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 Corporation, TN [U]
David J. Burkhart, Code Consultants Inc., MO [SE]
Bruce G. Carpenter, Aero Automatic Sprinkler Co., AZ [IM]
Jefrey W. DeLong, Industrial Risk Insurers, WA [I]
James Devonshire, Buckeye Fire Equipment Company, TX [M]
James Doctorman, The Boeing Company, KS [U]
Scott Enides, SRI Fire Sprinkler Corporation, NY [IM]
Rep. National Fire Sprinkler Association
Joseph E. Gott, U.S. Naval Facilities Engr Command, DC [E]
L. Matthew Gwinn, Delta Air Lines, GA [U]
Elwin G. Joyce, Kentucky Division of Building Code Enforcement, KY [E]
Rep. International Fire Marshals Association
Michael I. Kemmis, Qantas Airways Limited, Australia [U]
Rep. Fire Protection Association Australia
L. M. Krasner, FM Research, MA [I]
Keith C. Kremkow, Marsh USA, Inc., IL [I]
Gene A. LaValle, Interloqics, GA [M]
Rep. National Electrical Manufacturers Association
Rep. NFPA Fire Service Section
Richard J. Louis, The Port Authority of New York & New Jersey, NY [E]
Sarah Maman, Schirmer Engineering Corporation, FL [SE]
Christy J. Marsolo, Tyco International Ltd., GA [M]
Al Mazur, Transport Canada, ON, Canada [E]
John J. O'Sullivan, British Airways, PLC, England [U]
Maurice M. Pilette, Mechanical Designs Ltd, MA [SE]
Jack Poole, Poole Fire Protection Engineering, Inc., KS [SE]
Randy D. Pope, Burns & McDonnell Engineering Company, MO [SE]
Robert Saunders, Wasatch Design Consultants, UT [SE]
(Vote Ltd to NFPA 415)
Michael T. Skinner, Massachusetts Port Authority Fire/Rescue, MA [E]
Fred K. Walker, U.S. Air Force, FL [U]

Alternates
Nathaniel J. Addleman, The RJA Group, Inc., TX [SE]
(Alt. to M. Aaron)
(Alt. to G. LaValle)
Delbert R. Chase, Jr., Federal Express Corporation, TN [U]
(Alt. to T. G. Burk)
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(Alt. to F. K. Walker)
Danny Luey, Port Authority of New York & New Jersey, NY [E]
(Alt. to R. J. Louis)
Robert C. Merritt, FM Global, MA [I]
(Alt. to L. M. Krasner)
Robert J. Tabet, Naval Facilities Engineering Command, VA [E]
(Alt. to J. E. Gott)

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.

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

This Report on Comments was prepared by the Technical Committee on Airport Facilities, and documents its action on the comments received on its Report on Proposals on NFPA 409, Standard on Aircraft Hangars, 1995 edition, as published in the Report on Proposals for the 2001 May Meeting.

This Report on Comments has been submitted to letter ballot of the Technical Committee on Airport Facilities, which consists of 28 voting members, in three segments.

Segment No. 1 consists of Comment 409-1 (Log #CC8).

On Segment No. 1, 19 voted affirmatively, 4 negatively after circulation of negative ballots (Devonshire Joyce, Maman, Walker), and 5 ballots were not returned (Burkhart, Gott, Lett, Mazur, Skinner).

Mr. Devonshire voted negatively stating:

Comment 409-1 (Log #CC8) requires review at committee.

Mr. Joyce voted negatively stating:

I do not see a problem with ROP 409-4 as each hangar has its own protection system and drainage requirements to keep any fuel problem within the hangar. Additionally, if one pump system supplies all hangars there is a redundant requirement for water supply.

Mr. Maman voted negatively stating:

The proposal does not make a significant change to the standard since the present "hangar building cluster" requirements would permit the same level of protection for Class I and II hangars. Section 2-3.2 in NFPA 409, 1995 edition discusses clear spaces around hangars and introduces the "hangar building cluster" concept. As far as I can see, there is no limit on the number of hangars that may be in a cluster even if they are wood frame. There is presently nothing in NFPA 409 that would disallow an unlimited number of Group I, II or III hangars even if positioned 1 in. apart as long as they are considered as a "hangar building cluster". In addition, the protection requirements for hangars are identical if they are arranged in a "hangar building cluster" or separated.

From a fire protection point of view, if a fire should occur in a hangar with no separation walls, the spill and subsequent fire could occur between two bays and/or two fire protection systems. However, when walls separate hangars, the fuel will be prevented from spreading to an adjacent bay. This would also hold true in the case of two detached hangars separated by unrated walls. While it is true that the unrated walls are not equal in protection to a 3 hour rated wall, the exterior wall in the hangar of fire origin would limit the spread of the fire and more likely the fire protection system will activate before exposing the adjacent building. This assumes that the two adjacent hangars are fully protected.

The bottom line is that the problem is not with the ROP Proposal 409-4 but with the cluster requirements in Section 2-3. Presently, there are no limits as to the number of total area of hangars permitted in a "hangar building cluster" even if they are constructed of wood. In addition, the protection of hangars in a "hangar building cluster" is based on the individual hangars not the aggregate.

Voting affirmative on this ballot will not address the underlying concern over hangars arranged in clusters and will create confusion with those using the standard as to the level of protection intended. Accordingly, revisions are required for "hangar building clusters" to address the issues raised in the substantiation section of this ballot and those I have outlined above including construction and protection of hangars arranged in clusters. I strongly suggest that if at all possible, these revisions be made during this code cycle.

Mr. Walker voted negatively stating:

The substantiation provided with the comment is technically incorrect in three critical areas:
1. First it claims the ROP no longer requires a clear distance between Group I and hangars and certain Group II hangars. That condition is already clearly approved in NFPA 409 Paragraph 2-3.2 which applies equally to both Group I and Group II hangars and mixed groups of Group I and Group II hangars. The last sentence states lesser separation distances down to and including zero clearance are acceptable provided you identify the grouping of hangars as a “cluster”.

“2-3.2 For single hangar buildings, the clear space distances specified in Table 2-3.2 shall be maintained on all sides of the single hangar. Where mixed types of construction are involved, the less fire-resistant type of construction shall be used to determine the clear space required. Where the minimum clear space specified in Table 2-3.2 is not met, the buildings shall be considered a hangar building cluster.”

2. Second, the substantiation claims the ROP would permit someone to build hangars with less water supply than is now required. Again this is incorrect since the three hangar configuration shown in the drawing is already permitted under Paragraph 2-3.2 in the current standard. 409 requires protection be designed based on the floor area of a hangar not based on exposures. Paragraph 2-3.2 permits any number of Group I and Group II hangars to be placed adjacent with zero clearance simply by identifying the grouping as a cluster.

3. Third, the current standard limits the building size (square footage) for individual Group II hangars, however, applying the rule in 2-3.2 you can place an unlimited number of Group II hangars in a cluster and jointly cluster them with Group I hangars. The ROP corrects this by limiting any cluster including Group II hangars to the maximum permitted for an individual Group II hangar.

Then what does the ROP really accomplish?
First, it corrects the significant oversight in the current code allowing unlimited groups of unseparated Group II and mixed Group I and II hangars.

Second, it writes in more rational language, similar to that found in building codes, what NFPA 409 has always permitted. This may be the first time many committee members have realized what is actually permitted by the code, but, it does not make good management to bury it back in the code.

To vote in the affirmative on the proposal based on the substantiation especially the water flow discussion is to state the current NFPA 409 is broken and should remain broken. If members believe the conditions depicted in the substantiation should not be permitted then the entire document should be returned to committee because regardless if you vote affirmative or negative the ability to build the conditions shown, exist now.

Segment No. 2 consists of Comment 409-16 (Log #6)

On Segment No. 2, 23 voted affirmatively, and 5 ballots were not returned (Burkhart, Gott, Lett, Mazur, Skinner).

Mr. Kremow voted affirmative with the following comment:
6.14.7.3 should delete reference to “within 5 ft of”, as we voted on during meeting.

Segment No. 3 consists of the balance of Comments 409-2 through 409-15 and 409-17 through 409-18.

On Segment No. 3, 22 voted affirmatively, 1 abstained (Krasner) and 5 ballots were not returned (Burkhart, Gott, Lett, Mazur, Skinner).

Mr. Krasner abstained stating:
Reasons for my negative ROP balloting are still valid. However, in the interest of moving on after all the chads have been counted and lacking any support from other committee members, I am not voting negatively.
Suggest deleting Table 2-3.2 and revising 2-3.2 to read as follows:

"All clear spacings in Table 2-3.2 shall to be maintained on all sides of a hangar or group of hangars meeting 2-3.1.1 through 2-3.1.3 shall be 50 ft (15 m)."

Then use exceptions based on existing text to complete the provision to read as follows:

"Exception No. 1: For Type V (111) and (000) construction the minimum separation distance shall be 75 ft (23 m).

Exception No. 2: Where there is mixed types of construction and Type V (111) or (000) construction is included, the minimum separation distance shall be 125 ft (38 m).

Exception No. 3: Where there is mixed types of construction including Types (443) and (332) and for Type II (222) construction the minimum distance may be reduced to 75 ft (23m).

Exception No. 4: Where there is mixed types of construction including Types (000), Type III, or Type IV construction and not Type V, the minimum separation distance shall be 100 ft (30 m)."

Also revise the new 2-3.4 to read as follows:

"2-3.4 The minimum required clear spaces between structures specified in 2-3.2 and 2-3.3, Tables 2-3.2 and 2-3.3 shall not be used for the storage or parking of aircraft or concentrations of combustible materials, nor shall buildings of any type be created therein."

SUBSTANTIATION: I feel that the suggested revision to utilize text instead of a reference to a table is more user friendly in this case because there are only two distances in the table and only one construction type requiring the second distance.

COMMITTEE ACTION: Reject.


SUBMITTER: Technical Committee on Airport Facilities

COMMENT ON PROPOSAL NO: 409-4

RECOMMENDATION: Reject Proposal 409-4 and return to previous edition text.

COMMITTEE STATEMENT: This proposal does make a significant change to the standard as it no longer requires a clear distance separation between Group I and certain Group II hangars.

The existing section 2-2 Internal Separations will remain as written in the 1995 edition of 409.

Consider that we have a three bay 747 hangar without any internal separations, the same hangar with internal separations, and three single bay 747 hangars built next to each other with only a 5 ft. walkway separating them. What would be the impact to the site water supply assuming that the 100 ft. radius rule is applied and covers two 747s?

Below is a 3 Bay 747 Hangar without internal separations. The 100 ft. radius rule requires water supply for 2 of the 3 bays.

(crosshatch)

Below is a 3 Bay 747 Hangar with 3-hour internal separations. The 100 ft. radius rule requires water supply for 1 of the 3 bays.

(crosshatch)

Below is single Bay 747 Hangars separated by only a man walkway as allowed in the ROP. The 100 ft. radius rule requires water supply for 1 of the hangars only.

(crosshatch)

If you were to examine the impact of the new Low level foam systems using these same examples you would find that the first hangar would require water for three bays and the other two examples would still require water for one bay.

The existing standard would require 3-hour firewalls or more separation between the third exampled hangars.

Although questions have been raised regarding the existing text, it would be best to return to the previous edition text until the committee has had a chance to discuss the above concerns and develop revised text that resolves all of the issues.

COMMITTEE ACTION: Accept.
(1) Name of owner and occupant.
(2) Location, including street address.
(3) Point of compass.
(4) Full height cross section, or schematic diagram, including structural member information if required for clarity and including ceiling construction and method of protection for nonmetallic piping.
(5) Location of partitions.
(6) Location of fire walls.
(7) Occupancy class of each area or room.
(8) Location and size of concealed spaces, closets, attics, and bathrooms.
(9) Any small enclosures in which no sprinklers are to be installed.
(10) Size of city main in street and whether dead end or circulating; if dead end, direction and distance to nearest circulating main; and city main test results and system elevation relative to test hydrant (see A-9.2.1).
(11) Other sources of water supply, with pressure or elevation.
(12) Make, type, model, and nominal K-factor of sprinklers.
(13) Temperature rating and location of high-temperature sprinklers.
(14) Total area protected by each system on each floor.
(15) Number of sprinklers on each riser per floor.
(16) Total number of sprinklers on each dry pipe system, preaction system, combined dry pipe-preaction system, or deluge system.
(17) Approximate capacity in gallons of each dry pipe system.
(18) Pipe type and schedule of wall thickness.
(19) Nominal pipe size and cutting lengths of pipe (or center-to-center dimensions). Where typical branch lines prevail, it shall be necessary to size only one typical line.
(20) Location and size of riser nipples.
(21) Type of fittings and joints and location of all welds and bends. The contractor shall specify on drawing any sections to be shop welded and the type of fittings or formations to be used.
(22) Type and locations of hangers, sleeves, braces, and methods of securing sprinklers when applicable.
(23) All control valves, check valves, drain pipes, and test connections.
(24) Make, type, model, and size of alarm or dry pipe valve.
(25) Make, type, model, and size of preaction or deluge valve.
(26) Kind and location of alarm bells.
(27) Size and location of standpipe risers, hose outlets, hand hose, monitor nozzles, and related equipment.
(28) Private fire service main sizes, lengths, locations, weights, materials, point of connection to city main; the sizes, types and locations of valves, valve indicators, regulators, meters, and valve pits; and the depth that the top of the pipe is laid below grade.
(29) Piping provisions for flushing.
(30) Where the equipment is to be installed as an addition to an existing system, enough of the existing system indicated on the plans to make all conditions clear.
(31) For hydraulically designed systems, the information on the hydraulic data nameplate.
(32) A graphic representation of the scale used on all plans.
(33) Name and address of contractor.
(34) Hydraulic reference points shown on the plan that correspond with comparable reference points on the hydraulic calculation sheets.
(35) The minimum rate of water application (density), the design area of water application, in-rack sprinkler demand, and the water required for hose streams both inside and outside.
(36) The total quantity of water and the pressure required noted at a common reference point for each system.
(37) Relative elevations of sprinklers, junction points, and supply or reference points.
(38) If room design method is used, all unprotected wall openings throughout the floor protected.
(39) Calculation of loads for sizing and details of sway bracing.
(40) The setting for pressure-reducing valves.
(41) Information about backflow preventers (manufacturer, size, type).
(42) Information about antifreeze solution used (type and amount).
(43) Size and location of hydrants, showing size and number of outlets and if outlets are to be equipped with independent gate valves. Whether hose houses and equipment are to be provided, and by whom, shall be indicated. Static and residual hydrants that were used in flow tests shall be shown.
(44) Size, location, and piping arrangement of fire department connections. (NFPA 13: 8-1.1.1)
COMMITTEE STATEMENT: ROP proposal 409-13 provides more substance, clarity, definition and guidance than the proposed acceptance of proposals 409-14, 409-15 and 409-16.

• ROP 409-14 was rejected by the committee. This proposal recommends that the language be changed to advise the user to consult the current edition of NFPA 20 standard. This has been done already in 409-13, paragraph 3-2.4.1 with the modified exceptions that the 409 committee discussed, agreed and voted on that were necessary variances from NFPA 20 for aircraft hangar fire protection.

• ROP 409-15 was rejected by the committee. This is addressing the name change of NFPA 20. It is editorial in nature and has already been addressed in Comment 409-6 (Log # 3).

The same reason for rejection as earlier, which states, “NFPA 409 is more definitive and provides clear concise requirements in one location.”

409-8 - (3-2.4.9 (new), 3-2.4.3 (old)): Accept
SUBMITTER: James L. Boyer, Firetrol, Inc.

COMMENT ON PROPOSAL NO: 409-13
RECOMMENDATION: Revise text to read as follows:
3-2.4.9 (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 electric foam pump controller shall be used.
(b) For electric drive foam concentrate pumps greater than 15 horsepower but not exceeding 30 horsepower, a listed fire electric foam pump controller or limited service foam pump controller shall be used.
(c) For electric foam concentrate pumps less than 15 horsepower, a listed limited service controller shall be used.

SUBSTANTIATION: (a) and (b): UL 218, Standard for Fire Pump Controllers, Section 71.1, requires the “foam pump controller” marking: 71.1. In addition to the requirements in Section 33, Marking, the controller shall be marked “Foam Pump Controller,” preceded by either the term “Electric” or “Limited Service,” depending on the type of controller.

(c) There is no technical reason to prevent a motor of less than 15 HP from being controlled by a limited service controller or a fire pump controller.

COMMITTEE ACTION: Accept.

409-9 - (3-2.5): Accept
SUBMITTER: Technical Committee on Airport Facilities

COMMENT ON PROPOSAL NO: 409-6
RECOMMENDATION: Revise section 3.2.5 as follows:
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.
3.2.5.3 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 area within 5 ft of the perimeter walls and doors within 3 minutes of system actuation.
3.2.5.4.1 Where AFFF concentrate is used, the minimum application rate shall be 0.10 gpm of foam solution per ft2 (4.1 L/min/m2). The minimum application rate shall be 0.16 gpm of foam solution per sq ft (6.3 L/min/m2) where protein-based or fluoroprotein-based concentrate is used.
3.2.5.4.2 The discharge rate of the system shall be based on the rate of application multiplied by the entire aircraft storage and servicing floor area.

3.2.5.4.3 Each 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.
3.2.5.4.4 Monitors 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.
3.2.5.4.5 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.
3.2.5.5 Low-Level High-Expansion Foam Systems.
3.2.5.5.1 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.
3.2.5.5.2 The effective application rate shall be a minimum of 3 cfm/ft2 (0.0014 m3/s).
3.2.5.5.3 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.
3.2.5.5.4 The high-expansion foam generators shall be arranged to achieve initial foam coverage in the expected aircraft parking area.
3.2.5.5.5 Foam generators shall be supplied with air from outside the aircraft storage and servicing area. Roof vents shall be located to avoid recirculation of combustion products into the aircraft inlets of the foam generators.
3.2.5.5.6 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.

SUBSTANTIATION: Editorially moved the title “Low-Level Low Expansion Foam Systems” and renumbered paragraphs accordingly.

COMMITTEE ACTION: Accept.

409-10 - (3-2.8): Accept
SUBMITTER: Technical Committee on Airport Facilities

COMMENT ON PROPOSAL NO: 409-1
RECOMMENDATION: Revise 3.2.8 to read as follows:
3.2.8 Detection/Actuation System Design.
3.2.8.1 General.
3.2.8.1.1 Actuation systems shall be provided with complete circuit supervision and shall be arranged in accordance with Section 3.4 of this chapter.
3.2.8.1.2 These detectors shall be installed in accordance with NFPA 72, National Fire Alarm Code.
3.2.8.1.3 Detection systems shall be provided with supervision as required by NFPA 72, National Fire Alarm Code.

SUBSTANTIATION: Editorial

COMMITTEE ACTION: Accept.

409-11 - (3-2.10.8.4): Accept
SUBMITTER: James L. Boyer, Firetrol, Inc.

COMMENT ON PROPOSAL NO: 409-6
RECOMMENDATION: Revise text to read as follows:
3.2.10.8.4 Fire pumps shall be started automatically by either a drop in water pressure or a signal from the detection control panel. Where two or more electrically driven or electric motors, Electric driven low pressure water fire pumps are considered fire pumps. The same electrical feeder are used, they shall be electrically controlled to prevent simultaneous provided with automatic sequential starting.
409- 12 - (4-1.3): Accept

SUBMITTER: Technical Committee on Airport Facilities

COMMENT ON PROPOSAL NO: 409-6

RECOMMENDATION: Revise 4.1.3 to read as follows:

4.1.3 Automatic 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 13, Standard for the Installation of Sprinkler Systems.

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The proposal should refer to the second paragraph of 5-1.7 as there is no 5-1.7.1

SUBSTANTIATION: Editorial

COMMITTEE ACTION: Accept.

409- 13 - (4-3.3): Reject

SUBMITTER: Southern Regional Fire Code Dev. Committee

COMMENT ON PROPOSAL NO: 409-20


SUBSTANTIATION: Proposals 409-19, 21, and 22 provide the appropriate guidance in installing these types of systems.

COMMITTEE ACTION: Reject.

COMMITTEE STATEMENT: The same reason as rejecting Comment 409-7 (Log # 9). The ROP proposal 409-20 provides more substance, clarity, definition and guidance than the proposed acceptance of proposals 409-19, 409-21 and 409-22. In addition, proposals 409-19 and 409-22 are referencing high expansion foam generator air sources; not foam pumps or their applications.

- ROP 409-19 was rejected by the committee. This proposal has nothing to do with foam pumps or foam pump applications. 409-19 is referring to outside air for high expansion generators.

- ROP 409-21 was rejected by the committee. This proposal is addressing NFPA 20 labeling requirements, is editorial in nature and has been addressed by the 409 committee in previous actions. NFPA 409 is more definitive and provides clear concise requirements in one location.

- ROP 409-22 was rejected by the committee. This proposal has nothing to do with foam pumps or foam pump applications. 409-22 is referring to outside air for high expansion generators.

409- 16 - (Chapter 6): Accept in Principle

SUBMITTER: Lee C. DeVito, FIREPRO Incorporated

COMMENT ON PROPOSAL NO: 409-25

RECOMMENDATION: Create a new chapter addressing the use of membrane-covered rigid steel frame structures as an acceptable construction type for aircraft hangars. This chapter would follow the existing Chapter 5 Group III Aircraft Hangars. Chapter 6 Membrane-covered Rigid Steel Frame Structures

6.1 Design.

6.1.1 The design, materials, and construction of the building shall be based on design documents, such as drawings, reports, calculation, and specifications, prepared and signed and sealed by a licensed architect or engineer knowledgeable in this type of construction.

6.2 Construction.

6.2.1 When membrane-covered rigid steel frame structures are used for the construction of aircraft hangars, they shall be constructed in accordance with this standard.

6.2.2 The hangar shall all limited to one story.

6.2.3 The hangar shall contain a single hangar fire area.

6.2.4 The height and area of the hangar shall be limited by the requirements of the applicable local building codes based on the occupancy and type of construction classification.

6.2.5 Testing of membrane materials for compliance with this section’s use of the categories of noncombustible and limited-combustible materials shall be performed on weathered membrane material.

6.2.6 Flame spread of all membrane materials exposed within the structure shall be Class A as defined in Section 6-5 of NFPA 101, Life Safety Code.

6.2.7 Flame Resistance. All membrane structure fabric shall meet the requirements of both the small-scale and large-scale tests contained in NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

6.2.7.1 The authority having jurisdiction shall require a certificate or other evidence of acceptance by an organization acceptable to the authority having jurisdiction or the report of tests made by other inspection authorities or organizations acceptable to the authority having jurisdiction as evidence that the fabric materials have the required flame resistance.

6.2.7.2 Where required by the authority having jurisdiction, confirmatory field tests shall be conducted using test specimens from the original material, which shall have been affixed at the time of manufacture to the exterior of the structure.

6.2.8 Material loading and strength shall be based on physical properties of the materials verified and certified by an approved testing laboratory.

6.2.9 The membrane roof for structures in climates subject to freezing temperatures and ice buildup shall be composed of two layers with an air space between them through which heated air can be moved to guard against ice accumulation. In lieu of the above, any other approved methods that protect against ice accumulations shall be permitted.

6.2.10 Where provided, roof drains shall be equipped with external elements to protect against ice buildup, which would prevent the drains from functioning. Such heating elements shall be served by on-site standby electrical power in addition to the

409- 15 - (5-1.7): Accept

SUBMITTER: Technical Committee on Airport Facilities

COMMENT ON PROPOSAL NO: 409-5

RECOMMENDATION: The proposal should refer to the second paragraph of 5-1.7 as there is no 5-1.7.1

SUBSTANTIATION: Editorial

COMMITTEE ACTION: Accept.

COMMITTEE STATEMENT: The time duration criteria is appropriate considering that the 30 minute duration is for protection utilizing foam and an overhead water sprinkler system. The 60 minute criteria is for just an overhead water sprinkler system.
normal public service. In lieu of the above, any other approved method that protect against ice accumulation shall be permitted.

6.3 Maintenance and Operation

6.3.1 Instructions in both operation and maintenance shall be transmitted to the owner by the manufacturer of the membrane-covered rigid steel frame structure.

6.4 Internal Separations

6.4.1 Mezzanines, tool rooms, and other enclosures within aircraft storage and servicing areas shall be constructed of noncombustible material or limited combustible material as defined in NFPA 220, Standard on Types of Building Construction, in all membrane-covered rigid steel frame structure type hangars.

6.4.2 Partitions and ceilings separating aircraft storage and servicing areas from all other areas, shops, offices, and parts storage areas shall have at least a 1-hour fire resistance rating with openings protected by listed fire doors or shutters having a minimum fire resistance rating of 45 minutes.

6.4.3 Where a storage and servicing area has an attached, adjoining, or contiguous structure, such as a lean-to, shop, office, or parts storage area, the wall common to both areas shall have at least a 1-hour fire resistance rating, with openings protected by listed fire doors having a minimum fire resistance rating of 45 minutes and actuated from both sides of the wall.

6.5 Clear Space Distance Around Hangars. Precautions shall be taken to ensure ready access to membrane-covered rigid steel frame structure hangars from all sides. Adequate separation shall be provided to reduce fire exposure between buildings. The minimum separation requirements shall be determined as specified in 2.3 or 5.2 for the type of construction to which the authority having jurisdiction has determined the membrane-covered rigid steel frame structure conforms.

6.6 Aprons and Floors.

6.6.1 The surface of the grade floor of aircraft storage and servicing areas shall be noncombustible and above the grade of the approach or apron at the entrance to the hangar.

6.6.2 Hangar aprons shall slope away from the level of the hangar floors to prevent liquid on the apron surfaces from flowing into the hangars.

6.7 Doors.

6.7.1 In membrane-covered rigid steel frame structure hangars with a hangar fire area greater than 12,000 ft² (1,115 m²), hangar doors that accommodate aircraft shall be of noncombustible construction.

6.7.2 The power source for hangar doors shall operate on independent circuits and shall not be de-energized when the main disconnect switches for general hangar power are shut off.

6.7.3 Vertical traveling doors shall be counterbalanced, and horizontal slide or accordion-type doors shall be arranged, so that manual or auxiliary operation by means of winches or tractors, for example, is feasible.

6.7.4 In an area where freezing temperatures can occur, door tracks of the bottom edges of doors shall be protected by heating coils or equivalent means to prevent ice formation that might prevent or delay operation.

6.8 Curtains. Where curtains are used to enclose a work area, they shall be of a listed flame-retardant type.

6.9 Landing Gear Pits, Ducts, and Tunnels.

6.9.1 Landing gear pits, ducts, and tunnels that are located below floor level in membrane-covered rigid steel frame structure hangars shall be designed on the premise that flammable liquids and vapors will be present at all times. Materials and equipment shall be impervious to liquids and shall be fire resistant or noncombustible.

6.9.2 Electrical equipment for all landing gear pits, ducts, and tunnels that are located below hangar floor level shall be suitable for use in Class I, Division 1, Group D hazardous locations in membrane-covered rigid steel frame structure hangars unless the hangar fire protection required by 6.17 is adequate to protect each pit.

6.9.3 Conduits or other means to prevent ice formation that might cause fire or explosion shall be provided. Where driven electrodes are used, they shall consist of 5/8 in. (15.9 mm) minimum diameter or larger metal rods driven at least 5 ft (1.5m) into the ground. Grounding receptacles shall be designed to minimize the tripping hazard.

6.9.4 All electrical equipment shall be protected by a protective device that is not more sensitive than High-expansion foam suppression systems other than High-expansion foam are utilized.

6.9.5 Where practiced, electrical equipment shall be located in a room separated from hangar service areas by a partition with a 1-hour fire resistance rating. The partition shall not be penetrated except by electrical raceways, which shall be protected by approved sealing methods maintaining the same fire resistance rating as the partition.

6.10 Exposed Interior Insulation. Exposed interior insulation in the aircraft storage and servicing area of membrane-covered rigid steel frame structure hangars shall comply with the requirements of NFPA 101®, Life Safety Code®, special provisions for aircraft storage hangars, interior wall and ceiling finish criteria.

6.11 Drainage of Aprons and Hangar Floors.

6.11.1 When a membrane-covered rigid steel frame structure hangar is placed on an undeveloped site, the drainage of aprons and hangar floors of hangars with a hangar fire area greater than 12,000 ft² (1,115 m²) shall be as specified in 2.11.

6.11.2 When a membrane-covered rigid steel frame structure hangar is to be placed on an existing apron, in establishing its location, consideration shall be given to the drainage pattern of the apron and the water requirements of the fire protection systems if suppression systems other than High-expansion foam are utilized.

6.12 Heating and Ventilating.

6.12.1 Heating, ventilating, and air conditioning equipment of membrane-covered rigid steel frame structure hangars shall be installed, as applicable, in accordance with 2.12.

6.13 Lighting and Electrical Systems.

6.13.1 Artificial lighting shall be restricted to electric lighting.

6.13.2 Electrical services shall be installed in compliance with the provisions for aircraft hangars contained in Article 513 of NFPA 70, National Electrical Code.

6.13.3 In hangars with aircraft storage and servicing areas greater than 12,000 ft² (1,115 m²), housing other than unfueled aircraft, main distribution panels, metering equipment, and similar electrical equipment shall be located in a room separated from the aircraft storage and servicing area by a partition having at least a 1-hour fire resistance rating. The partition shall not be penetrated except by electrical raceways, which shall be protected by approved sealing methods maintaining the same fire resistance rating as the partition.

6.14 Lighting Protection. Where provided, lightning protection for membrane-covered rigid steel frame structure hangars shall be installed in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.

6.15 Grounding Facilities for Static Electricity.

6.15.1 Membrane-covered rigid steel frame structure hangars, housing other than unfueled aircraft, shall be provided with grounding facilities for the removal and control of static electrical accumulations on aircraft, while aircraft are stored or undergoing servicing in a hangar.

6.15.2 An adequate number of floor-grounding receptacles shall be provided. The receptacles shall be either grounded through individual driven electrodes or electrically bonded together in a grid system and the entire system grounded to underground metal piping, such as cold water or sprinkler piping, or driven electrodes. Where driven electrodes are used, they shall consist of 3/8 in. (15.9 mm) diameter or larger metal rods driven at least 5 ft (1.5m) into the ground. Floor-grounding receptacles shall be designed to minimize the tripping hazard.

6.15.3 Grounding wires shall be bare and of a gauge that is satisfactorily durable and not subjected to mechanical strains and usage.

6.16 Exit and Access Requirements


6.16.2 Exit and access space shall be maintained to ensure access to sprinkler control valves, standpipe hose fire extinguishers, and similar equipment.

6.17 Fire Protection for Membrane-Covered Rigid Steel Frame Structure Hangars.

6.17.1 The protection of aircraft storage and servicing areas for membrane-covered rigid steel frame structure hangars, having a hangar fire area greater than 12,000 ft² (1,115 m²), housing either fueled or unfueled aircraft, the shall be in accordance with any of the following:
6.17.7 High-Expansion Foam Systems.
6.17.7.1 High-expansion foam systems shall utilize surfactants as the foaming ingredient and shall be designed for local application.
6.17.7.2 These systems shall be designed to discharge at a rate to cover the entire area to a depth of at least 3 ft (0.9 m) within 3 minutes.
6.17.7.3 If sprinklers are also used, discharge rates shall take into consideration the sprinkler breakdown factor required in 2.5.5.2(b) of NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.
6.17.7.4 The foam generators shall be located at the ceiling or on exterior walls in such a way that only air from outside the aircraft storage and servicing area can be used for foam generation unless data is provided to show that air from inside the hangar can be successfully employed to generate the foam. The data shall be specific for the products of combustion to be encountered and shall provide factors for increasing foam discharge rates over those for outside air if fire test indicate that need. When used, roof vents shall be located to avoid recirculation of combustion products into the air inlets of the foam generators.
6.17.7.5 Generators shall be powered by reliable water-driven or electric motors. Electric power reliability for generators shall be in accordance with electric fire pump requirements of NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.
6.17.8 Foam Concentrate Supply.
6.17.8.1 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.
6.17.8.2 The quantity of high expansion foam concentrate shall be sufficient for a 12-minute fire discharge at the water flow rate based on the supply calculation method required in 6.17.7.2.
6.17.8.3 The quantity of high expansion foam concentrate shall be sufficient for a 12-minute pump discharge at the water flow rate based on the supply calculation method required in 6.17.7.2.
6.17.8.4 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 in 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.
6.17.8.5 Control valves, foam concentrate liquid storage tanks, concentrate pumps, controllers, and bypass balancing equipment shall be located outside the aircraft storage and service area.
6.17.9 Foam Concentrate Pumps.
6.17.9.1 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.
6.17.9.2 Power supplies 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, or other applicable standard such that disconnecting power to the protected facility during a fire shall not disconnect the power supply to the foam concentrate pump feeder circuit.
6.17.9.3 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 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.
6.17.9.4 Piping shall be arranged so that maximum foam concentrate demand can be supplied from either primary or reserve foam concentrate tanks.
6.17.10 Detection / Actuation System Design.
6.17.10.1 General. Actuation systems shall be provided with complete circuit supervision and shall be arranged in accordance with 6.17.13.
6.17.10.2 Low-Expansion Foam Protection Systems.
6.17.10.2.1* Actuation of fire detectors shall operate the low-expansion foam protection system.
6.17.10.3.3 Actuation of fire detectors shall operate the high-expansion foam protection system.

6.17.10.3.4 Manual actuation stations shall be provided for each high-expansion 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.

6.17.11 Hand Hose Systems.

6.17.11.1 Hand hose systems shall be installed in every hangar, to provide for manual fire control.

6.17.11.2 The hand hose systems shall be arranged to permit application of water or other extinguishing agents on each side and into the interior of the aircraft located in the aircraft storage and servicing area. At least two hose lines shall be considered to be operated simultaneously.

6.17.11.3 Foam-Water Hand Hose Systems.

6.17.11.3.1 Foam-water hand hose systems shall be installed in the aircraft storage and servicing areas having a hangar fire area greater than 12,000 ft² (1,115 m²) housing other than unfueled aircraft.

6.17.11.3.2 The systems shall conform with the applicable portions of NFPA 14, Standard for the Installation of Standpipe and Hose Systems, and NFPA 11, Standard for Low-Expansion Foam or NFPA 11A, Standard for Medium- and High-Expansion Foam Systems.

6.17.11.3.3 These foam-water hand hose systems shall be supplied from a connection to the low-expansion or high-expansion foam system header or from a direct connection.

6.17.11.3.4 Each foam-water 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 and diameter to provide a minimum flow of 60 gpm (227 L/min) at an adequate nozzle pressure. The stream range shall be calculated based on the volume and pressures available under maximum demand conditions.

6.17.11.3.5 The hose shall be 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.

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

6.17.11.3.7 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.

6.17.11.4 Water Hand Hose Systems.

6.17.11.4.1 Water hand hose and standpipe systems shall be installed in accordance with NFPA 14, Standard for the Installation of Standpipe and Hose Systems, in aircraft storage and servicing areas having a hangar fire area greater than 12,000 ft² (1,115 m²) housing unfueled aircraft and all shop, office, and nonaircraft storage areas in hangars, except where special hazards that require special protection exist.

6.17.11.4.2 Water hand hoses shall be fitted with listed adjustable stream pattern nozzles designed to permit straight stream or water spray application.

6.17.11.5 Water Supply.

6.17.11.5.1 The total water supply shall be sufficient to satisfy the protection systems as described in Sections 6.17.11.1(a), 6.17.11.1(b), 6.17.12, and 6.17.13, and the requirements for hose stream and other equipment as determined in 6.17.11. Water shall be available in sufficient quantity and pressure to supply the maximum number of discharge devices likely to operate simultaneously. Water shall be suitable for the production of foam.

6.17.11.5.2 The total water supply duration shall be for a minimum of 45 minutes.

6.17.11.5.3 Hand Hose Systems. The water supply for hand hose systems shall be capable of satisfying the requirements of 6.17.11. Demand shall be calculated at the point where supply piping for the hand hose systems connects to the system piping or fire protection underground.

6.17.11.5.4 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.

6.17.11.5.5 Water Reservoirs. Where a single reservoir is used for the basic water supply, such reservoir shall be divided into approximately equal sections, arranged at least one-half of the water supply will always be maintained in service in order to increase the reliability of the water supply. The suction line from each section shall be sized to deliver the maximum water supply requirement.

6.17.11.6 Fire Pumps.

6.17.11.6.1 Fire pumps shall be installed in accordance with NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, and in accordance with the provisions of 6.17.11.6.2 through 6.17.11.6.6.

6.17.11.6.2 The total pumping capacity shall be such that maximum demand can be met with the largest fire pump out of service.

6.17.11.6.3 Pump houses and rooms shall be of fire-resistant 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.

6.17.11.6.4 Fire pumps shall be started automatically by either a drop in water pressure or a signal from the detection control panel. Where two or more electrically driven fire pumps supplied from the same electrical feeder are used, they shall be electrically controlled to prevent simultaneous starting.

6.17.11.6.5 Frequent operation of fire pumps shall be avoided by the installation of a small auxiliary pressure maintenance pump or other suitable means to maintain normal system pressures.

6.17.11.6.6 Once started, fire pumps shall be arranged to run continuously until they are stopped manually. There shall be an audible "pump running" alarm in a continuously attended area.

6.17.11.7 Flushing Underground Pipe. Underground mains and each lead-in connection shall be flushed as specified in NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

6.17.11.8 Acceptance Tests.

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

6.17.11.8.2 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, or NFPA 14, Standard for the Installation of Standpipe and Hose Systems, as applicable.

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

6.17.11.8.4 The maximum number of systems expected to operate shall be simultaneously discharged with foam. This test shall be run for a length of time sufficient to stabilize discharge before test samples are taken to determine foam concentrate percentage.

6.17.11.8.5 Any proportioner not tested under the requirements of 6.17.11.8.4 shall be individually tested with foam concentrate to determine concentrate percentage.

6.17.11.8.6 Low-expansion and high-expansion foam protection systems shall be subjected to foam flow tests, with foam flowing simultaneously from the maximum number of foam nozzles or generators expected to operate, in order to ensure that the hazard is protected in conformance with the design specification and to determine whether the flow pressures, agent discharge capacity, foam coverage, percent concentration, and other operating characteristics are satisfactory.

6.17.11.8.7 Low-expansion and high-expansion foam 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.

6.17.11.9 Final Approval. The installing company shall furnish a written statement that the work has been completed in accordance with 6.17.5, and tested in accordance with the provisions of 6.17.11.8.

6.17.11.10 Conversion of Existing Systems.

6.17.11.10.1 In converting one type of system to another, all provisions of this chapter pertaining to new systems shall apply.

6.17.11.10.2 Converted systems shall be tested in accordance with 6.17.11.8.

6.17.12 Wheeled and Portable Extinguishers.

6.17.12.1 Wheeled and portable extinguishers shall be provided in accordance with NFPA 409—May 2001 ROC—Copyright 2001, NFPA. Wheeled and portable extinguishers shall be provided in accordance with NFPA 409—May 2001 ROC—Copyright 2001, NFPA.
occupancy based on an analysis of each room or area following the requirements of NFPA 10, Standard for Portable Fire Extinguishers.

6.17.13 Protection System Alarms. In addition to local alarm service, alarms shall be transmitted to a constantly attended location.

Definitions
Add to the former Chapter 1, Section 1-3 Definitions:
Membrane. A thin, flexible, water impervious material capable of being supported by an air pressure of 1.5 in. (38.1 mm) of water column in use.
Weathered-membrane Material. Material that has been subjected to a minimum of 5,000 hours in a weatherometer in accordance with ASTM G26, Practice for Operating Light/Exposure Apparatus (Zenon-Arc Type) With and Without Water for Exposure of Non-Metallic Materials, or approved equivalent.

Referenced Publications
Add to the former Chapter 7, Section 7-1.1 NFPA Publications:
Add to the former Chapter 7, a new section 7-1.2 ASTM Publications:
Add to the former Appendix B, Section B-1.1 NFPA Publications:

Appendix A

A-6.1 Membrane-covered rigid steel frame structures are an evolving construction technology that is recognized by the model building codes and is being used for a variety of occupancies, including warehouses and hangars. The use of membrane-covered rigid steel frame structures for providing weather protection covering for aircraft has become a viable alternative to the traditional construction techniques that have been used for aircraft hangars. The fire protection scheme considered for these structures anticipates that, in the event of a fire, the structure will be self-venting.

A-6.11.2 There is little concern for a large volume of water being associated with a high-expansion foam solution. In an aggregation of mechanically expanded foam, the ratio of air or other gases to foam-water solution ranges from 200:1 to approximately 1000:1.

A-6.17.10.2.1 Additional guidance pertaining to detection systems can be found in NFPA 72, National Fire Alarm Code. The selection of fire detectors should take into account factors such as: the anticipated fuel, the ability of the detectors to sense fire in the fire zone, the speed at which the detector will sense the fire, and potential sources of stimuli that could be falsely detected as a fire.

A-6.17.10.3.1 Additional guidance pertaining to detection systems can be found in NFPA 72, National Fire Alarm Code. The selection of fire detectors should take into account factors such as: the anticipated fuel, the ability of the detectors to sense fire in the fire zone, the speed at which the detector will sense the fire, and potential sources of stimuli that could be falsely detected as a fire.

SUBSTANTIATION: Membrane-covered rigid steel frame structures are an evolving construction technology that is recognized by the model building codes and is being used for a variety of occupancies, including hangars, warehouses, and assembles. They are most prevalently used for assembly occupancies, and are addressed for those purposes in NFPA 102, Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures, in which life safety is a primary issue as compared to the building and property protection objectives of NFPA 409.

By establishing a chapter specifically addressing the membrane-covered rigid steel frame structures for aircraft hangars as a construction system, more definitive minimum standards can be established for the construction and protection of these facilities that are consistent with the known concerns for the protection of existing construction types and known hazards.

This chapter anticipates that membrane-covered rigid steel frame structures will be self-venting in the event of a fire, therefore the protection is focused on fire control within the hangar. Thus the two proposed protection schemes are the use of either high-expansion foam for low-expansion foam, which have been used as supplemental protection to sprinklers for conventional construction hangar applications. Sprinkler protection is proposed for enclosed offices, shops, and storage areas.

REFERENCES:

COMMITTEE ACTION: Accept in Principle.

Revise text to read as follows:
1. Add new definition in Section 1.3
   Where Specified-Options selected by the purchaser beyond the minimum requirements of the standard.
2. Add the following definitions:
   1. Side Slope: This angle is measured as either the percent of slope or the tilt angle at which the vehicle would become unstable should the vehicle be placed on a side of a steep angled hill or sloped surface.
3. Under Axle Clearance: Is the clearance distance between the ground and the center drive train of the vehicle. Generally this measurement is taken at the low point bottom of the drive differentials.
   4. Diagonal Opposite Wheel Motion: Is the measurement of vertical movement relationship of the wheel and suspension travel.
   5. Service Brake: A system capable of decelerating the vehicle at a controlled rate to a desired reduced speed or complete stop.
   6. Primary Turret: The largest capacity foam turret used to apply primary extinguishing agent.
   7. Ground Sweep Nozzle: Small nozzle(s) mounted in front of the vehicle disperses foam solution in front to provide protection.
   8. Under Truck Nozzles: Small nozzles devices which hang below the vehicle and disperses foam solution in a manner which provides protection for the vehicles from ground or grass proximity fires. These devices spray agent from wheel to wheel and front to back of the underside of the truck.
   9. Complementary Agent: Agents which provide unique extinguishing capability beyond the primary chosen agent. These agents can extinguish by means of chemical reaction, cooling or removal of oxygen and are applied to special fire situations such as three dimensional running fuel fires.

2. Add the following text at 2-1-5 (or where appropriate)
   2-1-5*Additional vehicle options where needed shall be selected by the purchaser.
   Include the following revised appendix material at A 2-1-5 (or where appropriate).

Note: Changes from original proposal are identified in the margin. Modify log 15 to leave only 2-4.8* and 2-24.1 (d) (e) (j) (k) (l) (m) to be deleted from the body of the standard.

A-2-1-5 List of available options which can be ordered from the ARFF vehicle manufacturer.

<table>
<thead>
<tr>
<th>General ARFF vehicle options</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Winterization system providing sufficient insulation and heating capacity, by means of hot circulating liquids and forced air exchangers, to permit satisfactory operation of the vehicle and fire fighting systems for a period of at least 4 hours at ambient temperatures as low as 40 degree F (&amp;F) with the vehicle fully operational and the engine running. At the end of the 4 hour period, the vehicle shall be capable of successfully discharging its agent(s). The winterization system shall not detract the performance of the vehicle and fire fighting system in ambient temperatures up to 115 degree F (43.5C).</td>
</tr>
<tr>
<td>· Training video tape covering the operation of the vehicle.</td>
</tr>
<tr>
<td>· Pintle hook type towing connection rated at 30000 lb gross trailer weight, attached to the vehicle's frame at the rear of the vehicle.</td>
</tr>
<tr>
<td>· Rollup type compartment doors (other than service doors)</td>
</tr>
<tr>
<td>· Windsheild deluge system (see 2-11.4.6)</td>
</tr>
<tr>
<td>· Navigation system of a driver's enhanced vision system (DEVIS) (see 2-11.4.7).</td>
</tr>
<tr>
<td>Monitoring and data acquisition system (MADAS) (see .1.7)</td>
</tr>
<tr>
<td>Dimensional, safety and stability enhancement options</td>
</tr>
</tbody>
</table>
- Added payload capacity (GVWR) to carry special equipment where the purchaser identifies added equipment.
- Increased overall width of the vehicle to facilitate increased performance and maneuverability with no concern for movement on public highway(s).
- Audiovisual devices that meet or exceed the field of vision provided by wide-angle mirrors.

Engine(s) related options
- Engine which operate at necessary performance above 2000 ft elevation.
- Radiator shutters (see 2-3.2.1.3)
- Engine coolant filler.
- Silicone coolant and heater hoses.
- Heated diesel fuel water separator
- Automatic drain(s) for the diesel fuel water separator.
- Auxiliary fuel tank(s) commensurate with need to meet local requirements.
- Stainless steel exhaust systems and muffler(s)

Vehicle electrical and lighting options
- Automatic eject type electrical receptacles.
- On-board battery charger/conditioner (see 2-4.5)
- Auxiliary generator(s) installed as per IAW and NFPA 1901, Chapter 21.
- High intensity spotlight(s) on the left and right side of the windshield, hand adjustable type, with controls for beam adjustment inside the truck cab.
- High intensity spotlight(s) mounted on the primary turret nozzle(s) with controls located in the cab instrument group.
- Two high intensity floodlight(s), mounted on each side of the vehicle.
- Two high intensity fog type driving lights mounted on the front bumper.
- Two high intensity driving lights mounted on the front bumper.
- Two high intensity floodlight(s) on the rear of the vehicle.
- Map lights on each side of the dash. A control switch on the instrument group panel in the cab for control of the lights.
- Rotating beacon type lights on the top roof deck and visible for 360 degrees in the horizontal plane. A control switch on the instrument group panel in the cab for control of the lights.
- Strobe type light(s) on the top roof deck and visible for 360 degrees in the horizontal plane. A control switch on the instrument group panel in the cab for control of the lights.
- Fused radio electrical connection in the cab adjacent to the instrument group panel in the cab for control of the lights.

Suspension, mobility and tire options
- Reduced under axle and under body clearances to provide a more stable performance on pavement when the vehicle suspension is designed to permit instantaneous adjustment to the required height for off pavement travel.
- Tag or other non powered axle(s) to assist in weigh distribution and/or stability requirements.
- Passive or active suspension components to increase the stability of the vehicle while decreasing the roll over threshold.
- Spare tire(s)
- Bead locks on tires and rims.
- Run flat devices in all tires and wheels mounted on the vehicle.

Vehicle brake options
- Air brake reservoirs drain valve(s) actuated by the driver form a location or compartment not requiring a creeper to access the actuator.
- Auto-eject type connectors air connection used to change brake air tanks from an external air source.

Vehicle cab, operating and driving options
- Tilt and telescoping steering wheel
- Supplementary designated seat positions for additional crew members.
- Quick access passage to the roof
- FLIR heads up display located in the cab.
- Cab air conditioning meeting current automotive-truck and environmental protection standards for vehicle air conditioning. The use of air conditioning shall not change the acceptable pass fail criteria.
409-17 - (A-3-2.8.3.1): Accept
SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: Revise A-3.2.8.3.1 to read as follows:
A.3.2.8.3.1 Where separate detection systems are provided for actuation of the supplementary systems, they 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.

SUBSTANTIATION: The supplementary or low level systems are required to be actuated by the actuation of any primary system or overhead system. The annex material is only applicable where a separate detection system is provided. This is not a substantive change, but a clarification of the committee's intent.

COMMITTEE ACTION: Accept.

409-18 - (A-3-2.8.5.1): Accept
SUBMITTER: Technical Committee on Airport Facilities

RECOMMENDATION: Revise to read as follows:
A.3.2.8.5.1 When separate detection systems are provided for the actuation of low-level systems, they 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.

SUBSTANTIATION: The supplementary or low level systems are required to be actuated by the actuation of any primary system or overhead system. The annex material is only applicable where a separate detection system is provided. This is not a substantive change, but a clarification of the committee's intent.

COMMITTEE ACTION: Accept.

Editorial Correction

The Technical Committee on Airport Facilities proposes the following editorial change to NFPA 409, Standard on Aircraft Hangars.

In Table A-3-3.1, line #1 under the column Aircraft change Airbus A-3xx to read Airbus A-380.