Report of the Committee on Airport Facilities

Gene E. Benzenberg, Chair
Alison Control Inc., NJ [M]

Michael E. Aaron, The RJA Group, Inc., IL [SE]
Thomas G. Burk, Federal Express Corp., TN [U]
David J. Burkhardt, Code Consultants Inc., MO [SE]
Bruce G. Carpenter, Aero Automatic Sprinkler Co., AZ [IM]
Joseph E. Gott, U.S. Naval Facilities Eng Command, DC [E]
L. Matthew Gwinn, Delta Air Lines, GA [U]
L. M. Krasner, FM Research, MA [I]
Keith C. Krednow, Marsh USA, Inc., IL [I]
Gene A. LaValle, Sentroll, Inc., GA [M]
Thomas J. Lett, Albuquerque Fire & Safety Assoc., NM [SE]
Edward V. Lockwood, U.S. Army Corps of Engr, VA [U]
Richard J. Louis, The Port Authority of New York & New Jersey, NY [E]
Sarah Maman, Schirmer Engr Corp., FL [SE]
Christy J. Marsolo, Tyco Int'l Ltd., GA [M]
Al Mazur, Transport Canada, ON, Canada [E]
John J. O'Sullivan, British Airways, PLC, England [U]
Maurice M. Pietta, Mechanical Designs Ltd, MA [SE]
Jack Poole, Pool Fire Protection Eng., Inc., KS [SE]
Randy D. Pope, Burns & McDonnell Eng Co., MO [SE]
Robert Saunders, Tyco Design Consultants, UT [SE]
(Mark T. Conroy)

Thomas J. Lett, Albuquerque Fire & Safety Assoc., NM [SE]

Alternates

Delbert R. Chase, Jr., Federal Express Corp., TN [U]
Ronald B. Coker, Carter & Burgess, TX [IM]
James M. Freeman, Industrial Risk Insurers, GA [I]
Kevin M. Green, Schirmer Engr Corp., CA [SE]
Frank M. E. Hughes, British Airways, PLC, England [U]
Dennis C. Kennedy, Ansul Fire Protection, WI [M]
John E. Loehe, Air Nat'l Guard Readiness Center, MD [U]
Danny Luey, Port Authority of New York & New Jersey, NY [E]
Robert C. Merritt, FM Global, MA [I]
Robert J. Tabet, Naval Facilities Engr Command, VA [E]

Nonvoting

Jerome Lederer, Laguna Hills, CA

Staff Liaison: Mark T. Conroy

Committee Scope: This Committee shall have primary responsibility for documents on fire safety for the construction and protection at airport facilities involving construction engineering but excluding airport fixed fueling systems.

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. A key to classifications is found at the front of this book.

The Report of the Technical Committee on Airport Facilities is presented for adoption.

This Report was prepared by the Technical Committee on Airport Facilities, and proposes for adoption, amendments to NFPA 409, Standard on Aircraft Hangars. 1995 edition. NFPA 409-1995 is published in Volume 6 of the 2000 National Fire Codes and is in separate pamphlet form.

This Report has been submitted to letter ballot of the Technical Committee on Airport Facilities, which consists of 26 voting members of whom 19 voted affirmatively, 3 negatively after circulation of negative ballots (Krasner, Lett, Marsolo), and 4 ballots were not returned (Dick, Kremkow, Lockwood, Skinner).

Mr. Joyce voted affirmative with the following comment:

“409-2 (Log #2). I agree in principle that there needs to be guidance concerning Group III hangars at least in the area of the usage of foam in fixed systems where the hangar is not large enough to require a full foam-water system but still is required by local code to be suppressed.”

Mr. Joyce voted affirmative with the following comment:

“409-6 (Log #CP17). Do not agree with the use of low level foam systems in lieu of overhead foam-water deluge. Actuation of the low-level systems has not been properly addressed. The “real world” of potential obstructions has not been properly addressed.”

Mr. Krasner voted negatively stating:

“For the past 20 or so years, the minimum acceptable protection requirements for Group I aircraft hangars has remained constant. Although the established radius rule has long been known to be in need of revision, it could be modified without changing the basic Group I hangar requirement of foam-water deluge. That basic requirement has been in effect over the 20 year period and has been based on a fairly constant hardware technology and foam agent base. In essence, during that time period, there have been no significant advancements in foam agent formulations resulting in better control/ extinguishment capability when discharged through supplemental or low level systems. In addition, as of this writing, there have been no significant advancements in listed/approved hardware capable of delivering that same foam agent to the fire through a supplementary or low level system. What then is the justification for drastically changing minimum acceptable protection requirements for Group I hangars (409-6, Log #CP17)? The answer is still not clear to me based on stated substantiation #4. However, the motivation for change is clear. As stated by several committee members on numerous occasions, the motivation is two-fold: 1) reduce the cost of protection and 2) minimize potential environmental issues (and associated costs) when deluge systems are discharged during a fire or inadvertently. It is also not clear to me whether the NFPA does or should condone change based primarily on such motivation without a clear stated conviction (with data to back it up) of at least equivalent levels of mandated minimum protection.

With the above said, I can accept that it may be time for change even if based on the stated motivation. However, if change is to be initiated, I believe a less radical option could have been promoted (e.g., closed head AFFF ceiling systems). It should be noted that the basic concept for the proposed new Group I protection options only narrowly moved forward in committee (from task group report) by a single vote at the October 1999 committee meeting.

It may even be possible to convince me that the proposed change to all our eggs in one foam basket, so to speak, is acceptable if we significantly tighten up related protection issues associated with the proposed new options. At the last committee meeting (3/27 and 3/28), considerable deliberation ensued regarding some of those issues and resulting in a certain amount of compromise. Unfortunately, minutes from that meeting were not provided along with the ballot, making it difficult to document issues discussed and other agreed upon related changes.

Two specific points from recollection are as follows:

1. Although the documentation provides a substantiation (#8) for mandatory trench drainage, no associated chapter two revised text is provided for this one of several compromise issues.

2. The task group in its presentation for acceptance of their recommendation, used the terminology of 100 percent floor coverage for the low level system requirement. The chapter three draft (3.2.5.3.3 and 3.2.5.4.3) requires that the discharge rate of the system shall be based on rate of application multiplied by the entire aircraft storage and servicing area. However, there is no requirement that the discharge actually be

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designed to cover the entire floor area. This issue was discussed at length including what constitutes “100 percent” floor coverage, within what time criteria and acceptance testing for validation. My recollection is that specific text was debated and voted and yet I see nothing on the issue in the proposed rewrite of chapter three. If I for one am to be convinced, at the very least we need to do a better job in addressing these and other related issues. I would encourage other committee members to reconsider their vote when this negative ballot is circulated. At the next meeting, we may then be in a position to do the job correctly or not at all.”

Mr. Lett voted negatively stating:
“1. 3-2.5.3.3 Why have the entire floor area specified when other sections such as 3.2.4.5 cite 15000 ft²? (This also affects cales per 3.2.6 and 3.2.7 et al.)
2. Negative on 3.2.4 and 3.2.9.3.4. These paragraphs need a general comment on the need for the occupants to receive safety training. Also, stream range should be addressed. Suggest the following sentence be added to 3.2.9.3.4: “A combination nozzle stream range shall be at least 15 ft in spray pattern and 25 ft in solid stream mode”.
3. Negative on paragraph 4.8.2(a) and (b). Why should unfueled ALFT take 60 minutes worth of water while (loaded) fueled ALFT take only 30 minutes?
4. Editorial Comments:
   (a) Suggest Coalesce paragraphs A.3.2.8.3.1 and A.3.2.8.5.1.
   (b) Reference paragraph 3.2.2.3, suggest insertion of words “per sprinkler head”.
   (c) Reference paragraph 3.2.3.4.5 suggest insertion of “temporary” after “nozzle” and before “removed”.
5. These comments concern 409-6 (Log #CP17), Chapters 2, 3, and 4. I have considered the other Committee Proposals that impact on Chapters 2, 3, and 4.”

Mr. Marsolo voted negatively stating:
“409-6 (Log #CP17). The substantiation (4) presented in this proposal, “these designs are to better cover the hangar floor area when random parking positions are used” has not proven and is not an adequate substantiation.
The Group I hangar requires the entire floor area to be covered with foam. The overhead foam deluge requirement, presently the only option for Group I (3-1.1), is the best way and proven way to accomplish this demand, and has been in the standard for years. The new proposal [3.1.1(b) and 3.1.1(c)] and the substantiation does not consider the following:
1. The everyday clutter of tool boxes, work platforms, aircraft parts, etc., on the hangar floor that obstruct monitor nozzles from delivering the proper coverage required.
2. The new requirement 409-18 (Log #CP9) for the monitor nozzles to be permanently secured once installed does not allow for aircraft random parking positions.
3. The cost of the new designs [3.1.1(b) and 3.1.1(c)] are much less, therefore making the overhead foam deluge system option seldom considered, as it presently does for Group II hangars.
4. Achieving initial foam coverage from low and high expansion foam (3.2.5.3.4) when the overhead water sprinkler system has to activate first (3.2.8.5.1) to activate the low and high expansion foam systems.

This proposal did not provide adequate substantiation to include these new designs. Again, the overhead deluge system can provide the coverage needed quicker and better than the new design options and without allowing the length of time and the non-coverage as proposed in 409-17 (Log #CP20).”

Note: Supporting material is available for review at NFPA Headquarters.
I am writing to you for guidance in regards to the aircraft hangar classifications offered by NFPA Standard 409: Group I, Group II, and Group III. Groups I and II require fixed fire protection foam systems, while Group III requires nothing.

The need for an additional classification would seem obvious, in view of the fact that the standard does not properly address “General Aviation” hangars, small (5,000 sq. ft. and less) hangars in which only incidental maintenance takes place. “Incidental maintenance” consisting of oil changes, tune-ups, valve calibration, electronics repair, and the changing of cylinders and pistons. As soon as the word “maintenance” is even mentioned, the facility can no longer be classified as a Group III hangar (storage).

We have consulted this issue with the Dade County Aviation Department's insurance carrier, Factory Mutual. Their recommendation for “General Aviation Hangars” (5,000 sq. ft. and less), based on NFPA's Loss Prevention Data Sheet 3-26 - Water Demand for Nonstorage Splinkered Properties, is to provide a fixed overhead wet-pipe fire protection system designed for a density of 0.25 gpm/sq ft. over 3,000 sq ft. This recommendation applies to hangars in which aircraft with wing areas of 500 sq ft. or less are serviced, and in which hazardous operations such as fuel transfer, welding, torch cutting, torch sanding, doping and spray painting, do not take place.

Furthermore, we have also consulted this issue with the engineering office of the National Fire Protection, and been informed that NFPA 13, Standard for the Installation of Sprinkler Systems, addresses this specific “General Aviation” application as an Extra Hazard Group 1 occupancy, requiring a fixed overhead wet-pipe fire protection system designed for a density of 0.28 gpm/sq ft. over 3,000 sq ft.

Nonetheless, inspection of NFPA-13, paragraph A-1.4.7.3.1 “Extra Hazard Occupancies” (Group 1) include occupancies having conditions similar to: Aircraft hangars (except as governed by NFPA-409)*, establishes, in the eyes of the public official, that the governing standard for all aircraft hangars is NFPA-409, and the circle starts all over again, with “mom and pop” hangars having to install fixed foam fire protection systems. Many can not afford to, and desist. Any guidance which you may be able to provide in regards to this issue would be greatly appreciated, as the Dade County Aviation Department is right now in the middle of an ambitious construction program which involves several of these hangars, and prompt action on your part would greatly expedite the permitting and code compliance process.

**COMMITTEE ACTION:** Reject

**COMMITTEE STATEMENT:** Paragraph 5-9-1 provides a clear requirement for fire protection for Group III hangars where hazardous operations are performed. Where hazardous operations are not conducted, no fire protection system is required.

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**RECOMMENDATION:** Revise the definition of “Fire Area” to become “Hangar Fire Area” as follows:

Hangar Fire Area. An area within an aircraft hangar subject to loss by a single fire because of lack of internal subdivisions as specified in Section 2-2 or Section 5-2 of this standard as appropriate.

**STUBSTANTIATION:** To retain the preferred definition of “Fire Area” by making it specific to hangars.

**COMMITTEE ACTION:** Accept.

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**RECOMMENDATION:** Make the following changes to Clear Space/Separation in Chapter 2:

2-3 Clear Space Distance Requirement Around Hangers

2-3.1 Precautions shall be taken to ensure ready access to hangars from all sides. Adequate separation shall be provided to reduce fire exposure between buildings.

2-3.1.2 No minimum clear space/separation is required between adjacent Group I hangars meeting the requirements of this document.

2-3.1.3 No minimum clear space/separation is required between adjacent Group II hangars meeting the requirements of this document provided the total combined square footage does not exceed the single fire area or the most restrictive construction type present in accordance with Table 1-3.

2-3.1.4 The clear space distances in Table 2-3.2 shall be maintained on all sides of an hangar or group of hangars meeting 2-3.1.1 through 2-3.1.3. Where mixed types of construction are involved, the least fire resistant type of construction present shall be used to determine the clear space required. Where the minimum clear space specified in Table 2-3.2 is not met, the building shall be considered a hangar building cluster.

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**Table 2-3.2 Minimum Separation Distance for Group I and II Hangars**

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Minimum Separation Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I (443) and (332)</td>
<td>50 ft (15 m)</td>
</tr>
<tr>
<td>Type II (222)</td>
<td>50 ft (15 m)</td>
</tr>
<tr>
<td>Type (111), Type III (211), and Type IV (21H)</td>
<td>50 ft (15 m)</td>
</tr>
<tr>
<td>Type II (000)</td>
<td>50 ft (15 m)</td>
</tr>
<tr>
<td>Type III (200)</td>
<td>50 ft (15 m)</td>
</tr>
<tr>
<td>Type V (111) and (000)</td>
<td>75 ft (23 m)</td>
</tr>
</tbody>
</table>

2-3.2.1 Where both exposing walls and openings therein of adjacent single hangar buildings have a minimum fire resistance rating of at least 3 hours, no minimum separation distance shall be required. These buildings shall be considered a hangar building cluster.

Exception No. 1: No minimum clear space distance is required between adjacent Group I hangars meeting the requirements of this document.

Exception No. 2: No minimum clear space distance is required between adjacent Group II hangars meeting the requirements of this document provided the total combined square footage does not exceed the single fire area or the most restrictive construction type present in accordance with Table 1-3.

2-3.2.2 Where the exposing wall and any openings therein of one hangar have a minimum fire resistance rating of at least 2 hours, the minimum separation distance shall be permitted to be reduced to not less than 25 ft (7.5 m) for single hangar buildings.

2-3.2.3* Where the exposing walls of both buildings have a minimum fire resistance rating of at least 2 hours, with all windows protected by listed glass in fixed steel sash having a minimum fire resistance rating of 3/4 hour, with outside sprinkler protection and each doorway protected with one automatically operated listed fire door having a minimum fire resistance rating of 1 1/2 hours, the clear space distance shall be permitted to be reduced to not less than 25 ft (7.5 m) between single hangar buildings. Under such
2-3.1 Where the exposing wall and any openings therein of a hangar have a minimum fire resistance rating of at least 2 hours, the clear space distance shall be permitted to be reduced to not less than 50 ft (15 m) between hangar buildings. 2-3.2* Where the exposing walls of both buildings have a minimum fire resistance rating of at least 2 hours, with all windows protected by listed glass in fixed steel sash having a minimum fire resistance rating of 1 hour, with outside sprinkler protection and each doorway protected with one automatically operated listed fire door having a minimum fire resistance rating of 1 1/2 hours, the clear space shall be permitted to be reduced to not less than 50 ft (15 m) between hangar buildings. Under such conditions, the glass area in the exposing wall shall not be more than 25 percent of the wall area.

A-2.3.2.1 No minimum clear space distance is required between adjacent Group I and II hangars meeting the requirements of this document provided the total combined square footage does not exceed the single fire area or the most restrictive construction type present in accordance with Table 1-3.

SUBSTANTIATION: A single Group I hangar can be built to unlimited size. It follows that two adjacent Group I hangars can be considered as a single hangar, since their total square footage could have been built as a single undivided hangar. Likewise a Group II hangar can be built undivided up to the limits in Table 1-3, therefore, any group of Group II hangars can be considered as a single hangar up to the limits of Table 1-3.

COMMITTEE ACTION: Accept.

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3.1.1 Group I aircraft hangar storage and servicing areas of hangars housing other than unfueled aircraft shall be equipped with an approved automatic foam-water deluge system, as specified in Section 3-2 of this chapter, as the primary protection system. In addition, a supplementary protection system as specified in Section 3-3 of this chapter shall also be provided where applicable.

Exception, where the hangar is a membrane-covered steel frame structure, primary protection shall be provided in accordance with the applicable sections of NFPA 102, Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures, and the provisions of Section 3-3 of this standard without regard to the wing area of the hangared aircraft.

3.1.2 Group I aircraft hangar storage and service areas housing unfueled aircraft shall be provided automatic sprinkler protection in accordance with Section 4-2 and 4-7.

Exception, where the hangar is a membrane-covered steel frame structure, automatic sprinkler protection shall be provided in accordance with the applicable sections of NFPA 102, Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures, and the provisions of Section 3-3 of this standard without regard to the wing area of the housed aircraft.

Revise text as follows:

4.1.1 The protection of aircraft storage and servicing areas of Group II aircraft hangars, other than those housing unfueled aircraft, shall be in accordance with any one of the following:

- A hangar is a membrane-covered steel frame structure, primary protection shall be provided in accordance with the applicable sections of NFPA 102, Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures, and the provisions of Section 3-3 of this standard without regard to the wing area of the housed aircraft.

Revise text as follows:

4-1.1* Group III hangars shall be constructed of any of the types of construction specified in NFPA 220, Standard on Types of Building Construction, and where the hangar is a membrane-covered steel frame structure, the applicable sections of NFPA 102, Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures. Group II hangars shall be constructed of any of the types of construction specified in NFPA 220, Standard on Types of Building Construction, or any combination thereof, and where the hangar is a membrane-covered steel frame structure, the applicable sections of NFPA 102, Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures.

5-9.1 Where hazardous operations including fuel transfer, welding, torch cutting, torch soldering, doping, and spray painting are performed in any Group III hangar, the Group III hangar shall be protected with the fire protection specified in Chapter 4 of this standard and also shall meet the requirements specified in 2-4.2 of this standard.

Exception, where the hangar is a membrane-covered steel frame structure, hangar fire protection shall be provided in accordance with the applicable sections of NFPA 102, Standards for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures, and the provisions of Section 3-3 of this standard without regard to the wing area of the housed aircraft.

Add a new reference as follows:

7-1.1 NFPA Publications


SUBSTANTIATION: The use of membrane structures for providing a weather protection covering for aircraft has become a viable alternative to the traditional construction techniques that have been used for aircraft hangars. When local code officials review potential aircraft hangars they typically reference NFPA 409, Standard on Aircraft Hangars. However, this standard only addresses traditional construction techniques, it does not address membrane structures. When a code official’s review addresses the use of a membrane structure, their unfamiliarity with the construction technique creates questions and a reluctance to digress from NFPA 409. Therefore, guidance should be inserted into NFPA 409.

COMMITTEE ACTION: Reject.
COMMITTEE STATEMENT: Material was not accepted by the Committee but is being published to request comments on the material for consideration at the ROC meeting. The Committee felt that it was incomplete and could not include this material in the document at this time. The Committee provided guidance to a task group to further develop this material for consideration at the ROC meeting.

SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: Revise:

2-17 Draft Curtains.

2-17.1 Draft curtains shall be installed and provided. Draft curtain areas shall be around each roof/ceiling fire suppression system and subdivided such that a single draft curtain area shall not exceed 7,500 square feet. The maximum projected floor area under an individual sprinkler system shall be in accordance with Chapters 3 and 4 of this chapter.

2-17.2 Draft curtains 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 curtains shall be provided with self-closing doors constructed of materials equivalent in fire resistance to the draft curtain itself.

2-17.3 Draft curtains shall extend from the roof or ceiling of aircraft storage and servicing areas not less than one-eighth of the height from the floor to roof or ceiling. Under curved or sloping roofs extending to grade level or close to grade level, draft curtains need not be continued below 16 ft (4.8 m) from the floor.

2-17.4 Structural features of a building that serve the purpose of draft curtains shall be permitted in lieu of specially constructed draft curtains provided they meet the dimensional requirements of Section 2-17.3.

2-17.1 The reason for limiting a draft curtain area to 7,500 square feet is to improve detection and sprinkler response times, and not to limit the fire suppression system size. Draft curtains 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, might best be subdivided by a “grid” system of draft curtains that are both at right angles and parallel to the doors. In arch-type hangars, draft curtains can be hung on exposed interior roof supports running parallel to the doors. The method of installation should be based on obtaining maximum operational efficiency from the sprinkler protection, taking into consideration mean wind conditions, floor drains, floor pitch, and details of occupancy usage.

Chapter 3 Protection of Group I Aircraft Hangars

3.1 General.

3.1.1 The protection of aircraft storage and servicing areas for Group I aircraft hangars, other than those housing unfueled aircraft, shall be in accordance with any one of the following:

(a) A foam-water deluge system, as specified in Section 3.2.3.

In addition, supplementary protection systems as specified in Section 3.2.3 of this chapter shall be provided in hangars housing single aircraft having wing areas greater than 3,000 ft² (279 m²).

(b) A combination of automatic sprinkler protection in accordance with Section 3.2.4 of this chapter AND an automatic low-level low-expansion foam system in accordance with Section 3.2.5 of this chapter.

(c) A combination of automatic sprinkler protection in accordance with Section 3.2.4 of this chapter AND an automatic high-level high-expansion foam system in accordance with Section 3.2.5 of this chapter.

3.1.2 Group I aircraft hangar storage and service areas housing unfueled aircraft shall be provided with automatic sprinkler protection as specified in Sections 4.2 and 4.7.

3.1.3 Automatic sprinkler protection shall be provided inside separate shop, office, and storage areas located inside aircraft maintenance and servicing areas, unless they are otherwise provided with automatic fire protection systems.

3.1.4 Each sprinkler system shall be designed and installed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, and NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, as applicable, and in accordance with the requirements of this chapter.

3.1.5 Additional protection, as specified in Sections 3.2.9, 3.3, and 3.4 of this chapter, shall be provided in all Group I aircraft hangars in addition to other protection systems required by this chapter.

3.2 Fire Protection Systems.

3.2.1 Plans and Specifications.

3.2.1.1* Before systems are installed, complete specifications and working plans shall be drawn to scale showing all essential details, and plans shall be easily reproducible to provide necessary copies.

3.2.1.2 Information supplied in these plans and specifications shall be in accordance with NFPA 11, Standard for the Installation of Sprinkler Systems, and shall include the following:

(a) The design purpose of the systems;
(b) The discharge densities and the period of discharge;
(c) The hydraulic calculations;
(d) The details of tests of the available water supply;
(e) The details of proposed water supplies;
(f) The detailed layout of the piping and of the detection systems;
(g) The make and type of discharge devices, operating equipment, and foam concentrate to be installed;
(h) The location and spacing of discharge devices;
(i) The pipe hanger and bracing location and installation details;
(j) The location of draft curtains;
(k) The accurate and complete layout of the area to be protected, including drainage layout;
(l) The details of any foam concentrate, its storage and injection, and other pertinent data to provide a clear explanation of the proposed design.

(m) Location and spacing of supplementary or low-level agent distributors, showing the area of coverage;
(n) Installation layout of the actuation systems; and
(o) Detailed layout of water supply piping, agent storage, pumping and piping, power sources, and location and details of mechanical foam-liquid concentrate injection equipment.

3.2.2 Deluge Foam-Water Sprinkler System Design and Performance.

3.2.2.1 In aircraft storage and servicing areas, each sprinkler system shall be designed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, and NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems as applicable, and in accordance with this chapter.

3.2.2.2 In aircraft storage and servicing areas, the maximum projected floor area under an individual deluge system shall not exceed 15,000 ft² (1394 m²).

3.2.2.3 In aircraft storage and servicing areas, the protection area as projected on the floor shall be limited to 130 ft² (12.1 m²). The maximum distance between sprinklers either on branch lines or between branch lines shall be 12 ft (3.7 m).

3.2.2.4 System piping shall be hydraulically designed using two separate calculation methods. The demand calculation method shall be performed to determine the adequacy of the water supply. The supply calculation method shall be performed to determine the amount of foam concentrate required. Where steel pipe is installed, the coefficient C in the Hazen and Williams formula shall be taken as 120 in the calculations.

3.2.2.5 In other portions of hangars protected by sprinklers, the spacing shall be in accordance with the hazard requirements of the areas involved.

3.2.2.6 Uniform sprinkler discharge shall be based on a maximum variation of 15 percent between the sprinkler providing the lowest density and the sprinkler providing the greatest density within an individual deluge system as specified in 3.2.2.12 or 3.2.2.13. Variation below the required density shall not be permitted.

Orifice plates, sprinklers of different orifice sizes, piping of less than 1 in. diameter, or multiple fittings installed between a branch line swivel fitting and an individual sprinkler for the sole purpose of increasing pressure loss shall not be permitted as a means to limit discharge.

Exception: Local application protection for columns.

3.2.2.7 Where open hangar doors result in interference with the distribution of overhead systems, additional devices shall be provided to ensure effective floor coverage.

3.2.2.8 Foam-water deluge systems discharge devices shall be either air-aspirating or air-aspirating and shall have deflectors designed to produce water discharge patterns closely comparable to those of spray sprinklers as defined in NFPA 13, Standard for the Installation of Sprinkler Systems, when discharging at the same rates of flow.

3.2.2.9 The discharge devices shall generate foam where supplied with the foam solution under pressure and shall distribute the foam in a pattern essentially similar to that of water discharging therefrom.
3.2.2.10 The discharge devices shall have a minimum nominal 1/4 in. (6.4-mm) orifice and shall be listed for use with the particular type of foam concentrate to be used in the system.

3.2.2.11 Strainers shall be installed in accordance with NFPA 16, Standard for the Installation of Foam-Water Sprinkler Systems and Foam-Water Spray Systems.

3.2.2.12 The discharge density from air-aspirating discharge devices using protein-type, fluoroprotein-type, or AFFF-type foam solutions shall be a minimum of 0.20 gal of foam solution per min per ft

3.2.2.13 The discharge density from non-air-aspirating discharge devices using AFFF-type foam solutions shall be a minimum of 0.16 gal of foam solution per min per ft

3.2.3* Hangars protected in accordance with Section 3.1.1(a) and housing aircraft having wing areas in excess of 3,000 ft

3.2.3.2* Each system shall be designed to cover a specified floor area beneath the aircraft being protected. The design objective shall be to achieve control of the fire within the protected area within 30 seconds of system actuation and extinguishment of the fire within 60 seconds.

3.2.3.3 Each supplementary protection system shall be designed, installed, and maintained in accordance with NFPA 11, Standard for Low-Expansion Foam, or NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.3.4* Supplementary Low-Expansion Foam Systems.

3.2.3.4.1* Supplementary low-expansion foam systems shall employ AFFF, protein, or fluoroprotein foam-liquid concentrates and shall be designed for local application.

3.2.3.4.2* Coverage of the specified floor area beneath the aircraft shall be by means of a horizontal foam discharge from nozzles located above floor level.

3.2.3.4.3* Where oscillating nozzles are used, the discharge pattern limits shall be established for the design. Positive securement of the limits of oscillation shall be provided by such devices as set screws, locking pins, or similar methods. When placed in service, the manual override feature, if any, shall be locked out to provide for automatic operation only.

3.2.3.4.4 Where protein- or fluoroprotein-based concentrates are used, the minimum application density shall be 0.16 gpm of foam solution per sq ft (6.5 L/min/m

3.2.3.5.3* The discharge rate of the system shall be based on the rate of application multiplied by the entire aircraft storage and servicing area. The design objective shall be to achieve coverage of the entire aircraft storage and servicing area to within 5 ft of the perimeter walls and doors within 3 minutes of system actuation.

3.2.3.5.3 The foam system shall be of the fixed type and shall be designed and installed in accordance with the requirements for fixed-type systems in NFPA 20, Standard for Low-Expansion Foam Systems.

3.2.3.5.3.2 Where AFFF concentrate is used, the minimum application rate shall be 0.10 gpm of foam solution per ft

3.2.3.5.3.3* The discharge rate of the system shall be based on the rate of application multiplied by the entire aircraft storage and servicing area.

3.2.3.5.4 The foam system shall use low-level discharge nozzles. Where monitor nozzles are used, they shall be provided with individual manual shutoff valves for each nozzle. The discharge nozzles shall be arranged to achieve initial foam coverage in the expected aircraft parking area.

3.2.3.5.5 Nozzles shall be located and installed so that aircraft positioning and workstand placement will not necessitate removal or repositioning of nozzles. All nozzle settings shall be marked and permanently secured in position after installation and acceptance testing.

3.2.3.5.6 Electric power reliability for oscillating nozzles shall be in accordance with electric fire pump requirements of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

3.2.3.5.7* Where AFFF concentrate is used, the minimum application rate shall be 0.16 gpm of foam solution per sq ft (6.5 L/min/m

3.2.3.6 Electric power reliability for oscillating nozzles shall be in accordance with electric fire pump requirements of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

3.2.3.6.1 Low-Expansion Foam systems shall be designed and installed in accordance with NFPA 11A, Standard for Medium- and High-Expansion Foam Systems, requirements for local application systems.

3.2.3.6.2 The effective application rate shall be a minimum of 3 cfh/ft

3.2.3.6.3 The discharge rate of the system shall be based on the application rate multiplied by the entire aircraft storage and servicing floor area. The application total discharge rate shall include the sprinkler breakdown factor specified in 2.3.5.2(b) of NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.3.6.4 The high-expansion foam systems shall be designed and installed in accordance with NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.3.6.5* Sprinkler generators shall be powered by reliable water-driven or electric motors. Electric power reliability for generators shall be in accordance with NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

3.2.3.6.6* Foam generators shall be supplied with air from the aircraft storage servicing area. Roof vents shall be located to avoid recirculation of combustion products into the air inlets of the foam generators.

3.2.3.6.7 Foam generators shall be powered by reliable water-driven or electric motors. Electric power reliability for foam generators shall be consistent with electric fire pump requirements specified in Chapters 6 and 7 of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

3.2.4* Sprinkler piping shall be hydraulically sized in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

The maximum system size shall not exceed 52,000 square feet (4,831 square meters).

3.2.4.3 Sprinkler spacing shall be as specified in 3.2.2.3 of this standard.

3.2.4.4 Where open hangar doors result in interference with the distribution of water from the hangar sprinkler systems, additional sprinklers shall be provided to ensure effective floor coverage.

3.2.4.5 The design density from sprinkler systems shall be a minimum of 0.17 gpm of water per sq ft (6.9 L/min/m

3.2.4.6 Sprinklers shall have a nominal orifice size of 1/2 in. (12.7 mm) or 3/4 in. (19.1 mm).

3.2.4.7 Quick response sprinklers having a temperature rating of 175°F (79.4°C) shall be used. Quick response sprinklers having a temperature rating of 200°F (93.3°C) shall be permitted in areas subject to high ambient temperatures.

3.2.4.8 Sprinkler systems shall be flushed and tested in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

3.2.5 Low-Level Foam Protection Systems.

3.2.5.1 Each low-level foam protection system shall be designed, installed, and maintained in accordance with NFPA 11, Standard for Low-Expansion Foam, or NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.5.2 Each low-level foam protection system shall be designed, installed, and maintained in accordance with NFPA 11, Standard for Low-Expansion Foam, or NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.5.3 Low-Level Low-Expansion Foam Systems. The low level foam system shall be designed to achieve distribution of foam over the entire aircraft storage and service area. The design objective shall be to achieve coverage of the entire aircraft storage and servicing area to within 5 ft of the perimeter walls and doors within 3 minutes of system actuation.

3.2.5.3.1 Foam systems shall be of the fixed type and shall be designed and installed in accordance with the requirements for fixed-type systems in NFPA 20, Standard for Low-Expansion Foam.

3.2.5.3.2 Where AFFF concentrate is used, the minimum application rate shall be 0.10 gpm of foam solution per ft

3.2.5.3.3* The discharge rate of the system shall be based on the rate of application multiplied by the entire aircraft storage and servicing floor area.

3.2.5.3.4 The foam system shall use low-level discharge nozzles. Where monitor nozzles are used, they shall be provided with individual manual shutoff valves for each nozzle. The discharge nozzles shall be arranged to achieve initial foam coverage in the expected aircraft parking area.

3.2.5.3.5 Nozzles shall be located and installed so that aircraft positioning and workstand placement will not necessitate removal or repositioning of nozzles. All nozzle settings shall be marked and permanently secured in position after installation and acceptance testing.

3.2.5.3.6 Electric power reliability for oscillating nozzles shall be in accordance with electric fire pump requirements of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

3.2.5.4 Low-Level High-Expansion Foam Systems. 3.2.5.4.1 Low-level high-expansion foam systems shall be designed and installed in accordance with NFPA 11A, Standard for Medium- and High-Expansion Foam Systems, requirements for local application systems.

3.2.5.4.2 The effective application rate shall be a minimum of 3 cfh/ft

3.2.5.4.3 The discharge rate of the system shall be based on the application rate multiplied by the entire aircraft storage and servicing floor area. The application total discharge rate shall include the sprinkler breakdown factor specified in 2.3.5.2(b) of NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.5.4.4 The high-expansion foam systems shall be designed and installed in accordance with NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

3.2.5.4.5 Foam generators shall be supplied with air from the aircraft storage servicing area. Roof vents shall be located to avoid recirculation of combustion products into the air inlets of the foam generators.

3.2.5.4.6* Foam generators shall be powered by reliable water-driven or electric motors. Electric power reliability for foam generators shall be consistent with electric fire pump requirements specified in Chapters 6 and 7 of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps.

3.2.6* Foam Concentrate Supply.
3.2.6.1 Where foam concentrate is introduced into the water stream by pumping, the total foam concentrate pumping capacity shall be such that the maximum pressures and flows can be met with the largest foam concentrate pump out of service.

3.2.6.2 The quantities of low expansion foam concentrate, either prefoamed, or foam, appropriate length, or AFFF, shall be sufficient for a 1-minute foam discharge based on the supply calculation method required in Section 3.2.2.4.

3.2.6.3 The quantity of high expansion foam concentrate shall be sufficient for a 12-minute discharge at the water flow rate based on the supply calculation method required in Section 3.2.2.4.

3.2.6.4 A reserve supply of foam concentrate of compatible type for the system shall be directly connected to the system and readily available. The reserve supply shall be the same quantity as the main supply. To prevent accidental depletion of this reserve supply, it shall be available to the system only by intentional manual operation.

3.2.6.5 Control valves, foam concentrate liquid storage tanks, concentrate pumps, controllers, and bypass balancing equipment shall be located outside the aircraft storage and service area.

3.2.7 Foam Concentrate Pumps.

3.2.7.1 Piping shall be arranged so that maximum foam concentrate demand can be supplied from either primary or reserve foam concentrate in all shop, office, and nonaircraft storage areas in hangars, except where special hazards that require special protection exist.

3.2.7.2 Foam-Water Hand Hose Systems.

3.2.7.2.1* Actuation systems shall be provided with complete circuit supervision and shall be located as close as possible to the aircraft positions to facilitate early system actuation in the event of a fire.

3.2.7.2.1.1* Actuation of any closed-head sprinkler system shall simultaneously operate the supplementary protection system.

3.2.7.2.2 Manual actuation stations shall be provided for each supplementary protection system and shall be located both inside and outside the aircraft maintenance and servicing area. Stations shall be located as close as possible to the aircraft positions to facilitate early system actuation in the event of a fire.

3.2.7.2.3 Closed-Head Water Sprinkler Systems.

3.2.7.2.3.1* Actuation of any closed-head sprinkler system shall simultaneously operate the low-level foam protection system.

3.2.7.2.3.2 Manual actuation stations shall be provided for each low-level protection system and shall be located both inside and outside the aircraft maintenance and servicing area. Stations shall be located as close as possible to the aircraft positions to facilitate early system actuation in the event of a fire.

3.2.7.2.4 Foam-Water Hand Hose Systems.

3.2.7.2.4.1 Water hand hose and standpipe systems shall be installed in accordance with NFPA 14, Standard for the Installation of Standpipe and Hose Systems, in all aircraft storage areas in hangars, except where special hazards that require special protection exist.

3.2.7.2.4.2 Hoses shall be fitted with listed adjustable stream pattern nozzles designed to permit direct stream or water spray application.

3.2.7.2.5 Water Supply.

3.2.7.2.5.1* The total water supply shall be sufficient to satisfy the combination of systems as described in Sections 3.1.1(a), 3.1.1(b), and 3.1.1(c), and the requirements for hose stream and other equipment as determined in Section 3.2.9. Water shall be available in sufficient quantity and pressure to supply the maximum number of discharge devices that can operate simultaneously. Water shall be suitable for the protection of foam.

3.2.7.2.5.2 The water supply shall be capable of furnishing water for the largest number of systems that possibly could be expected to operate. Sufficient water supply requirements are determined by assuming that a fire at any point will operate all the systems in every draft-curtained area that is wholly or partially within a 100-ft (30-m) radius of that point measured horizontally.

3.2.7.2.5.3 The water supply shall be capable of maintaining water discharge at the design rate and pressure for a minimum of 60 minutes covering the entire area protected by systems expected to operate simultaneously, unless protection is provided as specified in Section 3.2.10.3.

3.2.7.2.5.4 Supplementary Protection Systems. Where supplementary protection is installed in accordance with Section 3.2.5.1, the total water supply duration shall be for a minimum of 45 minutes.

3.2.7.2.5.5 Closed-Head Water Sprinkler Systems and Low-Level Foam Protection Systems. The water supply for the combination of closed-head water sprinkler systems and low-level foam protection systems shall have a minimum duration of 45 minutes.

3.2.7.2.5.6 H and Hose Systems. The water supply for hose hand systems shall be capable of satisfying the requirements of Section 3.2.9 of this standard. The demand shall be calculated at the point where supply piping for the hand hose systems connect to the system piping or fire protection underground.

3.2.7.2.5.7* Exterior Hose Streams. Where the water supply for the systems also serves as a supply for exterior hose streams, a hose stream allowance of 500 gpm (1893 L/min) shall be included in the water supply hydraulic calculations. Calculations for hose stream shall be in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, and 3.2.10.4.5.

3.2.7.2.5.8* Water Reservoirs. Where a single reservoir is used for the basic water supply, such reservoir shall be divided into approximately equal sections, arranged so that at least one-half of the installed water shall be available to supply the total demand for 30 minutes. This shall be in accordance with Sections 3.2.7.2.5.8 and 3.2.10.3.8.2. Where multiple water reservoirs are used, the total demand can be met with the largest fire pump out of service.

3.2.9.3.3 These hand hose systems shall be supplied from a connection to the sprinkler system header or from a direct connection to the water source.

3.2.9.3.4 Each hand hose connection shall be a minimum of 1 1/2 in. (38 mm) in size and fitted with a control valve. The hose shall be of suitable length, or AFFF, shall be sufficient for a 1-minute foam discharge. The hose shall be properly racked or reeled. Hoses shall be fitted with an approved foam-maker nozzle or a combination type nozzle designed to permit foam application or water spray. Nozzles shall be of the shutoff type or shall have a shutoff valve at the nozzle inlet.

3.2.9.3.5 Foam-liquid concentrate can be supplied from a central distribution system, separate from or a part of a foam-water sprinkler system, or from stationary foam-liquid concentrate containers fitted with listed proportioning devices.

3.2.9.3.6 The minimum supply of foam-liquid concentrate shall be sufficient to provide operation of at least two hand hose lines for a period of 20 minutes at a foam solution discharge rate of 60 gpm (227 L/min) each.

3.2.9.3.7 Foam-liquid concentrate can be supplied from a central distribution system, separate from or a part of a foam-water sprinkler system, or from stationary foam-liquid concentrate containers fitted with listed proportioning devices.

3.2.9.3.8 Foam-liquid concentrate can be supplied from a central distribution system, separate from or a part of a foam-water sprinkler system, or from stationary foam-liquid concentrate containers fitted with listed proportioning devices.
3.2.10.8.3 Pump houses and rooms shall be of fire-resistive or noncombustible construction. Where internal combustion engines used for driving fire pumps are located inside the fire pump house or room, protection shall be provided by automatic sprinklers installed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, or NFPA 11, Standard for Low Expansion Foam, NFPA 11A, Standard for Medium and High Expansion Foam Systems, or NFPA 14, Standard for the Installation of Standpipe and Hose Systems, or NFPA 16, Standard for the Installation of Foam-Water Sprinkler Systems and Foam-Water Deluge Systems. Hydrostatic pressure tests shall be conducted on each system as specified in NFPA 11, Standard for Low Expansion Foam, NFPA 11A, Standard for Medium and High Expansion Foam Systems, NFPA 13, Standard for the Installation of Sprinkler Systems, NFPA 14, Standard for the Installation of Standpipe and Hose Systems, or NFPA 16, Standard for the Installation of Foam-Water Sprinkler Systems and Foam-Water Deluge Systems.

3.2.11 Acceptance Tests

3.2.11.1 The following tests shall be performed prior to final acceptance of any fire protection system in an aircraft hangar.


3.2.11.1.2 All devices and equipment installed as part of the system shall be tested.

3.2.11.1.3 Full-flow tests with water only shall be made on each foam-water deluge system as a means of checking the sprinkler distribution and to ensure against clogging of piping and sprinklers by foreign matter carried by the water. The maximum number of systems that possibly could be expected to operate in case of fire, including supplementary systems, shall be in full operation simultaneously to provide a check on the adequacy and condition of the water supply. Suitable gauge connections and gauges shall be provided to verify hydraulic calculation and to determine whether the flow pressures, agent discharge capacity, foam coverage, percent concentration, and other operating characteristics are satisfactory.

Exception: Where separate proportioning systems are utilized for the foam-water deluge sprinklers and the supplementary protection systems, water only shall be permitted to be flowed in the foam-water deluge sprinklers simultaneously with foam in the supplementary protection system.

3.2.11.1.8 Supplementary and low-level protection systems shall be examined visually to determine that they have been properly installed. Checks shall be made for such items in conformity with installation plans, continuity of piping, tightness of fittings, removal of temporary blank flanges, and accessibility of valves and controls. Devices shall be properly identified and operating instructions prominently posted.

3.2.12 Final Approval. The installing company shall furnish a written statement that the work has been completed in accordance with Section 3.2.1, and tested in accordance with the provisions of Section 3.2.11.

3.2.13 Conversion of Existing Systems. In converting one type of system to another, all provisions of this chapter pertaining to new systems shall apply.

3.2.13.1 If water supplies are greater than necessary, the uniform discharge requirement of Section 3.2.2.6 shall be permitted to be waived if the required minimum discharge rate in gal per min per sq ft is available in all areas.

3.2.13.2 Where existing systems are designed with a discharge density higher than the minimum required discharge density (0.16 gpm per sq ft (6.5 L/min/m²)), a proportionate reduction in the time of discharge shall be permitted but shall not be less than 7 minutes.

3.2.13.3 Converted systems shall be tested in accordance with Section 3.2.11.

3.3 Wheeled and Portable Extinguishers. Wheeled and portable extinguishers shall be provided in accordance with NFPA 10, Standard for Portable Fire Extinguishers.

3.3.1 Supplementary protection systems shall be located outside aircraft storage and servicing areas.

A.3.2.2.2 The manual control valve for each individual sprinkler system should be located outside aircraft storage and servicing areas.

A.3.2.3.1 Supplementary protection systems for hangars containing several aircraft, each having wing areas less than 3,000 ft² (279 m²), can be warranted. Such systems are recommended where:

(a) Rapid control of a fire fuel exposing a single aircraft is considered essential.

(b) Strategically important military aircraft or multiple high valued aircraft are accommodated.

(c) Arrangement of aircraft within a hangar results in congestion and limited access to individual aircraft.

Table A.3.2.3.1* Gross Wing Area and Overall Height for Selected Aircraft

See Committee Proposal 409-27 (Log 409-16) for wing area data. In general, the specified floor area would be the area under the wing and wing center sections of the aircraft. Configuration of aircraft and positioning of aircraft and ground equipment within an aircraft storage and servicing area can compromise the effectiveness of any supplementary protection systems. Original design and testing of such systems should consider the obstruction of the fire protection system (such as jet engines, wings, etc.) as well as the potential for variation in the size and number of aircraft and their positioning arrangements, as well as the location of permanent service structures within the aircraft maintenance and servicing area. Protection of the entire aircraft maintenance and servicing area would be required because of the variety of possible aircraft positioning arrangements.

The total area to be protected by a single system depends on the number and configuration of aircraft and their proximity to one another and the drainage arrangements. If more than one aircraft is located within any drainage system, the supplementary foam system should preferably be capable of covering the floor area beneath all such aircraft.

A.3.2.3.4.2 The total area to be protected by a single system depends on the number and configuration of aircraft and their proximity to one another and the drainage arrangements. If more than one aircraft is located within any drainage system, the supplementary foam system should preferably be capable of covering the floor area beneath all such aircraft.

A.3.2.3.4.3 Experience has shown that the mechanism for manual operation of automatic oscillating monitor nozzles is a major factor in the failure rate of these devices. A large percentage of these failures has been due to failure to follow the instructions in the manual to the automatic mode after testing, maintenance, etc. It is considered that the most reliable device is one that is designed...
A.3.2.3.5 See A.3.2.7.2.
A.3.2.4.1 See A.4.2.1.
A.3.2.5.3 This design criteria can be achieved by means of multiple nozzles of the same or different capacities aimed to discharge toward the aircraft parking area. The fluidity of the foam will achieve coverage of the entire floor area.
A.3.2.5.3.3 It is recognized that the distribution of foam from this type of system will result in small areas that are not initially covered with foam. In addition, it is recognized that there are areas along the walls and corners which may not be covered with foam.
A.3.2.5.3.5 The design criteria can be achieved by means of multiple nozzles of the same or different capacities. The momentum and spreading characteristics of the foam will assist in achieving coverage of the entire floor area. It is not the intent that the initial discharge pattern of the nozzles cover the entire floor area. Also see A.3.2.3.4.3.
A.2.5.4.6 See A.3.2.7.2.
A.3.2.6 Experience has shown that different brands of foam might not be compatible and may have varying levels of fire-fighting effectiveness. Care should be utilized in the selection of foam concentrates.
A.3.2.6.2 Actual flow rates are often higher than calculated. This will often result in a reduction in foam supply duration.
A.3.2.6.3 Actual flow rates are often higher than calculated. This will often result in a reduction in foam supply duration.
A.3.2.6.4 To prevent accidental use and depleting of this reserve supply, it should be available to the system only by intentional manual operation.
A.3.2.7.2 Reliability of power supplies for drivers of water pumps, foam concentrate pumps, and foam generators will be a function of all the facilities between the pump driver and the power source. For a diesel engine driven pump and an electric motor driven pump, the independence of the power sources is very clear. This, of course, assumes there is a battery powered starter for the diesel engine. Independence of two diesel engines with separate fuel tanks is also fairly easily seen.
However, the degree of independence of the power sources for two electric motor drivers is much more difficult to establish. A single controller, a single switchgear panel, or a single cable route might easily negate the desired reliability. The considerations of power supply reliability are required in various sections of NFPA 20, Standard for the Installation of Centrifugal Fire Pumps, and NFPA 16, Standard for the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems. These considerations should demonstrate that the power supply reliability is consistent with that achieved for the mechanical components. There are a number of methods available. Such a method could be a complete inspection and statement of design philosophy or a sophisticated fault tree analysis.
A.3.2.8.2.2 In locating manual actuation stations inside, multiple stations should be considered to provide occupants with a selection of paths of exit from which they can actuate the system. The location of exterior actuation stations should ensure accessibility once the occupant has exited the hangar through any of the emergency exits. Security fences, adjacent buildings, or other obstructions should be considered when locating exterior actuation stations.
A.3.2.8.3.1 Detection systems for supplementary systems should be either a radiation (infrared or ultraviolet) or a heat responsive (continuous strip-type or thermistor-type) system. When initially installed, if there is any doubt as to the stability of these actuating devices because of environmental factors, it is recommended that the devices be utilized to actuate only an alarm rather than trigger the extinguishing systems. As soon as operational experience indicates that the devices are stable, they should be arranged to automatically actuate the extinguishing equipment. Spacing of detection devices should be no greater than the maximum recommended by the manufacturer.
A.3.2.8.5.1 Detection systems for low level systems should be either a radiation (infrared or ultraviolet) or a heat responsive (continuous strip-type or thermistor-type) system. When initially installed, if there is any doubt as to the stability of these actuating devices because of environmental factors, it is recommended that the devices be utilized to actuate only an alarm rather than trigger the extinguishing systems. As soon as operational experience indicates that the devices are stable, they should be arranged to automatically actuate the extinguishing equipment. Spacing of detection devices should be no greater than the maximum recommended by the manufacturer.
A.3.2.9.1 Section 3.2.9 provides a means for fire fighting by occupants of the hangar through the use of hand hose supplied from the hangar’s hand hose system or from an independent hand hose system. The hand hose system in aircraft storage and servicing areas is usually arranged for foam application with water spray or straight water streams used in other areas.
A.3.2.10.1 The presence of corrosion inhibitors, antifreeze agents, marine growth, oil, or other contaminants can result in the reduction of foam volume or stability. If the quality of the water used is questionable, the manufacturer of foam equipment should be consulted. In general, the performance of a foam-water extinguishing system depends on the agent composition, the proportioning concentration, and the application technique. Different brands or types of agents should not be mixed without the advice of the equipment manufacturer regarding their interchangeability and compatibility.
A.3.2.10.2.1 Actual flow rates are often higher than calculated. This will often result in a reduction in foam supply duration.
A.3.2.10.7 The development of satisfactory water supplies is a matter requiring engineering judgment and careful analysis of local conditions. See NFPA 419, Guide for Master Planning Airport Water Supply Systems for Fire Protection; NFPA 20, Standard for the Installation of Centrifugal Fire Pumps; and NFPA 22, Standard for Water Tanks for Private Fire Protection. Acceptable types of water supplies can consist of one or more of the following:
(a) Connections to reliable waterworks systems, including automatic booster pumps where required;
(b) Automatic fire pump systems taking suction under a head from storage reservoirs or other suitable supply; and
(c) Gravity tanks.
Combinations of these supplies can be used to advantage. It is desirable to have two independent water supplies. Where reliance is placed on automatic fire pumps, special consideration should be given to the use of multiple pumps rather than single pumps and the use of multiple sources of power in order to increase the reliability of pump operation. Water supply systems should be designed against entry of foreign material that would clog sprinklers or piping. Waterworks connections, where used as an independent supply, should be capable of delivering water at the specified rate and pressure as determined by the design pressure test. It is good design practice to provide a separate booster system for each water supply, given to any conditions that could have an effect on the design supply and pressure. Investigation should be made to determine the normal and emergency operation of the waterworks system, including domestic consumption and operation of the waterworks pumps at time of test, pressure-reducing valves, or other factors affecting adequacy of a public water supply. Automatic booster fire pumps should be used to provide effective pressure from waterworks connections. 2000.
A.3.2.10.8.4 Supplemental means for automatically starting the fire pumps should also be provided.
A.3.2.10.9 In connection with the flushing operation, preplanning should be made for means of disposing of the large quantities of water discharged.
A.3.4 For further information, see NFPA 72, National Fire Alarm Code.
4.1 Chapter 4 Protection of Group II Aircraft Hangars
4.1.1 The protection of aircraft storage and servicing areas of Group II aircraft hangars, other than those housing unfueled aircraft, shall be in accordance with the following:
(a) The provisions of Chapter 3 of this standard.
Exception: Where foam-water deluge systems utilizing air-pressurizing discharge devices are installed for the protection of Group II aircraft hangars, the discharge rate specified in
3.2.2.12 of this standard shall be permitted to be reduced to a minimum of 0.16 gal of foam solution per min per sq ft (6.5 L/min/m²) of floor area.

(b) A combination of automatic sprinkler protection in accordance with Section 4.2 of this chapter AND an automatic, low-level, low-expansion foam system in accordance with Sections 4.3 and 4.4 of this chapter.

(c) A combination of automatic sprinkler protection in accordance with Section 4.2 of this chapter AND an automatic high expansion foam system in accordance with Sections 4.3 and 4.5 of this chapter.

(d) A closed-head foam-water sprinkler system in accordance with Section 4.6.

4.1.2 Group II aircraft hangar storage and service areas housing unfueled aircraft shall be provided with automatic sprinkler protection specified in Sections 4.2 and 4.8.

4.1.3 A closed-head sprinkler protection shall be provided inside separate shop, office, and storage areas located inside aircraft maintenance and servicing areas. The design shall be in accordance with hazard classifications specified in NFPA 11A, Standard for the Installation of Sprinkler Systems.

4.1.4 In addition to the provision for sprinkler and foam extinguishing systems as required by this chapter, protection as required by Sections 3.2.9, 3.3, and 3.4 of this standard also shall be provided.

4.2 Closed-Head Foam-Water Sprinkler System for Aircraft Storage and Servicing Areas.

4.2.1 Sprinkler systems shall be either wet pipe or preaction, designed and installed in accordance with the applicable sections of NFPA 13, Standard for the Installation of Sprinkler Systems, and the provisions of this chapter.

4.2.2 Sprinkler piping shall be hydraulically sized in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

4.2.3 Sprinkler spacing shall be as specified in 3.2.2.3 of this standard.

4.2.4 Where open hangar doors result in interference with the distribution of water from the hangar sprinkler systems, additional sprinklers shall be provided to ensure effective floor coverage.

4.2.5 The design density from sprinkler systems shall be a minimum of 0.17 gpm of water per sq ft (6.9 L/min/m²) over any 5,000 ft² (464.5 m²) area, including the hydraulically most demanding area as defined in NFPA 11A, Standard for the Installation of Sprinkler Systems.

4.2.6 Sprinklers shall have a nominal orifice size of 1/2 in. (12.7 mm) or 1/32 in. (13.5 mm).

4.2.7 Sprinklers shall have a temperature rating of 325°F to 375°F (162°C to 190°C).

4.2.8 Sprinkler systems shall be flushed and tested in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

4.3 Foam Concentrate—General.

4.3.1 The foam concentrate supplied with the system shall be listed for use with the distribution equipment.

4.3.2 There shall be a reserve of foam concentrate of a compatible type directly connected to the system. The reserve supply shall be in the same quantity as the main supply.

4.3.3 Foam Concentrate Pumps. [See Proposal 409-20 (Log #CP6) for revised text for foam concentrate pumps.]

4.3.4.3 x Piping shall be arranged so that maximum foam concentrate demand can be supplied from either primary or reserve foam concentrate tanks.

4.3.5 The control valves, foam-liquid concentrate storage, injection system, and foam concentrate pump shall be located outside aircraft storage and servicing areas. The environmental conditions shall be suitable for the particular agent involved.

4.3.6 Plans and specifications for closed-head foam-water sprinkler systems shall provide the information required by 3.2.1 of this standard and NFPA 16A, Standard for the Installation of Closed-Head Foam-Water Sprinkler Systems. Plans and specifications for other foam extinguishing systems shall provide the information required by 3.2.1 of this standard.

4.3.6 Acceptance Tests.

4.3.6.1 Acceptance tests for closed-head foam-water sprinkler systems shall be performed in accordance with NFPA 16A, Standard for the Installation of Closed-Head Foam-Water Sprinkler Systems.
4.6.3 Sprinkler spacing shall not exceed 100 ft \(^2\) (9.3 m\(^2\)) as projected on the floor. The maximum distance between sprinklers either on branch lines or between branch lines shall be 12 ft (3.6 m).

4.6.4 In aircraft storage and servicing areas, the maximum projected floor area under an individual sprinkler system shall not exceed 15,000 ft \(^2\) (1393 m\(^2\)).

4.6.4.1 Each individual system shall have its own foam concentrate proportioner.

4.6.5 Sprinklers shall have a temperature rating of 175°F to 225°F (79.4°C to 107.2°C).

4.6.6 Foam concentrate supply shall be in accordance with 3.2.6 of this standard.

4.6.7 Branch lines shall be provided with provisions for periodic flushing.

4.6.7.1 Drains shall be a minimum of 1 in. (2.5 cm) in size.

4.7 Detection and Actuation Systems.

4.7.1 Detectors for actuating high- or low-expansion foam systems and for actuating preaction sprinkler systems shall be rate-of-rise, fixed temperature, or rate compensation type.

4.7.2 These detectors shall be installed in accordance with NFPA 72, National Fire Alarm Code.

4.7.3 Detection systems shall be provided with supervision as required by NFPA 72, National Fire Alarm Code.

4.7.4 Manual actuation stations shall be located so that each system can be individually operated from both inside and outside the aircraft storage and servicing area. The manual stations shall be installed so that they are unobstructed, readily accessible, and located in the normal paths of exit from the area.

4.8 Water Supply.

4.8.1 The total water supply shall be sufficient to satisfy the combination of systems and hose stations as described in 4.11(b), 4.11(c), and 4.13 of this chapter for durations as specified in this section.

4.8.2 The water supply for closed-head water sprinkler systems in aircraft storage and servicing areas shall meet one of the following:

(a) In aircraft storage and servicing areas housing other than unfueled aircraft, the water supply shall have a minimum duration of 30 minutes at the rate specified in 4.2.5.

(b) In aircraft storage and servicing areas housing unfueled aircraft, the water supply shall have a minimum duration of 60 minutes at the rate specified in 4.2.5.

4.8.3 The water supply for low-expansion foam systems shall be capable of furnishing water at the rate specified in 4.4.2 of this chapter for a period of time at least equal to twice the period of time used to calculate the quantity of foam liquid concentrate in 4.6.6.

4.8.4 Water shall be suitable for the production of foam.

4.8.5 The water supply for high-expansion foam systems shall be capable of furnishing water at the rate specified in 4.5.3 of this chapter for a minimum period of 24 minutes. Water shall be suitable for the production of foam.

4.8.6 The water supply for hose stations shall be capable of satisfying the requirements of Section 3.2.9 of this standard, in addition to those requirements specified in 4.8.2 and either 4.8.3 or 4.8.4 of this section. The demand shall be calculated at the point where supply piping for the hose stations connects to the system piping or fire protection underground.

4.8.7 he water supply for the systems also serves as a supply for exterior hose streams, a hose stream allowance of 500 gpm (1893 m\(^3\)/min) shall be included in the water supply hydraulic calculations. Calculations for hose stream shall be in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

4.8.8 Where provided, fire pumps and suction reservoirs shall be designed and installed in accordance with 3.2.10.7 and 3.2.10.8 of this standard.

A-2-6.3 A preaction standard sprinkler system should be used only if there is a possibility of freezing in an unheated hangar.

A-4.3 A-4.4 See A-3.2.6.

A-4.4.3 This design criteria can be achieved by means of multiple nozzles of the same or different capacities aimed to discharge toward the aircraft parking area. The fluidity of the foam will achieve coverage of the entire floor area.

A-4.4.5 Actual flow rates are often higher than calculated. This will often result in a reduction in foam supply duration.

A-4.6.7 This should be accomplished by providing manifolded drains.

A-4.8 See A-3.2.10.1.

SUBSTANTIATION:

1. 100 ft radius rule. The committee recognized that the smaller radius rules for lower hangars were not appropriate based on recent fire tests in hangars.

2. 7,500 sq ft draft curtain area. In an effort to limit the zones actuated and to increase the response time of a system, the committee has specified smaller draft curtain areas.

3. Floor drainage. Field experience has taught the committee that pot drains are not effective in draining fuel from the hangar floor, therefore the committee mandated the use of trench drains.

4. The additional fire protection system designs to Chapter 3. The committee added two systems to Group I hangar protection that have been approved for Group II for many years. The reasons for these designs are to better cover the entire hangar floor area when random parking positions are used and to cut back on the fire protection water demand.

COMMITTEE ACTION: Accept.

Sequence 409-7 was not used

409-8. (2-6.3, 2-6.3.1 and A-2-6.3): Accept

SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: Revise text to read as follows:

2-6.3* Fixed water or foam water systems or additional discharge devices as an extension of the overhead system shall be permitted to be used in lieu of a 2 hr fire resistance rating, if such systems are designed specifically to protect the columns. Overspray from overhead sprinklers to protect columns shall not be permitted.

2-6.3.1 Distances between discharge devices vertically shall not exceed 10 ft.

A-2-6.3 Additional guidance pertaining to fixed water spray systems can be found in NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. This information can also be used in the design of foam-water systems and when extension of discharge devices from the overhead sprinkler system is used. The design of such protection should take into account factors such as the shape of the column, wetting of lower sprinklers, obstructions, type of discharge device.

SUBSTANTIATION:

1. Provided an additional option in 2-6.3 to allow an extension of the overhead system to be used to protect columns.

2. Clarified that overspray from the overhead system is not adequate to protect columns.

3. Provided additional guidance in the appendix to protect columns.

COMMITTEE ACTION: Accept.
Type I (443 and 332) and Type II (222 and 111) Constructions from a practical standpoint, generally as exposed insulation, require spray applied fire protection material to develop the 4, 3, 2, and 1 hour fire resistance ratings (Table 2-3.3 in NFPA 409). This would rule out the use of some UL listed structural fire protection materials which perform well in the NFPA 251 standard fire test but under Section 2-10.1 cannot meet the definition of noncombustible. Some examples are in tumescent coatings which have a solvent base and some sprayed cementitious material listed in e UL Fire Resistance Directory. The very fact that NFPA 409 makes the point that the insulation is exposed on the interior indicates it should be treated as an interior finish material as covered in NFPA 101.

Furthermore, the NFPA 220 definition of limited combustible is not appropriate to apply to insulation materials by virtue to the materials used in the construction of buildings, but do not apply to furnishings, the contents of buildings, or the fire hazard evaluation of materials. When the limited combustible definition was first developed by the American Insurance Association (formerly the National Board of Fire Underwriters) it was clearly stated in the July 1973 and revised June 1976 Special Interest Bulletin No. 294 and in the National Building Code of the AIA 1976 edition that the limited combustible definition applies to materials used in he construction of buildings, but do not apply to furnishings, or the contents of buildings, or to the fire hazard evaluation of materials. A review of Appendix C in NFPA 220 shows basic fiber glass insulation materials (no vapor barrier) of thicknesses and densities different than those used for insulation purposes, as having Btu’s per pound very close to the 3500 limit. Insulation materials are generally used with a vinyl or other plastic vapor barrier. When the test sample includes the insulation and the plastic vapor barrier in the test prescribed by NFPA 259, the 3500 limit can be exceeded.

Commonly used insulation materials with vapor barriers exposed to the interior of commercial buildings such as aircraft hangars and meeting the 25 and 50 flame spread and smoke ratings can be found in the U.L., Inc. Building Materials Directory or similar listings of other testing laboratories under the heading Batts and Blankets.

Note: Supporting material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Accept in Principle.

Revise text to read as follows:

2-10.1 Exposed interior insulation attached to walls and roofs in an aircraft storage or servicing area of a hangar shall comply with the requirements for NFPA 101 Code for Safety to Life from Fire in Buildings and Structures, special provisions for aircraft storage hangars, interior wall and ceiling finish criteria. COMMITTEE STATEMENT: Referenced appropriate section of NFPA 101 for exposed interior insulation.

409-10 - (2-10.2): Accept

SUBMITTER: Richard G. Gewain, Hughes Assoc. Inc.

RECOMMENDATION: Delete 2-10.2.

SUBSTANTIATION: Exposed materials used to insulate the interior surfaces of walls and roofs cannot meet the criteria of ASTM E136, which is referenced in the definition of noncombustible material in NFPA 220. In the Life Safety Code, NFPA 101, exposed insulation and other finishes on walls and ceilings under Section 6-5.3 are treated as interior finish and not part of the building structure. As such, wall and roof insulation are limited in use by the flame spread ratings obtained from NFPA 255. NFPA 101, Section 29-6 Special Provisions for Aircraft Storage Hangars requires interior wall and ceiling finish in storage areas to comply with Section 6-5. (flame spread 25 and smoke index 50).

Type I (443 and 332) and Type II (222 and 111) Constructions from a practical standpoint, generally as exposed insulation, require spray applied fire protection material to develop the 4, 3, 2, and 1 hour fire resistance ratings (Table 2-3.3 in NFPA 409). This would rule out the use of some UL listed structural fire protection materials which perform well in the NFPA 251 standard fire test but under Section 2-10.1 cannot meet the definition of noncombustible. Some examples are in tumescent coatings which have a solvent base and some sprayed cementitious material listed in e UL Fire Resistance Directory. The very fact that NFPA 409 makes the point that the insulation is exposed on the interior indicates it should be treated as an interior finish material as covered in NFPA 101.

Furthermore, the NFPA 220 definition of limited combustible is not appropriate to apply to insulation materials by virtue to the materials used in the construction of buildings, but do not apply to furnishings, the contents of buildings, or the fire hazard evaluation of materials. When the limited combustible definition was first developed by the American Insurance Association (formerly the National Board of Fire Underwriters) it was clearly stated in the July 1973 and revised June 1976 Special Interest Bulletin No. 294 and in the National Building Code of the AIA 1976 edition that the limited combustible definition applies to materials used in he construction of buildings, but do not apply to furnishings, or the contents of buildings, or to the fire hazard evaluation of materials. A review of Appendix C in NFPA 220 shows basic fiber glass insulation materials (no vapor barrier) of thicknesses and densities different than those used for insulation purposes, as having Btu’s per pound very close to the 3500 limit. Insulation materials are generally used with a vinyl or other plastic vapor barrier. When the test sample includes the insulation and the plastic vapor barrier in the test prescribed by NFPA 259, the 3500 limit can be exceeded.

Commonly used insulation materials with vapor barriers exposed to the interior of commercial buildings such as aircraft hangars and meeting the 25 and 50 flame spread and smoke ratings can be found in the U.L., Inc. Building Materials Directory or similar listings of other testing laboratories under the heading Batts and Blankets.

Note: Supporting material is available for review at NFPA Headquarters.

COMMITTEE ACTION: Accept.

409-11 - (2-11.2): Accept

SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: 2-11.2 add “trench” before “drainage” throughout this section.

SUBSTANTIATION: Pot type drains are impractical

COMMITTEE ACTION: Accept.
RECOMMENDATION: Revise text to read as follows:
3-2.4.2 Power supply for the drivers of foam concentrate pumps shall be installed in accordance with NFPA 409, Standard for the Installation of Stationary Pumps for Fire Protection, Chapter 6, and NFPA 70, National Electrical Code., Article 695.

Power supplies shall be arranged such that disconnecting power to the protected facility during a fire shall not disconnect the power supply to the foam concentrate pump feeder circuit.

SUBSTANTIATION: The electrical installation is included in the scopes of NFPA 20 and NFPA 70. “Pointers” to NFPA 20 and NFPA 70 will assist the user of NFPA 409.

COMMITTEE ACTION: Submit.

COMMITTEE STATEMENT: The Committee feels that the requirement for power supplies is clear and should remain in the standard.

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SUBMITTER: James L. Boyer, Firetrol, Inc.

RECOMMENDATION: Revise text to read as follows:

3-2.4.1 Controllers for foam concentrate pumps shall be as follows:
(a) For electric drive foam concentrate pumps greater than 15 horsepower, a listed fire pump controller shall be used.
(b) For electric drive foam concentrate pumps greater than 15 horsepower but not exceeding 30 horsepower, a listed fire pump controller or listed limited service controller shall be used.
(c) For electric drive foam concentrate pumps less than 15 horsepower, a listed limited service controller shall be used.
(d) For diesel engine drive foam concentrate pumps, a listed fire pump controller shall be used.
(e) For diesel engine drive foam concentrate pumps, a listed Diesel Engine Fire Pump Controller shall be used. (See NFPA 409, Standard for the Installation of Stationary Pumps for Fire Protection, Chapter 9.)

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: NFPA 409 is more definitive and provides clear concise requirements in one location.

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409-19 - (3-6.5): Reject
SUBMITTER: Joe Behnke/ Dennis Kennedy, Ansul Inc.
RECOMMENDATION: Revise 3-6.5 to read as follows:
“Air from outside the hazard area shall be used for foam generation unless data is provided to show that air from inside the hazard can be successfully employed. Roof vents shall be located to avoid recirculation of combustion products into the air inlets of the foam generator.”

SUBSTANTIATION: NFPA 11A (1994 ed.) paragraph 1-10.9.1, allows the use of inside air if data is provided to show air from inside the hazard can be successfully employed. This would allow consistency with referenced standard. ANSUL has performed fire tests using inside air to support this proposal.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Life safety concerns.

409-20 - (4-3.3): Accept
SUBMITTER: Technical Committee on Airport Facilities
RECOMMENDATION: Revise text to read as follows:
4-3.3 (Revised) Foam Concentrate Pumps.
4-3.3.1 (Added) Foam concentrate pump installations shall comply with the applicable provisions of NFPA 20, Stationary Pumps for Fire Protection, except as modified by this standard.
4-3.3.2 (Existing 3-2.4.1) Where foam concentrate is introduced into the water stream by pumping, the total foam concentrate pumping capacity shall be such that the maximum flows and pressures can be met with the largest foam concentrate pump out of service. The reserve pump(s) shall be arranged to operate only upon failure of the primary pump(s).
4-3.3.3 (Existing 3-2.4.4) Piping shall be arranged so that maximum foam concentrate demand can be supplied by any foam concentrate pump from either primary or reserve foam concentrate tanks.
4-3.3.4 (Added) Foam concentrate pumps shall be provided with means of pressure relief from the pump discharge to prevent excessive pressure and temperature. Discharge from the relief valve shall be piped back to the foam concentrate storage tank.
Connection to the suction piping shall not be permitted.
4-3.3.5 (Added) The pressure regulating valve shall not be considered as the pressure relief valve. Foam concentrate pumps shall be started automatically by either a pressure drop in the foam concentrate piping system or a signal from the detection system control panel.
4-3.3.6 (Added) A pressure maintenance pump shall be provided to maintain pressure in the foam concentrate piping system where foam concentrate lines to the protective system injection points are run underground or where they run aboveground for more than 50 ft (15 m).
4-3.3.7 (Added) Once started, foam concentrate pumps shall be arranged to run continuously until stopped manually. There shall be an audible "pump running" alarm in a constantly attended location.
4-3.3.8 (Existing 3-2.4.2) Power supply for the drivers of foam concentrate pumps shall be installed in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, and NFPA 70, National Electrical Code. Power supplies shall be arranged such that disconnecting power to the protected facility during a fire shall not disconnect the power supply to the foam concentrate pump feeder circuit.
4-3.3.9 (Existing 3-2.4.3) Controllers for foam concentrate pumps shall be as follows:
(a) For electric drive foam concentrate pumps greater than 30 horsepower, a listed fire pump controller shall be used.
(b) For electric drive foam concentrate pumps greater than 15 horsepower but not exceeding 30 horsepower, a listed fire pump controller or listed limited service controller shall be used.
(c) For electric foam concentrate pumps less than 15 horsepower, a limited service controller shall be used.
(d) For diesel engine drive foam concentrate pumps, a listed fire pump controller shall be used.

SUBSTANTIATION: 4-3.3.1 Addresses recent changes in NFPA 20 that now includes foam pumps.
4-3.3.2 Clarifies the intended operation of the “reserve” pump.
4-3.3.3 Clarifies the intent of this provision.
4-3.3.4 Addresses requirement for relief valves on foam pumps.
4-3.3.5 Makes foam pump operation consistent with fire pump operation per NFPA 409, 3-2.6.4.
4-3.3.6 Provides specific means for checking tightness of piping required by other standards and is consistent with provisions of NFPA 409, 3-2.6.5.
4-3.3.7 Makes foam pump operation consistent with fire pump operation per NFPA 409, 3-2.6.4.
4-3.3.8 This is essentially an editorial change due to change in title of NFPA 20.
4-3.3.9 Renumbering.

COMMITTEE ACTION: Accept.

409-21 - (4-3.3.3): Reject
RECOMMENDATION: Replace existing 4-3.3.3 with:
4-3.3.3 Controllers for foam concentrate pumps shall be:
(a) a listed foam pump controller for electric drive pumps, NFPA 20, Section 7-9.
(b) a listed fire pump controller for diesel engine drive pumps, NFPA 20, Chapter 9.

SUBSTANTIATION: Foam pump controllers are defined in Section 7-9, NFPA 20, Standard for Installation of Centrifugal Fire Pumps.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: NFPA 409 is more definitive and provides clear concise requirements in one location.

409-22 - (4-5.5): Reject
SUBMITTER: Joe Behnke/ Dennis Kennedy, Ansul Inc.
RECOMMENDATION: Revise 4-5.5 to as follows:
“Air from outside the hazard area shall be used for foam generation unless data is provided to show that air from inside the hazard can be successfully employed. Roof vents shall be located to avoid recirculation of combustion products into the air inlets of the foam generator.”

SUBSTANTIATION: NFPA 11A (1994 ed.) paragraph 1-10.9.1, allows the use of inside air if data is proved to show air from inside the hazard can be successfully employed. This would allow consistency with referenced standard. ANSUL has performed fire tests using inside air to support this proposal.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: Life safety concerns.

409-23 - (5-1.5): Accept
SUBMITTER: Technical Committee on Airport Facilities
RECOMMENDATION: Revise first sentence of 5-1.5 as follows:
5-1.5 In freestanding hangars for a single aircraft, hangar building clusters and in row hangars, a minimum of 6-in. (15-cm) high curbing shall be provided between each aircraft space to prevent the flow of liquid from one space to adjacent spaces. Open-bay hangars capable of housing multiple aircraft shall be provided with floor drainage in accordance with Section 2-11 of this standard.

SUBSTANTIATION: Clarification.

COMMITTEE ACTION: Accept.
Revise text to read as follows:

- **SUBMITTER:** Richard G. Gewain, Hughes Assoc. Inc.
- **RECOMMENDATION:** Delete 5-1.7.1.
- **SUBSTANTIATION:** Exposed insulation materials used to insulate the interior surfaces of walls and roofs cannot meet the criteria of ASTM E136, which is referenced in the definition of noncombustible material in NFPA 220. This would rule out the use of some UL listed structural fire protection materials which perform well in the NFPA 251 standard fire test but under Section 2-10.1 cannot meet the definition of noncombustible material. Some examples are in tumescent coatings which have a solvent base and some sprayed cementitious material listed in the UL Fire Resistance Directory. The very fact that NFPA 409 makes the point that the insulation is exposed on the interior indicates it should be treated as an interior finish material as covered in NFPA 101.

- **FURTHERMORE,** the NFPA 220 definition of limited combustible is not appropriate to apply to insulation materials by virtue to the materials used in the construction of buildings, but do not apply to furnishings, the contents of buildings, or to the fire hazard evaluation of materials. When the limited combustible definition was first developed by the American Insurance Association (formerly the National Board of Fire Underwriters) it was clearly stated in the July 1973 and revised June 1976 Special Interest Bulletin No. 294 and in the National Building Code of the AIA 1976 edition that the limited combustible definition applies to materials used in the construction of buildings, but do not apply to furnishings, or the contents of buildings, or to the fire hazard evaluation of materials. A review of Appendix C in NFPA 220 shows basic fiber glass insulation materials (no vapor barrier) of thicknesses and densities different than those used for insulation purposes, as having Btu’s per pound very close to the 3500 limit. Insulation materials are generally used with a vinyl or other plastic vapor barrier. When the test sample includes the insulation and the plastic vapor barrier in the test prescribed by NFPA 259, the 3500 limit can be exceeded.

- Commonly used insulation materials with vapor barriers exposed to the interior of commercial buildings such as aircraft hangars and meeting the 25 and 50 flame spread and smoke ratings can be found in the U.L., Inc. Building Materials Directory or similar listings of other testing laboratories under the heading Batts and Blankets.

- **COMMITTEE ACTION:** Accept.
Additionally Chapter 6 of this standard may need to be revised to reflect other standards such as NFPA 16 which reads “Foam-Water sprinkler systems shall be tested and inspected in accordance with NFPA 25...” The five (5) requirements of Table 6-1.1 need to remain intact and not follow the one year requirement of NFPA 25.

COMMITTEE ACTION: Accept.

A-6-1.1 Type and frequency of inspection and tests are outlined in Table 6-1.1. Procedures for conducting inspections and testing can be found in NFPA 25.

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409-27 - (A-1-3, Table A-3-3.1): Accept

SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: 1. Add: A-1-3 For overall height of various transport-type aircraft, see Table A-3-3.1.
2. Revise Table A-3-3.1 to read as shown on the next page:

SUBSTANTIATION: The revised list includes current aircraft types in service and deletes aircraft no longer in significant service. The revised list sources data from a standard recognized document ensuring uniformity of information. It also allows users to readily evaluate new aircraft against a uniform standard. The additional information provided allows users to apply both wing area and hangar door size requirements to their technical projects and relate requirements to fuel loads.

COMMITTEE ACTION: Accept.

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409-28 - (A-3-2.2.7): Accept

SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: Add appendix material as follows:

A-3-2.2.7 This provision is for the purpose of addressing obstructions, which may be caused by hangar door positions. It is not intended to address interference due to wind.

SUBSTANTIATION: Added text to address the intent of obstructions.

COMMITTEE ACTION: Accept.

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409-29 - (Table A-3-3.1): Accept

SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: 1. Add the following to Table A-3-3.1:

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Wing Area</th>
</tr>
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<tbody>
<tr>
<td>A-320, 319 Airbus</td>
<td>1319 ft² (122.6 m²)</td>
</tr>
<tr>
<td>MD-11</td>
<td>3648 ft² (339.9 m²)</td>
</tr>
</tbody>
</table>

2. Change Item 9 in Table A-3-3.1 to read as follows:

<table>
<thead>
<tr>
<th>Aircraft Type</th>
<th>Wing Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC-10, MD-10</td>
<td>2932 ft² (272.4 m²)</td>
</tr>
</tbody>
</table>

SUBSTANTIATION: Added additional aircraft data

COMMITTEE ACTION: Accept.
## Table A-3.1 Gross Wing Area and Overall Height for Selected Aircraft

<table>
<thead>
<tr>
<th>Aircraft Description</th>
<th>Gross Wing Area</th>
<th>Overall Height</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aircraft Ft² (M²)</strong></td>
<td><strong>Ft</strong></td>
<td><strong>In</strong></td>
</tr>
<tr>
<td>Airbus A-3xx</td>
<td>6,760 (628.0)**</td>
<td>790</td>
</tr>
<tr>
<td>Antonov An-124</td>
<td>6,200 (576.0)**</td>
<td>65-1</td>
</tr>
<tr>
<td>Boeing 747</td>
<td>5,825 (541.1)**</td>
<td>63-8</td>
</tr>
<tr>
<td>Airbus A-340-500, -600</td>
<td>4,703 (437.0)**</td>
<td>54-11</td>
</tr>
<tr>
<td>Boeing 777</td>
<td>4,605 (427.8)**</td>
<td>60-9</td>
</tr>
<tr>
<td>Ilyushin II-96</td>
<td>4,215 (391.6)**</td>
<td>55-1</td>
</tr>
<tr>
<td>DC-10-20, 30</td>
<td>3,958 (367.7)**</td>
<td>58-1</td>
</tr>
<tr>
<td>Airbus A-340-200, -300, A-330-200, -300</td>
<td>3,892 (361.6)**</td>
<td>52-0</td>
</tr>
<tr>
<td>Boeing 747</td>
<td>3,861 (357.7)**</td>
<td>50-7</td>
</tr>
<tr>
<td>Ilyushin II-76</td>
<td>3,229 (300.0)**</td>
<td>48-5</td>
</tr>
<tr>
<td>Boeing 767</td>
<td>3,050 (283.4)**</td>
<td>40-6</td>
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<tr>
<td>DC-10 MD-10</td>
<td>3,000 (278.0)**</td>
<td>25-10</td>
</tr>
<tr>
<td>DC-8, 63, 73</td>
<td>2,972 (272.4)**</td>
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<td>1,994 (185.2)**</td>
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<td>Beach 1900</td>
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<tr>
<td>Beech King Air C90</td>
<td>294 (27.3)**</td>
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</table>

* Aircraft with wing areas in excess of 3,000 ft² (279 m²)
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