extinguishing equipments provided in the hangar. Periodic drills under simulated fire emergency conditions should be conducted. Other provisions of the Standards on "Private Fire Brigades" (No. 27) and on "The Watchman" (NFPA No. 601) should be followed. NFPA pamphlets on "Employee Organization for Fire Safety" and "Industrial Fire Brigades Training Manual" give additional guidance on this subject.

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*See footnote to Paragraph 1101.

Chapter 21. Exterior Fire Protection Facilities for Hangars.

NOTE: This Chapter is not intended to cover specifications for general exterior fire protection services for airports but is restricted to good practice recommendations for the protection of hangar structures and their contents.

2101. WATER SUPPLY—GENERAL. The airport should be provided with an adequate water supply for fire department use. This supply may be from suitable connections to a municipal underground source, from nearby surface supplies or from reservoirs or similar static sources. (See Standard for "Outside Protection", No. 24, for guidance on this subject.) Because elevated water tanks may constitute a hazard to air navigation (see Paragraph 106), ground reservoirs are normally used at airports if adequate water supplies are not available from municipal water supply systems or other sources.

2102. WATER SUPPLY—HANGAR PROTECTION.

a. For aircraft hangar protection purposes, the supply for hydrants (exclusive of sprinkler, inclusive of standpipe requirements) should be adequate to produce at least 500 to 1,000 gallons-per-minute for 45 minutes where the hangars are provided with automatic protection (see Chapters 15 or 16 and Paragraph 1513.a.(2)) and at least 1,500 to 2,000 gallons-per-minute for 45 minutes where the hangars are not so protected. The quantities specified should be delivered at the hydrant with at least 20 pounds-per-square-inch pressure where fire department pumpers are available and at least 75 pounds-per-square-inch pressure where direct hydrant hose streams are to be used.

b. Where pumps are required to provide the fire flows specified in Paragraph 2102.a., the Standard for the "Installation and Operation of Centrifugal Fire Pumps" (No. 20) shall be used as a guide.

c. Underground water supply piping serving hangar areas should be no smaller than 8 inches and should be part of the airport grid system to assure reliability and minimize friction loss.

d. Hydrants should be spaced according to the hazard requirements of each hangar. Where flush type hydrants are used their location shall be clearly marked and access to them shall be maintained by prohibiting aircraft or vehicle parking within a minimum of 10 feet radius (measured from any portion of air-

craft) and by keeping such hydrant locations clear of snow or ice accumulations during winter months.

2103. USE OF MOBILE FIRE EQUIPMENT.

a. AIRPORT FIRE DEPARTMENTS. Aircraft rescue and fire fighting equipment (see Paragraph 105.b.) and other mobile fire fighting equipment available at the airport should be very valuable in handling aircraft fires on hangar aprons and in the aircraft storage or servicing areas of hangars. Personnel manning such equipment should be trained in their application for this purpose, particularly as to their use and maneuverability within hangars. Aircraft parking methods, both on aprons and in hangars, should make proper allowances for emergency accessibility to assure the effective use of such equipment.

b. PUBLIC AND PRIVATE FIRE DEPARTMENTS. Airport managements should encourage the indoctrination and training of nearby public and private fire departments in the special problems of aircraft fire fighting and should assure that personnel in such departments are fully familiar with the airport's fire protection facilities.

PART D

CONSTRUCTION AND PROTECTION OF WING OR NOSE HANGARS.

Chapter 22. Definition.

2201. A wing or nose hangar is a structure which provides shelter for the servicing of aircraft without housing the aircraft aft of the trailing edge of the wings. Wing or nose hangars may have extensive service shops and offices incorporated within the structures.

Chapter 23. Construction, Wing or Nose Hangars.

2301. The construction of wing or nose hangars shall conform to the applicable portions of the recommendations contained in Part B, "Construction of Aircraft Hangars." In addition, the following recommendations are made:

a. Where canvas or other types of combustible curtains are used to enclose work areas, they shall be of an approved flame resistant type.

b. The provisions for floor drainage specified in Paragraphs 902.a.b.d.e.f.g. and h. of Chapter 9 should apply to the aircraft servicing areas under roof coverage.

Chapter 24. Protection, Wing or Nose Hangars.

2401. The protection of wing or nose hangars shall conform to the applicable portions of the recommendations contained in Part C, "Protection of Aircraft Hangars". In addition, the following recommendations are made:

a. The provisions of Chapters 15 and 16 shall apply to the roofed area of wing or nose hangars insofar as practical. The design of draft stops and water curtains may have to be individually engineered to assure maximum operating efficiency. The advice of the authority having jurisdiction should be sought for such special cases.

b. Fixed standpipe and hose systems shall be located so as to afford maximum coverage within the concepts specified in Chapter 17 with at least one station on each side extremity of the wing or nose hangar or at the exterior terminus of fire walls.

c. Each wing or nose hangar, regardless of size should be provided with at least one (1) approved wheeled extinguisher as defined in Paragraph 1801 of Chapter 18.