

3.0 ATTACK OR ASSAULT BATTALION, OR CAVALRY SQUADRON MAINTENANCE HANGAR (AAC HGR) <VER>(REV 1.1 – 31 JULY 2010)</VER>

3.1. GENERAL REQUIREMENTS:

Each hangar shall include maintenance and administrative areas co-located within one facility. Each AAC Hangar consists of the following functional areas.

- Aircraft Maintenance Area: Maintenance Bay (Hangar floor), Maintenance Shop Spaces, and Maintenance Support Spaces (Paragraph 3.3.1)
- Administrative Core: Aviation Unit Operations, Company Administration and Readiness Area, and Support Spaces (Paragraph 3.3.2)

3.2. AIRCRAFT MAINTENANCE HANGAR REQUIREMENTS:

Size aircraft repair parking module sizes for hangar floor space based on UFC 3-260-01. Table 3.1 summarizes parking module requirements for each hangar. Safety lanes are in addition to the module sizes indicated. (Note:UH-60 and HH-60 aircraft are similar) Use the UH-60 module size to accommodate the AH-64 aircraft and two OH-58 aircraft. The utilization of a single module for these aircraft facilitates future changes of mission and aircraft at all facilities.

Table 3 Hangar Modules and Sizes

AIRCRAFT GROUP	MODULE LENGTH	MODULE WIDTH	NO. OF MODULES AAC
TYPE	LENGTH	WIDTH	
Blackhawk (UH-60)	84'	64'	8

3.2.1. ACCESSIBILITY REQUIREMENTS:

The Hangar facility shall be handicap accessible for civilian employees and visitors, and Warriors-in-Transition that may be assigned in accordance with the Architectural Barriers Act (ABA) Standard for Department of Defense Facilities.

3.2.2. GROSS BUILDING AREA:

Gross areas of facilities shall be computed according to subparagraphs below. Maximum gross area limits indicated in Paragraph 2.0, SCOPE, may not be exceeded. A smaller overall gross area is permissible if all established net area program requirements are met.

- (1) Enclosed Spaces. The gross area includes the total area of all floors, including basements, mezzanines, penthouses, usable attic or sloping spaces used to accommodate mechanical equipment or for storage with an average height of 6'-11" measured from the underside of the structural system and with the perimeter walls measuring a minimum of 4'-11" in height, and other enclosed spaces as determined by the effective outside dimensions of the building.
- (2) One-Half Spaces. One-half of the area will be included in the gross area for balconies and porches; exterior covered loading platforms or facilities, either depressed, ground level, or raised; covered but not enclosed passageways or walks; covered and uncovered but open stairs; and covered ramps.
- (3) Excluded Spaces. Crawl spaces; exterior uncovered loading platforms or facilities, either depressed, ground level, or raised; exterior insulation applied to existing buildings; open courtyards; open paved terraces; roof overhangs and soffits for weather protection; uncovered ramps; uncovered stoops; and utility tunnels and raceways will be excluded from the gross area.

3.2.3. UTILITY AND SUPPORT SPACE:

Provide mechanical, electrical and communications rooms. Mechanical rooms shall accommodate space for equipment maintenance/repair access without having to remove other equipment. Key mechanical, electrical and communications rooms separately for access by Installation maintenance personnel. Exterior access is required for mechanical and electrical rooms located on the first floor. All communications rooms shall be conditioned space equivalent to office space with access from the interior of the building.

3.2.4. FURNITURE, FIXTURE AND EQUIPMENT:

See Furniture, Fixture and Equipment (FFE) listing at Table 3.3 for loose item requirements and related design considerations for individual spaces. Table 3.3 lists GFGI items around which the Contractor is to design individual spaces. Each required workstation unless noted is to include appropriate work surface area, upper cabinets or shelves, file cabinet(s), pencil drawer, space for computer and monitor, telephone, ergonomic administrative chair, task lights, power, and data (network, internet including NIPR and SIPR where required, and required Logistics STAMIS) connections. Provide centralized areas for photocopier, laser printer and fax machine with waste and paper recycling receptacles and supply cabinet for paper storage as required in each office area. Where marker boards are shown and are installed (see 3.2.6 below), provide demountable wall connections.

3.2.5. CONFERENCE OR BRIEFING AREAS OR ROOMS, AND CLASSROOMS:

Provide, as a minimum, a dry- erase marker board, a motor operated projector screen, a ceiling-mounted projector bracket, and ceiling mounted 110 VAC receptacle and data receptacle for digital projector in each conference/training and classroom.

3.2.6. FLAT SCREEN DISPLAYS:

Where dry erase marker boards are required, verify whether flat screen displays are to be installed in lieu of the marker boards. If flat screen displays are required, provide space and wall mount supports for them matching number of referenced marker boards unless noted. If flat screen displays are required, provide power and data connections at selected locations. Flat screen displays are GFGI.

3.2.7. RESTROOMS:

Except where indicated otherwise, provide restrooms on each floor with fixture counts per IPC with fixture distribution calculated for 80% male and 20% female.

3.2.8. JANITOR CLOSET:

Provide janitor closets on each floor of the facility. Each janitor closet shall have a mop sink, mop rack and space for buckets, vacuum and storage for janitorial supplies.

3.2.9. OIL-WATER SEPARATOR SYSTEM:

The design of the separator system will account for the operational effects of the fire protection system per ETL 1110-3-481.

3.3. FUNCTIONAL AND AREA REQUIREMENTS

Hangar facility functional requirements, and net and gross area limitations are summarized in Table 3.2.

3.3.1. AIRCRAFT MAINTENANCE AREA:

A consolidated multi-purpose space for the maintenance, repairs, and major overhaul of military aircraft and includes maintenance bays, tech supply, shop space, production control, and quality control areas directly related to the maintenance and supervision of aircraft, component and assembly rebuilding, and quality control of aviation maintenance. The area can be broken down into two primary functions, aircraft maintenance bay and shop space. Where a workstation is specified, provide 110 VAC receptacles, voice and data receptacle in addition to what may be specified in Table 3.2.

3.3.1.1. AIRCRAFT MAINTENANCE BAY:

Size and provide required functions for the hangar floor space based on UFC 3-260-01 and Table 3-2. Table 3.2 summarizes aircraft parking module requirements for the hangar. Safety lanes are in addition to the module sizes indicated.

3.3.1.2. AIRCRAFT MAINTENANCE SHOP SPACE:

Size and provide required functions for the aircraft maintenance shop spaces based on Table 3.2.

3.3.1.3. AIRCRAFT MAINTENANCE SUPPORT SPACE:

Maintenance support spaces generally include storage rooms for maintenance tools, parts and POL materials. Maintenance support space functions and size requirements shall be as indicated in Table 3.2.

3.3.2. ADMINISTRATIVE CORE

Company Operations (CO)in hangar facilities required below vary from Company Operations Facilities (COF) defined in separate standard designs. Hangar CO provide administration, operations and supply functions. COFs provide administration and readiness modules.

3.3.2.1. AVIATION UNIT OPERATIONS AREA:

Provide areas for pilots and air crews to prepare flight plans, conduct mission planning and briefings, and debriefings. Aviation Unit Operations space functions and size requirements shall be as indicated in Table 3.2.

3.3.2.2. COMPANY ADMINISTRATION AND READINESS AREA:

The company administration and readiness area consists of offices, storage, etc., to accommodate designated personnel within the battalion. See Table 3.2 for specific hangar function/space requirements.

This facility will accommodate a total of 4 companies to include: 3 flying companies and 1 aviation support company.

3.3.2.3. SUPPORT SPACES:

Provide support spaces as required for the hangar facility to include but not limited to showers, restrooms, mechanical, fire suppression room, electrical, communications, janitor closet(s), and hallways.

3.3.3. ASSAULT HANGAR FUNCTIONAL AND SPACE REQUIREMENTS:

See Table 3.2 following this Section.

Provide required utility connections and mounting connections for equipment and furniture listed in Table 3. 2. Unless otherwise noted, equipment and furniture listed in Table 3. 2 is CFCI. Reference Table 3.3 for FFE listing.

Table 3.2 Hangar Functional Requirements and Space Authorizations

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
AIRCRAFT MAINTENANCE AREA		
	AIRCRAFT MAINTENANCE BAY	Total 71,660

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
AIRCRAFT MAINTENANCE BAY (Hangar Floor)	<p>Assigned Aircraft: 30 UH-60 (Assault); or 24 AH-64D (Attack); or 30 OH-58 (Cavalry).</p> <p>Required Aircraft Modules for AAC hangars:</p> <p>UH-60, 84'L x 64'W x 8</p> <p>Provide space for eight UH-60 (25% of assigned Assault aircraft) aircraft modules with safety lanes at perimeter of modules in accordance with UFC 3-260-01.</p> <p>The following two numbered paragraphs are provided for information only to explain the use of UH-60 Aircraft Modules for Attack and Cavalry hangars:</p> <p>(1) AH-64D, 77' L x 60' W x 6, (84' L x 64' W x 6)</p> <p>Module increased to 84' long x 64' wide to accommodate UH-60 module in rectangular maintenance module in hangar bay. Assault hangar bay will accommodate 6 AH-64D aircraft.</p> <p>(2) OH-58, 77'L x 30'W x 8, (84' L x 32' W x 8)</p> <p>Module increased to 84' long x 32' wide to accommodate UH-60 module in 2 OH-58 rectangular Maintenance modules in hangar bay. Assault hangar bay will accommodate 8 OH-58 aircraft.</p> <p>Interior Tow Lane & Hangar Doors</p> <p>Perimeter 5'W Safety Lane (Perimeter LF x 5')</p> <p>Provide hangar floor grounding and mooring points IAW UFC 3-260-01.</p> <p>Provide motorized hangar doors capable of manual operation. Provide personnel doors. Meet opening clearance requirements of UFC 3-260-01 based on UH-60 aircraft. Provide hangar doors to meet and operate under anticipated climatic conditions.</p> <p>Provide 20 utility connection stations, two for each aircraft module plus 4 additional utility connection stations. Each utility connection station will include compressed air, electrical, and data lines (including Logistics STAMIS). Install utility connection stations at walls wherever possible. At aircraft modules located away from walls, install utility connection stations at interior columns or elevated pedestals designed to resist damage from movement of aircraft and equipment.</p> <p>Utility connections must be accessible providing least</p>	<p>43,008</p> <p>22,692</p> <p>5,960</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>safety hazard to maintenance personnel. Provide a minimum of four dedicated 110VAC power outlets at each utility connection station. Provide two 220V 3 Phase outlets and Aircraft Electric Power Supply (200/115V/400 Hz/3 Phase system and 28V DC) at each utility connection station.</p> <p>Provide space for L-shaped workbench at each aircraft module with 110VAC power.</p> <p>Provide two data outlets at each utility connection station.</p> <p>Provide two compressed air outlets at each utility connection station.</p> <p>Provide a minimum of two 10 ton overhead bridge cranes that cover the entire length and width of the multiple aircraft modules.</p> <p>Provide access lanes where required by the notional plan design.</p> <p>Provide clear spans over a minimum of two adjacent aircraft modules as indicated on the notional plan design.</p> <p>Provide space for one GFGI high pressure (3000 psi) hydraulic oil delivery system cart. <AAC TRONAIR YES> <u>The hydraulic oil delivery system cart is a Tronair Model 52200EAOCFK, 208V three phase 60 Hz.</AAC TRONAIR YES></u></p> <p>Provide emergency shower and eye wash stations a maximum of 55 feet from location where personnel are exposed to hazardous/corrosive materials or POL.</p> <p>Provide two total hand wash stations near personnel exits to administrative functions.</p>	
AIRCRAFT MAINTENANCE SHOP SPACE		Total 8,470
PRODUCTION CONTROL	<p>Provide private offices for two individuals with space for admin workstations (Logistics STAMIS), and standard 4 - drawer safe separated from common work area with lockable door. Provide space for printer.</p> <p>Provide space for six admin workstations (Logistics STAMIS) in a common work area (one workstation intended for POL Fuel Handler).</p> <p>Provide space for file storage, laptop storage, metal storage cabinets, printer, fax machine and copier in the common work area.</p> <p>Provide progress/scheduling marker board(s) or provide</p>	600

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>space for flat screen monitor(s) in the common work area.</p> <p>Provide meeting space for 20 persons at conference table integrated in the common work area.</p> <p><AAC PRODUCTION MARKER>Provide progress/scheduling marker board(s) in the common work area.</AAC PRODUCTION MARKER></p> <p><AAC PRODUCTION FLATSCREEN>Provide progress/scheduling flat screen monitor(s) in the common work area.</AAC PRODUCTION FLATSCREEN></p> <p>Provide space for relocatable Logistics STAMIS network server at one admin workstation.</p> <p>Locate adjacent to Tech Supply.</p>	
<p>QUALITY CONTROL / QUALITY ASSURANCE</p>	<p>Provide lockable private office with space for admin workstation (Logistics STAMIS) and printer.</p> <p>Provide customer service counter restricting access to common admin area. The counter shall have three Logistics STAMIS connections.</p> <p>Provide admin workstation space for 11 personnel (two of the workstations shall have Logistics STAMIS connection.)</p> <p>Provide space for file storage, metal storage cabinet, fax machine, printer, and copier.</p> <p><AAC QAQC MARKER>Provide progress/scheduling marker board(s). </AAC QAQC MARKER>Provide progress/scheduling marker board(s) or provide space for flat screen monitor(s).</p> <p><AAC QAQC FLATSCREEN>Provide progress/scheduling flat screen monitor(s). </AAC QAQC FLATSCREEN></p> <p>Locate adjacent to Production Control.</p>	<p>800</p>
<p>TECHNICAL ASSISTANCE REP (LARS/CLS)</p>	<p>Provide space for admin workstations for five people.</p> <p>Provide space for file storage, metal storage cabinet, fax machine, printer, and copier.</p> <p>Locate adjacent to Quality Control/Quality Assurance and Production Control.</p>	<p>420</p>
<p>TECHNICAL LIBRARY</p>	<p>Provide space for 4 study carrels, file cabinets, media storage cabinet, tables and chairs.</p> <p>Provide built-in bookshelf space for 24 sets aircraft tech manuals and 60 binders / company.</p>	<p>300</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	Locate adjacent to Quality Control/Quality Assurance.	
AIRCRAFT MAINT PLATOON HQ	Provide single office with space for three workstations, bookcases, files, printer and storage for the following personnel: Platoon Leader, Maintenance Tech, and Platoon Sergeant.	450
REPAIR SECTION	<p>Provide private office with space for four workstations (Logistics STAMIS) and printer.</p> <p>Provide meeting space for 14 persons at conference table integrated in the common work area.</p> <p>Provide 14 work benches (each with Logistics STAMIS connection) with 110VAC power. Work benches shall be 3' high, 8' long, 3' deep.</p> <p>Provide means to secure individual tool boxes.</p> <p>Provide space for secure storage for shop tools.</p> <p>Provide double door to hangar bay.</p>	1,250
AIRCRAFT COMPONENT REPAIR PLATOON HQ	Provide private office with space for three workstations, bookcases, lateral files and printer for the following personnel: Platoon Leader, Maintenance Tech, and Platoon Sergeant.	450
POWER PLANT	<p>Provide space for one admin workstation (Logistics STAMIS) [Note: Separate space preferred but could be combined with power train.]</p> <p>Provide space for two engine repair stands each approximately 5.5 feet by 10 feet.</p> <p>Provide space for two work benches with 110VAC power. Work benches shall be 3' high, 8' long, 3' deep.</p> <p>Provide space for secure storage for shop tools.</p> <p>Provide a 2-ton bridge crane that can cover entire shop area.</p> <p>Provide single personnel door and 10 foot clear opening height roll-up doors large enough for passage of engine stands from Aircraft Maintenance Bay to Shop.</p> <p>Provide 110VAC and 220V 3 Phase power.</p> <p>Provide two compressed air connections.</p>	900

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	Provide stainless steel deep sink connected to oil/water separator.	
POWERTRAIN	<p>Provide space for one admin workstation (Logistics STAMIS) [Note: Separate space preferred but could be combined with power plant.]</p> <p>Provide space for two rotor head repair stands each 4 feet by 4 feet.</p> <p>Provide space for two work benches with 110VAC power. Work benches shall be 3' high, 8' long, 3' deep.</p> <p>Provide space along one wall approximately 25 feet long by 5 feet wide for GFCI blade repair and blade balancing equipment.</p> <p>Provide space for secure storage for shop tools.</p> <p>Provide a 2-ton bridge crane that can cover entire shop area.</p> <p>Provide single personnel door and 8 foot minimum clear height roll-up doors large enough for passage of rotors and rotor heads on stands from Aircraft Maintenance Bay to shop.</p> <p>Provide 110VAC power.</p> <p>Provide two compressed air connections.</p> <p>Provide stainless steel deep sink connected to oil/water separator.</p> <p>Provide NDI (fluorescent penetrate) "darkened room" (Note: curtain-type is adequate). Provide appropriate Industrial ventilation.</p>	750
STRUCTURAL REPAIR (AIRFRAME)	<p>Provide space for one admin workstation (Logistics STAMIS).</p> <p>Provide space for four work benches with 110VAC power, data (one Logistics STAMIS), and compressed air. Work benches shall be 3' high, 8' long, 3' deep.</p> <p>Provide space, and 110VAC and 220V 3 Phase power for GFCI: 48" box and pan break machine(s), 48" foot shear, shrinker/stretcher machine, and one drill press.</p> <p>Provide space for secure storage for shop tools.</p> <p>Provide space at floor level and at walls for bench stock</p>	1,400

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>storage.</p> <p>Provide space for a GFGI prefabricated modular paint booth (8' x 12') for spray painting and composite repair. Provide compressed air for paint guns. Provide power. Provide paint booth exhaust to exterior.</p> <p>Provide single personnel door and roll-up doors to accommodate stabilator.</p> <p>Provide floor area to accommodate one 6' X 8' stabilator.</p> <p>Provide stainless steel deep sink connected to an oil/water separator.</p> <p>Provide space for repair of one rotor blade at a time.</p> <p>Provide power and space for GFGI refrigerator for adhesive storage.</p> <p>Provide power and space for GFGI residential convection oven.</p>	
<p>PNEUDRAULICS REPAIR</p>	<p>Prefer separate shop - however, may be combined with Structural Repair.</p> <p>Provide space for one admin workstation (Logistics STAMIS).</p> <p>Provide space for two work benches with with power and compressed air. Work benches shall be 3' high, 8' long, 4' deep.</p> <p>Provide space for secure storage for special tools and equipment.</p> <p>Provide stainless steel deep sink connected to oil/water separator.</p> <p>Provide containment/floor drain to oil/water separator.</p> <p>Provide space for GFGI relocatable hose cutting saw(s), tube bender, inspection box for host/tube connections, solvent tank, and two parts storage cabinets.</p> <p>Provide 110 VAC and 220 V 3 Phase power for GFGI saw(s) and tube bender.</p> <p>Provide 8 rows of shelving 16 feet long spaced 6 inches vertically by 6 inches deep for tubing and hose bench stock.</p> <p>Provide double personnel doors.</p>	<p>400</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
SYSTEMS REPAIR SECTION (Avionics / Electrical Repair)	Provide space for one admin workstation (Logistics STAMIS). Provide space for two work benches along walls. Work benches shall be 3' high, 8' long, 3' deep. Provide raceways with outlets evenly space at each work bench for 110 VAC, 28 VCD, 115 V/400 Hz/3 Phase power. Equip one bench height work station with 115V, 400Hz, 3 Phase. Provide local downdraft exhaust ventilation for soldering. Provide space for secure storage for shop tools and test equipment. Provide space for NiCad battery charging. Provide double personnel doors.	750
AIRCRAFT MAINTENANCE SUPPORT SPACE		TOTAL 6,600
HANGAR PARTS STORAGE (Tech Supply)	Provide minimum 20 linear feet of issue and turn-in counters with base cabinets. Provide private office with space for two admin workstations (Logistics STAMIS). Provide 3 foot deep by 6 foot high industrial steel heavy duty shelving for parts, equipment, etc. Provide double doors to Maintenance Bay. Provide 10' w x 12' h overhead coiling door with exterior access for delivery of parts. Provide single exterior personnel door. Provide visual access to exterior. Locate adjacent to Production Control, Aircraft Maintenance Bay floor, and Exterior Storage.	600
SPECIAL TOOL ROOM	Provide minimum 20 linear feet of issue and turn-in counter with base cabinets. Provide space for one admin work station. Provide space for secure storage for special tools and equipment. Provide double personnel doors.	500

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>Provide cage and gate around open floor space area to secure large equipment and tools (e.g. maintenance stands, jacks, torque adapters).</p> <p>Provide 40 linear feet of 3 foot deep by 6 foot high industrial steel heavy duty shelving for equipment and tools.</p> <p>Locate adjacent to Aircraft Maintenance Bay Floor.</p>	
CONTRACTOR LOGISTICAL SUPPORT	<p>Provide single finished shop area with power, lighting, HVAC, and communications and data conduit to support CLS Contractor operations. Verify requirements.</p>	1,200
BREAK ROOM	<p>Provide break room with a small kitchen with a double sink and garbage disposal. Provide base cabinets, counter and wall cabinets. Provide power and space for GFGI microwave(s), coffee maker(s), refrigerators, and three vending machines.</p> <p>Provide space for seating of 24 people at tables.</p> <p>Provide wall mounted telephone outlet.</p> <p>Provide CATV cable drop, power, and wall-mount for GFGI TV.</p>	400
HAZARDOUS / FLAMMABLE / OIL STORAGE	<p>Provide compliant storage area for six 55-gal drums of hazardous materials either within the hangar or as a prefabricated facility outside of the hangar.</p> <p>A separate pre-fabricated compliant facility is preferred.</p> <p>Provide space for six metal hazardous material storage cabinets adjacent to hangar maintenance bay and special tool room.</p>	400
HAZARDOUS WASTE STORAGE	<p>Provide compliant space for temporary storage of used lubricants, flammable solvents, dry sweep, etc.</p> <p>Provide space for six 55-gallon barrels.</p>	300
WASTE OIL STORAGE TANK (EXTERIOR)	<p>Provide compliant above-ground 300-gallon waste oil storage tank accessible by installation for removal of waste oil.</p> <p>The tank shall be constructed of non-corrosive material.</p> <p>Provide secondary containment in compliance with applicable environmental regulations.</p>	Site related non-assignable space

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>Tank construction and location shall comply with IBC and NFPA code requirements. Provide 12-inch diameter x 5'-4" high, concrete-filled, schedule 80 galvanized steel pipe bollards, painted safety yellow, around the perimeter of above-ground tank areas.</p>	
<p>WASTE FUEL STORAGE TANK (EXTERIOR)</p>	<p>Provide compliant above-ground 300-gallon waste fuel storage tank accessible by installation for removal of waste fuel.</p> <p>The tank shall be constructed of non-corrosive material.</p> <p>Provide secondary containment in compliance with applicable environmental regulations.</p> <p>Tank construction and location shall comply with IBC and NFPA code requirements. Provide 12-inch diameter x 5'-4" high, concrete-filled, schedule 80 galvanized steel pipe bollards, painted safety yellow, around the perimeter of above-ground tank areas.</p>	<p>Site related non-assignable space</p>
<p>S-280 AIRCRAFT MAINTENANCE SHELTER</p>	<p>Provide covered exterior space attached to the hangar facility for three mobile GFGI shelters approximately 8' W X 8' H X 15' L.</p> <p>Provide canopy sized to permit access by material handling equipment to move shelters.</p> <p>Provide exterior lighting, fire detection and fire suppression under canopy.</p> <p>Provide double personnel door access to hangar interior.</p> <p>Provide security fencing and swing gates.</p> <p>Provide 115VAC/60Hz/100Amps/single phase/5-wire; 115V/400Hz/20Amps/3 phase/5-wire; and 28VDC/50</p> <p>Amps power via exterior rated plug/receptacle connections to each shelter.</p> <p>May be included with Exterior Covered Storage.</p> <p>Maximum covered area = 1,400 SF.</p>	<p>700</p> <p>(Net space based on ½ gross covered area)</p>
<p>EXTERIOR COVERED STORAGE</p>	<p>Provide covered exterior space for temporary storage of equipment such as SPAMs, generators, MILVANs, shop sets (M109), power generation, ground support equipment, and transformers.</p> <p>Provide canopy sized to permit access by material handling equipment to move stored equipment.</p>	<p>2,500</p> <p>(Net space based on ½ gross covered area)</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>Provide exterior lighting, fire detection, and fire suppression under canopy.</p> <p>Provide double personnel door access to hangar interior.</p> <p>Provide security fencing and swing gates.</p> <p>Provide a concrete load-bearing pad and apron with direct vehicle access to the flight line and hangar facility.</p> <p>Locate adjacent to primary facility.</p> <p>Maximum covered area = 5,000 SF.</p>	
ADMINISTRATIVE CORE		
AVIATION UNIT OPERATIONS AREA		TOTAL = 8,740
FLIGHT PLANNING	<p>Provide 30 linear feet of bar height counter space with knee space along wall with power and data connections spaced along length of counter. Counter will be used by up to six individuals using AMPS ruggedized laptops and data transfer system.</p> <p>Provide bar height wood sloped surface counter with knee space 6 feet long by 6 feet wide for paper map planning. Plexiglas surfaces each side of counter to be sloped to permit users to work on each side of counter. Install Plexiglas on hinges to permit changes of maps on each side of counter. Provide flat top approximately 12 inches wide at top center of counter.</p> <p>Provide space for one admin workstation.</p> <p>Provide space for printer.</p> <p>Provide wall mount electrical outlets for three GFI digital clocks.</p> <p>Provide wall height wall-mounted map displays consisting of Plexiglas covered panels - 1 fixed panel and 2 horizontal sliding panels per flight company.</p> <p>Provide space for marker boards or provide space for flat screen monitors.</p> <p>Provide space for storage.</p> <p>Locate adjacent to briefing room and flight operations.</p>	1,800
SECURE PLANNING	Provide space for two admin workstations with non-secure	300

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
ROOM	<p>and secure telephone, NIPR, SIPR and power.</p> <p>Provide space for printer, storage, shredder and 4 drawer safe.</p> <p>Provide secure door access.</p>	
FLIGHT OPERATIONS	<p>Provide space for five admin workstations.</p> <p>Provide bar height customer service counter and base cabinets approximately 15 feet long. Base cabinets shall include shelving for regulations on public face and storage shelving on side facing work stations. Provide counter drop panel to restrict access to admin workstations. Provide 1 phone jack at customer service counter for use by Flight Operations personnel. Provide one Logistics STAMIS drop at service counter for use by Flight Operations personnel.</p> <p>Provide 2 foot 6 inch deep bar height wall hung counter as an L to the customer service counter approximately 6 feet long. Provide 2 phone jacks for telephone use by pilots.</p> <p>Provide space for storage, printer, fax machine and copier.</p> <p>Provide marker boards or provide space for flat screen monitors that can be viewed from the workstation area and customer service counter. If flat screen monitors are required, provide space and wall mounted power and data outlets for six total.</p> <p>Provide bulletin boards in workstation and public areas.</p> <p>Provide wall mounted CATV and power outlet with bracket for GFGI television that can be viewed from workstation area and customer service counter.</p> <p>Provide wall mount electrical outlets for three GFGI digital clocks that can be viewed from workstation area and customer service counter.</p> <p>Provide 2 foot 6 inch deep wall mounted sitting height counter with knee space approximately 12 feet long for GFGI relocatable HF, FM and UHF radios. Provide power raceway and outlets at counter surface. Provide conduits for antennas to roof. Provide access to roof from Flight Operations. At roof, provide permanent mounts and tie-downs for relocatable GFGI HF, FM and UHF antennas.</p> <p>Provide space for secure storage for Night Vision Goggles (40 per company).</p>	800

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>Locate adjacent to briefing room and flight planning room.</p> <p>Flight line view is preferable (CCTV camera would be an option).</p>	
BRIEFING ROOM	<p>Provide two ceiling-mounted projector supports with power and data connections, two recessed ceiling-mounted screens, marker boards, and PA system.</p> <p>Provide dimmable lighting. Provide ability to control room lighting level from fixed lectern.</p> <p>Provide space to accommodate 120 people utilizing stackable seating.</p> <p>Provide space for 30 folding tables with seating.</p> <p>Provide separate storage space for chairs and tables.</p> <p>Provide wall mount electrical outlets for three GFGI digital clocks.</p> <p>Provide a fixed lectern station at the front of the briefing area adjacent to the screens and room lighting controls. Provide power and data connections including AMPS laptop and data transfer system, and PA capability from the lectern station. Size lectern surface for placement of laptop and data transfer system.</p>	1,950
AVIATION OPS BREAKROOM	<p>Provide break room with a small kitchen with a double sink and garbage disposal. Provide base cabinets, counter and wall cabinets. Provide power and space for GFGI microwave(s), coffee maker(s), and refrigerator.</p> <p>Provide space for seating of 12 people at tables.</p> <p>Provide wall mounted phone jack.</p> <p>Provide CATV cable drop, power, and wall-mount for GFGI TV.</p>	200
CREW CHIEF WORKROOM	<p>Provide space for workbenches with Logistics STAMIS, power and data connections to accommodate 10 individuals.</p> <p>Provide caged area, gate, and shelving to secure 40 tool boxes (kits).</p> <p>Provide space for marker boards.</p> <p>Provide 4' X 8' bench-height worktable with metal surface - locate in center of room.</p>	1,250

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>Provide space for GFGI tool and parts storage cabinets and laptop charging cabinet.</p> <p>Locate adjacent to aircraft maintenance bay floor.</p>	
AVIATION LIFE SUPPORT EQUIPMENT (ALSE) SHOP	<p>Provide two bar height counters arranged in an L at the entry with base cabinets minimum 8' long each for customer issue and turn in. Provide counter drop panel or gate to restrict access to the shop functions.</p> <p>Provide space for two admin workstations with power and data connections.</p> <p>Provide space for uniform/equipment fitting (approx 12' x 16') in public side at issue/turn-in counters.</p> <p>Provide utilities and space for GFGI refrigerator, commercial washing machine, commercial dryer, residential convection oven, and vacuum sealer. Provide overhead cabinets.</p> <p>Provide dual compartment stainless steel deep sink.</p> <p>Provide space for:</p> <ol style="list-style-type: none"> (1) two 8' workbenches; (2) floor to ceiling shelving for storage of ALSE and related equipment; (3) two 4' x 8' work tables; (4) four lockers; and table for GFGI sewing machine <p>Provide low-pressure, high-volume compressed air (moisture and oil free) at workbenches and work tables.</p> <p>Provide 150 dual lock lockers (approximately 2.5' x 2.5' x 2.5' for helmet and flight vest storage) for flight crew members adjacent to customer service counters accessible from public side and ALSE shop.</p>	<p>1,800</p>
MAINTENANCE TEST PILOTS	<p>Provide space for 8 admin workstations with power, data and telephone. Provide space for printer. Locate adjacent to crew chiefs workroom.</p>	<p>640</p>
COMPANY ADMINISTRATION AND READINESS AREA		TOTAL = 14,380
COMMANDER	<p>Provide space for admin workstation with power, telephone and NIPR, SIPR, printer, small conference table and side chairs in private office. Provide one per company.</p>	<p>600</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
1ST SGT	<p>Provide space for admin workstation with power, telephone, and data. Provide one per company</p> <p>Locate adjacent to Commander office as part of orderly room.</p>	400
ORDERLY ROOM (Each Flying Company)	<p>Provide space for 4admin workstations with power, telephone, and data for platoon leader, training officer and platoon sergeants.</p> <p>Provide space for four guest chairs in waiting area space adjacent to 1SG and Commander's Office.</p> <p>Provide space for printer, copier, fax, file cabinets, storage and mail distribution.</p> <p>Provide separate lockable 96 NSF storage room.</p> <p>Provide one per flight company (562 NSF per room).</p>	1,686
ORDERLY ROOM (Aviation Support Company)	<p>Provide space for 4admin workstations with power, telephone, and data for platoon leader, training officer and platoon sergeants.</p> <p>Provide space for four guest chairs in waiting area space adjacent to 1SG and Commander's Office.</p> <p>Provide space for printer, copier, fax, file cabinets, storage and mail distribution.</p> <p>Provide separate lockable 96 NSF storage room.</p>	562
AVIATION SAFETY OFFICER (Flying Companies Only)	<p>Provide space for admin workstation with power, data and telephone, printer, two guest chairs, and file cabinet in private office.</p>	360
AVIATION STANDARDIZATION OFFICER (Flying Companies Only)	<p>Provide space for admin workstation with power, data and telephone, printer, two guest chairs, and file cabinet in private office.</p>	360
AVIATION TAC OPS OFFICER (Flying Companies Only)	<p>Provide space for admin workstation with power, data and telephone, printer, two guest chairs, and file cabinet in private office.</p>	360
MULTI-PURPOSE / BREAK / CONFERENCE	<p>Provide room divider or folding partition. At each half of area provide marker board, recessed ceiling mounted projection screen, and ceiling mounted projector support with power and data connections.</p>	600

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>Provide one SIPR drop in each half of room.</p> <p>Provide space for tables and chairs.</p> <p>Provide dimmable lights in each multipurpose space.</p> <p>Provide separate break room with door. Provide countertop with double compartment stainless steel sink and garbage disposal, base and overhead cabinets. Provide space and power for GFGI refrigerator, coffee maker and microwave. Provide space for break tables and side chairs. Provide space for two GFGI vending machines.</p> <p>Locate adjacent to company orderly rooms.</p>	
<p>DISTRIBUTED / COMPUTER BASED TRAINING ROOM (DT/CBT)</p>	<p>Dedicated computer enabled digital training room equipped with Classroom XXI technology.</p> <p>Provide space for FFE equivalent to the requirements for a small Resource Center, paragraph 2-4.9, GIB and ACES Standard Design Criteria.</p> <p>Provide space for 10 individual carrel type computer stations, an administrative work station, printer, and copier.</p> <p>Provide space for marker boards, tables and chairs for group training.</p> <p>Provide power, telephone and data.</p> <p>Provide dimmable light fixtures.</p> <p>Locate adjacent to company orderly rooms and multipurpose/ break/conference room.</p>	<p>572</p>
<p>COMPANY READINESS STORAGE</p>	<p>Provide 42" w x 24" d x 78" h lockable permanently installed individual steel lockers with base and sloped top for each assigned personnel.</p> <p>There shall be a shelf and clothes rod at the top and a removable shelf at midpoint.</p> <p>Provide 1,600 NSF per company.</p>	<p>4,800</p>
<p>ARMS VAULT INDIVIDUAL WEAPONS</p>	<p>Provide arms vault(s) to accommodate storage of arms, ammunition and explosives (AA&E) for each company.</p> <p>Arms vault(s) are not intended to provide space for aircraft armaments.</p>	<p>1,920</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>These vaults shall be designed in accordance with physical security requirements contained in AR 190-11, Appendix G.</p> <p>An option exists for use of prefabricated, modular vaults conforming to Fed. Spec. AA-V-2737 requirements.</p> <p>Provide vault door/s and day gate/s.</p> <p>Provide electronic security system to arms vault(s). Electronic system shall include electronic access control system and intrusion detection system.</p> <p>May provide one for the entire battalion if the arms storage area is sub-divided into companies for control considerations.</p> <p>Provide customer service counter(s) for armorer/s with bar height countertop and base cabinets.</p> <p>Provide space for weapons racks.</p> <p>Provide shared space for two admin workstations, bookcases for manuals, 4-drawer file cabinets, and two work benches.</p>	
<p>ARMS VAULT</p> <p>AIRCRAFT MOUNTED WEAPONS</p>	<p>Provide arms vault to accommodate storage of arms, ammunition and explosives (AA&E).</p> <p>These vaults shall be designed in accordance with physical security requirements contained in AR 190-11, Appendix G.</p> <p>Provide vault door and day gate.</p> <p>Provide electronic security system to arms vault(s). Electronic system shall include electronic access control system and intrusion detection system.</p> <p>Provide single vault sub-divided in thirds with metal caging/gates for the flight companies.</p> <p>Locate adjacent to Arms Vault Individual Weapons.</p>	<p>300</p>
<p>SECURE STORAGE/ NBC STORAGE/ COMM EQUIPMENT/ CONSUMABLE UNIT STORAGE</p>	<p>Provide secure storage room for non-sensitive items (high value items, other than AA&E, for which accountability is a concern).</p> <p>AR 190-51 and AR 190-13 shall govern construction standards for this space.</p> <p>Provide separate caged space with 'Dutch' gates for each company. Within each company area, provide individual</p>	<p>1,860</p>

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	<p>caged space with gates for secure storage, NBC equipment, communications equipment, and consumable item storage. Cages construction shall extend to the bottom of the structure above.</p> <p>Provide 465 NSF per company. For each company provide:</p> <ul style="list-style-type: none"> • Provide space for one admin workstation with power, data and telephone, and one 4 drawer file cabinet. • Secure and communications equipment storage - provide space for six lockable metal cabinets and install industrial heavy duty steel shelving approximately 10'w x 4'd x 6'h. • NBC Storage - provide space for four lockable metal cabinets, desk with power connections, file cabinet, and chair. Install industrial heavy duty steel shelving approximately 10'w x 4'd x 6'h. • Consumable Unit Storage - provide space for four lockable metal cabinets and install industrial heavy duty steel shelving approximately 10'w x 4'd x 6'h. 	
SUPPORT SPACES		TOTAL = 4,526
RESTROOMS AND SHOWERS	<p>Provide fixtures and equipment based on a personnel ratio of 80% male and 20% female.</p> <p>Provide restroom space for administrative personnel adjacent to Aviation Unit Operations and Company Administrative areas assumed at second floor.</p> <p>Provide restrooms and showers at ground floor sized for:</p> <ul style="list-style-type: none"> • Administrative personnel – provide 12 inch wide x 24 inch deep x 72 inch high lockable lockers for 50% of flight company assigned personnel to support physical training. Provide dressing benches. • Aviation Support Company – provide 12 inch wide x 24 inch deep x 72 inch high lockable lockers for assigned personnel. Provide dressing benches. <p>Base plumbing fixture counts on 116 personnel assigned to the Aviation Support Company and 105 total personnel assigned to the three flight companies.</p>	2,500
FACILITY MAINTENANCE & STORAGE	<p>Provide lockable store rooms at appropriate locations throughout facility.</p> <p>Provide janitor closets at appropriate locations around facility.</p>	2,026
MECHANICAL	<p>Include space for sprinkler systems components, boilers, fan motors, etc. with adequate space to service</p>	Included in net to gross area

SPACE	HANGAR FUNCTIONAL REQUIREMENTS	AUTHORIZED AREA (SF)
	equipment.	calculation
ELECTRICAL	Provide space for Service Rated Entrance Equipment, transformers, Distribution Panels, Lighting Panels, Fire Alarm System Control, etc.	
COMMUNICATION ROOMS	Telephone, and Data Racks and distribution for communications, NIPR and SIPR. Centrally locate room(s).	
FIRE SUPPRESSION ROOM	Include space for fire suppression equipment.	
CIRCULATION	Minimum corridor width 6'.	

Table 3.3 Furniture, Fixture and Equipment Listing

AIRCRAFT MAINTENANCE AREA		
AIRCRAFT MAINTENANCE BAY		
AIRCRAFT MAINTENANCE BAY HANGAR FLOOR	8	L-shaped Technical Workbench w/ESD worktop and grounding points, wrist straps, 2 overhead shelves and task lighting; provide metal powerstrip w/minimum 6 receptacles
	8	Operable Stools w/hard surface casters
AIRCRAFT MAINTENANCE SHOP SPACE		
PRODUCTION CONTROL	2	Private office with U-Shaped workstations. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	5	L-shaped Admin Workstations. Provide: center drawer; Box/Box File & File/File Storage; Overhead Storage & task lighting
<u><AAC PRODUCTION MARKER></u>	2	5' h x 8' w Dry Erase Markerboards<AAC PRODUCTION MARKER>
<u><AAC PRODUCTION FLATSCREEN></u>	4	5' h x 8' w Flat Screen Monitors<AAC PRODUCTION FLATSCREEN>
	20	Conference Chairs
	10	Ergonomic Task Chairs
	1	10' Conference Table

	2	Lockable metal storage cabinet 72" h x 30" w x 30" d with shelves
	2	2 High Lateral File Cabinets
	1	4-Drawer Safe for COMSEC
QUALITY CONTROL/QUALITY ASSURANCE	1	Private office with U-Shaped workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	11	L-shaped Admin Workstations. Provide: center drawer; Box/Box File & File/File Storage; Overhead Storage & task lighting
	12	Ergonomic Task Chairs
	1	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
<AAC QAQC MARKER>	2	5' h x 8' w Dry Erase Markerboards<AAC QAQC MARKER>
<AAC QAQC FLATSCREEN>	4	5' h x 8' w Flat Screen Monitors<AAC QAQC FLATSCREEN>
TECHNICAL ASSISTANCE (LARS/CLS)	5	L-Shaped Admin Workstations. Provide: center drawer; Box/Box File & File/File Storage; Overhead Storage & task lighting
	5	Ergonomic Task Chairs
	1	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
TECHNICAL LIBRARY	4	Study Carrels
	4	Rotating File Cabinet
	1	Media Storage Cabinet
	1	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
	2	Round Study tables
	8	Side chairs
AIRCRAFT MAINT PLATOON HQ	3	Private/Semi-private U-Shaped workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage
	3	Ergonomic Task Chair
	3	4 H Bookcases

	1	Printer storage cabinet 72" w x 30"d x 30"h
	3	4 H Lateral Files
REPAIR SECTION	4	Private Office with U-Shaped workstations. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage
	14	Conference Chairs
	1	10' Conference Table
	14	Technical Workbench w/ESD worktop and grounding points, wrist straps, 2 overhead shelves and task lighting; provide metal powerstrip w/ minimum 6 receptacles
	4	Ergonomic Task Chair
	14	Operable Stools w/hard surface casters
	1	5' h x 8' w Dry Erase Markerboard
	4	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	4	Lockable Tool Storage Shelving 60" W x 57"H
AIRCRAFT COMPONENT REPAIR PLATOON HQ	3	Private Office with U-Shaped workstations. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage
	3	Ergonomic Task Chair
	3	4 H Bookcases
	1	Printer storage cabinet 72" w x 30"d x 30"h
	3	4 H Lateral Files
POWER PLANT	1	U-Shaped Admin workstation in Semi-Private Office. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Technical Workbench w/ESD worktop and grounding points, wrist straps, 2 overhead shelves and task lighting; provide metal powerstrip w/minimum 6 receptacles
	4	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	1	Ergonomic Task Chair
	2	Operable Stools w/hard surface casters

POWERTRAIN	1	U-Shaped Admin workstation in Semi-Private Office. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Technical Workbench w/ESD worktop and grounding points, wrist straps, 2 overhead shelves and task lighting; provide metal powerstrip w/minimum 6 receptacles
	4	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	1	Ergonomic Task Chair
	2	Ergonomic Operable Stools w/hard surface casters
STRUCTURAL REPAIR (AIRFRAME)	1	L-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	4	Technical Workbench w/ESD worktop and grounding points, wrist straps, 2 overhead shelves and task lighting; provide metal powerstrip w/minimum 6 receptacles
	4	Operable Stools w/hard surface casters
	1	Ergonomic Task Chair
	2	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	2	Storage cabinets; 36" w x 18" d x 68" h
	1	Top Mount Freezer/Refrigerator w/Icemaker 21.7 Cu. Ft.
	1	Conventional Oven
PNEUDRAULICS REPAIR	1	L-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Technical Workbench w/ESD worktop and grounding points, wrist straps, provide metal powerstrip w/minimum 6 receptacles
	2	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	2	Lockable Tool Storage Shelving 60" W x 57"H
	2	Operable Stools w/hard surface casters
	1	Ergonomic Task Chair
SYSTEMS REPAIR SECTION (AVONICS/ELECTRICAL REPAIR)	1	L-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.

	2	Technical Workbench w/ESD worktop and grounding points, wrist straps, 2 overhead shelves and task lighting
	14	Operable Stools w/hard surface casters
	4	Rubber Mats at Workbenches
	2	NiCad battery charging banks
	3	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	1	Ergonomic Task Chair
POL FUEL HANDLERS (Provide in Production Control)	1	L-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	1	Ergonomic Task Chair
AIRCRAFT MAINTENANCE SUPPORT SPACE		
HANGAR PARTS STORAGE (Tech Supply)	2	U-Shaped Admin workstation in Private Office with adjoining Common Workspace. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Ergonomic Task Chair
SPECIAL TOOL ROOM	1	U-Shaped workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Lockable Tool Storage Cabinet w/Drawers 30"Wx57"H
	2	Lockable Tool Storage Shelving 60" W x 57"H
	2	Ergonomic Task Chair
BREAK ROOM	2	Microwave
	2	Coffee Maker
	2	Top Mount Freezer/Refrigerator w/Icemaker 21.7 Cu. Ft.
	6	Table 36"sq. x 30" h
	24	Side Chairs
	1	Television
HAZARDOUS/FLAMMABLE OIL STORAGE	6	Hazmat Storage Cabinets
ADMINISTRATIVE CORE		

AVIATION UNIT OPERATIONS AREA		
FLIGHT PLANNING	10	Operable Stools w/casters
	1	U-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	3	5h x 8' w Dry Erase Markerboards
	2	Lockable metal storage cabinets 72" h x 30" w x 30" d with shelves
	1	Ten Drawer Map Flat File
	1	Ergonomic Task Chair
	3	Wall Mounted Digital Clocks
SECURE PLANNING ROOM	2	U-Shaped Admin workstation in Private Office. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Ergonomic Task Chair
	1	Printer storage cabinet 72" w x 30"d x 30"h
	1	4-Drawer Safe for Classified Material
	1	Shredder
FLIGHT OPERATIONS	5	L-Shaped Admin workstation in Common Area. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	8	Ergonomic Task Chair
	3	5' h x 8' w Dry Erase Markerboards
	3	Wall Mounted Digital Clocks
	3	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
	1	Television
BRIEFING ROOM	2	5' h x 8' w Dry Erase Markerboards
	120	Stacking/Ganging chair
	30	Folding Tables 2' w x 8' l
	3	Wall Mounted Digital Clocks
	2	Digital Projectors

AVIATION OPS BREAKROOM	2	Microwave
	2	Coffee Maker
	1	Top Mount Freezer/Refrigerator w/Icemaker 21.7 Cu. Ft.
	3	Table 36"sq. x 30" h
	12	Side Chairs
	1	Television
CREW CHIEF WORKROOM	10	Technical Workbench w/ESD worktop and grounding points, 2 overhead shelves and worklight (equal to 60 lf of 24"D bench height w storage peds every 3 ft.) provide metal powerstrip w/minimum 6 receptacles per workbench.
	10	Operable Stools w/hard surface casters
	4	5' h x 8' w Dry Erase Markerboards
	1	4'x8' Work Table w/ Metal Surface
	8	Lockable Tool Storage Cabinet w/Drawers 60"Wx57"H
	4	Lockable Tool Storage Shelving 60" W x 57"H
	10	Small Parts Storage Cabinets placed at workbenches
	1	Laptop Charging Cabinet
	4	5' h x 8' w Dry Erase Markerboards
ALSE SHOP	2	U-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Ergonomic Task Chair
	1	Convection Oven
	1	Vacuum Sealer
	1	Top Mount Freezer/Refrigerator w/Icemaker 21.7 Cu. Ft.
	1	Washing Machine
	1	Dryer
	2	Technical Workbench w/ESD worktop and grounding points, 2 overhead shelves and worklight provide metal powerstrip w/minimum 6 receptacles

	2	Naughahyde or rubber surfaced work tables 4' w x 8' l x 3' h with power outlets.
	2	Floor to Ceiling Storage Shelves and space for hanging uniforms and vests.
	1	Table
	4	Single-tier lockers
	4	Operable Stools with hardsurface casters
MAINTENANCE TEST PILOTS	8	U-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	8	Ergonomic Task Chair
COMPANY ADMINISTRATION AND READINESS AREA		
COMMANDER	4	U-Shaped Admin workstation in Private Office. Provide: Wardrobe storage, Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	4	Executive Ergonomic Task Chair
	4	36"D Conferencing Table
	16	Guest Chairs
1ST SGT	4	U-Shaped Admin workstation. Provide: Wardrobe storage, Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	4	Ergonomic Task Chair
	16	Guest Chairs
ORDERLY ROOM	4	U-Shaped Admin workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	4	Ergonomic Task Chair
	16	Guest Chairs
	8	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
	8	Five drawer lockable file cabinets
AVIATION SAFETY OFFICER	3	U-Shaped Admin workstation in Private Office. Provide: Wardrobe storage, Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.

	3	Ergonomic Task Chair
	6	Guest Chairs
	3	Five drawer lockable file cabinets
AVIATION STANDARDIZATION OFFICER	3	U-Shaped Admin workstation in Private Office. Provide: Wardrobe storage, Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	3	Ergonomic Task Chair
	6	Guest Chairs
	3	Five drawer lockable file cabinets
AVIATION TAC OPS OFFICER	3	U-Shaped Admin workstation in Private Office. Provide: Wardrobe storage, Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	3	Ergonomic Task Chair
	6	Guest Chairs
	3	Five drawer lockable file cabinets
ORDERLY ROOM (Three Flight Companies)	9	U-Shaped workstations. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File & File/File Storage.
	3	L-shaped admin workstations: Provide: Overhead storage w/task lighting, center drawer; Box/Box File & File/File Storage.
	12	Ergonomic Task Chair
	3	Printer storage cabinet 72" w x 30"d x 30"h
	3	Mail Distribution Center with 18 openings.
	12	Guest Chairs
	6	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
	6	Five drawer lockable file cabinets
ORDERLY ROOM (Aviation Support Company)	4	U-Shaped workstations. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File & File/File Storage.
	1	L-shaped admin workstations: Provide: Overhead storage w/task lighting, center drawer; Box/Box File & File/File Storage.

	5	Ergonomic Task Chair
	1	Printer storage cabinet 72" w x 30"d x 30"h
	1	Mail Distribution Center with 18 openings.
	4	Guest Chairs
	2	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
	2	Five drawer lockable file cabinets
MULTIPURPOSE/BREAK/CONFERENCE	2	5' h x 8' w Dry Erase Markerboards
	12	Heavy Duty Training Tables w/T-Leg Folding w/dolly
	40	Seminar Chair on Casters (Nesting; seat folds up)
	2	36"D Break Table
	8	Side Chair
	1	Top Mount Freezer/Refrigerator w/Icemaker 21.7 Cu. Ft.
	1	Microwave
	1	Coffee Maker
DISTRIBUTED/COMPUTER BASED TRAINING ROOM (DT/CBT)	1	L-shaped admin workstations: Provide: Overhead storage w/task lighting, center drawer; Box/Box File & File/File Storage.
	10	Individual Carrel Type Computer Stations
	11	Ergonomic Task Chair
	4	Lockable metal storage cabinet 72" w x 30" d x 30" h with shelves
	2	Five drawer lockable file cabinets
	2	5' h x 8' w Dry Erase Markerboards
	1	Conference table
	8	Side Chairs
ARMS VAULT INDIVIDUAL WEAPONS	2	L-Shaped workstation. Provide: Overhead storage w/ task lighting; center drawer; Box/Box File, & File/File Storage.
	2	Ergonomic Task Chair
	4	4-High Bookcase

	4	4-Drawer File Cabinet
	2	Technical Workbench w/ESD worktop and grounding points, 2 overhead shelves and worklight (equal to 60 lf of 24"D bench height w storage peds every 3 ft.) provide metal powerstrip w/minimum 6 receptacles;
	4	Operational Task Stool with hard surface casters
	TBD	Weapons Racks
SECURE STORAGE/ NBC STORAGE/ COMM EQUIPMENT/ CONSUMABLE UNIT EQUIPMENT	4	L-Shaped workstation. Provide: center drawer; Overhead Storage, Task Lighting, center drawer, Box/Box File, & File/File Storage.
	4	4-Drawer File Cabinet
	56	Lockable Metal Cabinet with Shelves
	4	Single pedestal desk.
	4	4-Drawer File Cabinet
	8	Ergonomic Task Chair

3.4. FUNCTIONAL ADJACENCIES

See Table 3.4 <https://eportal.usace.army.mil/sites/COS/HGRC/Shared%20Documents/Adjacency-Matrix-AAC-Hangar.pdf>.

3.5. SITE FUNCTIONAL AREAS:

Site selection and real property master planning for all Active Component HGR Complexes (and Reserve Component complexes when applicable) shall comply with all safety, obstruction, and airspace boundaries as stipulated by AR 95-2 and implemented by the Transportation Systems Mandatory Center of Expertise (TS MCX) for DCS G-3, HQDA. The major components of a HGR Complex and minimum sitting requirement for any hangar project (inside the five-foot line) include the primary facility FCC 211 10, Hangar Access Apron FCC 113 40, and Aircraft Wash Apron FCC 113 70. ASB hangars also include Aircraft Parts Storage Building FCC 211 13 external storage space allocations. All other hangar complex space is contained within the confines of these facility categories. The outer boundary of the hangar complex (outside the five-foot line) abuts the Rotary Wing Aircraft Parking Apron FCC 113 20, Hover Taxi lanes FCC 112 21, and Taxiways FCC 112 31. This assures safe and efficient transition from the power-on components of an AAF/AHP (primary landing surface (i.e., runway or helipad) and aircraft parking) to non-power ingress/egress into the hangar.

3.6. ARCHITECTURAL MATERIALS AND FINISHES:

3.6.1. FLOORS:

- (a) Hangar floors: Non-skid, light reflective, non-oxidizing dry shake surface hardened or light reflective epoxy or polyurethane coating.
- (b) Shop floors: Sealed concrete, non-skid, light reflective, non-oxidizing dry shake surface hardener or light reflective epoxy or polyurethane coating.
- (c) Restroom floors: ceramic tile / porcelain tile.
- (d) Shower floors: ceramic tile
- (e) Office floors: carpet or vinyl composition tile.

- (f) Corridors / Vestibules: Vinyl composition tile, concrete sealer.
- (g) Other auxiliary spaces: Concrete sealer.

3.6.2. BASES:

- (a) Hangar and Shop Spaces: Painted CMU/Rubber base
- (b) Restrooms: Ceramic tile, porcelain tile
- (c) Showers: Ceramic tile
- (d) Offices / corridors, Vestibules: Rubber base
- (e) Other auxiliary spaces: Rubber base

3.6.3. WALLS: (STC and fire rated where required)

- (a) (a) Hangar and shop Spaces:

Up to 10'-0" Above Finished Floor: Durable, impact resistant, corrosive resistant, and easily cleaned material. The lower portion of the walls is to be protected against incidental damage caused by movement of aircraft parts, equipment, etc. Protect exterior surface against incidental damage. Painted.

Above 10'-0": Moisture resistant gypsum board, exposed vinyl faced insulation, metal liner panels solid or perforated. Painted.

- (b) Restrooms: ceramic tile / porcelain tile (Utilize cement board backer board).
- (c) Showers: Ceramic tile / porcelain tile (Utilize cement backer board).
- (d) Offices: Painted gypsum board.
- (e) Corridors, Vestibules: Painted gypsum board.
- (f) Other Auxiliary spaces: Painted gypsum board, CMU.
- (g) Where gypsum board is indicated, provide paperless fiberglass mat faced gypsum wall board. At the hangar and shops where gypsum wall board is used, and at corridors and stairways, provide paperless abuse resistant gypsum wall board. At janitor closets and mechanical rooms where gypsum wallboard is used, provide paperless moisture/mold resistant gypsum wallboard.

3.6.4. CEILINGS:

- (a) Hangar and Shop Spaces unless otherwise noted: Paint exposed structure. Note: Do not paint exposed vinyl faced insulation, if used.
- (b) Offices & Technical Shops: Acoustical Ceiling Tile.
- (c) Restrooms & Lockers: Moisture resistant Acoustical Tile
- (d) Showers / Lockers: Painted moisture resistant gypsum board.
- (e) Corridors: Acoustical Ceiling Tile.
- (f) Vestibules: Acoustical Ceiling Tile with hold-down clips, Painted Gypsum Board.
- (g) Auxiliary Spaces: Acoustical Ceiling Tile, Painted Gyp Bd.
- (h) Arms Vault: Painted.

3.6.5. DOORS AND FRAMES: (STC and fire rated where required)

- (a) Painted Insulated Galvanized Hollow Metal (corrosive resistant at Hangar and Shop Areas).
- (b) Aluminum Entrance System – color PVF finish.
- (c) Plastic Laminate, hollow core metal, insulated metal, or solid core wood doors (Administrative spaces).
- (d) Hangar Doors: Motorized Fabric; Motorized Insulated Metal Horizontal Sliding– color to compliment other exterior finishes.

- (e) Service Doors: Insulated metal motorized overhead coiling doors.
- (f) Folding partitions: Manually operated vinyl, pantograph acoustical folding partitions. Provide minimum 42 STC rating.
- (g) Movable wall panels: Single or paired panels. Provide minimum 42 STC rating. Provide hinged doors in panels where access through the movable wall is required for function or code.

3.6.6. WINDOWS AND GLAZING: (Fire rated where required)

- (a) Hangar Floor or Shop Space: Fixed High-Bay windows, clerestory windows, or insulated translucent wall system where required.
- (b) Offices, exterior and Vestibule interior: Aluminum, insulated windows, fixed, color PVF finish.
- (c) Interior Windows: Hollow core metal with fire or safety glazing as required.

3.6.7. SPECIALITIES:

- (a) Marker boards: Liquid writing marker boards.
- (b) Bulletin boards: Bulletin boards shall consist of a natural cork tack board, and aluminum tubular frame.
- (c) Signage: Comply with requirements of ADA and ABA. Accessibility Guidelines. Fully integrate interior signage as a design element with the architecture and interior design.
- (d) Fire Extinguisher Cabinets and fire extinguisher bracket supports.
- (e) Millwork: Built-in components and accessories for worktops, counters, cabinets, work benches, shelving.
- (f) Audiovisual Supports: Brackets.
- (g) Restroom Accessories

3.7. PLUMBING

3.7.1. EXTERIOR WALL HYDRANTS:

Provide wall hydrants around perimeter of building as well as one inside of the Mechanical Room(s).

3.7.2. DOMESTIC HOT WATER SYSTEM:

Locate the main water heating equipment within a mechanical room, on the ground floor level only. Instantaneous water heaters are permissible. Size system storage and recovery for delivery of hot water at every shower head over a continuous operation of all heads for a duration of 90 minutes. Usage diversity factor for the showers shall be one. Size water heater(s) based upon usage anticipated and accounting for this diversity factor. Determine the energy source for the domestic water heating system by Life Cycle Cost Analysis.

3.7.3. SINKS:

Where sinks are required, provide hot and cold water service.

3.7.4. TRENCH DRAINS:

Design trench drain for easy cleaning. Provide basket strainers to facilitate trash removal where trench drains discharge to piping systems. Convey waste to exterior oil/water separator prior to discharge to the sanitary sewer system. When a dedicated, walled welding area is provided, provide a solid cover to the trench drain where it runs through the welding area.

3.7.5. EMERGENCY SHOWERS AND EYEWASHES:

See Table 3.2 for eye wash, hand wash and emergency shower requirements within the hangar and shop areas. Locate emergency wash stations in accordance with OSHA standard 1910.151(c) and ANSI Z358.1.

Ground Service	Aviation Platform Ground Service					
	Baseline Requirements					
	AH-64A	AH-64D	UH-60A/L	UH/MH-60M,X	OH-58D	ARH
Hydraulic Servicing	6 gpm @ 3000 psig (dual system)	6 gpm @ 3000 psig (dual system)	8 gpm @ 3000 psig (triple system)	8 gpm @ 3000 psig (triple system)	3 gpm @ 3000 psig (single system)	2.4 gpm @ 1000 psig
Pneumatic Start	30 lb/min @ 30 - 50 psig	30 lb/min @ 30 - 50 psig	30 lb/min @ 30 - 50 psig	30 lb/min @ 30 - 50 psig	none	None
Pneumatic Servicing	ECU PAS hyd press	PAS only	none	none	none	None

3.8.2. STANDBY POWER SYSTEMS:

Standby Generator and UPS Back-Up Power Systems generally are not required for these facilities. Government Furnished – Government Installed (GFGI), UPS systems may be considered for communications and data systems but will generally not be large in nature and will not be provided by the design.

3.8.3. GROUNDING:

Use a ground counterpoise around the building perimeter for grounding incoming service, building steel, telephone service, piping, lightning protection, aircraft static ground points, and facility internal grounding requirements (e.g. shop areas). Install ground straps where required by function, connected to the building grounding system. Provide a grounding point under each raised access floor. Provide additional grounding based on project-specific requirements and the US Army I3A Technical Criteria.

3.8.4. POWER DISTRIBUTION:

Provide power receptacles per NFPA 70 and in conjunction with proposed equipment and furniture layouts. 110VAC Power is required at each work station in the office and shop areas. In addition, work stations in the hangar bay and shop areas will require consideration for 200/115VAC 400HZ, 28VDC as well as 110VAC/60HZ.

3.8.5. LIGHTING:

The exterior and hangar bay lighting shall be compatible with any future security cameras and security requirements as applicable. Provide interior lighting controls in accordance with ASHRAE 90.1. Supplement automatic controls in offices and specialized areas such as conference rooms with local manual controls. Provide occupancy sensor controls in restrooms, electrical rooms, telecommunication rooms and similar spaces. Interior ambient illumination shall provide a generally glare free, high quality lighting environment in conference rooms and training rooms.

3.8.6. TELECOMMUNICATIONS:

3.8.6.1. GENERAL:

(a) Connect the facility to the Installation wide area network system (WAN) and telephone system. Allocate communications system resources IAW the I3A Technical Criteria regarding outlet amounts based on the functionality of the facility's various component floor spaces. Design in accordance with UFC 3-580-01 and the I3A.

(b) An acceptable building telecommunications cabling system encompasses, but is not limited to, copper and fiber optic (FO) entrance cable, termination equipment, copper and fiber backbone cable, copper and/or fiber horizontal distribution cable, workstation outlets, racks, cable management, patch panels, cable tray, cable ladder, grounding, and labeling. Provide telecommunications outlets per the I3A based on functional purpose of the various spaces within the facility as modified by user special operational requirements.

3.8.6.2. WIRELESS ACCESS POINT OUTLETS:

In addition to providing standard voice/data outlet configuration throughout the facility per the I3A, provide wireless access point (WAP) outlets in the hangar bay areas with one-Cat 6, unshielded twisted pair (UTP) cable, each to a standard 8-pin modular connector for each wireless WAP outlet. Provide a minimum of one WAP outlet in each aircraft module.

3.8.6.3. OUTSIDE PLANT TELECOMMUNICATIONS SYSTEMS:

Connect the project's facilities to the Installation telecommunications (voice and data) system through the outside plant (OSP) underground infrastructure per I3A requirements. Connect to the OSP cabling system from each facility main cross connect located in the main telecommunications room or telecommunications equipment room to the closest OSP access point. Components include the physical cable plant and the supporting structures. Items included under OSP infrastructure encompass, but are not limited to, maintenance hole and duct infrastructure, copper cable, fiber optic cable, cross connects, terminations, splices, cable vaults, and copper and FO entrance facilities.

3.8.6.4. TELECOMMUNICATIONS ROOMS (TR):

Provide telecommunications rooms and telecommunications entrance facilities for unclassified network and voice equipment and cabling infrastructure throughout the facilities. There shall be a minimum of one telecommunications room on each floor, located near the center of the building, and stacked between floors. Provide one telecommunications entrance capability for each facility. The telecommunications entrance may be collocated with the main TR for the facility. Size TR's for the area supported. TIA/EIA-569 compliant Telecommunications Enclosures (TE) may be used in hangar areas where the horizontal cable distance exceeds 90 meters.

3.8.6.5. SIPRNET:

(a) Install eight SIPR drops where indicated in Table 3.2. Rooms indicated are not authorized for open storage. Construct perimeter interior walls for these rooms to meet an STC rating of 50. Extend partitions to the deck above. Doors to these rooms shall be insulated hollow metal or solid core wood with an STC 45 rating with jamb, head and sill sound seals. Door locksets will include outside key and inside thumbturn controlling the latchbolt.

(b) Provide a SIPRNET room adjacent to primary communications room. Refer to the USAISEC Technical Guide for the Integration of Secret Internet Protocol Router Network (SIPRNET) for detailed information and references regarding SIPRNET. Section 6.2.5 of the USAISEC SIPRNET Tech Guide provides guidance on physical security. Construct the SIPRNET room in accordance with AR 380-5, Section III, Chapter 7. The room requires an intrusion detection system. Provide a steel entrance door, with a CD-X09 lock, minimum width of 42" to accommodate a cabinet. Connect the SIPRNET room to the main telecommunications room via a single 2" trade size steel conduit. Bar all ventilation ducts per security requirements of AR 190-11 App G.

3.8.6.6. CATV:

(a) Provide a completely operational CATV cabling system including, but not limited to, all necessary raceways, cabling, terminations, jacks and faceplates will be provided. The horizontal cable for the CATV system will be RG-6 with "F" type connectors on the terminal end. Terminate the CATV cabling on splitters in the telecommunications room, or in a location indicated by the Network Enterprise Center (NEC – formerly the DOIM). CATV riser cable will be RG-11 type. Locate splitters on the CATV backboard in the telecommunications

room, or in a location indicated by the NEC. Homerun all CATV horizontal cabling between CATV jacks and the CATV backboard. Coordinate service requirements to the building with the local CATV service provider. CATV shall be provided where indicated in Table 3.2.

(b) Provide each utility space, such as mechanical, electrical and telecommunications rooms with at least one wall mounted telecommunications outlet, with a wall mounting lug face plate near the entrance door.

3.8.7. MISCELLANEOUS SYSTEMS:

Design Secure Access Systems, Intrusion Detection Systems (IDS), Closed Circuit Television (CCTV) to only provide raceways and back boxes for installation of these systems, unless otherwise specified for Project specific requirements.

3.8.7.1. Coordinate anticipated locations of devices and provide raceways and back boxes for installation of a secure access system per Army Installation Design Standards paragraph 3.5.11, "Locks and Locking Devices".

3.8.7.2. Coordinate anticipated locations of devices required for a complete IDS and CCTV system. Design raceways and back boxes for installation of a complete system.

3.9. HEATING, VENTILATING AND AIR CONDITIONING

3.9.1. HANGAR AREAS:

For hangar bay areas, consider heating and ventilating units, radiant heating, or some combination of the two. In colder climates, consider supplemental heating at the floor level of repair shops and maintenance shops. Coordinate system selection with the installation. Base the system selection on energy usage and life cycle cost, reliability and operating considerations, and the maintenance capabilities and resources of the user.

3.9.2. ADMINISTRATIVE AND SHOP AREAS:

See Table 3.5 for heating and cooling of administrative areas. HVAC system design should consider including flexibility in zoning to where it can address future changes in occupant densities. Administrative areas shall be temperature-controlled by the DDC system. Accomplish temperature set point adjustment via DDC System by authorized personnel. Consider all viable alternative systems meeting the functional requirements of the hangar bays. Shops shall be mechanically ventilated, heated, and air conditioned. Consider packaged equipment, split systems or systems utilizing chilled/heating water from either a central plant or decentralized sources. Provide independent and dedicated packaged A/C units for the Arms Vaults and Non-Sensitive Secure Storage Areas. Do not use floor space to mount air handling unit system(s) within the actual spaces served. Condition administrative-type areas located within the shops per Paragraph 5 requirements.

3.9.3. BUILDING EXHAUST SYSTEMS:

Provide exhaust systems at heat sources, restrooms, battery rooms, and contamination sources. Battery room systems will be ducted exhaust system with explosion proof fans. Exhaust systems will operate continuously while the building is occupied. Exhaust systems shall be in accordance with NFPA 30 and 30A.

3.9.4. DESIGN CONDITIONS:

3.9.4.1. Base the design on weather data from recognized and authoritative sources weather data. Indoor design conditions shall conform to Table 3.5. Indoor air quality shall conform with the current ASHRAE Standard 62.1 and OSHA requirements.

TABLE 3.5 – INDOOR DESIGN DATA

HEATING:

Indoor Design Temperature 70°F

Unoccupied Space Design Temperature 55°F

COOLING:

Indoor Design Temperature 75°F
Unoccupied Space Design Temperature 85°F

3.9.4.2. In geographical areas of high humidity, take appropriate measures to control moisture. In areas of high humidity, provisions will be made for cure rooms/spaces to have dehumidification procedures to bring ambient relative humidity in the cure rooms/spaces down to 40 percent relative humidity to allow for acceptable cure times.

3.10. FIRE PROTECTION

3.10.1. STANDARDS AND CODES:

Fire protection and life safety features shall meet UFC 3-600-01, Attachment A following this Paragraph (Army Hangar Fire Protection), NFPA 409 and additional requirements of this contract. Code references to "authority having jurisdiction" shall be interpreted to mean the Contracting Officer.

3.10.1.1. ALLOWABLE FLOOR AREA

The allowable floor area of the facility is unlimited when all of the following conditions are met:

- (a) 100 percent of the facility has full automatic sprinkler coverage in accordance with this document.
- (b) Water supply to the sprinkler systems is in compliance with the criteria in this document.
- (c) Internal separation walls between hangar bay areas and non-hangar bay areas comply with NFPA 409.
- (d) Separation distances from adjacent structures comply with NFPA 409.

~~Hangars are classified as mission essential. Provide fire protection. The Army's first priority after life safety is to minimize collateral damage to aircraft which would affect full "mission ready" status after a fire incident. As such, the aggressive application of Standards and Codes to minimize damage, down time, clean up, and return of aircraft to "fully mission capable" readiness state is a high priority. Aircraft hangars shall use a fire suppression system that meets ALL the following requirements, in the order of priority shown. Do not use water systems as the primary suppression system without waiver approval:~~

- ~~(5) Maximum protection of personnel (least risk to personnel within hangars during dispensing).~~
- ~~(6) Maximum protection of airframes (least potential loss of airframes resulting from dispensing and cleanup).~~
- ~~(7) Fastest return of airframes to operational/mission ready state after discharge.~~
- ~~(8) Minimal use of water (least use of water system (quantity and content) from dispensing through cleanup).~~
- ~~(9) Least infrastructure/lifecycle sustainment requirements.~~
- ~~(10) Maximum protection of the facility (least replacement impact).~~

3.10.2. HANGAR BAYS FIRE PROTECTION AND LIFE SAFETY ANALYSIS:

3.10.2.1. FIRE SUPPRESSION

NFPA 409, Protection of Group II Aircraft Hangars applies except as modified herein. Comply with referenced NFPA standards including advisory provisions listed in the appendices of such standards as though the word "shall" had been substituted for the word "should" wherever it appears. The requirements of this contract govern. In the event of a conflict between specific provisions of this contract and applicable NFPA standards. Comply with Attachment A and Attachment A1 following this Paragraph.

3.10.1.1-3.10.2.2. <AAC FS OPTION1>Provide a combination of automatic low-level high expansion foam system and automatic sprinkler systems for the hangar bays in accordance with Attachment A1 following this Paragraph. </AAC FS OPTION1><AAC FS OPTION2>Provide an automatic closed-head foam water sprinkler system for the hangar bays in accordance with Attachment A1 following this Paragraph.</AAC FS OPTION2><AAC FS OPTION3>Provide either a combination of automatic low-level high expansion foam system and automatic sprinkler system, or a closed head foam water sprinkler system for the hangar bays in accordance with Attachment A1 following this Paragraph.</AAC FS OPTION3>

Comment [sdn1]: [NOTE TO SPECIFIER:
Select one of the following allowable systems best meeting the requirements of Paragraph 3.10:

Allowable hangar bay fire suppression system options:

1. A combination of automatic low-level high expansion foam system and automatic sprinkler system.
2. A closed-head foam-water sprinkler system.
3. Combination of automatic low-level high expansion foam system and automatic sprinkler systems, or closed-head foam water sprinkler system. This option is provided to allow the Contractor to determine which fire suppression system best meets the requirements of Paragraph 3.10.

Perform a fire protection and life safety design analysis for all buildings in the project conforming to the requirements of UFC 3-600-01. Include a life safety floor plan for all buildings in the project showing occupant loading, occupancy classifications and construction type, egress travel distances, exit capacities, areas with sprinkler protection, fire extinguisher locations, ratings of fire-resistive assemblies, and other data including hazard classification plans and sections in accordance with NEC 70 necessary to exhibit compliance with life safety code requirements.

3.10.2.3. TYPE OF CONSTRUCTION

Use Type I or Type II construction for hangar bays in accordance with the IBC.

3.10.3. HANGAR AREAS OTHER THAN HANGAR BAYS FIRE ALARM AND NOTIFICATION:

3.10.1.2-3.10.3.1. FIRE SUPPRESSION

Provide automatic sprinkler systems IAW UFC 3-600-01, applicable NFPA standards, and other requirements contained in this contract including applicable portions of Attachments A and A1 following this Paragraph. Provide a complete detection and notification system that is able to interface with all facility fire protection systems, including, but not limited to the Hangar suppression system, fire pumps (where necessary), mass notification system, and installation fire station. See section 5.10 for general requirements.

3.10.1.3-3.10.3.2. TYPE OF CONSTRUCTION SPRINKLER SYSTEM:

Meet the requirements of Paragraphs 1.0 PROJECT OBJECTIVES, 3.10 FIRE PROTECTION, and 3.10.1.1 ALLOWABLE FLOOR AREA. Fully protect the facility with automatic systems. Protect the hangar bay areas per NFPA 409 Hangar bay fire suppression system shall have an objective goal of returning 85% of any damaged systems to duty within 24 hours after a fire event and a threshold goal of returning 90% of any damaged systems to duty within 72 hours after the event. Design the sprinkler system in accordance with UFC 3-600-01 and NFPA 13. Include the exterior hose stream demand in the hydraulic calculations. Show a complete sprinkler system design, including sprinklers, branch lines, floor mains and risers on the drawings. Plans shall include node and pipe identification used in the hydraulic calculations. Route all sprinkler system drains, including main drains, test drains, and auxiliary drains to a 2-foot by 2-foot splash block at exterior grade.

3.10.1.4. Sprinkler Service Main and Riser:

Make the required electrical connection to the tamper switch on the PIV. Route this conductor to and make the connection to the building fire alarm control panel (FACP). Sleeve the ground floor entry penetration per NFPA 13 requirements for seismic protection. The sprinkler entry riser shall include a double check backflow preventer, a fire department connection, and a wall hydrant for testing of backflow preventer. The sprinkler system shall include an indicating control valve for each sprinkler system riser, a flow switch reporting to the FACP, and an exterior alarm bell. All control valves shall be OS&Y gate type. Provide with tamper switches connected to the FACP. For facilities with multiple floors, provide with floor control valves for each floor. The floor control valve assembly shall be in accordance with UFC 3-600-01, Figure 4-1.

3.10.1.5. Exterior Hose Stream:

Exterior hose stream demand shall be in accordance with UFC 3-600-01.

3.10.2. PROTECTION OF PIPING AGAINST EARTHQUAKE DAMAGE:

Protect sprinkler and fire pump piping systems against damage from earthquakes. Seismic protection shall include flexible and rigid couplings sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by NFPA 13 for protection of piping against damage from earthquakes.

3.10.3. FIRE WATER SUPPLY:

Verify the government furnished fire flow data by conducting necessary fire flow tests at the project site during project design and base the design of fire protection system on the results of this test. If actual conditions, differing from those provided by government furnished fire flow data, require an adjustment to the design that would have otherwise resulted from the furnished flow tests, either party may initiate an equitable adjustment change, in accordance with the Differing Site Conditions Clause.

3.10.4. FIRE PUMP:

Determine the requirement for a fire pump installation based on fire flow test data from the project site and fire protection system design requirements for the project. If required, provide a complete fire pump installation for the facility. Comply with the requirements of UFC 3-600-01, NFPA 13, and NFPA 20.

3.11. 10-TON CRANEMASS NOTIFICATION AND PAGING SYSTEM:

3.10.5.3.11.1. CONTROLS

Provide static reversing, adjustable frequency controllers for the hoist, bridge and trolley electric drives. Provide dynamic braking for all electric drives. Speed control must be infinitely variable type for the hoist function and infinitely variable type for the bridge and trolley functions. The hoist, trolley and bridge brakes must set only after the associated controller decelerates the motor to a controlled stop. All motors must run smoothly, without torque pulsations at the lowest speed and be energized at a frequency not exceeding 60 HZ at the highest speed. The hoist controller must enable the drive motor to develop full torque continuously at zero speed. Provide a Mass Notification and Paging System in accordance with UFC 4-021-01. Hangar Bay areas shall comply with exterior criteria. This system may be a combined system that both performs as an individual building MNS and as the building fire alarm voice evacuation system.

On deceleration, resistors or reactors must be inserted into the motor's high speed leads prior to de-energization of the high speed contactor. Acceleration and deceleration must be smooth. Provide the bridge and trolley motor control systems with a drift point between OFF and the first speed control point in each direction. Do not use definite purpose contactors. All contactors must be NEMA rated. Feed control circuits from a single phase, air cooled, double wound transformer with a grounded metal screen between the primary and secondary windings of the transformer.

Design and construct cranes to CMAA 70 (Class C) or CMAA 74 (moderate requirements) for operation with hoist in accordance with ASME HST-1 or HST-4. The 10-ton crane shall have the following rated load speeds (plus or minus 15%):

- (a) Hoist – 20 fpm
- (b) Trolley – 65 fpm
- (c) Bridge – 125 fpm

Provide runway stops at limits of crane bridge travel.

3.11.2. RADIO CONTROL

Provide radio control system conforming to FCC Part 15 (unlicensed frequencies). The remote radio control system must be designed to meet the requirements of NEMA ICS 8, Part 9.

3.11.3. PENDANT PUSHBUTTON STATION

Suspend the pendant pushbutton station from an independent festooned messenger track system, operating the length of the bridge. Locate the pendant pushbutton station 4 feet above the finished floor. Clearly mark all controls for identification of functions. Provide directional contactors with both mechanical and electrical interlocks.

3.11.4. FLOODLIGHTS

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Provide four US Lighting Tech Daytona Tunnel Lighting induction fixtures, 200W, 5,000 Kelvin (or equivalent), mounted evenly spaced along the bridge. Lights shall be switched on independently of the crane power, on a switch mounted on the crane column, near the crane disconnect, so that the lights can operate even when the crane power is turned off.

3.12. 2-TON CRANE

Design and construct cranes to CMAA 70 (Class C) or CMAA 74 (moderate requirements) for operation with hoist in accordance with ASME HST-1 or HST-4. The 2-ton crane shall have the following rated load speeds (plus or minus 15%):

- (a) Hoist – 20 fpm
- (b) Trolley – 65 fpm
- (c) Bridge – 125 fpm

Hoist motor control system shall provide one speed in each direction. Bridge and trolley main control systems shall provide one speed in each direction. Provide runway stops at limits of crane bridge travel.

3.11.3.13. REFERENCES:

In addition to general references in Paragraph 4, the following publications are applicable to the AAC Hangar Facility type to the extent specifically mentioned in Paragraph 3 and/or the remainder of the Solicitation:

- 10 CFR 436, Sub Part A, Methodology and Procedures for Life Cycle Cost Analyses.
- ANSI/IESNA RP-1-04. American National Standard Practice for Office Lighting.
- ANSI/TIA/EIA 569-B, Commercial Building Standards for Telecommunications Pathways and Spaces.
- ANSI/TIA/EIA 569-B.1, Commercial Building Standards for Telecommunications Pathways & Spaces, Part 1 General Requirements.
- ANSI/TIA/EIA 569-B.2, Commercial Building Standards for Telecommunications Pathways & Spaces, Part 2 Balanced Twisted Pair Cabling Components.
- ANSI/TIA/EIA 569-B.3, Commercial Building Standards for Telecommunications Pathways & Spaces, Part 3 Optical Fiber Cabling Components.
- ANSI Z358.1, Standard for Emergency Eyewash and Shower Equipment
- ASHRAE Underfloor Air Distribution (UFAD) Design Guide, 2003
- ASHRAE 55 Thermal Environmental Conditions for Human Occupancy.
- AR 190-51, Security of Unclassified Army Property (Sensitive and Nonsensitive).
- AR 380-381 Special Access Programs (SAPS) and Sensitive Activities.
- AR 380-40 Policy For Safeguarding And Controlling Communications
- AR 95-2, Air Traffic Control, Airspace, Airfields, Flight Activities, and Navigational Aids
- Clean Air Act Amendment of 1990
- Costing for MILCON Design (March 1996)
- DCID 6/9 Manual for Physical Security Standards for Sensitive Compartmented Information Facilities.
- Discount Factors for Life-Cycle Cost Analysis, Annual Supplement to NIST Handbook 135.
- DoD MIL-STD-188-124B, Grounding, Bonding, and Shielding for Common Long Haul/Tactical Communication Systems Including Ground Based Communications-Electronics Facilities and Equipments, Notice 3, 18 December 2000.
- DoD MIL-HDBK-419A, Grounding, Bonding, and Shielding for Electronic Equipments and Facilities, Volume 1, Theory, Volume II, Applications, 29 December 1987.
- DoD 5105.21-M-1 Sensitive Compartmented Information Administrative Security Manual.

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DoD Regulation 5200.1-R, Information Security Program, Appendix 7 – Physical Security for Vault and Secure Room Construction Standards.

DOE Guidance on Life Cycle cost Analysis Required by Executive Order 13123.

ETL 1110-3-481, Containment and Disposal of Aqueous Film

General Instruction Building (GIB) and Army Continuing Education System (ACES) Standard Design Criteria, Norfolk District, U.S. Army Corps of Engineers. (Document provides guidance on computer-based resource center for distributed / computer based training room (DT/CBT).)

IEEE Standard 519-1992, IEEE Recommended Practice and Requirements for Harmonic Control in Electrical Power Systems

Memorandum of Agreement (MOA) on Criteria/Standards for Economic Analyses/Life Cycle.

MIL-HDBK-232A, Red/Black Engineering-Installation Guidelines

NEMA PE 1 Uninterruptible Power Systems.

NFPA 110 Emergency and Standby Power Systems

NIST Handbook 135 (with the annual supplement of discount factors)

NSTISSI NO 7003, National Security Telecommunications and Information Systems Security Instruction, Protected Distribution System (PDS).

NSTISSAM/2-95, National Security Telecommunications and Information Systems Security Advisory Memorandum, Red/Black Installation Guidance.

OSHA Standard 1910, Occupational Safety and Health Standards

SECURITY-- (COMSEC) MATERIEL

TB- 380-41 Procedures for Safeguarding, Accounting and Supply Control of COMSEC Material

Technical Manual (TM) 5-690 Grounding and Bonding in Command, Control, Communications, Computer, Intelligence, Surveillance, and Reconnaissance (C4ISR) Facilities, 15 February 2002.

Testing and Balancing Bureau

UL 1008 Transfer Switch Equipment.

UL 1440 Transient Voltage Surge Suppressors.

UL 1778 Uninterruptible Power Systems.

UFC 3-260-01, Airfield and Helipoint Planning and Design

USAISEC Lightning Protection, Power Quality analysis, Grounding, Bonding, and Shielding, V1.0, Nov 2006 or latest version.

3.12.3.14. GLOSSARY:

ABA	Architectural Barriers Act
AMPS	Aviation Mission Planning System
AR	Army Regulation
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
AT/FP	Anti-Terrorism/ Force Protection
CATV	Cable Television

CBT	Computer-Based Training
CCTV	Closed-Circuit Television
Classroom XXI	A fully networked multimedia classroom with interoperable video tele-training, internet access, and full distance learning capability. The classroom is specified in the GIB and ACES GENERAL INSTRUCTION BUILDING (GIB) and ARMY CONTINUING EDUCATION SYSTEM (ACES) Standard Design Criteria authored by the U. S. Corps of Engineers, Norfolk District.
CLS	Contractor Logistics Support
COF	Company Operations Facility
COS	Center of Standardization
DA	Department of the Army
DA PAM	Department of Army Pamphlet
DAC	Department of the Army Civilian
DDC	Direct Digital Control
DT/CBT	Distributed/Computer-Based Training Program
EMI Bleed	Electromagnetic Interference (causing information to migrate).
ER	Engineer Regulation
ESD	Electrostatic Discharge
FACP	Fire Alarm Control Panel
FB-6 Fence	Fence utilizing green knitted fabric for visual screening.
FE-6 Fence	Fence detailed in U. S. Army Corps of Engineers Protective Design Center web site (https://pdc.usace.army.mil/library/drawings/fence)
FDC	Facility Design Criteria
FDT	Facility Design Team
FFE	Furniture, Fixtures and Equipment
FM	Frequency Modulation
FY	Fiscal Year
GFCI	Government Furnished Contractor Installed
GFGI	Government Furnished Government Installed.
GPM	Gallons Per Minute

HF	High Frequency
IAW	In Accordance With
IT	Information Technology
IESNA	Illumination Engineering Society of North America
IEEE	Institute of Electrical and Electronics Engineers, Inc.
LARS	Logistics Assistance Representative
LCCA	Life-Cycle Cost Analysis
LEED-NC	Leadership in Energy and Environmental Design-New Construction.
MNS	Mass Notification System
MILCON	Military Construction
MTOE	Modified Table of Organization and Equipment
NDI	Non-destructive Inspection
NFPA	National Fire Protection Agency
NIC	Not In Contract
NIPR	Non-Classified Internet Protocol Router
NLT	Not Less Than
NMT	Not More Than
NSF	Net Square Footage
NSTISSAM	National Security Telecommunications and Information Systems Security Advisory Memorandum
NSTISSI	National Security Telecommunications and Information Systems Security Instruction
NSTS	National Secure Telephone System
NTE	Not To Exceed
OS&Y	Outside stem & yoke (a type of plumbing gate valve)
OTOE	Objective Table of Organization and Equipment
PA	Public Address
PDS	Protective Distribution System
PIV	Pressure Indicator Valve

POL	Petroleum, Oil and Lubricants
POV	Privately Owned Vehicle
RFP	Request for Proposal
RH	Relative humidity
SIPR	Secret Internet Protocol Router
SOW	Scope of Work
SPAM	Shelter Portable Air Mobile
STAMIS	Standard Army Management Information System
STC	Sound transmission coefficient
STP	Shielded Twisted Pair
TDA	Table of Distribution and Allowance
TEMF	Tactical Equipment Maintenance Facility
TER	Telecommunications Equipment Room
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
UFAD	Underfloor Air Distribution
UFC	Unified Facilities Criteria
UHF	Ultra-high Frequency
UPS	Un-interrupted Power Supply
USAISEC	U. S. Army Information Systems Engineering Command
UTP	Unshielded Twisted Pair
VAV	Variable air volume

Attachment A: Army Hangar Fire Protection

See contract for paragraphs 3.10.1 through 3.10.3.

3.10.4 Fire Protection Engineer (FPE): A FPE qualified IAW UFC 3-600-01 with a minimum of five (5) years experience in the design and construction of aircraft hangar fire protection systems of similar complexity shall design and specify these systems.

3.10.4.1 The fire protection design documents including calculations and specifications shall be prepared, signed and stamped by a qualified FPE.

3.10.4.2 Shop drawings shall be prepared by a qualified FPE or a National Institute for Certification in Engineering Technologies (NICET) certified Level IV technician. A qualified FPE shall sign the shop drawings and calculations, and certify that the shop drawings and calculations meet contract requirements.

3.10.5 Fire protection and life safety design analysis: Submit a fire protection and life safety design analysis IAW UFC 3-600-01 for all buildings in the project. Include the following:

- a. Life safety analysis and egress diagrams
- b. Fire separation (fire rated walls) diagram. Show all fire rated walls with fire rating.
- c. Locate all fire dampers/fire rated penetrations.
- d. Hazard classification plans and sections IAW NEC 70.
- e. Fire water supply plans, include fire hydrants, fire water tanks and fire pumps as applicable.
- f. Flow test data, Include hydrant flow test data IAW NFPA 291 and/or fire pump flow test data IAW NFPA 20. Use appropriate size gages calibrated within six months from the date of flow test. Include calibration certificates for gages.
- g. Hydraulic Calculations: Calculations in the absence of a specific design will constitute, at best, rough approximations. While such approximations may suffice for the concept submittal, subsequent submittals shall include calculations based on an actual layout of discharge devices and corresponding piping configuration. Perform hangar fire protection system hydraulic calculations using commercially available recognized fire protection software similar to "HASS" (Hydraulic Analyzer of Sprinkler Systems).
- h. System Sketch: Include a sketch representative of the overall fire protection system. It should show all pipes and nodes in the sprinkler, foam and underground water distribution systems. Assure that the sketch corresponds to what is indicated on the project drawings as well as in the hydraulic calculations.
- i. Manufacturer's Catalog Data: Include catalog information for all major items of equipment upon which the design is based. This includes, but is not limited to, fire pumps, jockey pumps, foam concentrate tanks, foam pumps, automated foam concentrate valves, foam proportioners, foam generators, automatic water control, back flow preventers, strainers, FSCP, FACP, horns, strobes, manual pull stations, manual foam discharge stations.etc.

3.10.6 Fire Protection Plans: Include the following separate sheets. Symbols shall be in accordance with NFPA 170.

- a. General notes, symbols and abbreviations.
- b. Sprinkler system in aircraft area.

- c. Sprinkler system in non aircraft area.
- d. Foam system.
- e. Foam system detection and controls (FSCP).
- f. Facility fire detection and alarm system (FACP).
- g. Mass notification system (MNS).
- h. Longitudinal and transverse sections.
- i. Separate riser diagrams for:

1. Piping/Riser Diagram – Provide a consolidated fire suppression system single line piping/riser diagram showing all major components from PIV to discharge devices, such as foam generators, nozzles, strainers, backflow preventer, fire pumps, jockey pump, flow meter, foam proportioners, foam concentrate tank etc. Show all devices such as tamper switches, flow switches, pressure switches, flow meter, strainers, etc. Indicate pipe sizes, all valving, all appurtenances etc.

2. Devices connected to FSCP.
3. Devices connected to FACP.
4. Devices connected to MNS.

- j. Strobe coverage diagram

- k. Fire pump system plans, sections and schematic diagrams.

- l. Details: Include details of critical system components including valve headers, foam generators, nozzles, concentrate tanks, test headers, etc.

3.10.7 Fire Protection Shop Drawings: Prepare shop drawings IAW NFPA standards including foam liquid travel time and foam spread diagrams, riser/piping diagrams, conduit layout diagrams, complete point to point wiring diagrams (typical point to point wiring diagram in lieu of complete wiring diagrams are not acceptable), hydraulic calculations, foam calculations, seismic calculations, voltage drop calculations and battery calculations. Prepare shop drawings only after completion of fire protection design documents.

3.10.8 Seismic protection: Protect fire suppression systems and equipment against damage from earthquakes. Seismic protection shall include flexible and rigid couplings sway bracing, seismic separation assemblies where piping crosses building seismic separation joints, and other features as required by UFC 3-310-04 and NFPA 13 for protection of piping against damage from earthquakes.

3.10.9 Underwriters Laboratory (UL) listed or Factory Mutual (FM) approved. All equipment and material shall be UL Listed or FM Approved for the purpose it is used. Pipes 6" and below shall be schedule 40. Shop fabricated or field fabricated fittings, and fittings which require making a hole in the pipe are not permitted. Air exhausters are not permitted in high expansion foam systems. Valves 65 mm (2.5 inch) and larger shall be flanged outside screw and yoke (OS&Y) type.

3.10.10 Underground Piping: Do not install any piping under hangar/facility floor slabs. Do not install any piping (including the fire protection water service entrance into the building) that allows pressurization of the space below the floor slab. Minimize piping under paved exterior operational surfaces (taxiways and aircraft parking, vehicle pavement, etc.). Do not install piping carrying foam concentrate or foam-water solution underground.

3.10.10.1 Provide ductile iron pipe or other pipe listed for buried fire service application for all underground uses.

3.10.7.2 Install fire water service entrance to the hangar in a pit. Do not install any fire protection piping under the floor slab. Use flanged or welded fittings to transition the fire protection water service entrance from horizontal to vertical as it enters the building. Do not use gasketed compression fittings (including locking type) or flanged fittings with set screws.

3.10.10.3 Size underground mains to ensure the maximum flow velocity does not exceed 3 meters per second.

3.10.11 Interior Piping Systems

3.10.11.1 Provide a UL Listed/FM Approved strainer in the water supply for all foam systems.

3.10.11.2 Do not use galvanized piping for foam-water system piping.. Threaded, flanged, or grooved fittings shall be used for foam-water systems. Do not use fittings that couple plain-end pipe or welded sprinkler fittings or outlets for foam-water solution.

3.10.12 Foam Concentrate Pipe: Foam concentrate pipe shall be one of the following:

- a. Stainless steel pipe shall be grooved, welded, or flanged; or,
- b. Filament-wound fiberglass shall conform to ASTM D2996, designation code "RTRP-11 FF-3121," installed in accordance with ASME/ANSI B31.4-1996, Process Piping.

3.10.13 Exposed interior piping marking: Mark all exposed interior piping at 8.2 meter (27-foot) intervals with plastic wraparound-type pipe labels conforming to ASME/ANSI A13.1-1996, Scheme for the Identification of Piping Systems, indicating the type of fluid carried and direction of flow. Do not use labels on sprinkler system branch lines and pipes less than 51 millimeters (2 inches) in nominal size. Follow the following labeling scheme:

- a. FOAM CONCENTRATE – Use on lines supplying low-expansion foam concentrate.
- b. FIRE SPRINKLER or SPRINKLER FIRE – Use on lines supplying standard water-only sprinkler systems.
- c. AFFF FOAM WATER– Use on lines supplying combination foam-water sprinkler systems.

3.10.14 Containment and disposal of foam solution: Provide a system for containing the test flow for foam discharge solution. Containment capacity is based upon testing requirements only. Minimum capacity should provide for containment of the test flow of foam solution from the system proportioner with the greatest design flow rate for the duration of flow. Provide calculations to determine volume of foam solution discharge.

3.10.15 Fire Water Supply:

3.10.15.1 The fire water supply shall be IAW UFC 3-600-01, NFPA 409 and NFPA 24 except as modified in this document. Perform a detailed water supply and demand analysis. Determine variations in fire water supply. Acquire fire flow test data for preliminary fire protection system design if fire flow test data is not provided in the request for proposal. Verify the fire flow data by conducting necessary fire flow tests at the project site during project design and base the design of fire protection system on the results of this test. Use calibrated liquid filled gages with 3 ½ inch dial and listed nozzles for flow test. Perform hydrant flow test at a flow greater than the maximum system demand IAW NFPA 291. Perform fire pump test IAW NFPA 20. A representative of the installation fire department shall witness the flow tests.

3.10.15.2 The total water supply shall be sufficient to satisfy the combination of maximum hydraulically calculated system demand of automatic sprinkler protection, low-level foam system and the requirements for exterior hose streams. Water shall be available in sufficient quantity and pressure to supply the maximum number of discharge devices likely to operate simultaneously, for the minimum specified duration.

3.10.15.3 Provide booster fire pumps when the water flow rate and storage capacity is adequate but pressure is inadequate to meet system pressure demands.

3.10.16 Fire Protection Water Storage System

3.10.16.1 If fire water storage tank requirements are not specified, determine the requirement for a fire water storage tank installation based on fire flow test data from the project site and fire protection system design requirements for the project. Provide a complete fire water storage system for the facility if required.

3.10.16.2 A single water storage system may be used, when practical, for multiple aircraft facilities. Water supply distribution mains from a fire pump station to an aircraft hangar shall not exceed 457.2 meters (1500 feet).

3.10.16.3 Provide storage capacity equal to 120 percent of the maximum demand for the required duration. Divide the required storage capacity between two equal-sized water tanks, each storing one-half of the required volume. The piping configuration shall allow water to be supplied by both reservoirs, and either of the reservoirs if the other is out of service. The water supply for closed-head foam-water sprinkler systems shall have a minimum duration of 60 minutes. The water supply for high expansion foam systems shall have a minimum duration of 30 minutes.

3.10.16.4 Provide each tank with a low-water-level alarm and a low-temperature alarm, each transmitting back to the fire department as separate supervisory signals.

3.10.16.5 In areas with a 90% dry bulb temperature of 0.5 °C (33 °F) or less per UFC 3-400-02, Design: Engineering Weather Data, provide appropriate freeze protection IAW NFPA 22.

3.10.16.6 Provide an external visual water-level gauge on each tank.

3.10.16.7 Provide automatic tank refill from the base water distribution system. The maximum duration for the replenishment of fire protection water storage shall not exceed the limits identified in UFC 3-600-01. The heating system shall be reliable and of such capacity that the temperature of the coldest water in the tank or riser, or both, will be maintained at or above 42 degrees F (5.6 degrees C).

3.10.17 Fire Pumps

3.10.17.1 Determine the requirement for a fire pump installation based on fire flow test data from the project site and fire protection system design requirements for the project. Select pumps at a flow not exceeding 120% of fire pump rated flow. At no time shall the system pressure exceed 175 PSI. Do not use pressure regulating valves to control discharge pressure. Do not use pressure relief valves to control discharge pressure of electrical fire pumps without an electric variable speed pressure limiting control driver. If there is a potential of system pressure exceeding 175 PSI, use variable speed fire pumps. Submit fire pump design analysis, calculations and drawings during the design phase.

3.10.17.2 Provide one redundant pump for every fire water pump system. Pumps shall have electric motor drivers conforming to NFPA 20, supplied by a single reliable power source. Use dual power sources when a single reliable power source is not available. Use diesel engine drivers only when the installation electrical service fails to meet the reliable standard and dual power sources are not available.

(For pump systems with one primary and one redundant pump, provide one electric and one diesel if the electrical service fails to meet the reliability standard and dual power sources are not available.)

3.10.17.3 The designer shall determine and document the reliability of the existing power sources. A power source is adequate when it meets the reliability requirements of UFC 3-600-01.

3.10.17.4 Provide "soft start" or variable frequency pump controllers when electric-driven pumps are installed.

3.10.17.5 Limit the maximum rated pump size to 9,463 Lpm (2500 gpm) at 862 kPa (8.62 bar) (125 psi).

3.10.17.6 Ensure the pumping system will have capacity to meet the maximum demand when the largest capacity pump is out of service.

3.10.17.7 Provide pressure maintenance pumps ("jockey pumps") to maintain normal operating pressure on the system and to compensate for normal system leakage IAW NFPA 20.

3.10.17.8 Arrange multiple-pump installations for sequential starting at 10-second intervals until the operating pumps maintain the required pressure. The starting sequence will begin automatically as follows:

- a. Pump start signal transmitted from the foam system control panel in the protected facility.
- b. Drop in system water pressure IAW NFPA 20.

3.10.17.9 Required monitoring of fire pumps shall be through the FACP and transmitted to the fire department to notify the fire department of pump running signals, pump system trouble, and tamper and supervisory signals provided by the pump controllers. Jockey pumps shall not transmit an operating signal. The FACP shall monitor Jockey pump power supply.

3.10.17.10 Provide surge arresters to moderate the potentially destructive effects of pressure surges or water hammer due to pump starting and stopping and valve opening and closing. Install surge arresters on the system side of the fire pump discharge check valve, as close to the valve as possible. Provide at least one arrester for each pump and each shall be listed/approved as a surge arrester for fire protection piping, with a volume of not less than 378.4 liters (100 gallons) and a rated working pressure not less than 1,724 kPa (250 psi). Provide each arrester with an indicating valve to isolate it from the system. Supervision of this valve is not required. The manufacturer shall engineer each surge arrester installation due to the complex effects of system variables on satisfactory performance. Provide manufacturer prepared sizing calculations.

3.10.18 Foam Concentrate Pumps

3.10.18.1 Provide Listed/Approved foam concentrate pumps of the positive displacement rotary gear or vane type. Provide a pressure rating at least 103.4 kPa (15 psi) greater than the maximum water pressure, but not less than that recommended by the manufacturer, at the point of foam injection.

3.10.18.2 The designer shall determine and document the reliability of the existing power sources. A power source is adequate when it meets the reliability requirements of UFC 3-600-01.

3.10.18.3 Provide pressure maintenance pumps ("jockey pumps") to maintain normal operating pressure on the system IAW NFPA 20.

3.10.18.4 Provide connection through the installation fire reporting system to notify the fire department of pump running signals, pump system trouble, and tamper and supervisory signals provided by the pump controllers. Jockey pumps shall not transmit an operating signal. The FACP shall monitor Jockey pump power supply.

3.10.19 Foam Concentrate Tanks

3.10.19.1 Bladder tanks shall be horizontal. Vertical bladder tanks are not permitted.

3.10.19.2 Concentrate Storage. Atmospheric foam storage tanks shall be either plastic or fiberglass construction and listed/approved for the storage of foam concentrate. Pressure tanks for bladder tank systems shall be steel and listed/approved for the storage of foam concentrate. Do not provide back-up supply of foam concentrate in the facility.

3.10.19.3 Provide clear space at one end of horizontal bladder tanks, at least equal to the length of the tank, to permit bladder replacement. Doors to the outside or adjacent open space at the end of the tank are an acceptable alternative.

3.10.19.4 Provide the foam tank (regardless of type) with a minimum 150-mm (six-inch) curb. This curbing is not intended for containment. Its purpose is to control accidental spillage during filling or for unintended leaking.

3.10.19.5 Provide independent concentrate storage and proportioning systems for each aircraft hangar facility. Locate foam concentrate storage, foam proportioning, foam injection, and system risers in a dedicated fire protection equipment room isolated from the aircraft servicing area by construction rated for at least one hour. These rooms shall have direct exterior access.

3.10.20 Special Requirements

3.10.20.1 Manual Foam-Water/Water Fire Hose Stations: Do not use interior or exterior hose stations or fire hose connections.

3.10.20.2 Fire Department Connections: Do not use fire department connections on foam-water systems.

3.10.20.4 Foam System Test Header: Provide a test header for all overhead and low-level foam-water systems. Locate the header inside the aircraft servicing area as near as practicable to an outside door. Configure the test header to permit each proportioner to be individually tested. Each test header shall have at least four valved 2.5-inch (no equal metric standard) hose fittings.

3.10.20.5 Sprinkler System Simulation Test Header: Provide sprinkler system simulation test headers for simulating hangar sprinkler system maximum flow based on supply calculations during the foam system discharge test.

3.10.20.6 Route all sprinkler system drains, including main drains, test drains, and auxiliary drains to a 2-foot by 2-foot splash block at exterior grade.

3.10.21 Detection and Actuation Systems

3.10.21.1 Fire Alarm Control Panels

3.10.21.2 Fire Detection and Alarm Control Panel (FACP): Provide a single FACP for all detection and fire alarm functions in the facility not part of the foam-water fire suppression system. The system shall be fully compatible with and integrated with the local installation central monitoring system. The FACP shall supervise all control valves. Plug type tamper switches are not permitted.

3.10.21.3 Foam System Detection and Control Panel (FSCP)

Provide a dedicated FSCP (not a part of FACP) for monitoring and operation of all hangar sprinkler & foam systems and detection/releasing functions. The FSCP shall supervise all control valves. Plug type tamper switches are not permitted.

3.10.21.3.1 The FSCP shall be fully compatible with the installation fire alarm receiving system without field modifications to any system hardware or software. A separate and distinct fire signal shall be transmitted to the fire department upon activation of any portion of a foam system.

3.10.21.3.2 Separate fire alarm transmitters/receivers are permitted when they are fully compatible with the FACP and the installation fire alarm receiving system without field modifications to the FACP.

3.10.21.3.3 Define the specific number of alarm signals (e.g., fire, supervisory, tamper) to be annunciated and transmitted in a system matrix. See samples in Figures 1 and 2.

3.10.21.3.4 FSCP activating deluge, pre-action, or nozzle systems shall be listed/approved as releasing panels. All releasing panels shall be specifically listed/approved for use with the automatic water control valves/solenoid release valves specified for the fire suppression system. Provide a switch within the lockable control panel to disable the releasing functions of the panel while leaving all detection and other functions of the panel operational. Activation of this switch will transmit a trouble signal to the Base Fire Department.

3.10.22 Mass Notification Systems (MNS): Provide a Mass Notification System in accordance with UFC- 4-021-01. Hangar Bay areas shall comply with exterior criteria.

3.10.23 Special Requirements:

3.16.23.1 Locate all fire control panels in a clean environment having temperature and humidity control in accordance with the unit's Listing/Approval.

3.10.23.2 Provide transient Voltage Surge Suppression (TVSS) on all fire alarm FACP, FSCP and MNS circuits entering and leaving the facility IAW manufacturer's instructions.

3.10.24 Manual fire alarm pull stations: Provide pull stations throughout the facility at all exit doors. Manual pull stations located in the hangar bay shall be weatherproof.

3.10.25 Thermal Detectors (for pre-action systems): Provide automatic thermal fire detection systems to activate any pre-action sprinkler systems. Locate detectors at the underside of the roof of the aircraft servicing area. The detection system shall consist of rate-compensated fire detectors having a temperature rating between 71 °C (160 °F) and 76 °C (170 °F). The spacing between detectors shall be 12.2 meters (40 feet). The area covered by the fire detection system shall correspond with its affiliated roof-level sprinkler system and shall be bounded by draft curtains. The activation of any heat detection device in the sprinkler zone shall immediately:

- a. Send a start signal to the fire pumping system (if any).
- b. Activate all low-level fuel spill fire suppression systems in the aircraft servicing area of fire origin.
- c. Activate the low-level foam fire suppression systems.
- d. Activate the foam system annunciation signal.
- e. Actuate the appropriate suppression system pre-action valves for the floor area covered by the detection system.
- f. Activate the fire evacuation alarm signal throughout the facility.

g. Activate the visual foam system activation signals.

h. Transmit a fire alarm signal to the base fire alarm communications center (fire department). The number and type of signals transmitted to the fire department shall be locally determined based on the current fire alarm receiving equipment and planned upgrades.

3.10.26 Water Flow Devices: Activation of hangar bay water flow will cause the FSCP to:

a. Send a start signal to the fire pumping system (if any).

b. Activate the low-level foam fire suppression systems.

c. Activate the foam system annunciation signal.

d. Actuate the appropriate suppression system pre-action valves for the floor area covered by the detection system.

e. Activate the fire evacuation alarm signal throughout the facility.

f. Activate the visual foam system activation signals.

h. Transmit a fire alarm signal to the base fire alarm communications center (fire department).

3.10.27 Wiring: Connect all initiating devices to Class A initiating device circuits, and Class A and signal line circuits IAW NFPA 72. Connect alarm notification appliances to Class A notification appliance circuits IAW NFPA 72. All wiring in unfinished areas such as hangar and shop space shall be in electrical metallic tubing (EMT) or metallic conduit. Paint all EMT, conduits and junction boxes connected to FSCP, FACP and MNS red or prefinished red from the factory. Label all conduits "FSCP", "FACP" or "MNS" every 10' as appropriate. Make connections and splices using screw terminal blocks. Do not use wire nut type connectors in the system.

3.10.28 Fire System Riser Diagram: Identify and group the various inputs and outputs associated with the fire alarm control panels (FACP and FSCP). This will include alarm initiating and supervisory input circuits as well as alarm notification output circuits.

a. Alarm Initiating Device Circuits--includes water-flow switch, low level foam fire suppression system manual discharge station, heat detector, triple infrared flame detector, etc.

b. Supervisory Device Circuits-- includes valve supervisory (tamper) switches, pump controllers, low liquid level, etc.

c. Release Device Circuits--includes circuits to solenoid valves for actuation of automatic water control/deluge valves controlling foam solution flow to foam generator systems and pre-action sprinkler system.

d. Alarm Notification Device Circuits-- includes alarm bells, horns, speakers, sirens, strobe lights, rotating beacons, etc.

3.10.29 Fire Alarm System Matrix: Define and indicate the specific alarm signals to be annunciated and transmitted in a system matrix. See sample in Figure 3.

3.10.30 Fire Protection Equipment Room

a. The fire protection equipment room will be large enough to accommodate all required equipment. All equipment will be fully accessible for inspection, testing, maintenance, and removal/replacement without the removal of any other equipment. Separate the room equipment room from the aircraft

servicing and other areas by a minimum of 1-hour fire resistive construction. Locate water and foam flow control valves and proportioning equipment in the hangar bay to minimize the foam delivery time and to meet design criteria. Provide doors with direct access to the exterior of the structure. Locate equipment to permit removal of tanks, bladders, valves, pumps, and motors without the removal of other components.

b. Provide independent concentrate storage and proportioning systems for each aircraft hangar facility. Assure that the equipment is arranged to facilitate maintenance and regular testing. Arrange components to be serviceable from the floor. Provide an open steel grate mezzanine, with a permanent ladder, at that equipment level for any equipment and or valves requiring access for maintenance, periodic testing, or re-servicing are located more than 2.4 meters (8 feet) above the floor. All platforms and ladders shall be in compliance with Occupational Safety & Health Administration (OSHA) requirements. Include an enlarged plan at a scale of 1:50 (1/4": 1'-0") of the fire protection equipment room. Show the water service entrance, strainer, back flow preventer if provided, altitude valve if provided, foam concentrate tank, sprinkler riser/valve manifold, foam system control panel, and piping. Provide sections and details to clearly show the riser manifold and all associated components, piping, valves, fittings, etc.

3.10.31 Fire Pump Building or Room: Fire pumping systems for most hangar fire protection systems often involve multiple, high capacity, diesel or electric engine driven fire pumps. It is preferred to locate and arrange such pumping systems in a separate pump house or building adjacent to the water storage tanks from which the pumps take suction. This pump facility will house the pumps, drivers, controllers, fuel tanks, fire pump test headers, altitude valve if provided and associated equipment. The configuration of the equipment space should consider the need to test, maintain and even replace major components of the system. If the fire pump installation shall be co-located with the foam concentrate tank, proportioning equipment, valve header and control panels, assure that adequate space is allocated to facilitate maintenance of all subsystems.

3.10.32 Fire Protection Equipment Power: Clearly indicate power to fire pumps, fire pump controllers, foam concentrate pumps and controllers, foam system and fire alarm system control panels on the electrical drawings. Assure that power supply arrangements to pumps are in compliance with NFPA 20 including centrifugal fire pumps (water) and pumps used for foam concentrate.

3.10.33 Inspection and Testing: Test the entire fire protection system to ensure that all equipment, components, and subsystems function as intended.

3.10.33.1 Test Plan and Procedure

Provide an initial test plan with test procedures 60 days prior to final acceptance test. Include the following information:

- a. Schedule of tests for each day, Example: Day 1, Day 2, Day 3 etc.
- b. List of tests.
- c. Blank forms for recording test data for each test.
- d. Test procedure for each test.
- e. List of equipment required for each test.
- f. Calibration certificate for testing equipment

3.10.33.2 Preliminary Acceptance Test

Perform preliminary acceptance tests for the entire fire protection system. Provide written confirmation of all preliminary test results. A professional videographer shall record digitally or on videotape all preliminary tests to document the methods and equipment employed to conduct the test. This digital record shall be provided by the Contractor. The preliminary test shall include stray voltage test and loop resistance tests. Perform 100% of system testing including foam discharge.

3.10.34.2.1 The High Expansion Foam hangar fire suppression system flow tests shall include the following:

a. Simultaneous flow of simulated overhead sprinkler system maximum demand and foam generators flowing water only. Take pressure readings at each foam generator and risers with calibrated liquid filled gages.

b. Simultaneous flow of simulated overhead sprinkler system maximum demand and foam generators flowing foam for one minute. Take foam tank level readings at beginning and at end. Overhead sprinkler system maximum demand shall be simulated by using a simulation test header, UL listed play pipes and liquid filled pressure gages.

c. Flow foam from foam generators for one minute only. Foam tank level readings shall be recorded at the beginning and at the end.

3.10.34.2.2 The AFFF Proportioning System Tests shall include the following:

a. Flow test each AFFF proportioner (ratio controller) to determine that proportioning accuracy is within specified limits.

b. Test each proportioner supplying sprinkler systems with closed heads at two flow rates; the minimum flow rate specified in the manufacturer's published data and a flow rate at least four times the minimum.

c. Collect AFFF samples from each proportioner in accordance with NFPA 16, and the approved test plan. Determine foam solution concentrations using the methods outlined in NFPA 16.

d. Proportioning for nominal 3 percent concentrate shall be between 3 percent and 3.9 percent. If test results indicate proportioning below or above this range, make necessary adjustments and retest as directed by the Contracting Officer.

3.10.34.2.3 Safety Plan

Provide a safety plan for conducting the test of the High Expansion Foam system. Provide a sketch of safe egress path for persons conducting and witnessing the test to exit the building without entering the foam blanket. Obtain approval from the installation Safety Manager.

3.10.34.2.4 Foam Disposal Plan:

a. Provide Foam Containment Plan and Procedures.

b. Provide Foam Disposal Plan and Procedures.

3.10.34.2.5 Protective Measures

Provide procedures for taking protective measures to avoid damage to property during and after the test protection of property during the Final Acceptance Test .

3.10.34.3 Preliminary Acceptance Test Report

Submit the preliminary acceptance test report to the Contracting Officer and to USACE District Fire Protection Engineer before requesting a Final Acceptance Test. Provide the preliminary acceptance test report, digital recording or videotape of the preliminary test, a "Punch List" (list of deficiencies prepared at the completion of preliminary test), and a Final Acceptance Test plan 15 days prior to final acceptance test

3.10.34.4 Final Acceptance Test

The Final Acceptance Test shall begin only after approval of the preliminary test report. The final test will be a repeat of all preliminary test requirements except do not repeat flushing and hydrostatic tests. The Contractor's Fire Protection Engineer and manufacturer's representatives shall conduct the Final Acceptance Test and shall provide a complete demonstration of the operation of the system. The USACE District Fire Protection Engineer and the installation fire department representative will witness tests. A professional videographer will record or videotape final acceptance tests. A failed final acceptance will be treated as a preliminary acceptance test. Correct and retest all system failures or other deficiencies identified during the testing in the presence of the USACE District Fire Protection Engineer.

3.10.34.5 Final Acceptance Test Report

Provide the Final Acceptance Test Report within 15 days after the completion of the Final Acceptance Test. Provide the final acceptance test report in booklet form showing field tests performed with the digital or videotape of the final test to document compliance with the specified performance criteria. Provide documentation of readings, test results, and indicate the final position of control valves. Include all required Final Acceptance Test NFPA forms. The Final Acceptance Test report shall include the resolution of punch list items developed during preliminary acceptance testing.

3.10.34.6 Training

The Contractor Fire Protection Engineer and manufacturer's representatives shall conduct four 6-hour training courses: two for operators and two for maintenance personnel designated by the Contracting Officer. Lesson plans, operating instructions, maintenance procedures, and training data shall be furnished in manual format for the training courses. The operations training course shall familiarize designated government personnel with proper operation of the fire protection systems. The maintenance training course shall provide designated government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system. The training sessions shall be given for two different work shifts. The schedule of training shall be approved by the Contracting Officer. Training sessions shall start after successful completion of the Final Acceptance Test. The field instruction shall cover all of the items contained in the approved O&M manual. Film or tape all training sessions and provide to the Government.

3.10.34.7 Spare Parts

Submit spare parts data for each different item of material and equipment specified. Include a complete list of parts and supplies, with current unit prices and source of supply (with address and telephone number), and a list of parts recommended by the manufacturer to be replaced after 1, 5 and 10 years of service. Include a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

SYSTEM INPUTS		ANNUNCIATION AT LOCAL PANELS		FIRE SUPPRESSION SYSTEM FUNCTIONS					TRANSMIT SIGNALS TO FIRE DEPARTMENT						AUXILIARY FUNCTIONS			EVACUATION SIGNALS				
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R			
FIRE ALARMS																						
1	Manual Fire Alarm Stations																					
2	Spot-Type Smoke Detectors																					
3	Fixed-Temp. & Rate-of-Rise-Type Heat Detectors																					
4	In-Duct Smoke Detectors																					
5	Rate-Compensated Type Heat Detectors on Hanger Ceilings																					
6	Water Flow Switches - Wet or Dry-Pipe Sprinkler Systems in Adjacent Areas																					
7	Water Flow Switches - Wet-Pipe Sprinkler Systems	X				X															X	
8	Water Switches - Low Level System	X				X															X	
9	Manual Foam Discharge Station for Low-Level	X				X															X	
10	Low-Level Optical Fire Detector																					X
SUPERVISORY SIGNALS																						
11	Valve Supervisory Switch - Wet or Dry-Pipe Sprinklers in Adjacent Areas																					
12	Valve Supervisory Switches - Sprinklers																					
13	Valve Supervisory Switches - Low-Level High-Expansion System																					
14	Valve Supervisory Switches - Water Supply Entrance																					
15	Hi-Lo Pressure Switches - Dry-Pipe Sprinklers																					
16	Temperature Monitoring System																					
17	Low-Level Optical Fire Detector Trouble	X				X																
18	Control Component Trouble Condition	X				X																
19	Low-Level Air Flow Switch	X				X																
TROUBLE CONDITIONS																						
20	Low Battery Voltage																					
21	Circuit Fault	X																				
22	Supervised Component Failure																					
23	AC Power Failure																					

- NOTES:
1. Fire alarm signals and supervisory alarm signals shall be clearly differentiated at the fire alarm control panel(s).
 2. General area means the specific bay, dock, mezzanine, office area, or mechanical area. System zoning shall be sufficient to direct responding firefighters directly to the fire area.
 3. This sample matrix shows the basic requirements and is expected to be tailored to each individual project.

Figure 1. Sample Wet Pipe and Low Level High Expansion Foam System Functional Matrix

ATTACHMENT A1: OPTION 1 - Combination of Automatic Low-level High Expansion Foam System and Automatic Sprinkler Systems for Hangar Bays

3.10.2.2 Provide a combination of automatic low-level high expansion foam system and automatic sprinkler systems in hangar bays .

- a. Provide a wet-pipe automatic sprinkler system in the hangar bays. Provide building temperature supervision when the 99.6% dry bulb temperature is less than 0.5 °C (33 °F).
- b. Provide a pre-action automatic sprinkler system activated by a roof- or ceiling-level thermal detection system in hangar bays in lieu of the wet pipe sprinkler system in geographic locations having a 99.6% dry bulb temperature less than -17.7 °C (0 °F).

3.10.2.2.1 Provide the following features for pre-action sprinkler systems :

- a. Provide a surge arrester (expansion tank) not less than 38-liter (10-gallon) capacity for each separate pre-action riser below the riser control valve. Provide a surge arrester of not less than 95-liter (25-gallon) capacity for each set of multiple pre-action risers below the control valves on the header. All tanks shall be Listed/Approved as a surge arrester with a rated working pressure of not less than 1895 kPa (275 psi). Provide sizing calculations prepared by the manufacturer.
- b. Provide externally resettable automatic water control (deluge) valves for pre-action systems (without opening the valve assembly and without use of special tools).
- c. Supervisory air is not required for pre-action sprinkler systems in aircraft servicing areas.

3.10.2.2.2 Low-Level High-Expansion Foam Systems: Locate low-level high-expansion foam generators so that foam discharge falls close to, but not directly on, the aircraft fuselage or wings. Mount generators in the overhead roof support structure and/or high on the walls just below the roof support structure. Initial discharge of foam shall protect the under-aircraft and under-wing area and then spread to the remaining hangar floor area.

- a. Low-level high-expansion foam generators may be designed to use either outside or inside air.
- b. Provide a surge arrester (expansion tank) of not less than 38-liter (10- gallon) capacity for each separate high-expansion riser below the deluge valve. Tanks shall be listed/approved as a surge arrester with a rated working pressure of not less than 1895 kPa (275 psi).
- c. Low-level high-expansion foam systems shall cover 100 percent of the floor in one minute or less from the activation of a manual foam discharge station without the required depth. (Wall mounted generators alone in larger rectangular/square shaped hangars cannot normally achieve this performance requirement). Low-level high-expansion foam systems shall cover the aircraft servicing area and adjacent accessible areas to a depth of one meter (3.2 feet) in four minutes or less. Failure to achieve these requirements during acceptance testing indicates a design failure.
- d. Rate of Discharge: Calculate the minimum rate of discharge or total generator capacity in accordance with NFPA 11; however, never less than 0.8 m³min/ m² (2.6 ft³min/ ft²).

Application rates in the range of 0.8 to 1.2 m³min/m² (2.6 to 4 ft³ min/ ft²) are required to meet the performance requirements.

e. Calculate the minimum rate of discharge or total generator capacity from the following formula:

$R = ([V/T] + RS) \times CN \times CL$, where:

R = Rate of discharge in m³/min (ft³/min)

V = Submergence volume in m³ (ft³) determined by the following formula:

$V = A \times D$, where:

A = Area of the aircraft servicing floor and adjacent floor areas not cut off from the aircraft servicing floor m² (ft²)

D = Depth = 1 meter (3.28 feet) (see paragraph A1.3.3.2 of NFPA11) which is greater than the 0.6-meter (2-foot) minimum foam depth over the hazard required in

T = Submergence time in minutes = 4 (see paragraph A1.3.3.2 of NFPA 11)

RS = Rate of foam breakdown by sprinklers in ft³/min (m³/min) determined by the following formula:

$RS = S \times Q$, where:

S = Foam breakdown from sprinkler discharge = 0.0748 cubic meters per minute • L/min (10 cubic feet per minute • gpm)

Q = Estimated total discharge from maximum number of sprinklers expected to operate in L/min (gpm).

CN = Compensation for normal foam shrinkage = 1.15. This is an empirical factor based on average reduction in foam quantity from solution drainage, fire, wetting of surfaces, and absorbency of stock.

CL = Compensation for loss of foam due to leakage around doors and windows and through openings that cannot be closed determined by the design engineer after proper evaluation of the structure. This factor for Army hangars cannot be less than 2.0 for hangars less than 1394 square meters (15,000 square feet), 2.5 for hangars less than 2787 square meters (30,000 square feet), and 3.0 for all other hangars.

f. Concentrate and Water Supply: Concentrate and water supply shall permit continuous operation of the system to generate four times the submergence volume, but for not less than 15 minutes. No additional foam is required for maintenance of the submergence volume beyond 15 minutes. Perform the supply calculation method to determine quantity of foam concentrate and fire water supply. A connected reserve concentrate supply is not required.

g. Power Supply: Low-level high-expansion foam generators may be either hydraulically (water) or electrically powered. Electrically powered low-level high-expansion foam generators

shall be supplied ahead of the building disconnect and do not require a secondary power source when the power source meets the reliability requirements of UFC 3-600-01.

- h. Activation: The low-level high-expansion foam system shall be activated by:
 - 1. Manual foam activation stations located at main exits from aircraft servicing area.
 - 2. Water flow signal in overhead sprinkler systems.
 - 3. Roof or ceiling level heat detection systems associated with pre-action systems (when installed).
- i. Foam Proportioning Systems: Specifically list/approve all components and assemblies used in this fire protection subsystem for their intended use by a nationally recognized testing organization whose listing/approval process includes follow-up factory inspections to ensure that products comply with the listing/approval conditions.
- j. High-Expansion Concentrate. Use only high-expansion foam (Hi-Ex) concentrate listed/approved for use with the foam generators and foam proportioners installed.
- k. Proportioning. Limit proportioners to 152 millimeters (6 inches) or less. Use in-line balanced-pressure (ILBP) proportioners on all pumped concentrate systems. Do not use ILBP proportioners on bladder tank systems. ILBP proportioners shall be factory assembled and tested by the manufacturer, and the entire ILBP proportioner assembly shall be listed/approved by a recognized laboratory. Disassembly, reassembly, and or modification by the installing contractor is prohibited. Use pressure proportioners for all bladder systems.
- l. Control Valve. Provide water-powered ball valves as foam concentrate control valves. Operate the valve by connection to the alarm line of the automatic water control valve or alarm valve. Provide a retard chamber in the line to the water-powered ball valve on wet pipe foam water systems.
- m. Application Time. Provide a connected foam concentrate supply sized for a single 15-minute application (or four times the submergence volume, whichever is greater) of foam. The foam concentrate supply shall be verified at final acceptance test by displacement test method in accordance with NFPA 11.
- n. Additional Features: Connect all drains to an appropriately sized sanitary drain. Provide sizing calculations prepared by the manufacturer. Automatic water control (deluge) valves shall be externally resettable (without opening the valve assembly and without use of special tools). The maximum valve size shall be 150 millimeters (6 inches). Provide basket-type strainers upstream of the foam system risers. Provide each foam proportioner with a test connection for the connection of a hose lines in order to test the foam proportioners individually. Locate the header inside the aircraft servicing area as near as practicable to an outside door. Provide a supervised control valve for the test header.
- o. Manual Foam Discharge Stations for Low-Level Foam Fire Suppression Systems.
 - 1. Provide manual foam discharge stations inside the aircraft servicing area at all exits to actuate the low-level foam fire suppression systems. Manual foam discharge stations shall be the locking type that when activated require a key to be reset.

2. Manual foam discharge stations shall be yellow and distinctively different from the manual fire alarm stations, and shall have distinctive signage at each device stating "START FOAM SYSTEM" in red lettering not less than 76 millimeters (3 inches) high on a yellow or lime-yellow background. Mount the manual foam discharge station directly on the sign.

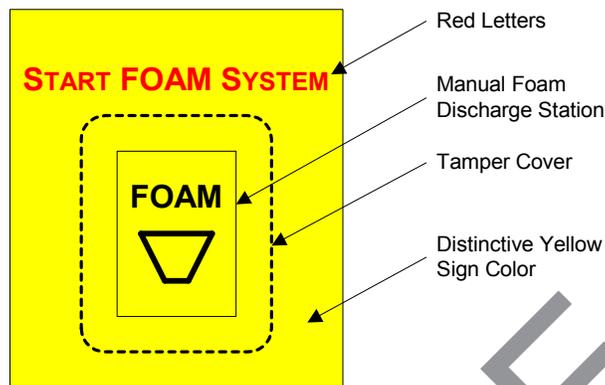


Figure 1 Manual Foam Discharge Station, Tamper Cover, and Signage

3. House manual foam discharge stations within a clear plastic tamper cover that shall be lifted prior to actuating the station. Any colored portions of the tamper covers shall be yellow and any lettering on the cover shall be "FOAM"; the words "fire" or "fire alarm" will not appear on the cover.

4. Actuation of any manual foam discharge stations will cause the FSCP to:

- a. Activate foam discharge through the low level foam fire suppression systems.
- b. Activate the facility fire evacuation alarm and the foam system annunciation signal.
- c. Transmit a fire alarm signal to the fire department. The number and type of signals transmitted to the fire department shall be locally determined based on the current fire alarm receiving equipment.

p. Provide blue visual alarm signals (strobes or rotating beacons) within the aircraft servicing area to indicate foam system activation. Mount signals 10 to 20 feet above the finished floor and located to be visible from all parts of the aircraft maintenance and servicing area.

Attachment A1: Option 2 - Closed-Head Foam Water Sprinkler System for Hangar Bays

3.10.2.2 Provide an automatic closed-head foam water sprinkler system.

- a. Provide an automatic closed head wet-pipe foam-water sprinkler system in the hangar bays. Provide building temperature supervision when the 99.6% dry bulb temperature is less than 0.5 °C (33 °F).
- b. Provide a pre-action automatic closed head foam-water sprinkler system activated by a roof- or ceiling-level thermal detection system in hangar bays in lieu of the wet pipe sprinkler system in geographic locations having a 99.6% dry bulb temperature less than -17.7 °C (0 °F).
- c. Foam-water sprinkler systems shall have risers with check valves and vane-type water flow switches rather than alarm check valves and associated trim. Discharge main drains to an appropriately sized sanitary drain. Do not provide fire department connections on foam-water systems.
- d. Provide surge arrester (expansion tank) not less than 38-liter (10-gallon) capacity for each separate pre-action riser below the riser-indicating valve. Provide a surge arrester (expansion tank) not less than 96-liter (26-gallon) capacity for each set of multiple pre-action risers below the riser indicating valves on the header. All tanks shall be listed/approved as a surge arrester with a rated working pressure of not less than 1895 kPa (275 psi). Provide sizing calculations prepared by the manufacturer.
- e. Automatic water control (pre-action) valves shall be externally resettable (without opening the valve assembly and without use of special tools). The maximum valve size shall be 150 millimeters (6 inches).
- f. Provide basket-type strainers upstream of the foam system risers.
- g. Provide an open steel grate mezzanine and a permanent ladder at the equipment level at any equipment and/or valves requiring access for maintenance, periodic testing, or servicing located more than 2.4 meters (8 feet) above the floor. All platforms and ladders will be in compliance with Occupational Safety & Health Administration (OSHA) requirements.
- h. Use brass piping on trim piping for all deluge, flow control and alarm check valves.
- i. Foam Concentrate. Military Specification MIL-F-24385F, Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater.
- j. Locate water and foam flow control valves and proportioning equipment in the hangar bay in order to minimize the foam delivery time. Provide independent concentrate storage and proportioning systems for each aircraft hangar facility.
- k. Do not provide a reserve supply of foam concentrate.
- l. Proportioners : Limit proportioners to 150 millimeters (6 inches) or less. Use in-line balanced-pressure (ILBP) proportioners on all pumped concentrate systems. Do not use ILBP proportioners on bladder tank systems. ILBP proportioners will be factory assembled and tested by the manufacturer, and the entire ILBP proportioner assembly will be Listed/Approved.

Disassembly, reassembly, and or modification by the installing contractor is prohibited. Use pressure proportioners for all bladder systems.

SAMPLE

Attachment A1: Option 3 - Combination of Automatic Low-level High Expansion Foam System and Automatic Sprinkler Systems, or Closed-Head Foam Water Sprinkler System for Hangar Bays

3.10.2.2 Provide one of the following hangar bay fire suppression systems based on a determination of which best meets the requirements of Paragraph 3.10 FIRE PROTECTION:

- a. A combination of automatic low-level high expansion foam system and automatic sprinkler system; or
- b. A closed-head foam water sprinkler system.

3.10.2.2.1 Combination of Automatic Low-level High Expansion Foam System and Automatic Sprinkler Systems

a. Provide a wet-pipe automatic sprinkler system in the hangar bays. Provide building temperature supervision when the 99.6% dry bulb temperature is less than 0.5 °C (33 °F).

b. Provide a pre-action automatic sprinkler system activated by a roof- or ceiling-level thermal detection system in hangar bays in lieu of the wet pipe sprinkler system in geographic locations having a 99.6% dry bulb temperature less than -17.7 °C (0 °F).

1. Provide a surge arrester (expansion tank) not less than 38-liter (10-gallon) capacity for each separate pre-action riser below the riser control valve. Provide a surge arrester of not less than 95-liter (25-gallon) capacity for each set of multiple pre-action risers below the control valves on the header. All tanks shall be Listed/Approved as a surge arrester with a rated working pressure of not less than 1895 kPa (275 psi). Provide sizing calculations prepared by the manufacturer.

2. Provide externally resettable automatic water control (deluge) valves for pre-action systems (without opening the valve assembly and without use of special tools).

3. Supervisory air is not required for pre-action sprinkler systems in aircraft servicing areas.

c. Low-Level High-Expansion Foam Systems: Locate low-level high-expansion foam generators so that foam discharge falls close to, but not directly on, the aircraft fuselage or wings. Mount generators in the overhead roof support structure and/or high on the walls just below the roof support structure. Initial discharge of foam shall protect the under-aircraft and under-wing area and then spread to the remaining hangar floor area.

1. Low-level high-expansion foam generators may be designed to use either outside or inside air.

2. Provide a surge arrester (expansion tank) of not less than 38-liter (10-gallon) capacity for each separate high-expansion riser below the deluge valve. Tanks shall be listed/approved as a surge arrester with a rated working pressure of not less than 1895 kPa (275 psi).

3. Low-level high-expansion foam systems shall cover 100 percent of the floor in one minute or less from the activation of a manual foam discharge station without the required depth. (Wall mounted generators alone in larger rectangular/square shaped hangars cannot normally achieve this performance requirement). Low-level high-expansion foam systems shall cover the aircraft servicing area and adjacent accessible areas to a depth of one meter (3.2 feet) in four minutes or less. Failure to achieve these requirements during acceptance testing indicates a design failure.

4. Rate of Discharge: Calculate the minimum rate of discharge or total generator capacity in accordance with NFPA 11; however, never less than $0.8 \text{ m}^3/\text{min}/\text{m}^2$ ($2.6 \text{ ft}^3/\text{min}/\text{ft}^2$). Application rates in the range of 0.8 to $1.2 \text{ m}^3/\text{min}/\text{m}^2$ (2.6 to $4 \text{ ft}^3/\text{min}/\text{ft}^2$) are required to meet the performance requirements.

5. Calculate the minimum rate of discharge or total generator capacity from the following formula:

$$R = ([V/T] + RS) \times CN \times CL, \text{ where:}$$

$$R = \text{Rate of discharge in } \text{m}^3/\text{min} \text{ (ft}^3/\text{min)}$$

$$V = \text{Submergence volume in } \text{m}^3 \text{ (ft}^3) \text{ determined by the following formula:}$$

$$V = A \times D, \text{ where:}$$

A = Area of the aircraft servicing floor and adjacent floor areas not cut off from the aircraft servicing floor m^2 (ft^2)

D = Depth = 1 meter (3.28 feet) (see paragraph A1.3.3.2 of NFPA11) which is greater than the 0.6-meter (2-foot) minimum foam depth over the hazard required in

$$T = \text{Submergence time in minutes} = 4 \text{ (see paragraph A1.3.3.2 of NFPA 11)}$$

RS = Rate of foam breakdown by sprinklers in ft^3/min (m^3/min) determined by the following formula:

$$RS = S \times Q, \text{ where:}$$

S = Foam breakdown from sprinkler discharge = $0.0748 \text{ cubic meters per minute} \cdot \text{L}/\text{min}$ ($10 \text{ cubic feet per minute} \cdot \text{gpm}$)

Q = Estimated total discharge from maximum number of sprinklers expected to operate in L/min (gpm).

CN = Compensation for normal foam shrinkage = 1.15. This is an empirical factor based on average reduction in foam quantity from solution drainage, fire, wetting of surfaces, and absorbency of stock.

CL = Compensation for loss of foam due to leakage around doors and windows and through openings that cannot be closed determined by the design engineer after proper evaluation of the structure. This factor for Army hangars cannot be less than 2.0 for hangars

less than 1394 square meters (15,000 square feet), 2.5 for hangars less than 2787 square meters (30,000 square feet), and 3.0 for all other hangars.

d. **Concentrate and Water Supply:** Concentrate and water supply shall permit continuous operation of the system to generate four times the submergence volume, but for not less than 15 minutes. No additional foam is required for maintenance of the submergence volume beyond 15 minutes. Perform the supply calculation method to determine quantity of foam concentrate and fire water supply. A connected reserve concentrate supply is not required.

e. **Power Supply:** Low-level high-expansion foam generators may be either hydraulically (water) or electrically powered. Electrically powered low-level high-expansion foam generators shall be supplied ahead of the building disconnect and do not require a secondary power source when the power source meets the reliability requirements of UFC 3-600-01.

f. **Activation:** The low-level high-expansion foam system shall be activated by:

(1) Manual foam activation stations located at main exits from aircraft servicing area.

(2) Water flow signal in overhead sprinkler systems.

(3) Roof or ceiling level heat detection systems associated with pre-action systems (when installed).

g. **Foam Proportioning Systems:** Specifically list/approve all components and assemblies used in this fire protection subsystem for their intended use by a nationally recognized testing organization whose listing/approval process includes follow-up factory inspections to ensure that products comply with the listing/approval conditions.

h. **High-Expansion Concentrate.** Use only high-expansion foam (Hi-Ex) concentrate listed/approved for use with the foam generators and foam proportioners installed.

i. **Proportioning.** Limit proportioners to 152 millimeters (6 inches) or less. Use in-line balanced-pressure (ILBP) proportioners on all pumped concentrate systems. Do not use ILBP proportioners on bladder tank systems. ILBP proportioners shall be factory assembled and tested by the manufacturer, and the entire ILBP proportioner assembly shall be listed/approved by a recognized laboratory. Disassembly, reassembly, and or modification by the installing contractor is prohibited. Use pressure proportioners for all bladder systems.

j. **Control Valve.** Provide water-powered ball valves as foam concentrate control valves. Operate the valve by connection to the alarm line of the automatic water control valve or alarm valve. Provide a retard chamber in the line to the water-powered ball valve on wet pipe foam water systems.

k. **Application Time.** Provide a connected foam concentrate supply sized for a single 15-minute application (or four times the submergence volume, whichever is greater) of foam. The foam concentrate supply shall be verified at final acceptance test by displacement test method in accordance with NFPA 11.

l. **Additional Features:** Connect all drains to an appropriately sized sanitary drain. Provide sizing calculations prepared by the manufacturer. Automatic water control (deluge) valves shall be externally resettable (without opening the valve assembly and without use of

special tools). The maximum valve size shall be 150 millimeters (6 inches). Provide basket-type strainers upstream of the foam system risers. Provide each foam proportioner with a test connection for the connection of a hose lines in order to test the foam proportioners individually. Locate the header inside the aircraft servicing area as near as practicable to an outside door. Provide a supervised control valve for the test header.

m. Manual Foam Discharge Stations for Low-Level Foam Fire Suppression Systems.

(1) Provide manual foam discharge stations inside the aircraft servicing area at all exits to actuate the low-level foam fire suppression systems. Manual foam discharge stations shall be the locking type that when activated require a key to be reset.

(2) Manual foam discharge stations shall be yellow and distinctively different from the manual fire alarm stations, and shall have distinctive signage at each device stating "START FOAM SYSTEM" in red lettering not less than 76 millimeters (3 inches) high on a yellow or lime-yellow background. Mount the manual foam discharge station directly on the sign.

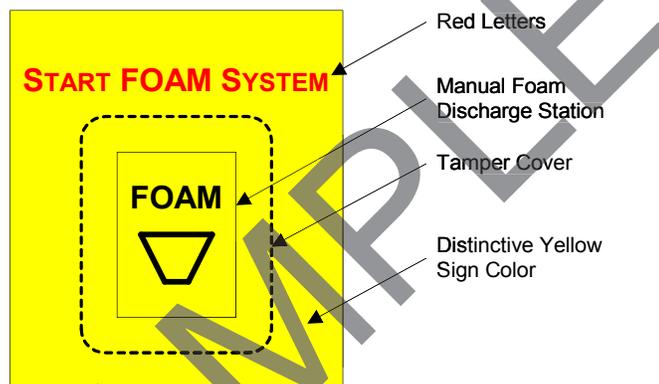


Figure 1 Manual Foam Discharge Station, Tamper Cover, and Signage

(3) House manual foam discharge stations within a clear plastic tamper cover that shall be lifted prior to actuating the station. Any colored portions of the tamper covers shall be yellow and any lettering on the cover shall be "FOAM"; the words "fire" or "fire alarm" will not appear on the cover.

(4) Actuation of any manual foam discharge stations will cause the FSCP to:

- (a) Activate foam discharge through the low level foam fire suppression systems.
- (b) Activate the facility fire evacuation alarm and the foam system annunciation signal.
- (c) Transmit a fire alarm signal to the fire department. The number and type of signals transmitted to the fire department shall be locally determined based on the current fire alarm receiving equipment.

n. Provide blue visual alarm signals (strobes or rotating beacons) within the aircraft servicing area to indicate foam system activation. Mount signals 10 to 20 feet above the

finished floor and located to be visible from all parts of the aircraft maintenance and servicing area.

3.10.2.2.2 Provide an automatic closed-head foam water sprinkler system.

a. Provide an automatic closed head wet-pipe foam-water sprinkler system in the hangar bays. Provide building temperature supervision when the 99.6% dry bulb temperature is less than 0.5 °C (33 °F).

b. Provide a pre-action automatic closed head foam-water sprinkler system activated by a roof- or ceiling-level thermal detection system in hangar bays in lieu of the wet pipe sprinkler system in geographic locations having a 99.6% dry bulb temperature less than -17.7 °C (0 °F).

c. Foam-water sprinkler systems shall have risers with check valves and vane-type water flow switches rather than alarm check valves and associated trim. Discharge main drains to an appropriately sized sanitary drain. Do not provide fire department connections on foam-water systems.

d. Provide surge arrester (expansion tank) not less than 38-liter (10-gallon) capacity for each separate pre-action riser below the riser-indicating valve. Provide a surge arrester (expansion tank) not less than 96-liter (26-gallon) capacity for each set of multiple pre-action risers below the riser indicating valves on the header. All tanks shall be listed/approved as a surge arrester with a rated working pressure of not less than 1895 kPa (275 psi). Provide sizing calculations prepared by the manufacturer.

e. Automatic water control (pre-action) valves shall be externally resettable (without opening the valve assembly and without use of special tools). The maximum valve size shall be 150 millimeters (6 inches).

f. Provide basket-type strainers upstream of the foam system risers.

g. Provide an open steel grate mezzanine and a permanent ladder at the equipment level at any equipment and/or valves requiring access for maintenance, periodic testing, or re-servicing located more than 2.4 meters (8 feet) above the floor. All platforms and ladders will be in compliance with Occupational Safety & Health Administration (OSHA) requirements.

h. Use brass piping on trim piping for all deluge, flow control and alarm check valves.

i. Foam Concentrate. Military Specification MIL-F-24385F, Fire Extinguishing Agent, Aqueous Film Forming Foam (AFFF) Liquid Concentrate, for Fresh and Seawater.

j. Locate water and foam flow control valves and proportioning equipment in the hangar bay in order to minimize the foam delivery time. Provide independent concentrate storage and proportioning systems for each aircraft hangar facility.

k. Do not provide a reserve supply of foam concentrate.

l. Proportioners : Limit proportioners to 150 millimeters (6 inches) or less. Use in-line balanced-pressure (ILBP) proportioners on all pumped concentrate systems. Do not use ILBP proportioners on bladder tank systems. ILBP proportioners will be factory assembled and tested by the manufacturer, and the entire ILBP proportioner assembly will be Listed/Approved.

Disassembly, reassembly, and or modification by the installing contractor is prohibited. Use pressure proportioners for all bladder systems.

SAMPLE