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From: Chief Engineer, Naval Facilities Engineering Systems Command

Subj: INTERIM TECHNICAL GUIDANCE (ITG) FY26-03 DESIGN CRITERIA FOR LOW
LEVEL FIRE PROTECTION IN NAVY AND MARINE CORPS AIRCRAFT HANGAR
FACILITIES

Ref: (a) National Defense Authorization Act for Fiscal Year 2020 (NDAA FY20)
(b) Assistant Secretary of the Navy (Energy, Installations and Environment) Sundown
Policy for Foam-Based Fire Suppression Systems in Department of Navy Hangars of 07
Aug 24
(c) Assistant Secretary of Defense Memorandum, Guidance for the Change Out from
Aqueous Film Forming Foam to Fluorine-Free Firefighting Systems in Facilities of 30 Jul
24
(d) UFC 3-601-02, Fire Protection Systems Inspection, Testing, and Maintenance of 07 Oct
21
(e) UFC 4-211-01, Aircraft Maintenance Hangars, Change 3 of 20 Apr 21
(f) UFC 3-460-01, Design: Petroleum Fuel Facilities, Change 3 of 08 Jun 23
(g) UFC 3-600-01, Fire Protection Engineering for Facilities of 02 Jul 26
(h) NFPA 409, Standard on Aircraft Hangars, 2026 Edition

Encl: (1) ILDFA Introduction, Background, and Coverage Diagrams
(2) UFGS 13 50 00, Ignitable Liquid Drainage Floor Assemblies
(3) Viking Technical Bulletin – Viking Peak Nozzle Series
(4) New Construction Hangar – 4-Way-Fall Floor Slope Diagram
(5) Existing Hangar - Maximum Grate Water Nozzle Spacing

1. Purpose. This Interim Technical Guidance (ITG) provides requirements for acceptable low level fire protection for flammable liquid fires in Navy and Marine Corps aircraft hangars.

2. Cancellation. This ITG cancels and supersedes ITG FY26-01 Acceptable Design Criteria for Low Level Fire Protection in Navy and Marine Corps Aircraft Hangar Facilities dated 5 Feb 2026.

3. Background.

a. Reference (a) prohibits the purchase of fluorinated AFFF concentrate that contains in excess of one part per billion of per- and polyfluoroalkyl (PFAS) after 1 October 2023 and removal from service 1 October 2024. The third one-year extensions for the use of AFFF have

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been exercised by the Secretary of Defense, establishing a final removal date for all AFFF no later than 30 September 2027.

b. Reference (b) details the requirements to sundown foam-based Fire Suppression Systems (FSS) in Department of Navy (DoN) and United State Marine Corps (USMC) hangars. The memo requires immediate action to cease operations of installed foam FSS and replace with a permanent installation of a non-foam code compliant solution.

4. Discussion.

a. To provide acceptable fire protection for DoN and United States Marine Corps (USMC) aircraft hangars, one of the following approved options must be implemented: 1) a combination of an automatic sprinkler system and an Ignitable Liquid Drainage Floor Assembly (ILDFA), 2) a combination of an automatic sprinkler system and a low-level water-based flushing nozzle system, or 3) an automatic overhead water sprinkler system for hangars housing only unfueled aircraft. A low-level Fluorine-Free Foam (F3) grate nozzle system is a fourth code compliant solution for DoN and USMC aircraft hangars. However, per reference (b), this system can only be used under certain conditions, and its use must be approved by the Assistant Secretary of the Navy for Energy, Installations, and Environment, ASN(EI&E). If conditions warrant, the NAVFAC HQ Chief Engineer (CHENG) will request the necessary approvals from ASN(EI&E).

b. As part of the initiative to phase out the use of AFFF, the Navy has developed a new low-level, water flushing nozzle system engineered to meet the design criteria outlined in NFPA 409. The suppression system pushes the fuel fire off the floor into collection trenches and out of the building. Ongoing testing, modeling, and analysis confirm that the system will perform at a level equivalent to the requirements in NFPA 409. A Performance Based Design analysis will be published for the water flushing nozzle system documenting equivalency. The technical aspects of this system for new and retrofit applications are contained in this ITG to provide design parameters for Architects and Engineers to use in designing FSS for DoN and USMC aircraft hangars.

c. The final testing has validated performance of the water-flushing nozzle system. The following technical guidance is approved for use in new and existing hangar projects and no waivers are required.

5. Applicability. This ITG is effective until superseded by additional guidance, and applies to projects in new and existing Navy and USMC hangar facilities.

6. Action. The strategies described below are presented as options for providing a protected facility housing aircraft.

a. Facilities must comply with one of the following code compliant solutions as described above and detailed by this ITG:

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(1) ILDFA

(2) Water Flushing Nozzle

(3) Defueled Aircraft

(4) Fluorine Free Foam (F3) Grate Nozzle if approved by ASN (EI&E) per reference (e)

7. Technical Criteria.

a. ILDFA

(1) ILDFA is a fire protection system and will be designed, installed, and tested under the oversight of a Fire Protection Engineer. Before selecting or designing an ILDFA system, consider all customer mission requirements which may prohibit or alter the design requirements of the ILDFA such as radar verification equipment, direct infrared countermeasure alignment, or other emerging technology. Design the ILDFA system in compliance with this ITG and applicable UFCs, FM Data Sheet 7-93, and NFPA 409. Design the system to control an ignitable liquid fire in an industrial hangar environment with aircraft maintenance, aircraft washing, corrosive materials, and electrical hazards. Design the ILDFA for environmental conditions such as humidity, solar (heat and glare), and consider the potential for exposure to freezing temperatures and impact to flushing water, residual trench water, waterflow detection, and other sensitive systems. ILDFA systems must be capable of activation with a fluid spill of 400 gpm (1,515 L/min) within 60 seconds, and 50 gpm (190 L/min) within 120 seconds. A supply pump is required if there is not sufficient pressure from the water supply to satisfy system demand. A flushing supply tank is required if there is insufficient water flow rate to meet system demand. ILDFA discharge must either flow by gravity or be pumped from the trench to the approved point of disposal or containment.

(2) Refer to enclosure (1), for an introduction and background information, and enclosure (2) for relevant Unified Facilities Guide Specifications (UFGS). Due to the complexity involved in these delegated designs, it is recommended the designer of record contact an ILDFA manufacturer during design to fully coordinate and integrate the system.

(3) Location. When a hangar employs ILDFA, the space below the surface of the floor must be considered Class I, Division 1, in accordance with NFPA 70, and the electrical systems must be designated for the appropriate Class and Division. Recess the ILDFA system into hangar floors to provide level transition between adjacent floors in all new construction. For existing hangar floors recess in a new slab on grade, install directly on top of the hangar bay floor with level transitions or ramps on all sides, or as approved by the AHJ based upon project specific parameters. The ILDFA must be in continuous contact with the concrete slab and sloped to match the slope of the hangar bay floor slab. For existing hangar bay floor slabs that are not being demolished, modifications to slab slope and/or use of shims are permitted if proven acceptable through structural analysis of the existing slab and design by the Structural Engineer

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of Record. Coordinate with the ILDFA system manufacturer for compatibility with required floor design, slope, and flatness criteria.

(4) Obstructions. The ILDFA system must accommodate floor obstructions such as grounding locations, utility pits or pedestals, utility trenches and penetrations, tie down points, aircraft grounding points, and structure interferences. The ILDFA system must permit the opening of, and access to, all pits, trenches, utilities, aircraft grounding points, and tie down points without disabling or disassembling the ILDFA.

(5) Ramps. Ramps are only permitted when installing ILDFA over an existing concrete slab and may only exist outside of the required full (or partial) ILDFA coverage area. Ramps may not interfere with perimeter egress paths, emergency equipment, or maintenance areas. Slope of ramps shall be compatible with aircraft, vehicle, and cart traffic. Where ramps or transition plates are utilized, provide the same finish as the ILDFA floor. Design all ramp and transition plates to meet the same structural strength requirements as the ILDFA. Include built-in thermal expansion in the design and installation.

(6) Finishes. Provide permanent striping and markings as described in this ITG and applicable UFCs. The ILDFA surface must be a non-reflective brushed metal finish. Consider solar glare at East, South, and West facing hangar bays or hangars that have bays that open from both sides. Minimize solar glare interference with maintenance operations in accordance with solar glare analysis in 2-16. Provide slip resistant surface in accordance with third-party certified testing in accordance with ANSI B101.1 with wet and dry static coefficient of friction (SCOF) between 0.6 and 1.0 for traction. Provide options for knurling for increased slip resistance at User request.

(7) ILDFA Performance.

(a) Provide an ILDFA floor surface including ramps that match the durability of the concrete slab under frequent large tool, part drops, and forklift traffic with pallet impacts.

(b) Design the ILDFA system structurally such that fatigue life of the ILDFA is greater than the expected building life assuming design loading cycles and stresses.

(c) Provide means to accommodate thermal variations for expansion and contraction of the ILDFA.

(d) The ILDFA floor must not shift under vehicle loads and include features to prevent foreign object debris (FOD).

(e) Do not reduce overall concrete slab thickness for ILDFA depressed slab. Define ILDFA tolerances for overall dimensions of the depressed area of slab.

(8) Additional ILDFA Requirements for Existing Construction. Install ILDFA on floors

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uniformly sloping towards the hangar door with continuous floor support where possible. Shims are only permitted for use with existing slabs when structural analysis and ILDFA manufacturer both permit. Material used for the purposes of shimming existing slabs to modify the slope of the ILDFA relative to the existing hangar slab, shall be fixed in place by chemical bonding agents or mechanical fixtures. Reslope floors where shims of 3 in. (76.2 mm) or greater are required. Do not exceed a shim spacing of 12 in. (0.3 m) on center and reduce spacing as required by ILDFA manufacturer's installation requirements. Where shims are used, structural calculations accounting for ILDFA material strength and concrete slab strength must be provided with requirements on maximum shim spacing (frequency) and material type.

(9) Strength and Durability. Specify that the manufacturer must provide an ILDFA system, including trench covers and grates, capable of supporting all hangar bay loads required by this UFC and the FRD, uniform loads, wheel loads, aircraft loads, jack loads, dynamic or impact loads without fatigue or loss of strength in accordance with established, recognized standards for the material utilized. Design to accommodate temperature changes and associated movement of the ILDFA system. Structural components of the ILDFA system, including floor panels, trench covers, and grating must be designed to support all specified loads. Cyclical loading and fatigue must be avoided by staying below the stress limits. Design will incorporate the effects of cyclic loading. The designated load quantity of load cycles will be identified by the user and specified by the A/E.

(10) ILDFA Zoning. Provide zoning and controls, such that no more than four zones of a maximum 1,320 sq. ft. (122.6- sq. m), can be triggered or activated. Each zone must have its own liquid detection sensor, flushing water distribution device, and control valve. When a spill occurs, only the flushing manifolds that detect a spill must activate. Design fuel spill is 18 ft. (4.9 m) lateral distance (horizontal radius) from the spill location unless FM 6090 requires larger area.

(11) ILDFA Water Supply. Water supply for the ILDFA varies based upon location and Installation; connect to a water supply source approved by the AHJ. Provide a dedicated backflow preventer for the ILDFA system ahead of all ILDFA components. Connect the ILDFA system to the domestic water supply upstream of the facility water meter, to the facility sprinkler water supply upstream of the sprinkler backflow preventer, or to a continuously maintained dedicated nonpotable water source, such as a flushing supply tank or water recycle system. If the ILDFA supply is connected to the domestic water or sprinkler lead-in, include 50 gpm flushing flow rate to flow calculations. ILDFA system requires a minimum of 100 psi (690 kPa) at the discharge of the water supply pump and 50 psi (15.2 kPa) at each nozzle at its design flow rate, in accordance with the manufacturer's calculations. Provide a minimum 3-inch (75 mm) water line. Where the water supply does not provide the required flow and pressure, provide a pump and/or tank in a dedicated room. Design in accordance with FM 6090, including minimum 50 gpm (190 L/min) flushing per zone and a minimum of four zones activated at a single time for a 200 gpm (760 L/min) flushing rate. Design flushing water supply for 60-minute duration.

(12) ILDFA Flushing Supply Pump. The pump must be an FM Approved booster pump

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installed with a listed pump controller. Pump must be in a dedicated room separated by 1-hour fire barriers. In areas with 99% winter, design temperatures below 32 °F (0.0 C), or where heating systems cannot be maintained above 40 °F (4.4 C), provide a heated room or enclosure for water supply, supply pump, and a dry pipe or preaction valve, in accordance with NFPA 13. The ILDFA control panel must monitor pump room or enclosure temperature.

(13) Manifold Flow Monitoring. Monitor flushing manifold supply piping by a flow meter which is monitored by the ILDFA control panel.

(14) ILDFA Control Panel. UL 698A, UL 508A, FM Approved, and appropriate for use in an ILDFA system. Provide controls listed by a Nationally Recognized Testing Laboratory (NRTL).

(a) Control System Features. Control systems must provide the following features, at a minimum:

1. Fully Automatic Operation with alarms when the system detects a design spill.
2. Emergency Manual Operation with alarm (one for each zone if there are multiple zones) and an automatic return to Fully Automatic after an adjustable time delay.
3. Manual Cleaning Mode Operation without alarms with adjustable run time (one for each zone if there are multiple zones) and an automatic return to Fully Automatic after an adjustable time delay.
4. Temporary Off Mode for washing of aircraft or similar wet functions with an automatic return to Fully Automatic after an adjustable time delay.
5. Test Mode to test each zones' sensors and flow with an automatic return to Fully Automatic after an adjustable time delay following testing.
6. All operating features must be double action (for example, lift cover then push, or turn to pull, or two buttons/selections in an HMI).
7. The Control Panel must provide a real time display of current liquid detection and system status, at all liquid detection sensors.
8. Provide Manual Start and Stop stations. The signage wording must read "FLOOR SPILL SYSTEM".
9. Standby power supply must be capable of operating the system for 48 hours standby, and 30 minutes operation after failure of primary power supply.

(b) Liquid Detection Sensors. Liquid detection sensors must be UL listed or FM approved for both hydrocarbon and water detection, and for Class I, Division 1, and wet

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locations, and must monitor continuously and automatically. Sensors must activate within 60 seconds at a minimum spill rate of 400 gpm (1,514 L/min) or within 120 seconds at a minimum spill rate of 50 gpm (189 L/min).

(15) ILDFA Discharge Trenches. Hydraulically design the discharge trench system to accommodate floor rinse water at 200 gpm (758 L/min) plus full flow from the fuel dump valve without overflowing the trench. To allow for sufficient space for maintenance in the trench, increase the volume of the trench by the volume of non-ILDFA piping. Trench must be wide enough to accommodate piping, elbows, tees, and drain valves. Provide minimum 12 in. (0.3 m) wide by 16 in. (0.4 m) deep trenches parallel to the hangar door and perpendicular to the floor slope, with maximum spacing of 40 ft. (12.2 m) on center. An ILDFA trench may serve as the required interior hangar door trench if located along the entire interior of the hangar doors and if it collects drainage from the hangar door rails or pits. Increase trench free area (width or depth) if piping or duct systems other than those serving the ILDFA are installed in drainage trenches. Trench must be designed to accept full design flow without overflowing the trench. To allow for sufficient space for maintenance in the trench, consider the volume of piping within the trenches and the turning radii of the fittings in the design. Provide non-conductive isolation materials such as fluoroelastomer or bituminous coatings and dielectric unions for prevention of galvanic corrosion when aluminum ILDFA components contact dissimilar metals such as cast iron or carbon steel trench components.

(a) ILDFA Trench Drain Collection System Flushing Water Volumetric Flow Rate. If the hangar floor slopes uniformly towards the hangar door, the trench drain collection system will collect volumetric flow rate of the design fuel spill, plus the flushing flow rate of four adjacent 1,320 sq. ft. (122.6 sq. m) maximum area zones. For existing hangars, if the hangar floor does not slope uniformly to the hangar door, the trench drain collection system will collect the volumetric flow rate of the fuel spill, the flushing flow rate of four adjacent zones, and the design overhead sprinkler discharge over the four adjacent ILDFA zoned, plus 500 gpm (1,893 L/min) outside hose stream. Classify volume inside trench and below grade as Class I, Division 1 in accordance with NFPA 70.

1. Wash Bay. Design trench drain collection systems and discharge/containment for the wash bay floor rate and volume. If the wash apparatus is not designed to shut down on activation of the ILDFA, the trench drain collection system must be designed to remove both the wash system flow rate plus the ILDFA flushing flow rate.

(b) ILDFA Trench Arrangement. Slope drainage trench inverts at a minimum of 1.0% plus or minus 0.5%, towards the out-fall points from the drainage trench. Capture oily wastewater contaminants from the hangar bay door trench system, as directed by the office overseeing environmental policy for the installation using an oil-water separator or other approved methods.

(c) ILDFA Trench Discharge. Slope trenches to discharge by gravity and discharge from the trenches via gravity or effluent pump. Comply with the Installation's environmental

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policy for trench discharge. Where drainage from flushing and fuel spill is to be pumped, size the trench and underground piping system to accommodate the anticipated flushing volume of water plus the volume of the largest anticipated fuel bladder or tank that could spill into the ILDFA. This calculation assumes the effluent pumps do not operate, and spillage occurs in a single zone.

1. Effluent Discharge Options. Direct trench discharge to a location outside the building. Coordinate with the installation environmental office, the Publicly Owned Treatment Works (POTW), and the POTW's National Pollutant Discharge Elimination System permit to determine an acceptable discharge solution, considering the following options or combination of options:

- a. Discharge into an industrial wastewater collection system.
- b. Discharge to an oil-water separator that has the ability to separate and store the maximum fuel spill (rate and capacity) before releasing to an industrial wastewater collection system, domestic wastewater collection system, or water recycle system.
- c. Discharge to a containment tank for holding and testing. Containment tank to be manually pumped for removal and/or connect to a subsequent system for controlled release after testing or to a water recycle system.

2. Effluent Discharge Options Oil-Water Separator. Design the oil-water separator for the maximum potential design flow rate of the ILDFA system. This consists of 200 gallons (757 liters) per minute ILDFA flushing water plus the maximum fuel dump valve (200 gpm (757 liters per minute) for a small aircraft and 400 gallons (1514 liters) per minute for a large aircraft in accordance with NFPA 409) plus ILDFA cleaning mode wash rate if not automatically shut down when the ILDFA is activated, or as approved by the AHJ.

(16) ILDFA Effluent Pump and Controller. Effluent pump (where required): Provide effluent pumps rated for Class I, Division 2 environments and for pumping hydrocarbon type liquids, supplied by the ILDFA manufacturer, capable of passing material not less than 0.375 in. (10 mm). Provide skid mounted centrifugal pumps resistant to chemicals used in the hangar and for pumping fuel, water, and fuel/water solution, sized for the design discharge rate, and with a welded aluminum bollard frame. Locate in an enclosure protected from freezing, near the containment tank. Locate skid and piping outside the hangar or inside the hangar bay but outside the aircraft clear zone, and without obstructing circulation at the perimeter of the hangar bay.

(17) ILDFA Containment Tanks. When trench discharge does not leave through an oil-water separator, sanitary sewer, industrial sewer, or requires containment, provide an ILDFA containment tank. Design containment tank for pumped or gravity flow trench discharge. Underground tanks must comply with UL 1316 and must be double walled. Aboveground tanks must comply with UL 142 or UL 2085. Comply with the installation's environmental policy for above or below grade discharge tanks. Provide a minimum 15,000 gallon (56,800 liters) capacity containment and remote containment monitoring with level sensors for low level alarm (minimum 20%) and high level (critical) alarm for use in a Class I, Division 1 location. Optical

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level sensors are not allowed.

(18) ILDFA Water Recycle System. Where water is not readily available, when life-cycle-cost effective (LCCE), or when required by country, state, local, or environmental regulations, provide ILDFA water recycle system to recycle effluent discharge water to be reused for flushing water. An oil-water separator, UV filter, particulate filter, carbon filter, recycle pump, and control panel may be required for the recycle system. Provide a flushing tank with makeup water and level alarms with an ILDFA supply pump in a dedicated space to provide the required pressure and flow to the ILDFA system. Water recycle system panel troubles and battery calculations must be the same as, and report to, the ILDFA control panel.

(19) ILDFA Pipe Labeling. Mark all exposed interior piping with plastic wrap-type pipe labels, conforming to ASME and ANSI A13.1, Scheme for the Identification of Piping Systems. Indicate the type of fluid carried and direction of flow. Labels that stick-on (adhesive backed) or are held on with straps or adhesive tape, are not permitted. Labels are not required on piping routed below the floor line in trenches or pits. At a minimum, the following labels are required:

(a) ILDFA SUPPLY – used on ILDFA supply piping downstream of backflow preventer or supply pump.

(b) ILDFA EFFLUENT – used on ILDFA piping downstream of trench.

(20) Fire Alarm Interface.

(a) ILDFA Monitoring

1. ILDFA activation alarms are local alarms, not connected to the building fire alarm control panel.

2. Provide a tamper switch on the main water supply to the ILDFA system that is monitored by the building FACP, programed as a supervisory signal.

(b) Triple Infrared (IR) Optical Flame Detectors

1. Provide triple infrared (IR) optical flame detectors listed/approved for the expected fuel hazards in the hangar bay to be used for early warning of a fire. This detection is in no way tied into the ILDFA system. Provide detectors that are verified by an independent 3rd party testing service to be immune to radar and radio frequency emissions from handheld equipment or equipment on-board the aircraft as identified in NFPA 409 Annex C. Provide shielded circuiting for both the Signaling Line Circuit (SLC) and power circuit supplying the optical detectors.

2. Flame detectors in hangars protected by ILDFA are required to be tied to the building fire alarm control panel (FACP). Flame detectors must be individually addressed.

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3. Provide single coverage flame detection across the hangar bay designed in accordance with NFPA 72.

(21) ILDFA Acceptance Testing and Commissioning. The ILDFA design and installation must be under the supervision of the Fire Protection Quality Control Specialist, who is part of the Contractor's Quality Control Team, as specified in UFGS 01 45 00. Provide NFPA 409 recommended system documentation and acceptance testing of system controls. Provide integrated testing of interconnected systems, in accordance with NFPA 4. All system functions and controls must be tested. Test ILDFA supply piping, pumps, manifolds, solenoids, effluent components, and all other equipment to confirm they function as intended. Provide system documentation indicating test results and system set points in Operations and Maintenance (O&M) Manuals.

b. Water Flushing Nozzle.

(1) Definitions:

(a) Collection Trench: the trench located within lower elevation (valley) of the hangar bay slab used to collect a liquid spill and direct it out of the hangar. The perimeter trenches along the back wall and hangar doors are also considered collection trenches.

(b) Peak Trench: the trench located at the highest ridge within the aircraft parking area to facilitate water flushing nozzles and piping and may be used to provide utility services such as compressed air to the parking areas. The peak trench is for new construction and is not required for retrofitting existing hangars.

(2) Hangar Bay Floor and Trench General Requirements: Provide hangar bay floor in accordance with the requirements herein.

(a) Provide a "four-way-fall grading scheme" hangar bay floor in accordance with UFC 4-211-01, reference (e) and the below.

1. Provide hangar floor sloping at a minimum 0.5% but no greater than 1.5% towards the flight line door. Provide additional cross-slopes at a minimum 0.5% but no greater than 1.5% towards collection trench drains.

(b) Provide sloped collection trench drains in and around the hangar floor per UFC 4-211-01, reference (e). See the Navy Specific Chapter (7-11) for specific requirements. Follow this ITG for nozzle location and specific water flushing system requirements.

1. Trench Width: Provide nominal trench clear open widths equal to 12, 18, 24, or 32 inches as required to allow for sufficient space for other utilities and maintenance in the

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trench, consider the volume of piping within the trenches and turning radius of the fittings in the design.

2. Trench Depth: Provide a minimum trench depth of 12 inches within all collection trenches. Size trench drains to account for the flow of the sprinkler system, water flushing system discharge, hose stream allowance, and an additional 50 gpm (fuel flow) and allow for sufficient space for maintenance in the trench, consider the volume of piping within the trenches and turning radius of the fittings in the design. Hangar bay trenches must drain to hangar waste collection pipeline.

3. Collection Trench Covers:

a. At a minimum, provide ductile iron or steel trench grate covers manufactured to withstand a minimum proof-load of 100,000 lbs. (45,359 kg) from a tire with a 250 psi (1.72 Megapascal (MPa)) pressure in accordance with UFC 4-211-01, reference (e).

b. Provide trench grate covers of nominal widths equaling 14, 20, 26, or 32 inches corresponding to the trench opening width.

c. All trench grate covers must be aircraft rated/bolted down, have a minimum draft of 5 degrees, a nominal depth of 2 inches.

d. Provide Collection Trench Covers with minimum opening width to account for flow of the sprinkler system, water flushing system discharge, hose stream allowance, and an additional 50 gpm (fuel flow).

4. Provide Viking Grate Flame Barriers in accordance with manufacturers recommendations and within all collection trenches under every trench grate cover (slotted grate) designed to receive a fuel spill.

a. Exception: Grates/covers supporting water flushing nozzles do not require grate flame barriers.

b. Grate Flame Barriers must be stainless steel, positioned directly below the trench grate cover it serves to cover all open areas of the cover, shaped to shed water and fuel into the trench (not collect any liquid on the surface or within the assembly), and to allow for drainage of the sprinkler system, water flushing system discharge, hose stream allowance, and an additional 50 gpm (fuel flow).

c. Grate flame barriers must be modified to fit shortened grate lengths to accommodate varying trench lengths. Provide a minimum length of trench covers of 8 inches. Grate Flame Barriers are available in 14, 20, 26 or 32 inch widths.

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d. Grate flame barriers must cover all collection trench cover openings **in new and retrofit applications** to limit flame protrusion above the trench and limit impact of flame and heat on adjacent aircraft.

5. Provide a drainline from the hangar door trench at the intersection of each collection trench leading to an underground hangar waste collection pipeline outside the hangar bay doors. Use a plumbing trap to connect each drainline to the waste collection system to prevent the continuation of fire from exiting building per enclosure (4).

a. Size the plumbing trap to account for the associated trench drains (flow of the sprinkler system in the area served, water flushing system discharge in the area served, hose stream allowance, and an additional 50 gpm (fuel flow)). Ensure water does not back up into the hangar bay trenches.

6. Design the hangar waste collection pipeline to give minimum cleansing velocities, when flowing full, of not less than 2.0 feet per second (0.6 m/s), based on Mannings formula using an “n” value of 0.013. Design the waste collection pipeline to carry the peak flow at a flow depth of no more than 0.9 d, where d is the sewer diameter. The hangar waste collection pipeline must maintain a parallel distance of at least 10 feet from building foundations. The highest crown elevation of the hangar waste collection pipeline must be at least 1 foot below the lowest elevation of the drainage trenches in the hangar bay.

7. Use a flow splitter to separate normal everyday use from large fire suppression flows. Provide an oil water separator to treat normal everyday flows prior to discharge to sanitary sewer. Containment of all water flushing system is not required.

8. Overflow from the hangar waste collection system (flow splitter) must be directed away from the hangar and into a ditch, swale, onto the tarmac or as directed by installation environmental policy.

(3) General Low-Level Water Flushing Nozzle System Requirements: Design and construct a low-level water flushing nozzle system in accordance with the requirements herein. This section applies to all new and existing hangars.

(a) Provide zoning controls such that the zone of fire incident activates and the two immediately adjacent zones activate during a system discharge event, a total of 3 zones activated.

(b) Provide system piping, location of equipment, and zoning such that water delivery time to the most remote low-level water flushing nozzle does not exceed 20 seconds.

1. Provide water delivery time calculations.

2. Perform water delivery time trip test during pre-final acceptance inspection. Provide test results as part of the pre-final acceptance inspection documentation.

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3. Perform water delivery time trip test during final acceptance inspection. Provide test results as part of the final acceptance inspection documentation.

(c) Provide hydraulic calculations.

1. Provide calculations based on the flow control valve regulating pressure at the trench so there is no balancing issue with the overhead sprinkler system.

2. Provide hydraulic calculations in conjunction with the overhead sprinkler system such that both systems are operating during a fire event. The overhead sprinkler system is required to be calculated in accordance with UFC 4-211-01 reference (e), paragraph 3-6.15.1.

(d) Provide all piping downstream of low-level water-only flushing nozzle flow control valves as follows and in accordance with UFGS 21 13 19:

1. Provide hot dipped galvanized cut groove schedule 40 piping.

2. Provide all low-level water flushing nozzle system branch piping pitched with greater than 0.5% slope towards the end of each branchline for drainage.

3. Provide each low-level water flushing nozzle system branch piping with a pressure test connection located at the most remote point of each branchline.

(e) Provide surge suppression for low-level water flushing nozzle systems in accordance with UFC 4-211-01 reference (e), paragraph 3-6.5.

(f) Additional system notes:

1. The low-level water flushing nozzle systems are not required to be supplied by a Fire Department Connection (FDC), however for ease of installation, the FDC can connect to the main fire water header which may supply the low-level water flushing nozzles.

2. No low-level water flushing nozzle system test header is required. Adjustment of flow control valves/systems shall be via flowing of the trench piping.

(4) New Construction Low-Level Water Flushing Nozzle System Requirements:

Design and construct a low-level water flushing nozzle system in accordance with the requirements herein.

(a) Provide a low-level water flushing nozzle system at the peak of the hangar bay floor slope to move hazardous fuels from the hangar bay floor to the collection trench drainage system.

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(b) Peak Trench: Provide a single peak trench within each aircraft parking bay provided, refer to 4-Way-Fall Floor Slope Diagram (4).

1. The peak trench shall be located at the ridge of the 4-way-fall sloping scheme, (highest point) of the hangar bay floor and contain the low-level water flushing nozzles and associated branch piping.

2. Trench Width: Provide nominal trench clear open widths equal to 18 or 24 inches as required to allow for sufficient space for utilities and maintenance in the trench.

3. Provide a minimum 8-inch drainline within the slab from the low point of the peak trench to the hangar bay door collection trench per enclosure (4).

(c) Peak Trench Covers:

1. Provide solid trench covers within the Peak Trench. At a minimum, provide bolted ductile iron or steel trench grate covers manufactured to withstand a minimum proof-load of 100,000 lbs. (45,359 kg) from a tire with a 250 psi (1.72 Megapascal (MPa)) pressure in accordance with UFC 4-211-01, reference (e).

(d) Provide low-level water flushing nozzles as outlined below, refer to Viking Technical Bulletin – Viking Peak Nozzle Series per enclosure (3):

1. Provide nozzles such that spacing between each nozzle does not exceed 12 feet 6 inches from nozzle to nozzle.

2. Provide branchline end nozzles at the end of the peak/ridge. This nozzle shall be within 25 feet of the hangar bay door/shops area collection trench drain.

3. Provide zoning such that no more than one low-level water flushing nozzle branchline is supplied by one single flow control valve.

a. Provide all low-level water flushing nozzle system control valves and equipment within the hangar bay.

4. Provide each low-level water flushing nozzle system branch piping with a minimum 1-inch flushing orifice on the bottom of the pipe at the end of each branchline.

(5) Existing Construction Low-Level Water Flushing Nozzle System Requirements:
Design and construct a low-level water-only flushing nozzle system in accordance with the requirements herein. This approach is ideally suited to retrofit aircraft hangars with existing low level AFFF great nozzles.

(a) Provide a low-level water flushing nozzle system within the existing collection

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trenches to move hazardous fuels from the hangar bay floor to the trench drainage system.

- (b) Provide Viking Grate Flame Barriers in accordance with manufacturers recommendations and within all collection trenches under every trench grate cover (slotted grate) designed to receive a fuel spill.

(c) Provide low-level water flushing nozzles to replace existing AFFF grate nozzles as outlined below, refer to enclosure (5) Existing Hangar - Maximum Grate Water Nozzle Spacing for nozzle models, locations and spray pattern:

- 1. Provide nozzles such that spacing between each nozzle does not exceed 12 feet 6 inches from nozzle to nozzle.

- 2. Provide nozzle within the hangar bay back wall (admin/shops) collection trench centered within the two adjacent collection trenches.

- 3. Provide zoning such that no more than two low-level water flushing nozzle branchlines are supplied by one single flow control valve.

- a. Provide all low-level water flushing nozzle system control valves and equipment within the hangar bay adjacent to the zone being supplied.

(6) Releasing System Requirements.

(a) Triple Infrared (IR) Optical Flame Detectors.

- 1. Provide triple infrared (IR) optical flame detectors listed/approved for the expected fuel hazards in the hangar bay. Provide detectors that are verified by an independent 3rd party testing service to be immune to radar and radio frequency emissions from handheld equipment or equipment on-board the aircraft as identified in NFPA 409 Annex C. Provide shielded circuiting for both the Signaling Line Circuit (SLC) and power circuit supplying the optical detectors.

- 2. Flame detectors in hangars protected by low-level water flushing nozzle systems are required to be tied to a releasing service fire alarm control unit (RSFACU). Flame detectors must be individually addressed.

- 3. Provide flame detection such that each zone has coverage in all areas from three separate flame detectors. Consult manufacturer for detector layout to ensure detector coverage is limited to each protected zone minimizing bleed over to other zones via detector placement and sight limiters.

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4. Provide fire alarm system activation upon single detector in a single zone activation to notify occupants and the fire department. Provide low-level water-only flushing nozzle system zone activation upon second detector activation. Releasing control sequencing should ensure the low level flushing nozzles operate in the first zone with two detectors activated and the two adjoining zones. Additional zones should be locked out if the water supply cannot support them.

5. Provide optical flame detectors around the perimeter of the hangar bay, such that all portions of the hangar bay are within the range and cone-of-vision of at least one detector. Exception: The area of the hangar bay within 5 ft. of the perimeter wall is not required to be within the cone-of-vision of an optical flame detector.

6. Angle detectors and provide manufacture approved blinds (field of view inhibitors) so the cone-of-vision does not extend beyond the hangar doors, or is within the view of hot sources such as radiant heaters if detectors are subject to alarm under these conditions. Locate optical flame detectors at a sufficient distance per the manufacturer's recommendations from sources that may cause false alarms such as welding, solar glare, radiant heaters, aircraft engine exhaust, strobes, hot surfaces and other relevant sources.

c. Defueled Aircraft.

(1) Defuel all aircraft prior to bringing into the hangar for maintenance or storage. Per reference (f), defueled is defined as an aircraft that has never been fueled or whose fuel system has had flammable or combustible liquid removed to meet one of the following criteria:

(a) Individual tanks/cells contain less than 1 percent of their volumetric capacity;

(b) Aircraft is drained to remove fuel to the greatest extent possible utilizing sump drains and other accessible non- maintenance means.

(2) Signs are posted around the hangar bay stating “This Hangar Does Not Have a Fire Suppression System rated for fuel fires. All Aircraft Must be Defueled.” Signage and their locations need to be approved in advance by the base Safety Department and meet the requirements of reference (b), figure 1-1.

(3) All building personnel must be instructed annually that fueled aircraft cannot be in the hangar because a FSS rated for fuel fires is not installed or active in the hangar. This can be accomplished as part of a safety brief.

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8. Points of Contact: If you have questions or concerns with respect to this ITG, please contact NAVFACSYSCOM technical representatives listed below:

a. For clarification or additional information related to fire protection systems, Mr. Darryl Nemeth, P.E., NAVFAC Fire Protection Engineering Technical Warrant Holder at telephone (757) 322-4408 or email at darryl.s.nemeth.civ@us.navy.mil.

a. For clarification or additional information related to hangars, Mr. Scott Herold, P.E., at (757) 322-4294 or scott.t.herold2.civ@us.navy.mil.

**S. Keith
Hamilton**

Digitally signed by S.
Keith Hamilton
Date: 2026.09.23
17:05:26 -04'00'

S. KEITH HAMILTON, P.E.
Chief Engineer and Assistant Commander
for Planning, Design and Construction

Copy to:

NAVFAC Atlantic
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NAVFAC Washington
NAVFAC EURAFCENT
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