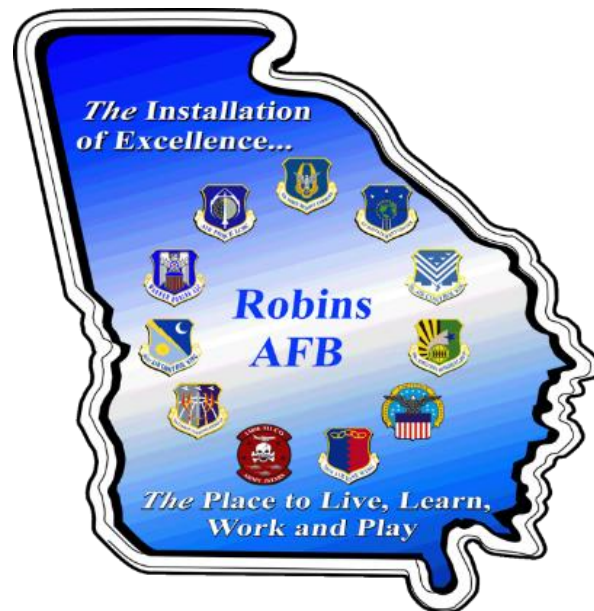




RAFB BFS 2026

ROBINS AIR FORCE BASE

2026 BASE FACILITY STANDARD



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2026 BASE FACILITY STANDARDS

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AIR FORCE MATERIAL COMMAND/ 78 AIR BASE WING/ 78 CIVIL ENGINEERING GROUP

This update of the Base Facility Standards is a minor update of the document. All changes have been listed in the "Record of Changes" below.

Record of Changes (requirement changes are indicated by \1\ ... /1/)

Paragraph	Description
1F	Revised and updated contractor trailer requirements
2B-1	REPLACED: twelve culturally affiliated Native American tribes with thirteen federally recognized tribes
2C-1	Paragraph completely replaced and shall be reviewed.
3C-3.1	ADD: "Primary level detection shall be MultiTrobe, supplemented by conventional floats as backup level detection."
3C-3.1	ADD "Roam Technologies Model MTC7003ES2K4-BOY manual transfer switch is required; TEMP TAP/ESL-ITEM3640-0127 may be used as an alternative." AFTER "A manual transfer switch with camlock connections for emergency backup power shall be installed."
3C-3.7	Added camera inspection requirement for sanitary lines before and after demolition during renovations.
3G-1	Added compliance statement for "Better Site Design Practices"
3G-2.2	Added requirement for filtering of stormwater discharge when pumped
3G-2.9.1	ADD: Trees must be approved for removal by 78 CEG/CEIEC during the project planning process. Every tree that is approved for removal must be replaced at a 4:1 ratio. Reference section 2C-2 for GIP instructions on protocol for tree replacements.
4F	Added standardized corian and porcelain tile requirements for restroom and breakrooms.
4F-4.5	Added: "Floor drains shall be provided in all new restrooms and restroom renovations.", and corrected typo.
4F-4.6	Added requirement for atmospheric vacuum breaker on janitor sink faucet
5A-1.3	Added identification of Robins SCADA system and compatibility for RTU's
5A-1.4	Added flange gasket requirements for condensate water, make-up water, chilled water, and steam lines.
5A-2.3.1	Changed basis of design from Thermacor HT-406 to DUO-THERM 505
5A-3.4.2	Added requirement for warranty claim action plan to be submitted in 24 hours of notification
5B-1.7.5	Expanded list of approved Chiller manufacturers.
5C-2.2.2	Added requirement for no bypass without protection
5C-2.3.3.1	REPLACE: "Minimum gallon per flush (gpf) will be the maximum allowable gpf allowed by code, including state of Georgia and local amendments" Added Table 5C-1: below fixture flow requirement chart

FIXTURE FLOW REQUIREMENTS		
Fixture	Desired Flow	Minimum Flow
Water Closets	3.5 GPF	1.6 GPF
Urinals	1.0 GPF	0.5 GPF
Faucets	2.2 GPM	1.5 GPM

5C-2.3.3.2	CHANGE: "All wall mounted water closets shall be replaced with floor mounted, rear discharge" TO: "All wall mounted water closets shall be replaced with floor mounted, rear discharge, for new construction or whenever feasible."
5E-2.1.1	Changed Viking brand to Reliable for clapper valves.
5F-5.2.1	Removed specific meters and added meter requirements.
Add section: 5F-2.4.4	Added pulse splitter requirements for electrical meter and control system connection
6C-8.1.6	Changed from: Robins AFB currently uses the UVIC UltraVoice® Indoor Controller with an UltraVoice® Audio and Relay Module (UARM) manufactured by Federal Signal Safety and Security Systems to interface with the Mass Notification System (MNS). To: Robins AFB currently uses MNS componenets manufactured by Federal Signal Safety and Security Systems to interface with the MNS.
6C-8.1.6.2 6C-10.2.1 6C-10.2.4	Changed "Big Voice" to Base Mass Notification System (BMNS)
6C-8.2.1	Defined minimum occupancy
6C-9.1.2.1	Defined location of MNS panels
6C-9.4.5	Defined sound level requirements
6C-10.2.7	Added coordination requirement for programming of Federal Signal.
6C-10.3.2.10	Added sound level requirement and report to be submitted to PWCS Office.
6F-2	Updated for minimum size of comm room per UFC 3-580-01.
6F-2.1	Added HVAC and lighting requirement for CER. Added verbiage at the end of paragraph regarding separation requirement for other networks.
6F-2.2	Added clarification for comm room not to be used as storage.
6F-2.4.4	Added verbiage at the end of paragraph regarding housekeeping after construction/installation.
6F-3.11.2	Updated NIPRNet cabling color.
6F-3.4	Added verbiage after first sentence to specify the type of conduits to install
6F-4	Clarified that premise wiring is provided by the 78 ABW/SC BTS at user/customer expense for FSRM projects.
6H-1.1.1	Replaced with: Generators shall be designed, installed, and accepted in accordance with UFC 3-540-07, UFC 3-540-01, AFMAN 32-1062, and NFPA 110 (7.13)
6H-1.1.2	Generator standardization authorized to be Cummins, removed alternate language.
Add section: 6H-1.2.1	Added: <u>Safety</u> Include sloped steps with handrails IAW OSHA 1910.25(c) as well as an OSHA compliant platform (catwalk) if needed for maintenance and operations of lifted generators and automatic transfer switches.
Add section: 6H-4.2.1.3	Added: Provide permeant automated fuel polishing system for storage tanks over 500 gallons

This Base Facility Standard supersedes all previous versions.

FOREWORD

The Robins AFB Base Facility Standards (BFS) is both a resource and a guidebook to facilitate the design and construction of successful, high-performance buildings and infrastructure projects. The guidance provided in this document applies to all new construction and renovations carried out by all Mission Partners at Robins AFB.

The 2026 Edition of the Base Facility Standards is a minor update and includes changes for clarity and technical content. Note that the Criteria Reference Documents are combined into Appendix A at the end of the document, and Forms are consolidated into Appendix B. Thanks go to the many subject matter experts that provided their time and expertise to make this happen.

Please contact the Chief, Project Execution Section with all recommendations for updates, corrections, or changes.

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CHAPTER 1 SPECIAL STANDARDS



SECTION 1A GEOBASE PROGRAM

1A-1 GENERAL REQUIREMENTS

1A-1.1 The Robins AFB GeoBase Program is the primary repository of utility, planimetric and environmental data on Robins AFB. The goal of the program is to ensure that all design and construction projects make use of the most up-to-date utility and planimetric data, and that post construction updates are properly submitted and integrated to keep the base utility and planimetric data current.

1A-1.2 All project files prepared and modified throughout the construction process, shall be in electronic format red-lines, as-builts and delivered record drawings as specified in the contract documents.

1A-1.2.1 Planimetric and utility features are the responsibility of the 78 CEG/CENME.

- Planimetric Data: Airfield, Roads, Sidewalks, Buildings, Geodetic, Hydrography, Landform, Pedestrian and Land Status.
- Utility Data: Air, Electrical, Fuel, Gas, Heating/Cooling, Industrial, Storm, Wastewater and Water.

1A-1.2.2 The Environmental features are the responsibility of the 78 CEG/CEIE office.

- Environmental Data: Air Quality, Groundwater Quality, Pollution Control, Regulated Tanks, Solid Waste, Hazardous Materials (Hazmat), Hazardous Waste (Hazwaste), Remediation, Cultural, Fauna, Flora and Wetlands.

1A-1.2.3 The location and orientation of all elements shall be based on the following:

Table 1A-1

COORDINATES				
COORDINATE SYSTEM				
DATUM	North American Datum (NAD) of 1983			
FORMAT	State Plane Coordinates for Georgia West FIPS 1002			
GEOGRAPHIC COORDINATES				
Location	Station ID	Latitude	Longitude	Country
ROBINS AFB	KWRB	32.64	-83.59	UNITED STATES - GA

SECTION 1B SAFETY PROVISIONS

1B-1 SAFETY PLAN REQUIREMENTS

The Contractor shall prepare a detailed project-specific Industrial Safety and Health Requirements Plan (Safety Plan) IAW OSHA guidance and DAFI 91-202, "The Air Force Mishap Prevention Program," dated April 2024; AF Policy Directive 91-2, "Safety Programs," dated September 2019; and as outlined in each Construction Contract or Task Order at Robins AFB. The Safety Plan shall be submitted for review by the 78 ABW Safety Office and used to coordinate and perform work in a manner that does not impact the safety of Government or non-Contractor personnel, or cause damage to government property. The Contractor shall not start any construction activities until the Safety Plan has been deemed acceptable and all aspects of the Plan are in place.

1B-2 SITE PROTECTION

1B-2.1 Temporary Structures

1B-2.1.1 Plans for the layout of temporary structures such as buildings, facilities, fencing, access routes and anchoring systems for temporary structures shall be submitted for review and approval prior to implementation. The plans shall consider the following loading IAW American Society of Civil Engineers (ASCE) 7 current edition, Minimum Design Loads for Buildings and Other Structures:

- Dead and live loads
- Soil and hydrostatic pressures
- Wind loads
- Rain and snow loads
- Flood and ice loads
- Seismic forces

1B-2.1.2 Trailers and other temporary structures used as field offices, personnel housing or for storage shall be anchored with rods and cables or by steel straps to ground anchors. The anchor system shall be designed to withstand winds and meet applicable state or local standards for anchoring mobile trailer homes.

1B-2.2 Temporary Fencing

1B-2.2.1 Temporary project fencing (or an acceptable substitute) shall be provided on all projects located in areas of active use by members of the public, including those areas near family housing areas and/or daycare facilities.

1B-2.3 Signage for Construction Sites

Warning signs shall be posted at each construction site to identify the presence of construction hazards and require that unauthorized people "keep out" of the designated construction area. Signs shall be posted along each side of the project and spaced no more than 150 feet apart. Provide safety signs as required at job sites, such as MEN WORKING ABOVE, DO NOT WATCH WELDER, and NO SMOKING.

1B-2.4 Protective Barriers

Contractor is responsible to provide barricades when it is necessary to protect an area due to operations including excavation, open manholes, overhead work, hazardous operations, or moving equipment. Erect barricades before the work begins. If the barricades are in a roadway or walkway, blinking lights must be used during the hours of darkness. Barricades and associated equipment shall be always kept neat and orderly. Immediately remove barricades from the job site when the work is complete. Kerosene lamps and open flame pots shall not be used for or with warning signs or devices.

1B-3 OPERATIONS SAFETY**1B-3.1 Foreign Object Damage (FOD) Prevention for Flightline Projects**

1B-3.1.1 To prevent damage to aircraft from construction-generated debris, the Contractor shall establish and maintain an effective FOD prevention program as an overall component of project execution.

1B-3.1.2 All vehicles must stop at FOD checkpoints on the Flightline. The vehicle operator will visually inspect all tires treads for rocks and other debris to ensure all trapped items are removed and disposed of properly to prevent the loose objects from being carried onto the Flightline.

1B-3.2 Fire Reporting

Report all fires as soon as discovered. The fire reporting number on or off Base is 911 (RAFB 911: 478-222-2900). The caller should give his or her name and location of the fire and any other information that may be requested by the Fire Department dispatcher. Stay on the telephone until the dispatcher has obtained all necessary information.

1B-3.3 Welding, Cutting, Brazing and Open Flames

1B-3.3.1 Do not start operations involving welding, cutting, brazing and open flames until the Technical Representative of the Contracting Officer has been notified, the site has been inspected and approved by the authorized Fire Inspector.

1B-3.3.2 Complete AF Form 592 (Welding, Cutting, and Brazing Permit).

1B-3.3.3 Perform a fire watch for at least one-half hour after the operations are finished. Sign and return the AF Form 592 to the Fire Department at Building 377 within one hour.

1B-3.4 Utilities

The Contractor shall coordinate with the respective shop prior to performing any activity that will affect utilities, systems, or operations at Robins AFB.

1B-4 OVERHEAD DOOR OPERATIONS

All overhead doors shall be wired for momentary operation i.e., constant pressure must be applied to the manual controls to operation in either direction. The only exception will be for Fire Department and DLA infrastructure requiring remote control doors. Any door with remote control operation capability will require a safety edge at the bottom of the door. Door controls

shall be mounted on opposite side of door from motor and gear. Any exception shall require written approval from 78 CES.

1B-5 GUIDANCE FOR CLEAN WORK AREAS

Wipe samples are routinely collected in industrial areas at Robins AFB by the Bioenvironmental Office. The Contractor shall review posted Bio Survey Assessments at individual work areas to determine special procedures or requirements associated with doing construction activities in that facility.

SECTION 1C PRE-ENGINEERED METAL BUILDINGS (PEMB)

1C-1 SYSTEM COMPONENTS AND DESIGN REQUIREMENTS

1C-1.1 Metal Building Manufacturer Accreditation

Manufacturer shall be accredited by the International Accreditation Service Inspection (IAS) Programs for the Manufacturers of Metal Building Systems, AC472. Provide copy of the current accreditation.

1C-1.2 Structural Frame Configuration

- Buildings not containing finished spaces: Tapered Columns
- Buildings containing finished spaces: Straight Columns

1C-1.2.1 All new PEMB shall be expandable unless otherwise noted in the statement of work.

1C-1.2.2 For pre-engineered metal buildings on design-build and design-bid-build projects, the structural drawings shall include, but not be limited to, the following:

- Column reactions for each frame line
- Foundation plan and details
- Base plate and anchor location and details
- Elevations showing primary and secondary member locations and sizes, including all framing for architectural and mechanical openings.
- All bracing, wind post, and portal frame locations.

The contractor shall coordinate with a PEMB manufacturer for preliminary drawings during design for preliminary data.

1C-1.3 Roof Panel Configuration

Roof panel configuration shall meet the requirements of Table 1C-1 below for new industrial and simple commercial roofs with no valleys; or new commercial Architectural roofs, which may contain valleys. Roof selection shall be consistent with adjacent facilities.

Table 1C-1

ROOF PANEL CONFIGURATION	
New Industrial & Simple Commercial Roofs (No Valleys)	New Commercial Architectural Roofs (May Contain Valleys)
3" min. height trapezoidal mechanically seamed standing seam roof panels	2" min. height vertical leg mechanically seamed standing seam roof panels
360° seam (90°/180° seams not allowed)	360° seam (90°/180° seams not allowed)
24" max. width panels shall have intermediate low profile ribs (flat pans not allowed)	18" max. width panels shall have intermediate low profile ribs (flat pans not allowed)

1C-1.4 Insulation**1C-1.4.1 Minimum Thickness for Walls, Fascia (if applicable) and Roof**

3.5 inches (R = 13) in unconditioned buildings.

1C-1.4.2 Scrim or Facing on Insulation (also referred to as Vapor Retarder)

- Factory applied white polypropylene film, fiberglass, and polyester scrim, 30# natural kraft and metalized polyester (PSKP) or Polypropylene-Scrim-Kraft Polyester
- Tensile strength MD - 65 pounds per inch (lbs/in) / XD - 60 lbs/inch minimum
- Water Vapor Transmission Rate (WVTR) - 0.02 perm (unit of permeance) or less
- Basis of Design – Lamtec® WMP-50

1C-1.4.3 Configuration

Insulation/scrim system shall be installed as a 100% vapor barrier with a six (6) inch single side tab. Tabs shall be sealed as required to maintain the barrier. Designer shall provide sufficient detailing to adequately describe installation so that no condensation is trapped inside the wall section. Insulated metal panels shall not be used, unless specifically directed by 78 CEG Engineering Division.

1C-1.5 Finishes

Structural Steel Frames and Columns/Posts - Preferred Finish: Factory applied primer and painted for exposed conditions; shop primed only for concealed locations.

1C-1.6 Girts and Purlins

Primed and painted for exposed conditions, primed only for concealed locations.

1C-1.7 Panels

Coated with Kynar 500® Polyvinylidene Fluoride (PVDF) or Hylar® 5000 PVDF meets the required finish warranty requirements.

1C-2 WARRANTIES

All warranties shall be from a single source manufacturer. Manufacturer used as a design basis shall be capable of meeting warranty requirements. Contractor shall provide sample warranty to 78 CEG/CEN for review prior to proceeding with design or submitting any other PEMB submittals for review.

1C-2.1 Weather-Tightness System – Labor and Materials

20-Year No Dollar Limit (NDL) Warranty Required - The warranty shall cover roof weather tightness up to the required design wind speed. Repairs that become necessary because of defective materials and workmanship while roof panel system is under warranty are to be performed within 48 hours after notification. Failure to perform repairs within 48 hours of notification will constitute grounds for having emergency repairs performed by others and will not void the warranty. Follow-up and completion of repairs must be performed within 14

calendar days from date of notification.

1C-2.2 Roof and Wall Panel Finish System – Labor and Materials

20-Year No Dollar Limit (NDL) Warranty Required - The warranty shall cover repairs that become necessary because of defective materials and workmanship while the roof and wall panel system is under warranty are to be performed within 48 hours after notification unless additional time is approved by the Contracting Officer. Failure to perform repairs within 48 hours of notification will constitute grounds for having emergency repairs performed by others and will not void the warranty. Follow-up and completion of repairs must be performed within 14 calendar days from date of notification

SECTION 1D GREEN PROCUREMENT PLAN

1D-1 GENERAL

The Green Procurement Plan (GPP) is a mandatory federal acquisition program that focuses on the purchase and use of environmentally preferable and bio-based products and services. Air Force GPP Policy includes the purchasing of Energy and Water Efficient Products; Alternative Fuels and Fuel Efficiency; Bio-based Products; Non-Ozone Depleting Substances; Priority Chemicals; and Environmentally Preferable Products.

GPP requirements apply to all acquisitions including services and new requirements. Federal Acquisition Requirement 23.404(b) applies and requires 100% of US EPA designated product purchases to contain recovered materials unless the item cannot be acquired competitively within a reasonable timeframe; meeting reasonable performance standards; or at a reasonable price.



SECTION 1E FLIGHTLINE PHOTOGRAPHY

1E-1 GENERAL GUIDANCE

Photographs of facilities or assets within the industrial flightline area of Robins AFB may be taken only with prior authorization. Any such photographs shall be taken FOR OFFICIAL USE ONLY and may include but not be limited to the following:

- Recording of existing conditions associated with specific building construction and repair projects; or
- Providing documentation of progress, details or issues associated with specific building construction and repair projects.

1E-2 PROHIBITED PHOTOGRAPHY

Photography of classified assets or activities is strictly prohibited.

1E-3 PHOTOGRAPHIC DEVICES

Official photographs shall be taken with a government owned camera or other approved devices with photo-taking capabilities. Use of personal cameras, cell phones or other devices is prohibited.

SECTION 1F CONTRACTOR TRAILER POLICY

1F-1 GENERAL GUIDANCE

Only the prime contractor is allowed office trailer space at Robins AFB. Office Trailer locations authorized for use outside of construction laydown sites are not authorized for storage or laydown areas.

1F-1.1 Office Trailer/Conex Policy

1F-1.1.1 Authorized use of Contractor Office Trailers, Conex/Storage containers and laydown yards are discretionary. Before any area is assigned, the prime contractor shall formally request in writing a siting approval for a trailer with full justification to the 78 Civil Engineer Group (78 CEG/CEN) Community Planning section. The assigned 78 CEG Construction/Project Manager will facilitate this request at the contract level.

1F-1.1.2 If water, sewage, or electrical power is required and available within the work areas, the contractor must request connection through the 78 CEG Construction/Project Manager.

1F-1.1.3 Digging or trenching for utilities requires a Digging Permit approval through the 78 Civil Engineer Squadron Digging Permit process. Consult the 78 CEG Construction/ Project Manager about instruction for the process.

1F-1.1.4 The Contractor is responsible for the utilities not available on site, by alternative means (portable containers/ tanks for water and sewage collection).

- Portable Generators shall not violate EPA Clean Air permitted levels.
- The contractor shall shield generators to control excessive noise levels.

1F-1.1.5 The contractor shall maintain the area assigned, keeping grass cut, shrubs trimmed, and debris properly disposed of.

1F-1.1.6 Once the contract, project, or task order is completed, the contractor shall have ten (10) calendar days to remove the Office Trailer, Conex/Storage Containers, laydown yard and all debris materials from the Base. The contractor shall restore impacted area to original condition.

1F-1.1.7 Existing trailer already located on the installation are not grandfathered in or exempt from this policy. This policy shall take effect at the publication of this document.

1F-1.1.8 Trailers shall be in good repair and give a presentable appearance. Trailers used as Offices shall be anchored with rods and cables or by steel straps to ground anchors. The anchor system shall be designed to withstand Risk III Class C winds, and must meet applicable local, state standards for anchoring mobile homes. Minimum one (1) anchor shall be installed at each corner.

1F-1.2 Office Trailer/Conex Size and Marking Requirements

1F-1.2.1 Office Trailer shall not be larger than 10 feet by 50 feet. Job site Conex and/or Office Trailer shall not be any larger than 8 feet by 20 feet.

1F-1.2.2 Office Trailer shall display 3 feet by 5 feet sign at least 4 feet from the bottom of the structure on the most visible exterior side of the trailer. The sign shall include:

- Company name with logo.
- Contract associated with the office trailer.
- Company representative and telephone number with 24-hour contact.

1F-1.3 \1\Prime Contractor Office Trailer and Site Policy

1F-1.3.1 Maintain the Prime Contractor Office Trailer and site in a neat, orderly, and safe manner. Cut grass regularly to maintain site to base standards. Prime contractor office trailer sites will be monitored by 78 CEG/CENPL personnel monthly to ensure office trailer and site locations are maintained according to the Robins AFB Facility Standard. Any location found to be in noncompliance will receive two warnings prior to being required to remove trailer from Robins AFB. No compensation for removal will be provided by the Government. \1\

CHAPTER 2 ENVIRONMENTAL REQUIREMENTS

SECTION 1560



Protected Wetland Area

SECTION 2A GENERAL GUIDANCE

2A-1 REGULATORY COMPLIANCE MANDATE

All contracts performed on Robins AFB are bound by requirements established by the Federal Government, State of Georgia, Houston County and Department of Defense (DoD); as well as Air Force laws, regulations and policies specific to Robins AFB. Work is coordinated through regulatory permits and management plans to ensure that hazardous work conditions are minimized, personnel are protected, accidental damage to Base assets is prevented, and disturbed sites are fully restored when excavation has been completed. Environmental compliance is required for the following programs: solid and hazardous wastes, toxics, water quality, air quality, natural resources, storage tanks, cultural resources, pollution prevention, hazardous materials, and fuels. Environmental Management, 78 CEG/CEIE, is the organization responsible for management of base environmental concerns. Contact program managers in 78 CEG/CEIE at (478) 926-9645, or via email: 78ceg.cev.FrontOfc@us.af.mil.

Contractors shall comply with all requirements of Robins Division 1 specifications Section 01560 *Environmental Requirements for Robins Air Force Base*. Section 01560 is updated regularly, request for copies of the updated document may be requested through the 78 CEG Construction/Project Manager.

SECTION 2B PRESERVING HISTORICAL AND ARCHAEOLOGICAL RESOURCES

2B-1 PROGRAMMATIC AGREEMENT

On 10 September 2014 a Programmatic Agreement was finalized between Robins AFB, the Georgia State Historic Preservation Office and the Advisory Council on Historic Preservation regarding maintenance, rehabilitation and minor development activities that may impact historic properties at Robins AFB that are eligible for inclusion in the National Register of Historic Places. When a building or archaeological site determined eligible for the National Register of Historic Places is within a project area, the Contractor shall take measures to prevent adverse impact to the cultural resource. This may include the development of a mitigation plan or consultation with the Georgia State Historic Preservation Office, the Advisory Council on Historic Preservation and \1\thirteen\1\ culturally affiliated Native American tribes. Specific facilities and archaeological sites were identified, including the following:

Table 2B-1

Buildings Eligible for the National Historic Register – Robins AFB						
12	98	107	220	410	415	2067
94	105	110	400	411	450	2081
97	106	125	405	412	1400	

Reference Division 1 Section 01560 for additional information.

2B-2 COORDINATION

The contractor shall provide 78 CEG/CEIE with project information about the building or archaeological site. The Contractor shall contact 78 CEG/CEIE Cultural Resources Program Manager at the beginning of the project prior to beginning any work.

2B-3 DISCOVERIES

When cultural resources are inadvertently discovered during construction, maintenance, or repairs, project personnel are directed to avoid the site of discovery and immediately contact the 78 CEG/CEIE Cultural Resources Program Manager. All work around discovery must stop until it can be investigated. 78 CEG/CEIE will send a qualified representative to the site and the resource will need to be recorded and evaluated and the effects mitigated as necessary.

2B-4 ARCHAEOLOGICAL FINDS

Archaeological finds are artifacts, eco-facts, or modifications to the landscape that are associated with past human activity and are a minimum of 50 years old. All archaeological finds are the property of Robins AFB. Do not remove or disturb finds without the CO's written authorization.

SECTION 2C CONSERVATION OF NATURAL RESOURCES

2C-1 GENERAL

Robins AFB has one federally endangered plant, the Ocmulgee skullcap (*Scutellaria ocmulgee*) and 8 other plant species that are considered rare. The American Alligator is also listed as federally threatened due to its resemblance to the protected American crocodile. One proposed federally threatened animal, the monarch butterfly (*Danaus plexippus*) has been found on Robins AFB due to its ideal habitat. Additionally, There is one proposed federally endangered animal, the tricolored bat (*Perimyotis subflavus*), that has been recorded on the installation. Bald Eagles (*Haliaeetus leucocephalus*) and Wood Storks (*Mycteria americana*) are occasionally seen on base and are federally protected as well. Additionally, most wildlife species including birds, bats, turtles, non-venomous snakes, and game species are protected by law.

2C-1.1 Coordination

The contractor shall not clear vegetation on project sites without prior approval from 78 CEG/CEIEC. The contractor shall not harm wildlife of any kind or injure any rare species or their habitats. If the Contractor encounters problems with wildlife, notify the Project Manager/ Construction Manager. The Project Manager/ Construction Manager shall contact the 78 CEG/CEIEC Natural Resources Program Manager to determine the best solution for each problem.

2C-2 GREEN INFRASTRUCTURE PLAN (GIP)

Green infrastructure planning is used to identify deficiencies and enhance natural functions and values of the interconnected network of waterways, wetlands, woodlands, grasslands, and other natural areas of significance throughout the Installation, collectively known as green infrastructure. The implementation strategy of the Green Infrastructure Plan (GIP) will be delivered through four major focus areas, including urban forestry, pollinator habitats, stormwater drainage vegetative buffers, and invasive species management. The GIP will provide sustainable practices, and promote societal and ecological benefits, giving the RAFB community more comfortable, attractive working and living conditions. The GIP will also support mission effectiveness and readiness by enhancing, maintaining, and preserving natural resources in both the built and natural environments on the Installation. Managers of the construction process and contractors shall consider the principles and implementation strategy of the GIP, consult with 78 CEG/CEIEC during construction planning, and incorporate these concepts into project execution when conducive to mission objectives.

The GIP can be found at <https://usaf.dps.mil/teams/10623/Robins/Shared%20Documents/Natural%20Resources/Robins%20AFB-GIP-Facility%20Standards.pdf> or requested from the Environmental Management front office at 78ceg.cev.FrontOfc@us.af.mil.

SECTION 2D PROTECTION OF WATER AND LAND RESOURCES

2D-1 GENERAL

The Contractor shall not take any action that will adversely affect the existing Water Quality Standards classification of any streams, rivers, lakes, wetlands, or reservoirs within or adjacent to the project site or otherwise contribute to the pollution of these water resources. No fuel, oils, bituminous materials, calcium chloride, acids, construction waste or otherwise harmful materials shall be permitted to enter these water resources. Land resources shall be preserved in their present condition or restored to a condition that appears natural and does not detract from the appearance of the surrounding area. Restoration of water and land resources through mitigation actions may be necessary for some projects. If restoration is to be accomplished, the Contractor shall submit an appropriate restoration plan and receive base approval from 78 CEG/CEIE on the proposed mitigation procedures.

Reference Robin AFB Division 1 Specifications Section 01560 and Section 3G of this document for additional information.

CHAPTER 3 STRUCTURAL AND CIVIL ENGINEERING ELEMENTS



SECTION 3A STRUCTURAL REQUIREMENTS

3A-1 GENERAL STRUCTURAL REQUIREMENTS

3A-1.1 All structural design work necessary to construct a new facility, to repair, modify or demolish an existing facility shall be analyzed and designed to safely support all applicable loads and load combinations and to meet all serviceability requirements of these loads and shall comply with relevant Codes and Standards.

3A-1.2 Structural design shall conform to the requirements of all applicable UFCs.

3A-1.3 The structural designer of record may not delegate responsibility of structural design at Robins AFB, and must provide a complete design package including, but not limited to, calculations, specifications, plans, details, and design of systems or component parts of the structure in compliance with UFC 3-301-01. The structural designer may utilize a manufacturer as a design basis for design development. For specifics on pre-engineered metal building design refer to Section 1C.

3A-2 SPECIAL STRUCTURAL REQUIREMENTS

3A-2.1 Stability

Wind loads shall be analyzed and designed for a minimum exposure of Category “C” IAW ASCE/SEI 7-latest edition, Chapter 26.

3A-2.2 Risk Factor

Analysis and design shall be based on Risk Category “III” as described in ASCE/SEI 7-latest edition, unless otherwise instructed by the 78 CEG/CEN.

3A-2.3 Non-Standard Floor Loads

The designer shall review the project for floor-loading conditions not normally encountered, such as safes, industrial equipment, etc.

3A-2.4 Mezzanines/ Additional Floor

The project shall be designed for any special floor loading requirements planned for mezzanine or added floor level areas.

3A-2.5 Clearances

Minimum clearances shall be allowed in design and construction of walkways, roads, and accessories.

3A-2.6 Fly Ash in Concrete

If fly ash is used as a component of concrete (typically to meet green procurement requirements), only Class F fly-ash may be used. Other classes of fly ash are not allowed at Robins AFB. Quality guidance for fly ash in Portland Cement Concrete may be found at AASHTO M295 (ASTM C 618).

3A-3 FOUNDATIONS

3A-3.1 No foundation shall be constructed over existing or new water, sewer, steam, natural gas, chilled-water, industrial waste, communications, or foundation main lines. Exceptions may be granted on a case-by-case basis. This does not apply to laterals or service lines. Minimum cover shall be provided between bottom of concrete and top of utilities as required by this document, UFC, or other industry standards.

3A-3.2 The safety factor used for Overturning, Sliding, and Uplift shall be a minimum of 1.50.

3A-3.3 ANTENNAS AND OTHER EXTERIOR USER EQUIPMENT

3A-3.3.1 No antennas or other user equipment shall be mounted on the roof or walls unless the mountings have been specifically analyzed and designed and approved by the Structural Engineer in 78 CEG/CEN prior to the installation.

3A-3.3.2 Exceptions may be granted only for small items approved on a case-by-case basis by the Structural Engineer in 78 CEG/CEN. Request and approval must be completed in writing.

SECTION 3B CIVIL ENGINEERING AND SITE PLANNING

3B-1 PLAN REQUIREMENTS

All civil design or site work necessary to construct or modify any existing or new facility, infrastructure, roadway or other element or appurtenance, including all applicable calculations, shall be provided at each design submittal level.

3B-1.1 Location Plan (Scale 1"=400')

- 1) Facility or Project Location at Robins AFB
- 2) Site Access Route entering through the Commercial Gate (Gate 7) or an alternate gate if directed
- 3) Designated Construction Material Storage Area, which shall be secured and maintained throughout the Construction Contract

3B-1.2 Site Plan (Scale 1"=50' minimum)

- 1) Existing grades and contours using a (minimum) one foot contour interval
- 2) The facility location (or location of element being constructed) and orientation based on the Project Coordinate System: North American Datum (NAD) 1983; State Plane Georgia West FIPS 1002
- 3) Designated Construction Material Storage Area showing Construction Office Trailer (if applicable)
- 4) Project Construction Limits
- 5) Existing and Proposed Pavements, including:
 - a. Sidewalks and walkways
 - b. Parking lot striping
 - c. Road cuts
 - d. Curbs, gutters, culverts and pads sufficient to comply with stormwater and drainage requirements
 - e. Runways, taxiways, aprons, overruns, and shoulders
- 6) Bridges and fences
- 7) Existing natural site features, including:
 - a. Existing State Waters and Streams with any prescribed buffers
 - b. Designated Wetlands
 - c. Trees greater than three inches measured diameter at breast height (DBH)
- 8) Proposed changes to site elements, encroachment into vegetation, buffer or wetland areas or removal of specific trees or mature vegetation
- 9) Existing and proposed structures and utilities, including:
 - a. Existing industrial and sanitary wastewater piping, manholes, valves, and lift stations
 - b. Storm piping and structures, drainage ditches/swales, headwalls, and ponds
 - c. Gas distribution and service lines
 - d. Water lines and valves
 - e. Communication lines
 - f. Electrical lines
 - g. Cathodic protection cables and equipment
 - h. Heat service or steam lines
 - i. Chilled water lines
 - j. POL facilities, including pipelines, valves, etc.
 - k. Fire hydrant

- I. Groundwater monitoring wells locations
- 10) All civil and site elements shall be analyzed and designed for safety as well as long-term maintainability and serviceability

3B-2 SITE VISIT

A site visit shall be scheduled with the Contractor and Base Officials prior to the first formal plans submittal to review on-the-ground site conditions and the potential impact of proposed site changes and improvements.

3B-3 SITE INVESTIGATIONS

All site investigations shall be done during the design phase of the project. Site investigations including topographic survey, utility locate including potholing, and geotechnical/environmental investigations shall be accomplished and incorporated prior to the 60% (preliminary) design phase.

SECTION 3C WASTE WATER TREATMENT

3C-1 GENERAL INFORMATION

3C-1.1 A Design Analysis shall be completed for the projected industrial or functional wastewater discharge of any proposed project to include the following:

- A Site Plan showing all existing and proposed sewer lines
- Calculations, sewer profiles and related hydraulic information for proposed wastewater connections
- Plan shall be stamped by registered professional engineer from the State of Georgia

3C-1.2 An Operation and Maintenance Manual shall be provided by the Construction Contractor for all new wastewater pretreatment systems, lift stations or wastewater treatment facility systems.

3C-2 WASTEWATER TREATMENT SYSTEM

3C-2.1 The project shall be evaluated to verify the existing wastewater flow and available design capacity for treatment, including limitation of the existing systems that require wastewater pretreatment and segregation.

3C-2.2 The quantity and quality of wastewater discharged shall be evaluated to determine if it can be adequately handled by the existing Robins AFB wastewater treatment system.

3C-2.3 Adequate capacity shall be assessed for all downstream lift stations. Sewer flow characteristics shall be modeled for projects with high-volume (>50,000 gallons per day), or large-batch discharges (>5000 gallons).

3C-2.4 Proposed new process discharges of industrial wastewater that may affect the quality of the effluent shall be listed in the design narrative. An evaluation shall be prepared providing the strength and mass loading of the wastewater constituents, such as chemical oxygen demand, solids (including oil and grease), metals, nutrients and toxic pollutants, or any other chemical which could affect effluent quality.

3C-2.5 Any wastewater sludge or solids that may be accumulated as part of the project will be evaluated and methods for collection and removal of the accumulation shall be proposed. All efforts to incorporate recycling and reuse of wastewater shall be included.

3C-2.6 Any required changes or improvements in the existing treatment plants, pre-treatment systems, trunk mains, manholes, lift stations, fuel/oil-water separators, or storage and bypass restrictions will be identified and evaluated.

3C-3 WASTEWATER SYSTEM CONSTRUCTION

3C-3.1 All new lift stations shall be constructed using a duplex pump system, level controls, visible and audible alarms, and shall be connected to the Robins AFB SCADA system and include all appropriate appurtenances. Duplex pump system shall be Grundfos (or Flygt as alternative) manufactured pumps with MPE SC -1000 pump controllers. An additional valve pit, with a lockable metal hatch, shall be constructed outside of the wet-well to house isolation

valves, check valves, and air release valves. A manual transfer switch with camlock connections for emergency backup power shall be installed. \1\ Roam Technologies Model MTC7003ES2K4-BOY manual transfer switch is required; TEMP TAP/ESL-ITEM3640-0127 may be used as an alternative. \1\ Minimum 3-inch force main exiting the lift station. \1\ Primary level detection shall be MultiTrobe, supplemented by conventional floats as backup level detection. \1\

3C-3.2 Any structure that is built to surround the lift station will be secured. Doors will be locked; any vents or opening will be hardened and locked and will have an area of no more than 96 square inches. Any ladder on the exterior of the building shall have a minimum vertical clearance of 20 feet between the bottom rung and any appurtenance that could assist access by climbing.

3C-3.3 A nine (9) gauge, seven (7)-foot height chain link fence with three (3) barbed wire outriggers shall be constructed around the lift station and secured with a tamper-resistant lock. Vegetation shall be cleared from the area around the perimeter fence sufficient to avoid aid in climbing the fence or concealing an object near the fence. The area shall be illuminated to provide one (1) footcandle of light within a 50-foot radius of the lift station.

3C-3.4 The SCADA system connection shall be accomplished with a Remote Transmitting Unit (RTU) provided at each lift station that is compatible and capable of interfacing with the Robins AFB SCADA system manufactured by minsait ACS, Inc. of Norcross, Georgia. The RTU shall have battery back-up radio controls and transmit the following points to the central base monitoring system: pump status, water levels and power status for lift station. Contact the Electric Shop for information at 478-327-8945.

3C-3.5 Existing sewer main lines located underneath any proposed new facility shall be removed and relocated.

3C-3.6 No interruption of sewage flow shall occur during construction.

3C-3.7 \1\ Contractor shall camera and clean sanitary lines 100 feet ,or main line if less than 100 feet, from the existing fixtures before demolition for restroom renovations. Contractor shall also camera sanitary lines 100 feet, or main line if less than 100 feet, after demolition and before installing new fixtures to ensure no debris entered during demolition. \1\

SECTION 3D SUBSURFACE INVESTIGATIONS

3D-1 GENERAL REQUIREMENTS

3D-1.1 Each project that requires design of foundations and earth structures for new or existing facility at Robins AFB shall include one or more registered professional engineer(s) with experience in the principles of engineering associated with soil mechanics. Foundations and earth structures shall be designed to meet the requirements of UFC 3-220-01 Geotechnical Engineering (latest edition).

3D-1.2 Site data provided as part of the general bidding package is based on best available record drawings and may contain inaccuracies. The contractor shall be responsible for identifying all utilities and underground structures for each project. Additional potholing and/or GPR required to identify all underground elements not captured in the proposal shall be performed at no additional cost to the Government.

3D-2 DIGGING AND EXCAVATION REQUIREMENTS

3D-2.1 A Dig Permit is required for any land disturbance or earth movement.

3D-2.1.1 Contractor shall notify the AF Project Manager/Construction Manager 21 days prior to needing a dig permit. The process takes 15 business days from the date the completed submittal request is entered.

3D-2.1.2 The Georgia 811 dig permit clearance # and date shall be provided. Provide a copy of the GA811 clearance to the AF PM/CM.

3D-2.1.3 The Contractor shall clearly mark the area outlined in white paint and flags prior to requesting utility locate. Maintenance of markings and area are the responsibility of the contractor. Contractor shall be responsible for renewing markings at least once every 30 days.

3D-2.1.4 Drawings are required that accurately show all buried structures and utility lines and the full extent of digging and excavation including the width, depth, and length of any trench or hole.

3D-2.1.5 Utility personnel from 78 CEG will meet with the Contractor at the site and locate the underground utility lines and buried structures that may be affected.

3D-2.2 The following special provisions apply to all Dig Permits:

3D-2.2.1 No digging or excavation shall be done after 1600 hours on weekdays or anytime on weekends unless prior approval is obtained.

3D-2.2.2 Excavation, trenching or backfilling within three (3) feet on either side of buried structures or utility lines must be completed by hand digging. Do not use motorized equipment within these parameters. Only open these trenches when replacement work is ready to proceed.

3D-2.2.3 Trenches should be backfilled and stabilized as required by the drawings or specifications as quickly as possible after approval by the technical representative.

3D-2.2.4 The Contractor is responsible for any damage to underground structures and

utility lines identified on the drawings and as identified and marked in the field as a result of obtaining a Dig Permit. If any underground utility is damaged, notify the technical representative immediately.

SECTION 3E TERMITE PRE-TREATMENT

3E-1 GENERAL REQUIREMENTS

Provide termite pre-treatment for all exposed soil locations around the interior and exterior sides of slabs and footings, excluding sidewalks.

3E-2 SAFETY REQUIREMENTS FOR USE AND HANDLING

3E-2.1 Deliver termiticide material to the site in the original unopened containers bearing legible labels indicating the EPA registration number and manufacturer's registered uses. All other materials, to be used on site for the purpose of termite control, shall be delivered in new or otherwise good condition as supplied by the manufacturer or formulator.

3E-2.2 Inspect termiticides upon arrival at the job site for conformity to type and quality. Each label shall bear evidence of registration under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended or under appropriate regulations of the host county. Other materials shall be inspected for conformance with specified requirements. Any unacceptable materials shall be removed from the job site.

3E-2.3 Handle termiticides in accordance with manufacturer's warnings and precautions and prevent contamination by dirt, water, and organic material.

3E-2.4 Formulate, treat, and dispose of termiticides and their containers in accordance with label directions.

3E-2.5 Ensure that proper protective clothing and equipment are worn and used during all phases of termiticide application.

3E-2.6 Secure termiticides, other pesticides and related materials under lock and key when unattended.

3E-2.7 Dispose of used pesticide containers off Government property.

SECTION 3F LAWN SPRINKLER SYSTEMS

3F-1 GENERAL REQUIREMENTS

The following guidelines apply when a permanent underground sprinkler irrigation system is required to irrigate turf and planted areas associated with new facilities or projects.

Note that irrigation systems are no longer maintained by CES. The organization occupying the facility and requesting irrigation will be responsible for contracting maintenance services for the system.

3F-1.1 The water supply for the sprinkler system shall be the Base potable water system.

3F-1.2 The design shall concentrate on ease of maintenance, economy of water usage and durability of the working parts.

3F-1.3 Adequate pressure shall be provided to all sprinkler heads but water pressure required by the facility shall not be adversely affected.

3F-2 DESIGN REQUIREMENTS

3F-2.1 Minimum Water Pressure

The minimum design water pressure shall be 50 psi at connection to main backflow prevention device. All systems shall be automatic and shall be installed with a rain sensor and rain shut off valve.

3F-2.2 Component Design Basis

3F-2.2.1 Sprinkler Systems

Utilize Hunter I-20 Stainless Steel, Hunter I-25 Stainless Steel, Hunter Pop-Up Mist Heads 10A nozzle, 12A nozzle, 15A nozzle, and 17A nozzle spraying capabilities; and Hunter Spray Heads in the following specifications: PS0410A, PS0412A, PS0415A, or PS0417A, Hunter SS nozzle, Hunter PS045SS Spray Head, Hunter SRS 12 spray head spraying capabilities, whichever is applicable, and Irritrol Drip Irrigation Products or equivalent.

3F-2.2.2 Emitter Heads

3F-2.2.2.1 Use self-cleaning emitter heads with pressure compensating diaphragms and one or six self-piercing barbed outlets.

3F-2.2.2.2 Each shall be capable of emitting from ¼ to 2 gallons per hour flow.

3F-2.2.2.3 Emitter bodies shall be ultraviolet stabilized, algae and heat resistant plastic construction.

3F-2.2.3 Remote Control Valves

These shall be Hunter HPV series, Hunter ICV with filter sentry in the applicable size; Rain Bird PGA and PEB series in the applicable size; or Weathermatic in the applicable size

3F-2.2.4 Automatic Controllers

Use Hunter ICC Commercial Controller 8 or equivalent.

3F-2.2.5 Control Wire

3F-2.2.5.1 Use 12-gauge single or multi-strand, whichever is applicable, and UF type designed for direct burial.

3F-2.2.5.2 Wires shall be buried beside pipe in same trench and shall be attached to the piping in increments of every 15-20 feet.

3F-2.2.5.3 Rigid conduit shall be provided where wires run under paving.

3F-2.2.5.4 Each zone shall use different color wire to facilitate zone identification; zone wire color shall be continuous for the entire length of the circuit.

3F-2.2.5.5 One control circuit shall be provided for each zone and a circuit to control sprinkler system.

3F-2.2.5.6 A minimum loop of 24 inches shall be left at each valve, at each splice, at each change in direction, at every 500 feet of straight run and at each controller for expansion and servicing.

3F-2.2.5.7 Splices and connections shall be watertight and leak-proof and shall be indicated on the "as built" plan.

3F-2.2.5.8 Wire shall be within a protective sleeve for bridge or water crossings, and where other conditions make it necessary.

3F-2.2.6 Pipe and Fittings

3F-2.2.6.1 Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 (solvent welded) or Schedule 80 (threaded), as applicable.

3F-2.2.6.2 All joints shall be primed with a purple colored primer (for inspection purposes) and cleaned before final assembly.

3F-2.2.6.3 All above ground pipe shall be coated galvanized steel.

3F-2.2.6.4 Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40.

3F-2.2.6.5 Threaded type fittings shall conform to requirements of ASTM D2464, Schedule 80.

3F-2.2.7 Backflow Prevention Equipment

3F-2.2.7.1 This equipment shall conform to the requirements of ASSE 1015 and shall be constructed of brass with two check valves, field test cocks and two resilient seat full port ball valves.

3F-2.2.7.2 Double check valve and pressure reducing assemblies in the appropriate size

shall be used, placed above ground on a concrete pad, 12 to 36 inches above grade and covered by an insulated enclosure.

3F-2.2.7.3 Include freeze protection.

3F-2.2.7.4 Test in accordance with Backflow Device Test Report, the Double Check Valve Assembly portion (obtained from the Base Civil Engineer Plumbing Shop).

3F-2.2.8 Pressure Regulating Master Valve

3F-2.2.8.1 Shall be automatic mechanical self-cleaning; self-purging control system and have an adjustable pressure setting operated by a solenoid on alternating current with 0.70 amperes at 24 volts.

3F-2.2.8.2 The valve shall operate at 150 psi working pressure and pilot range from 10 to 125 psi.

3F-2.2.8.3 It shall close slowly and be free of chatter in each diaphragm position

3F-2.2.8.4 Have a manual flow stem to adjust closing speed and internal flushing

3F-2.2.8.5 Have one inlet tapping capable of being installed as straight pattern valve

3F-2.2.8.6 The body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system.

3F-2.2.9 Extra Stock

The following items shall be provided to the government at the time of acceptance of the system.

- 1) Two sprinkler heads of each size and type
- 2) Two valve keys for operating manual valves
- 3) Two wrenches for removing and installing each type of head
- 4) Two quick coupler keys and hose swivels
- 5) Four irrigation controller housing keys.

3F-3 INSTALLATION

The irrigation system design shall meet the manufacturer's requirements and meet the following standards:

3F-3.1 Establishing Ground Cover

In turf areas where grass has not yet been established, sprinklers shall be initially installed on risers above grade level. When grass is established, the Contractor shall lower sprinkler head to their permanent positions flush with the finished grade if the system will be installed permanently. Alternately, if the system is intended to be temporary, remove the system completely when ground cover is established.

3F-3.2 Depth of System

Minimum depth of cover shall be at least 24" for pressure main piping and 12" for lateral discharge piping, or at a sufficient depth to accommodate valves and other equipment, whichever is greater.

3F-4 POST CONSTRUCTION REQUIREMENTS

3F-4.1 Warranty

3F-4.1.1 The Contractor shall provide a one year warranty after acceptance by the government.

3F-4.1.2 At the end of the one-year maintenance period, the Contractor shall prove that system is fully functional and free from all defects, and shall schedule a 100% walk-thru inspection with the government.

3F-4.1.3 The Contractor shall continue to maintain the system, at no additional cost to the Government, until all defects found at the one-year inspection are corrected and repaired.

3F-4.2 As-Builts

The Contractor shall install laminated (40-mil plastic) "as-built" drawings in the building mechanical room indicating all underground lines and the location of heads and valves.

3F-4.3 Operating Manuals

3F-4.3.1 Operating manuals and electronic copies of the complete system shall be provided and include the following information:

3F-4.3.1.1 Manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features, including system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers

3F-4.3.1.2 Piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule

3F-4.3.1.3 Step-by-step procedures required for system startup, operation and shutdown.

3F-4.3.1.4 Routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides

STRUCTURAL AND CIVIL ENGINEERING ELEMENTS

RAFB BFS 2026

SECTION 3G CIVIL STORMWATER

3G-1 STORMWATER MANAGEMENT FOR FEDERAL FACILITIES - SECTION 438 OF THE ENERGY INDEPENDENCE AND SECURITY ACT (EISA)

Section 438 of the Energy Independence and Security Act (EISA) requires federal agencies to reduce stormwater runoff from development and renovation projects that create more than 5,000 square feet of new impervious area. The goal is to protect water sources and restore pre-development hydrology using a variety of stormwater management practices known as "Low Impact Development". Guidelines can be found at UFC 3-210-10, Low Impact Development. \1\ The project shall comply and be design using "Better Site Design Practices" as identified in the Georgia Stormwater Management Manual. \1\

3G-2 STORMWATER MANAGEMENT DURING CONSTRUCTION

3G-2.1 Land Disturbance Guidelines

All land disturbances shall be conducted in accordance with the Georgia Erosion and Sediment Control Act, the Rules of the State of Georgia, and if applicable, the Georgia General Permit Authorization to Discharge Under the NPDES Stormwater Discharges Associated with Construction Activity (a.k.a., NPDES General Permit).

3G-2.2 Construction Requirements for Sites Disturbing Less Than One Acre (<1 AC)

All minor construction projects involving less than one acre of land disturbance shall include design, installation, and maintenance of appropriate BMPs specific to the site to minimize erosion and sedimentation [ETL 14-1 6.3.1.2]. Minimum standard BMPs, include, but are not limited to: inlet protection, reinforced silt fence, sediment storage, \1\ use sediment bag to filter pumped stormwater before discharge \1\, provisions to minimize tracking onto roadways such as construction entrances or street sweeping, appropriate material storage and spill response equipment and controls, appropriate waste disposal practices, a concrete washout area and temporary and permanent stabilization. No documentation or permit submittals to off-base agencies are required. For more information on BMPs, contact the 78 CEG/CEIEC Stormwater Program Manager.

3G-2.3 Construction Requirements for Projects Disturbing Greater Than (or Equal to) One Acre (≥ 1 AC)

Projects that disturb one acre or greater must comply with NPDES Permits. There are currently three general NPDES Permits for construction projects in Georgia:

- GAR100001 for Stand Alone Projects
- GAR100002 for Infrastructure Projects
- GAR100003 for Common Developments

3G-2.4 Notification of Changes – National Pollutant Discharge Elimination System (NPDES) Wastewater Permit

The Civil Engineering Environmental Stormwater Program Manager shall be notified of any of the following planned changes:

3G-2.4.1 Physical alterations or additions to any facility that meet the following criteria:

3G-2.4.1.1 Any change that may be identified as a new discharge source IAW 40 CFR 122.29(b)

3G-2.4.1.2 Any change that could significantly alter the nature of or increase the quantity of pollutants discharged. This notification applies to pollutants that are NOT subject to effluent limitations in the permit or to notification requirements under 40 CFR 122.42(a)(1)

3G-2.4.1.3 Any change that may result in a significant modification to the Government's sludge use or disposal practices

3G-2.4.1.4 Changes to any facility or activity that may result in noncompliance with the NPDES Industrial, Municipal, or Construction Permits.

3G-2.4.1.5 Expansion or increase in production capacity

3G-2.4.1.6 Installation of new equipment or modification of existing processes that could increase the quantity of pollutants discharged or result in the discharge of pollutants that were not being discharged prior to the planned change

3G-2.5 Best Management Practices (BMPs)

3G-2.5.1 The Contractor shall not allow any debris to get into the storm drainage system. Chemicals, fuels, oils, lubricants, greases, or scrap metal stored on construction sites shall have containment and/or cover to prevent stormwater contact. No materials shall be discharged into a drain, ditch or ground surface that could result in pollution of stormwater runoff. Minimum control measures shall be implemented to prevent degradation of water quality downstream resulting from any construction activity. Construction activities such as concrete truck washing, cleaning of painting equipment, equipment fueling, dust control, dewatering, and general site housekeeping will require implementation of specific best management practices (BMP) to prevent stormwater contamination.

3G-2.5.2 The Contractor shall implement procedures and practices to eliminate or minimize stormwater pollution during construction activities in accordance with the Manual for Erosion and Sediment Control in Georgia (latest Edition). For information on BMPs contact the 78 CEG/CEIEC Stormwater Manager.

3G-2.6 Erosion, Sedimentation and Pollution Control (ES&PC) Plan

The NPDES Permits require the permittee to have an Erosion, Sedimentation and Pollution Control (ES&PC) Plan. Plans for each type of permit shall provide permanent stabilization and include Best Management Practices (BMPs) designed and implemented in accordance with design specifications contained within the "Manual for Erosion and Sediment Control in Georgia."

(a.k.a. GSWCC because the Georgia Soil and Water Conservation Commission prepares the document))[NPDES General Permit I.B.1 and IV.D; ETL 14-1 6.1.2]. NPDES General Permit IV]

3G-2.6.1 Robins AFB has developed an ES&PC Plan template recommended for use by Contractors performing land disturbance. The current version can be obtained from the 78 CEG/CEIEC Water Quality Program Manager.

3G-2.6.2 The Contractor shall submit an ES&PC Plan signed and stamped by a Georgia Professional Engineer with Level II Design Professional Certification from the Georgia Soil and Water Conservation Commission to 78 CEG/CEIE for review and concurrence as part of the design review process.

3G-2.7 Notice of Intent (NOI)

3G-2.7.1 The NPDES Permit requires the completion of an NOI along with the ES&PC Plan. Both the NOI and the ES&PC Plan must have 78 CEG/CEIE concurrence prior to submitting the NOI to GA EPD.

3G-2.7.2 The Contractor will create an account in the Georgia EPD Online System (GEOS) for Permitting, Compliance and Facility Information. The 78 CEG/CEIE Stormwater Manager shall be listed as "Preparer(s)" under the GEOS account in order to coordinate review and approval with GA EPD.

3G-2.7.3 After 78 CEG/CEIE concurrence with the ES&PC Plan, and at least fourteen (14) days prior to the commencement of land disturbance activities, the Contractor shall submit the NOI, associated fees and a return receipt request to the GA Environmental Protection Division (EPD) via the GEOS account.

3G-2.7.4 After 78 CEG/CEIE has concurred with the ES&PC Plan, the Contractor shall coordinate with 78 CEG/CEIE for submittal of fees to Houston County, who serves as the Local Issuing Authority (LIA).

3G-2.8 Inspections and Reports

The Contractor shall conduct inspections and complete inspection reports in accordance with the NPDES General Permit and retain the reports with the ES&PC Plan.

3G-2.8.1 Rainfall Event Inspections

3G-2.8.1.1 Inspections of the site disturbed areas, material storage areas and structural control measures are required to be conducted within 24 hours of the end of a storm event that is 0.5 inches or greater.

3G-2.8.1.2 The Contractor shall submit copies of Rainfall Event Inspection Checklist reports to Robins AFB 78 CEG/CEIE for review and approval by the 25th day of the month following the Rainfall Event Inspection.

3G-2.8.2 Sample Analysis Reports

3G-2.8.2.1 The Contractor shall conduct sampling for two rainfall events IAW NPDES General Permit guidance. Sample Analysis Reports shall be completed and retained along with the ES&PC Plan.

3G-2.8.2.2 The Sample Analysis Reports and a Return Receipt Request shall be sent to GA EPD by the 15th of the month following the sample collection date.

3G-2.8.2.3 The Sample Analysis Reports and postmarked Return Receipt shall be submitted to 78 CEG/CEIE for review and approval by the 25th day of the month following the sample collection date (in conjunction with Rainfall Event Inspection Checklist).

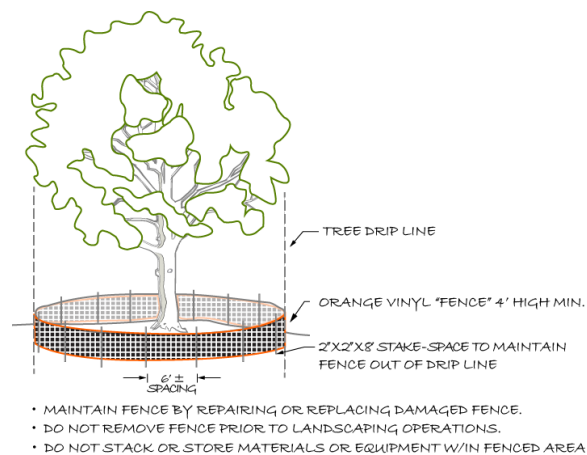
3G-2.9 Tree Protection and Landscape Maintenance**3G-2.9.1 Tree Protection**

Tree removal shall be approved by 78 CEG/CEIEC. Every tree that is approved for removal must be replaced provided by the GIP. Reference section 2C-2 for GIP instructions on protocol for tree replacements.

- 3G-2.9.1.1** The Contractor shall be responsible for any damage resulting to trees that are to remain on site. In general, trees shall be protected from either excavation or filling within the root zone closer than the normal drip line of the tree. No ropes, cables, or guys shall be fastened to, or attached to any existing trees for anchorage unless specifically authorized by the Contracting Officer (CO). The Contractor shall not allow vehicles to be routinely parked within the drip zone of trees that are designated for protection, nor will equipment be staged under these trees.

Figure 3G-1

- 3G-2.9.1.2** Trees marked for removal on approved plans and drawings shall have existing identification tags removed (if present) and forwarded to the CO. Except in areas marked on the plans to be cleared, no trees or shrubs shall be defaced, injured, destroyed, removed, or cut without authority from the CO and 78 CEG/CEIEC Natural Resources Program Manager. Where, in the opinion of the CO, trees may be defaced, bruised, injured, or otherwise damaged by the



Contractor's equipment, blasting, dumping or other operations, the CO may direct the Contractor to adequately protect such trees by placing boards, planks, plastic fence, or poles around them. When directed by the CO, barriers shall be constructed to protect trees from earthwork operations.

- 3G-2.9.1.3** In cases where construction necessitates the removal of a large number of trees, 78 CEG/CEIEC shall first evaluate whether or not a logging contract is warranted (to be arranged by CEIEC). Note: IAW AFI 32-7064, dated 17 March 2022, it is inappropriate to give away forest resources which have significant value.

3G-2.9.2 Landscape Plans

The Contractor shall submit all Landscape Plans to the 78 CEG/CEIEC Natural Resources Program Manager for review and approval before implementation. Plans shall emphasize the use of native plant and tree species whenever possible and shall include a one-year (minimum) pro-active watering and maintenance plan, and long term provisions for conserving water use and minimizing the need for pesticide and herbicide use.

3G-2.9.3 Tree Selection Guidance**3G-2.9.3.1** Provide tree shading or shade canopy for parking areas.**3G-2.9.3.2** Plant trees as windbreaks on the northwest side of buildings.**3G-2.9.3.3** Use trees that don't produce messy fruit or grow too fast in high-profile locations.**3G-2.9.3.4** Use indigenous or well-adapted plant material.**3G-2.9.4** Shrubs and Groundcover Selection Guidelines**3G-2.9.4.1** Limit planting to areas where long-term maintenance is planned and established at the time of planting.**3G-2.9.4.2** Select plant materials that have a maximum mature size that is no larger than the planting areas provides.**3G-2.9.4.3** Do not plant shrubs that must be (excessively) pruned on a recurring basis.**3G-2.9.5** Restoration of Landscape Damage

Trees are a Legacy Resource

Surface drainage from cuts and fills within the construction limits and from borrow and waste disposal areas, shall be held in suitable sedimentation ponds or shall be graded to control erosion. Temporary erosion and sediment control measures such as berms, dikes, drains, or sedimentation basins, shall be provided and maintained until permanent drainage and erosion control measures are completed and operating. The area of bare soil exposed by construction operations at any time shall be held to a minimum. Stream crossings by fording with equipment shall be limited to control turbidity. Fills and waste areas shall be constructed by select placement to eliminate adjacent streams.

3G-2.9.6 Soil Stabilization

Stabilization of permanent all slopes shall be accomplished with sod as soon as possible to establish vegetation. Pay special attention to the timing of project completion and soil conditions to ensure permanent vegetation can be established. Sod shall be irrigated by contractor until 100% established.

Table 3G-1

Groundcover for Permanent Soil Stabilization				
Method	Timeframe	Type of Grass Recommended	Allowed Grade	Application
Sod	March thru August	Bermuda or Centipede	<40%	Lay in staggered pattern. Backfill edges.
	September thru February	Rye may be used as Temporary Groundcover		

3G-2.10 Project Closure

3G-2.10.1 Notice of Termination (NOT)

After final stabilization has been achieved on the site, as defined by the NPDES General Permit [NPDES General Permit I.B, see definition for "Final Stabilization"], and the Contractor has received approval from 78 CEG/CEIE, the Contractor shall submit a Notice of Termination (NOT) and Return Receipt Request to GA EPD via the GEOS account. The NOT submittal shall include a copy of the current NOI and all sampling/inspection reports.

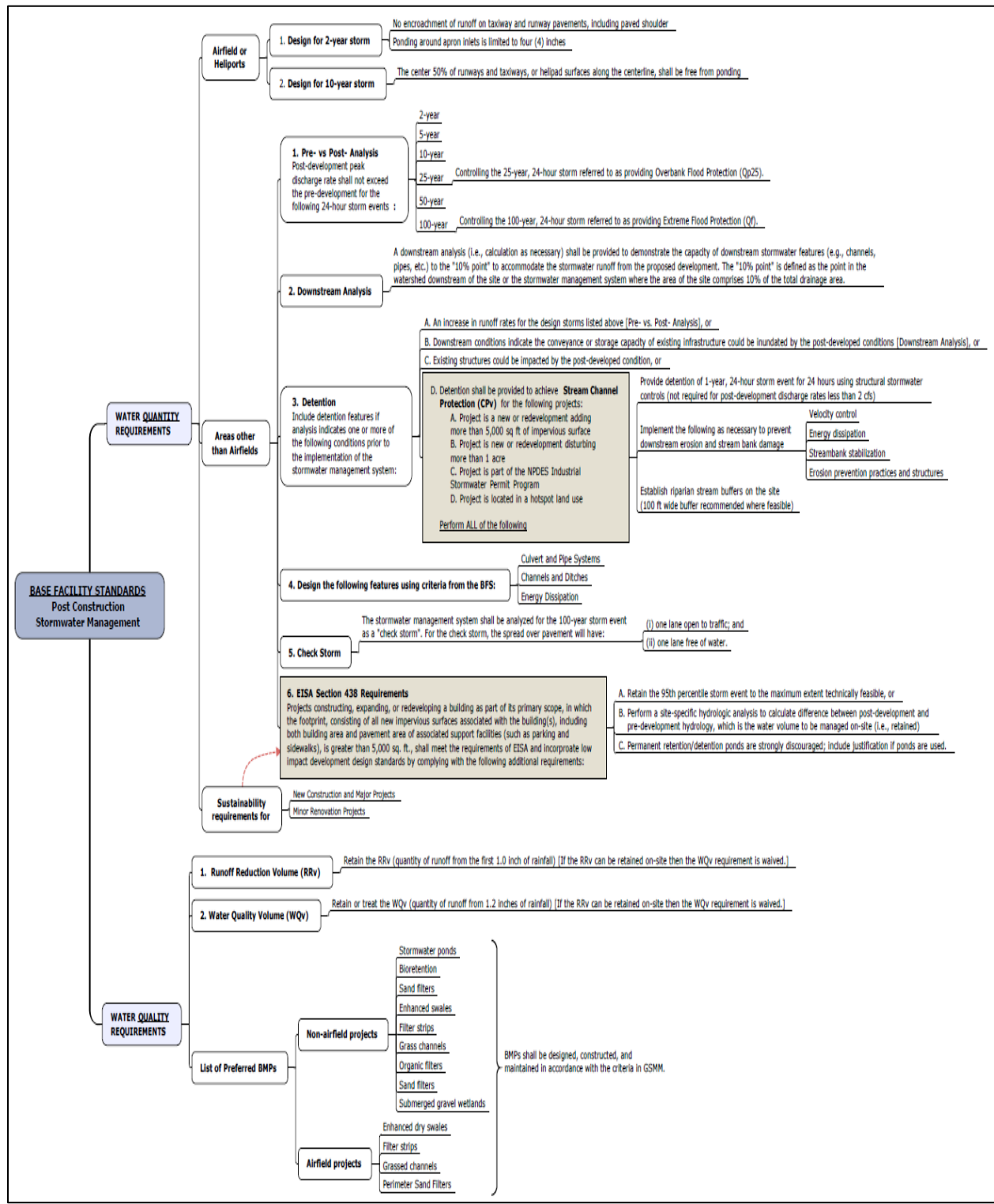
3G-2.10.2 Document Retention

All records required by NPDES shall be maintained for a period of three (3) years from the date the NOT is submitted. Copies of these documents shall be provided to 78 CEG/CEIEC Water Quality Program Manager.

3G-3 POST CONSTRUCTION STORMWATER MANAGEMENT

The Contractor shall design and implement control measures for stormwater runoff from new development and redevelopment projects to meet appropriate water quality and quantity requirements under the post construction condition. The work shall be accomplished in accordance with the: Stormwater Local Design Manual for Houston County, Georgia (LDM); Georgia Stormwater Management Manual (GSMM); Section 438 of the 2007 Energy Independence and Security Act (EISA); and UFC 3-210-10, Low Impact Development Manual. A Post Construction Stormwater Flow Chart is shown in Figure 2J-2.

Figure 3G-2 POST CONSTRUCTION STORMWATER FLOW CHART



3G-3.1 Water Quality Requirements

All projects shall comply with water quality requirements. Water quality requirements shall be accomplished through runoff reduction, water quality treatment or a combination of the two. [GSMM 2.2.4.1 ¶1]

3G-3.1.1 Runoff Reduction Volume (RRv)

Retain the first 1.0 inch of rainfall on the site to the maximum extent practical. This quantity of runoff is defined as the RRv, calculated as the runoff generated by 1.0 inch of rainfall. If the RRv can be retained on-site, the water quality treatment volume (WQv) requirement, described below, may be waived. If the entire RRv cannot be retained on-site, the remaining runoff from the 1.2-inch rainfall event must be treated in accordance with the Water Quality Volume (WQv) requirement. [GSMM 2.2.2.2 Standard #3; GSMM Table 2.2.3-1; GSMM 2.2.4.1 ¶2-3]

3G-3.1.2 Water Quality Volume (WQv)

Retain or treat the runoff from 85% of storms that occur in an average year to remove at least 80% of calculated average annual post-development Total Suspended Solids (TSS) loading from the site. This quantity of runoff is defined as the WQv, calculated as the runoff generated by 1.2 inches of rainfall. If the RRv can be retained on-site, the WQv requirement may be waived. [GSMM 2.2.2.2 Standard #4; GSMM Table 2.2.3-1; GSMM 2.2.4.1 ¶4-5]

3G-3.1.3 Preferred Best Management Practices (BMPs)

Preferred Best Management Practices (BMPs)	
NON-AIRFIELD PROJECTS	
Bioretention	Organic filters
Enhanced swales	Sand filters
Filter strips	Stormwater ponds
Grass channels	Submerged gravel wetlands
AIRFIELD PROJECTS	
Enhanced dry swales	Grassed channels
Filter strips	Perimeter sand filters

3G-3.2 Water Quantity Requirements

All projects shall comply with applicable design requirements, based on land use type or project area as follows:

3G-3.2.1 Airfields and Heliports Projects [FAA AC 2-2.4.1]

3G-3.2.1.1 Two-year storm: No encroachment of runoff on taxiway and runway pavements (include paved shoulder) is permitted and ponding around apron inlets is limited to four (4) inches. [FAA AC 2-2.4.1]

3G-3.2.1.2 Ten-year storm: No ponding shall be allowed in the center 50% of runways and taxiways, or along the centerline of helipad surfaces. [FAA AC 2-2.5]

3G-3.2.2 Areas other than Airfields [FAA AC 2-2.4.3 and 2-2.5]

3G-3.2.2.1 Pre- vs. Post- Analysis: Post-development discharge rates shall not exceed pre-developed discharge rates for the two (2)-, five (5)-, 10-, 25-, 50- and 100-year, 24-hour storm events. [LDM 2.1.1 and 2.1.2]

3G-3.2.2.2 Downstream Analysis: A downstream analysis (i.e., calculations as necessary) shall be provided to demonstrate the capacity of downstream stormwater features (e.g., channels, pipes, etc.) to the “10% point” to accommodate the stormwater runoff from the proposed development. [LDM 6.5; GSMM 2.2.2.2 Standard #8; GSMM 3.1.9; GSMM 3.19.2]

3G-3.2.2.3 Detention: Detention shall be required when analysis indicates a potentially adverse impact from the project without the implementation of a stormwater management system. Potentially adverse impacts include:

- An increase in runoff rates for the design storms being analyzed [Pre- vs. Post- Analysis]
- Downstream infrastructure that could be inundated by the post-developed conditions based on the analysis described [Downstream Analysis]
- Existing structures that could be impacted by the post-developed condition [LDM 2.1.1]

3G-3.2.2.4 Stream Channel Protection (CPv) [GSMM 2.2.2.2.Standard #5]: These guidelines shall be followed in the following circumstances:

- Project is new or redevelopment that includes the creation or addition of 5,000 square feet or greater of new impervious surface area.
- Project is new or redevelopment where the area disturbed exceeds one (1) acre.
- Project is included in the NPDES Industrial Stormwater Permit Program because it is a commercial or industrial, new or redevelopment project, regardless of size, with a Standard Industrial Classification (SIC) code that is listed in Appendix D of the NPDES Industrial Stormwater General Permits. [GSMM 2.2.2.1(3)]:
- Project is located at a “Hot Spot” where the “land use or activity on the site produces higher concentrations of trace metals, hydrocarbons or other priority pollutants than normally found in stormwater runoff.”
-

3G-3.2.2.5 General Design Guidance:

Culvert and Pipe Design	
Roadway or Use Classification	Design Storm
Bridges	100-Year
Major Arterials, Emergency Evacuation Routes, Roads with No Other Outlet	100- Year
Secondary or Collector Roadways	50-Year
Minor Roadways	25-Year
Parking Lots, Material Storage, Landscape Areas	10-Year

Flooding Depths for Inlets in a Closed Pipe System	
Roadways Classification or Use	Flooding Depth Allowed
Major Arterials or Emergency Evacuation Routes	8-ft Maximum Gutter Spread
Secondary or Collector Roadways	8-ft Maximum Gutter Spread
Roads with No Other Outlets	One Lane Width Open
Minor Roadways	8-ft Lane Width Open
Parking Lots	0.2-ft Maximum Depth
Detention Areas utilized for other purposes (such as parking lot detention)	1.5-ft Maximum Depth
Material Storage Areas or Landscape Areas Used by Public WITH flood warning sign	2.0-ft Maximum Depth

**Note that the flooding depth for parking lots has been adjusted by Robins AFB to be more stringent than that of the LDM criterion.*

3G-3.3 Allowable Discharges

3G-3.3.1 The following discharges are allowable into the storm management system:

- Air conditioning condensation
- Crawl space pump drainage
- Diverted stream flows
- Firefighting activity outflow
- Foundation or footing drainage (not including active groundwater dewatering systems)
- Groundwater infiltration to storm drains
- Landscape irrigation or lawn watering
- Natural riparian habitat or wetland flows
- Other non-polluted water sources, rising groundwater, springs
- Swimming pool discharge (if chlorination is less than one part per million chlorine)
- Uncontaminated pumped ground water
- Water line flushing or other potable water outflow

3G-3.3.2 Discharges necessary to protect public health and safety are allowable when specified in writing by 78 CEG/CEIEC Water Program Manager.

3G-3.3.3 Dye testing is an allowable discharge with written notification and approval prior to the time of the test from 78 CEG/CEIEC Water Program Manager.

3G-3.3.4 Any non-stormwater discharge that has been permitted under a National Pollution Discharge Elimination System (NPDES) permit, waiver or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency (EPA), may be discharged if the discharger is in full compliance with all requirements and written approval has been granted for this action.

3G-3.4 Prohibited Activities**3G-3.4.1 Illegal Discharges**

The Contractor shall not discharge or cause to be discharged into the municipal storm drain system or watercourses any materials, including but not limited to pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than stormwater.

3G-3.4.2 Illicit Connections

The construction, use, maintenance, or continued existence of illicit connections to the storm drain system is prohibited, including the following:

3G-3.4.2.1 (Without limitation) illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

3G-3.4.2.2 Installing connections conveying non-stormwater discharges to the stormwater conveyance system or allowing such a connection to continue.

3G-3.4.3 Spills

The Contractor shall be responsible for containment of all spills, including but not limited to the chemicals, fuels, oils, grease, bituminous materials, waste washings, herbicides, cement drainage, or any other hazardous materials, including broken fluorescent or HID lamps and tubes.

3G-3.4.3.1 The Contractor shall maintain appropriate and adequate cleanup equipment and materials onsite for containment of potential spills.

3G-3.4.3.2 Immediately report all spills to the Base Fire Department, 778 CES/CEX, and emergency number 911 (478-222-2900). Report all emergency information, including name, telephone number, location of spill, and type and amount of material spilled.

3G-3.4.3.3 Notify the Project/ Construction Manager of the spill immediately following initial reporting to the Fire Department and 911 (478-222-2900).

3G-3.4.3.4 The Contractor is responsible for the cleanup of material(s) spilled as well as any soil, grass, etc. that has absorbed spill materials.

3G-3.4.3.5 Ensure complete and thorough clean-up of materials spilled by testing water and/or soil (full analytical tests are required).

3G-3.4.3.6 No spill residue shall be transported off Robins AFB without specific approval from the CO.

3G-3.4.3.7 Spills involving large quantities and/or requiring special protective clothing and/or breathing devices to facilitate clean up may require action by the Base Spill Response Team. When the Base Spill Response Team is utilized, the Contractor shall provide support, as appropriate, for containment and clean-up of spills. The Contractor is responsible for all fees associated with the Base Spill

Response Team.

3G-3.4.3.8 Under no circumstance should anyone attempt to handle a spill situation that they have not been trained to handle.

3G-3.5 POST-CONSTRUCTION STORMWATER MANAGEMENT PLAN

A Stormwater Management Site Plan shall be submitted as part of the project design documents for the 60 percent design package (i.e., intermediate design), then coordinated by the Contractor during construction to document that appropriate and effective control measures are included during the project. The Plan shall be organized with the sections and contents as outlined in the Checklist in Table 2J.7 below.

STORMWATER MANAGEMENT PLAN CHECKLIST			
SECTION	SECTION TITLE	CONTENTS	REFERENCE
1	Certification	"I, (Name of Professional), a Registered (Professional Engineer/Landscape Architect/Land Surveyor) in the State of Georgia, hereby certify that the grading and drainage plans for the project known as (Project Name), lying in Land Lot (XXX), of the (XX) District, Houston County, Georgia, have been prepared under my supervision, and, state that in my opinion, the construction of said project will not produce storm drainage conditions that will cause damage or adversely affect the surrounding properties. This (day) day of (Month), (Year)."	LDM 6.1
2	Project Description	☐ Narrative summarizing the project & briefly explaining each project aspect. Include official project name, contracting mechanism, Base contact person, etc.	N/A
3	Natural Resources Inventory	☐ Narrative, maps and figures as needed to describe natural drainage divides, natural drainage features (e.g., swales, basins, depressional areas), wetlands, water bodies, floodplains, aquatic buffers, soils, erodible soils, steep slopes (i.e., areas with slopes greater than 15%), groundwater recharge areas, trees and other existing vegetation, and high quality habitat areas.	GSMM 2.4.2.6(1)
4	Existing Conditions Hydrologic Analysis & Narrative	☐ Existing Conditions Map depicting ((but not limited to) surface water features, topography, (sub-basin) drainage area delineation, direction of flow and exits from the site, existing stormwater features including channels, pipes, inlets, etc. ☐ Existing Conditions Table including acreage, soil type (including infiltration	LDM 2.1.1, 6.2 GSMM 2.4.2.6(2)

		rates of existing soils), land cover, sub-basin hydrologic data (e.g., peak runoff rates, total runoff volumes for required design storms), upstream drainage area hydrologic data, and analysis of existing detention facilities. ☐ Narratives addressing existing site conditions, name(s) of receiving waters, upstream runoff analysis, methodologies, assumptions, site parameters and design calculations used in hydrologic analyses.	
5	Post-Development Hydrologic Analysis & Site Condition Narrative	☐ Post-Development Conditions Map depicting (but not limited to) surface water features, topography, (sub-basin) drainage area delineation, direction of flow and proposed stormwater management features. ☐ Post-Development Conditions Table including acreage, soil type, impervious surface area, land cover information; sub-basin hydrologic data; and analysis of existing and proposed detention facilities. ☐ Calculations for the RRv, WQv, CPv Qp25, Qf, & required detention for each sub-basin. ☐ Narratives addressing post-development site conditions, methodologies, assumptions, site parameters, and design calculations used in hydrologic analyses.	LDM 6.3 GSMM 2.4.2.6(4)
6	Stormwater Management System Design	☐ Maps depicting stormwater features – existing to remain and proposed conveyance, detention, inlets and pipes. ☐ Tables presenting storage information for impoundment- type controls and inlets – maximum water surface elevation, depth and storage volume for design storms. ☐ Design calculations demonstrating how selected BMPs meet RRv and/or WQv requirements and how the design of features comply with appropriate design criteria. ☐ Include Site Development Tool as appropriate. Obtain from www.georgiastormwater.com. ☐ Narratives addressing stormwater feature selections, applicable design calculations and drawings showing profile and cross-section for all elements.	LDM 6.4 GSMM 2.4.2.6(5) GSMM 3.2.1
7	Downstream Analysis	☐ Map depicting drainage basin delineation to “the 10% point”, plus culverts, channels & other controls that	LDM 6.5

		runoff flows through prior to the 10% point. ☐ Narratives addressing supporting calculations associated with the 10% rule.	GSMM 2.4.2.6(6)
8	EISA Compliance (if applicable)	☐ EISA compliance calculations include: (i) pre-development and post-development runoff rates for the 95th percentile rainfall event; or (ii) pre- vs. post development hydrology volumes, and supporting calculations to demonstrate retention of the appropriate volume on-site, reference stormwater management.	EISA p. 17 ¶3 EISA p. 20 LID 2-1.4, 2-3

CHAPTER 4 ARCHITECTURAL ELEMENTS



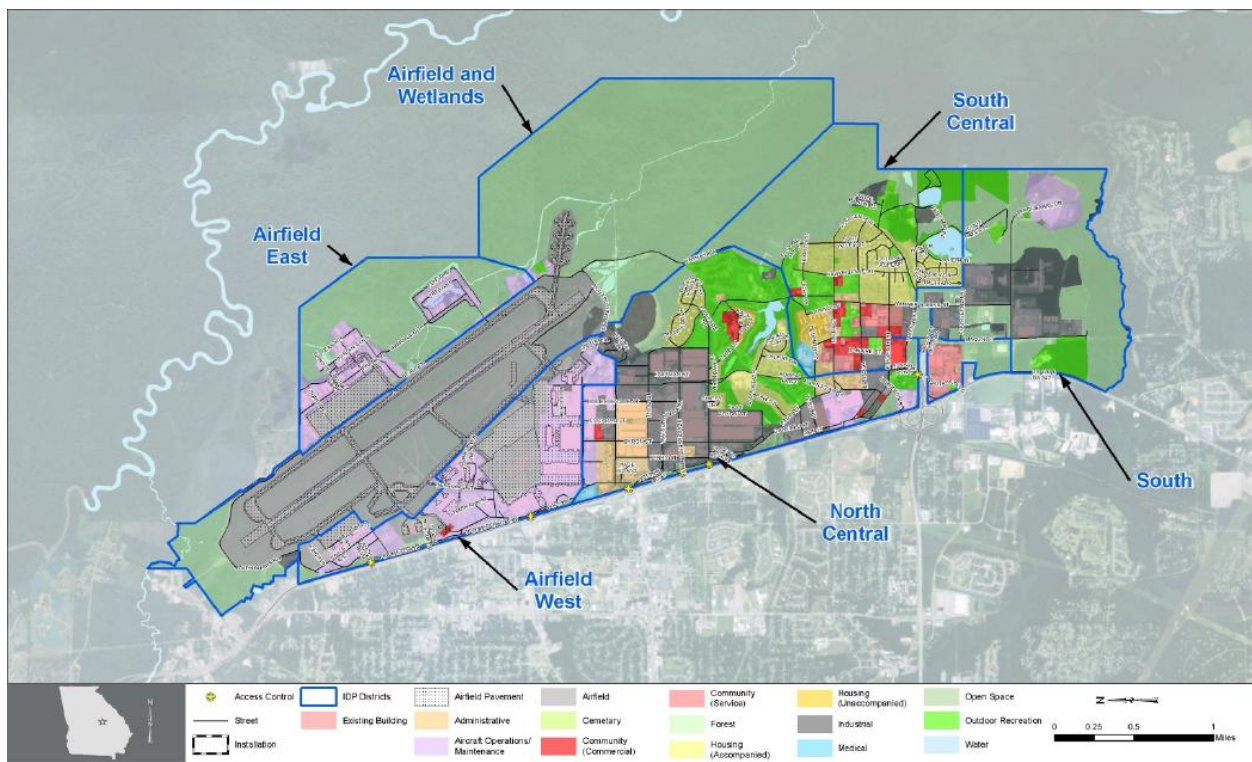
SECTION 4A SPECIFICATION, REGULATIONS, & STANDARDS

4A-1 INSTALLATION DEVELOPMENT PLAN

The current IDP was approved February 2023. It was developed through a comprehensive planning process that addresses mission capabilities, sustainability potential and opportunities for enhanced readiness and modernization. It serves as a tool for integrating a range of issues into facility projects and base-wide improvements.

Contact 78 CEG/CENPL at 478-327-2980 for additional information.

Figure 4A-1 Installation Development Plan



4A-2 HIERARCHY OF REQUIREMENTS

- 1) UFC 1-200-01 is the overarching document for buildings and facilities used by DoD. It directs the use of the IBC, the IEBC and UFCs applicable to the building, facility or structure being designed.
- 2) UFC 3-600-01 supplements the requirements listed in UFC 1-200-01. It is the primary fire protection criteria reference document for services provided by architectural and engineering (A&E) firms and consultants in the development of both design-bid-build and design-build contracts.
- 3) If conflict occurs between UFC 1-200-01 and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence.
- 4) If conflict occurs between a UFC 3-Series and UFC 3-600-01, the requirements of UFC 3-600-01 take precedence.

**WHOLE BUILDING DESIGN GUIDE
(WBDG)**

The WBDG is a comprehensive resource for federal construction and development projects. It includes data, guidance, mandates and specifications, including

- Unified Facilities Criteria (UFCs)
- Air force Instructions (AFIs)
- Engineering Technical Letters (ETLs)
- United Facilities Guide Specifications (UFGS)

See <http://www.wbdg.org/>

Figure 4A-2 High Performance Buildings

- 5) If conflict occurs between two UFCs within the UFC 3-Series, the requirements of the UFC that is more detailed pertaining to that specific building, facility, structure, or system take precedence.
- 6) If conflict occurs between a UFC 4- Series and UFC 3-600-01, the requirements of UFC 4- Series take precedence, except the UFCs addressing antiterrorism and security requirements must not preclude any fire protection requirements noted in UFC 3-600-01.
- 7) Use National Fire Protection Association (NFPA) 101- Life Safety Code and the current adopted International Building Code in accordance with UFC 1-200-01.
- 8) Current IBC adopted and modified by UFC 1-200-01. Use DoD Unified Facilities Criteria (UFC) as the source for planning, design, construction, sustainability, restoration and modernization criteria for military facilities and infrastructure components.
- 9) If there is a conflict between the military criteria and other directives or codes, use the military requirements.
- 10) In general, use the most up-to-date resource available. Appendix A provides an extensive list of applicable Criteria Reference Documents.
- 11) Use Unified Facilities Guide Specifications (UFGS) as the source for DoD technical specifications for facilities and infrastructure components.



- 12) Produce drawings using Computer Aided Design and Drafting (CADD) software. Provide drawings in both CADD (compatible with installation users) and Adobe Acrobat Portable Document Format (PDF) files with submittals. Drawings will comply with the ERDC/ITL TR-12-1 A/E/C Graphic Standard (Release 2.0) and ERDC/ITL TR-12-6 A/E/C CAD Standard (Release 6.0).

These documents are available at <http://www.wbdg.org/ffc/army-coe/cad-bim-technology-center>. The A/E/C Standards and CAD Details Library can also be accessed from this location.

4A-3 SUSTAINABILITY

4A-3.1 Sustainability Goals

Integrated design is the most important requirement in achieving a high performance building. Use a collaborative, integrated planning, and design team, composed of user, government support staff and appropriate professionals to identify requirements and to establish performance goals for siting, energy, water, materials, indoor environmental quality and other comprehensive design goals.

4A-3.2 Certification Requirement

Use USGBC/GBCI or the GBI rating systems for all projects. Use third-party certification only for applicable projects greater than 5,000 SF as outlined in UFC 1-200-02.

4A-4 ACCESSIBILITY

All facilities shall be barrier free and designed to meet the Architectural Barriers Act (ABA) Accessibility Standard for the Department of Defense Facilities as signed and adopted by the Secretary of Defense Memorandum dated October 31, 2008 and updated periodically.

4A-4.1 ADA/ABA and Military Facility Design

Facilities intended only for use and operation by able-bodied military and military support personnel are NOT required to be ACCESSIBLE. This may include specific areas such as elevator pits, elevator penthouses, mechanical rooms, equipment catwalks, lookout galleries, utility rooms; or entire facilities such as unaccompanied personnel housing, closed messes, or vehicle and aircraft maintenance facilities, but...

- Any portion of an excluded facility that may be open to the public or used by the public MUST be accessible.
- Any military facility that is converted to public use must be accessible.
- At least 5% of military housing (or at least one unit) must be built for accessibility or be easily adaptable.
- Note: If the cost of ACCESSIBILITY exceeds 15% of the total cost of alterations, a five-year completion schedule may be established.

4A-4.2 Parking

Parking can be located inside the 33 foot minimum unobstructed zone required for AT/FP standards, including handicap parking. Although parking in the unobstructed zone may be restricted during higher FPCONs, handicap parking may remain in close proximity to a building.

When providing handicap accessible parking spaces based on the design capacity of a facility, it is not necessary to include able-bodied military personnel in the calculation of spaces required.

4A-5 ANTITERRORISM/FORCE PROTECTION (AT/FP)

4A-5.1 The Robins AFB Design Basis Threat (DBT) is developed and maintained by the appointed Antiterrorism Representative for the 78th Civil Engineering Group. The DBT is developed in accordance with UFC 4-020-01 DoD *Security Engineering Facilities Planning Manual* and provides the basis and minimum requirements at Robins AFB for design and construction of successful, high-performance buildings and infrastructure projects that meet the Department of Defense Antiterrorism and Force Protection Measures. Contractor shall consult with the 78 CEG Construction/Project Manager to identify threat or level of protection required for a facility at a minimum provide standards when “triggered” in accordance with UFC 4-010-01.

SECTION 4B EXTERIOR FACILITY STANDARDS

4B-1 ARCHITECTURAL CHARACTER

4B-1.1 Design Rules at Robins AFB

DESIGN RULES at ROBINS AFB

1. Facility and site design shall be compatible with surrounding base architecture and architectural features.
2. Colors, materials, forms and details shall work together to maintain an overall orderly and cohesive character.
3. Architectural form and character shall be responsive to local climate and regional influences.
4. Architectural elements should be proportional and follow hierarchical protocols.
5. High quality and professional appearance shall not be compromised while striving for economical construction.
6. Construction materials used should be durable and easy to maintain.
7. SAFETY shall not be compromised.

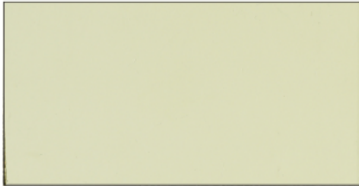
4B-1.2 Historical Exemptions

- There are no automatic exemptions from the BFS for buildings or structures at Robins AFB.
- If the provision of the BFS is impractical, request a Waiver from 78 CEG/CEN.

4B-2 EXTERIOR COLOR PLAN

Exterior colors at Robins AFB shall be in accordance with Figure 4B-1 and 4B-2 below.

**Figure 4B-1 EXTERIOR COLOR PLAN
EXTERIOR PAINT AND METAL COLORS**



ROBINS 22
PRIMARY BUILDING COLOR
a.k.a. ALMOND or LIGHT STONE



ROBINS 32
ALTERNATE BUILDING COLOR
a.k.a. BROWNSTONE



ROBINS 42
HISTORICAL BUILDING COLOR
Do not use for new applications.



ROBINS 48
ACCENT COLOR
Doors, Handrails, Partial Walls,
Standard Signs, Transformers,
Utility Boxes
a.k.a. KOKO BROWN



ROBINS 62
ACCENT COLOR
Window Frames, Fascia, Trim,
Gutters, Downspouts,
Roofs for ADM buildings
a.k.a. MIDNIGHT BRONZE,
DARK BRONZE,
BURNISHED SLATE



POLAR WHITE
ROOF (ALTERNATE) COLOR
Roofs on Flightline

- COLORS SHOWN HERE ARE FOR REFERENCE ONLY.
- ON-SITE VERIFICATION OF COLORS AND FINISHES IS REQUIRED.
- ALL TRIM ON A SINGLE BUILDING SHALL MATCH.
- ALL COLORS AND FINISHES MUST BE SUBMITTED TOGETHER FOR REVIEW AND APPROVAL BY 78 CEG/CEN.
- ALL EXTERIOR PAINT AND METAL COLORS ARE AVAILABLE AS FACTORY FINISHES USING KYNAR 500 OR HYLAR 5000 .

BRICK COLORS

CLASSIC VELOUR RED



VELOUR DIXIE ROSE



VELOUR LIGHT GRAY

- MATCH NEW BRICK WITH HISTORICAL COLORS AND ADJACENT BRICK COLORS.
- MORTAR SHALL BE LIGHT GRAY OR NATURAL UNLESS OTHERWISE APPROVED.

Figure 4B-2

EXTERIOR COLOR RULES at ROBINS AFB
1. All buildings at Robins AFB shall use the Robins AFB Exterior Color Plan. 2. New construction shall complement exterior colors and appearance of existing nearby buildings. 3. Renovations, repairs and additions shall have a style that complements existing structures. 4. If a building is “two-toned”, the dark color (or the heavier material) should be on the bottom.

4B-3 OUTSIDE WALLS AND FINISHES

EXTERIOR MATERIAL SELECTION GUIDELINES
1. Use natural finish, pre-finished or pigment-impregnated materials to the greatest extent possible. 2. Avoid trendy, highly customized or experimental materials. 3. Use only materials that are appropriate to the local climate. 4. A variety of materials can be used as long as the entire building appears to be a single, cohesively planned structure. 5. Materials selections shall be suitable and meet sustainability guidelines. 6. All construction materials are subject to applicable codes and standards. 7. Provide a continuous vapor barrier and thermal break in accordance with ASHRAE, and the IECC.

4B-3.1 Brick

4B-3.1.1 Brick is the preferred exterior cladding for high-profile administrative facilities.

4B-3.1.2 Use running bond as the primary brick layout pattern, except for accent runs.

4B-3.1.3 Use a brick color and type that most closely matches the adjacent structures.

4B-3.1.4 The default color for mortar and joint finishes is natural or gray.

4B-3.2 Concrete Masonry Units (CMU) or Cast Stone Masonry Units

4B-3.2.1 Match CMU product color to Robins Exterior COLOR PLAN (regardless of texture/finish).

4B-3.2.2 Minimize use of Grey Block in EXPOSED locations. Exterior Grey Block shall be painted IAW Robins Exterior COLOR PLAN.

4B-3.2.3 Match mortar to CMU color.

4B-3.3 Concrete / Pre-Cast Concrete / Concrete Aggregate Panels

4B-3.3.1 Color match all concrete building components with the Robins Exterior COLOR PLAN.

4B-3.4 Exterior Finish Systems

4B-3.4.1 Typical three (3) coat stucco system is the required finish system to be used when specified by the task order. EIFS will be considered on a case-by-case basis, designer shall provide analysis of both systems when recommending Exterior Insulation Finish System (EIFS) for consideration.

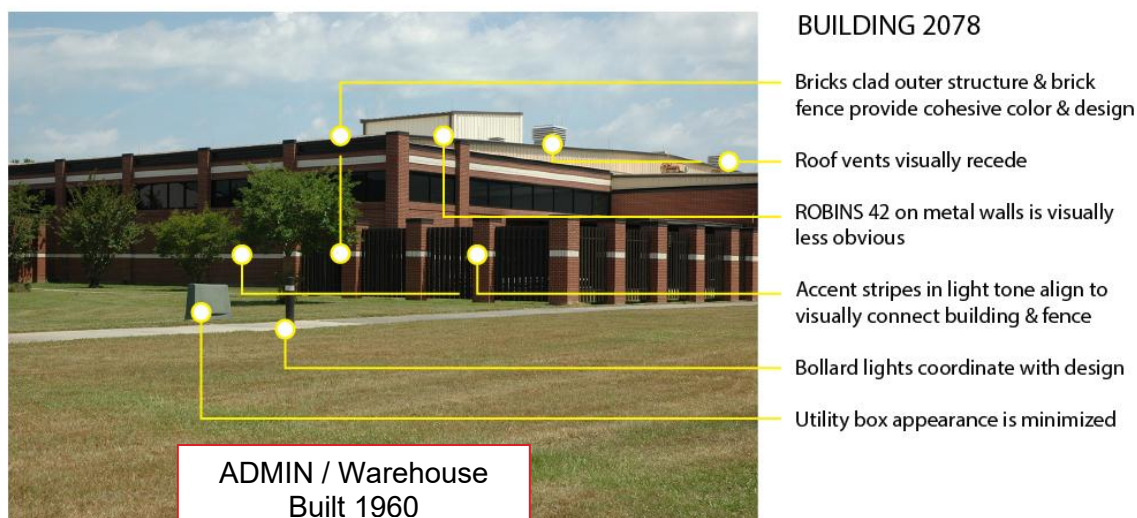
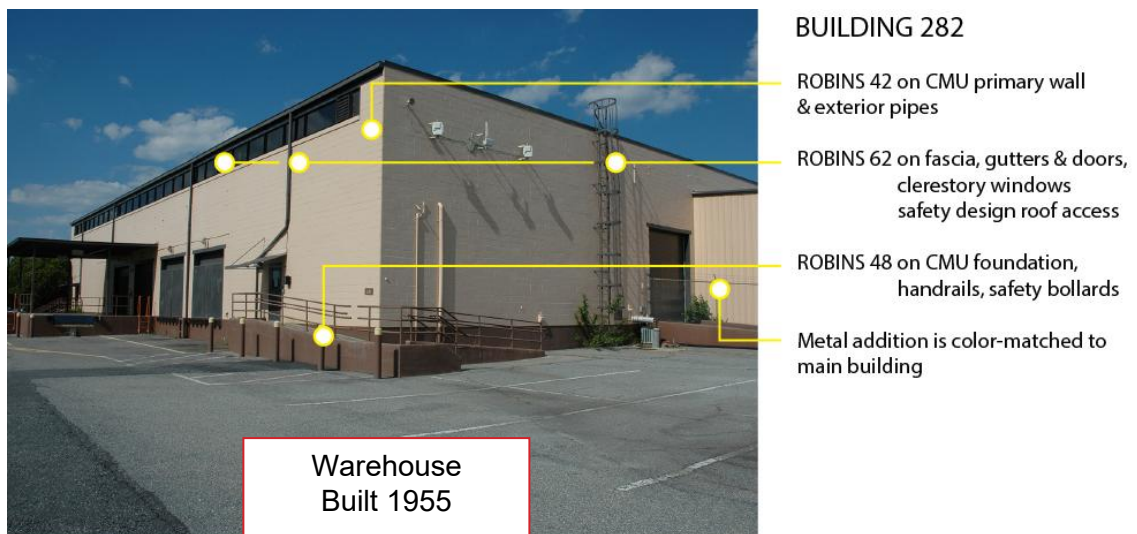
4B-3.4.2 Limit placement of Typical Stucco and EIFS to at least six inches above grade.

4B-3.4.3 Use with brick or CMU wainscot in heavily traveled or high-impact areas.

4B-3.4.4 Color match to Robins Exterior COLOR PLAN.

4B-3.4.5 Typical Stucco basis of design shall be StoPowerwall – Drainscreen with Sto Crack Defense Option.

Figure 4B-3 BUILDING EXTERIOR PROTOTYPES



4B-4 Metal

4B-4.1 All metals shall be factory-finished with manufacturer's standard paint colors to match the Robins Exterior COLOR PLAN as closely as possible.

4B-4.2 Metal conduit and cables mounted on the sides of facilities shall be factory-finished with the manufacturer's standard paint colors or field-finished to match the Robins Exterior COLOR PLAN as closely as possible.

4B-4.3 All pad mounted transformers, exterior pad mounted switchgear cabinets, etc. shall be factory-finished to match the Robins Exterior COLOR PLAN whenever practicable or they should be factory-finished in brown.

4B-4.4 Handrails shall be painted to match the Robins Exterior COLOR PLAN.

4B-5 Wood Framing, Sheathing and Decking

Paint any exposed material IAW the Robins Exterior COLOR Plan.

Storage Facility
Built 2008



AFRC Headquarters
Built 2019

4B-6 ROOFING

- The Robins AFB Roofing Program requires that all new or replacement roofs meet ENERGY STAR “cool roof” standards as established by the joint Environmental Protection Agency (EPA) and the Department of Energy (DOE) program.
- The Robins AFB Roofing Program requires that all new or replacement roofs over 100 square feet (including awning and canopies) be designed by a Professional Engineer that derives the majority of his/her income from roofing design.

4B-6.1 Allowable Roof Types**4B-6.1.1 Standing Seam Metal****4B-6.1.2 Single-Ply Membrane****4B-6.1.3 Built-Up Roofing (BUR)**
Requires 78 CEG/CEN approval.**4B-6.2 Warranty**

A 20-year, single source, “no dollar limit” (NDL) warranty on materials and labor is required for all roofs up to design wind speed at Robins AFB.

4B-6.3 Roof Colors

Match roof color to existing roofs on surrounding facilities. Verify color use with 78 CEG/CEN.

4B-6.4 Standing Seam Metal Roofs**4B-6.4.1 Design Requirements**

Fabricator Accreditation Required: Metal building and roof systems used at Robins AFB must be fabricated by a manufacturer accredited by the International Accreditation Service (IAS) Inspection Program for the Manufacturers of Metal Building Systems (AC472)

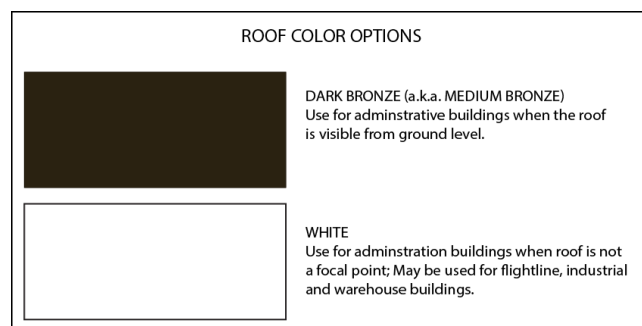
4B-6.4.2 Roof Profile Options

Design Guideline 1: Match existing roof profile, and provide consistency with adjacent facilities.

Design Guideline 2: Use transition to appropriate profile to enhance overall character of building or modify slope.

4B-6.4.3 Design Basis

Use polyvinylidene fluoride (PVDF) reflective coatings (Kynar 500® or Hylar 5000™), plus insulation. See Double-Lok® roofing systems.

Figure 4B-4 ROOF COLOR OPTIONS

4B-6.4.4 Configuration Options**4B-6.4.4.1** SIMPLE Standing Seam Metal Roof (with no valleys):

- Structural panels 360° mechanically seamed
- 24" maximum panel width
- 3" minimum nominal seam height; flat pans not allowed

4B-6.4.4.2 ARCHITECTURAL standing seam metal roofs (may contain valleys):

- Structural panels 360° mechanically seamed
- 18" maximum panel width
- 2" minimum nominal seam height; flat pans not allowed

4B-6.4.5 Trim and Accessories**4B-6.4.5.1** For trim, flashing or roof curbs exposed to view – Match roof and/or building trim color.**4B-6.4.5.2** For hatches, roof curbs, etc., not exposed to view – Match roof and/or adjacent wall color.**4B-6.4.5.3** For vents and other functional components – Match roof and/or provide visual screening.**4B-6.4.5.4** Kynar 500® or Hylar 5000™ PVDF factory-applied finish REQUIRED for all metal components.**4B-6.5** **Single-Ply Membrane Roofs****4B-6.5.1** Design Requirements**4B-6.5.1.1** The Single Ply Roofing Industry (SPRI), identifies three major categories of single ply membranes: thermoplastics, thermosets and modified bitumen.**4B-6.5.1.2** Mechanical fasteners required; ballasted and fully-adhered systems are rarely allowed.**4B-6.5.1.3** Minimum Thickness 60 mils**4B-6.5.1.4** Minimum Slope ½:12**4B-6.6** **Design Basis**

See Duro-Last® Cool Zone®-Cool Roofing System.

4B-6.7 **Fascias, Gutters and Downspouts****4B-6.7.1** Use continuous metal fascia that is scaled to match the roof.

- 4B-6.7.2** Typical Height: 8 inches minimum.
- 4B-6.7.3** Color Match fascia, gutters, and down spots on sloped roofs to roof color.
- 4B-6.7.4** Color Match downspouts and architectural details with fascia and gutters to contrast adjacent walls with pre-finished metal.
- 4B-6.7.5** Use underground piping to carry water away from foundations whenever possible. Alternately, use concrete splash blocks.
- 4B-6.7.6** Avoid the use of interior roof drains and open scuppers.

4B-6.8 Roof Vents and Elements

- 4B-6.8.1** Make mechanical vent sizes and shapes consistent with architectural elements.
- 4B-6.8.2** Color Match roof vent pipes and other elements to roof color.
- 4B-6.8.3** Avoid roof-mounted antennas.

4B-6.9 Identification Sign Required for Roof

Each new roof is required to have an identification (ID) sign:

- Material: ¼" REYNOBOND MATERIAL WITH VINYL
- Size: 16" high x 20" long
- Color: Background – AMS-STD-595 Color, STANDARD BROWN - #10100
- Letters: Block-Style, Arial Font, Vinyl – FED-STD 595A
- Color, WHITE - #17875
- Primary/Alternate: Contact maintenance engineering service desk at 478-926-5657
- Date: Get correct date 20 years in the future from 78 CEG/CEN
- Section: Get Section No. from 78 CEG/CEN

4B-7 DOORS AND WINDOW

4B-7.1 Glazing

- 4B-7.1.1** All windows and doors shall meet requirements for security, energy efficiency, safety and maintenance ease as required.
- 4B-7.1.2** For glazing in exterior elements such as storefronts, doors, windows, curtain walls, clerestories, and skylights that must comply with AT/FP Standard 10 refer to UFC 4-010-01.
- 4B-7.1.3** Fragment resistant film is not allowed as part of a window retrofit system.
- 4B-7.1.4** For exterior doors requiring glazing, follow the glazing guidelines outlined above.
- 4B-7.1.5** Bronze tinted glass is not required but may be used.
- 4B-7.1.6** Mirrored, spandrel, and plastic glazing are not allowed.

4B-7.2 Color Options

4B-7.2.1 Trim for doors and windows shall be factory finished to match the Robins Exterior COLOR PLAN with Robins 62 or Robins 48.

4B-7.2.2 New exterior metal doors shall be factory-primed and factory-finished; both new and existing doors shall match the Robins Exterior COLOR PLAN with Robins 48 or Robins 68.

4B-7.2.3 Sealants applied adjacent to windows and doors shall match the frame color.

4B-7.2.4 Wood exterior doors shall NOT be used.

4B-7.3 Exterior Hardware

- Hinges: Stainless Steel
- Hardware: Stainless Steel
- All hardware components must match and create a unified look.

4B-7.4 Locks

4B-7.4.1 All door hardware shall be compatible with the Base Master Keying System.

4B-7.4.2 All new or replacement keying systems shall have seven-pin, small-format interchangeable cores (IC), combine cores to include 2 keys each per core, made by BEST Locks (owned by Stanley Security Solutions, Inc.).

4B-7.4.3 The customer provided Key Plan must be presented to the Lock Shop at least four (4) weeks prior to acceptance of Beneficial Occupancy.

4B-7.4.4 New BEST cores shall be shipped to the following address:

**78 CES/CEOHS/Lock Shop, 775 Macon Street,
Robins Air Force Base, Georgia 31098**

4B-7.4.4.1 Shipping documents shall include:

- Building Number in which cores are being installed
- Purchase order number

SECTION 4C VEHICULAR CIRCULATION & PARKING

4C-1 PARKING DESIGN GUIDELINES

4C-1.1 Use 90 degree parking configuration as much as possible.

Parking Stall Size: 9' wide x 18.5' long (minimum).

4C-1.2 Maintain two-way movement as much as possible. Avoid dead end parking lots.

4C-1.3 Asphalt is the standard material for parking lots.

4C-1.4 Use concrete for heavy vehicles areas, loading and unloading, and where fuel spills may occur.

4C-1.5 Use 4" white striping to mark parking lots.

4C-1.6 Adhere to ADA standards.

4C-1.7 Parking labeled FPCON Handicap can be used by everyone when Normal Alert levels are in place.

4C-1.8 Requests for reserved parking must be submitted by the respective parking warden to CE Customer Service via TRIRIGA.

4C-1.9 Signage shall be designed to meet Georgia Department of Transportation, SDDCTEA, and UFC 3-120-01 ***Design Sign Standards*** requirements.

4C-2 PEDESTRIAN CIRCULATION

4C-2.1 Sidewalks

4C-2.1.1 Sidewalks shall be constructed in conjunction with all new facility and exterior remodel projects.

4C-2.1.2 Sidewalks shall be located to create an interconnecting base-wide pedestrian walkway system. Sidewalks at primary building entrances shall be connected with the walkway system. Sidewalk access to secondary and service entrances shall be provided as required.

4C-2.1.3 Minimum Width: 5'-0" (unless approved by 78 CEG/CEN due to space)

4C-2.1.4 Construction Material: Natural Colored Concrete (Typical); Solid Pavers or Permeable Pavers should be selected in colors complimentary to facility color.

4C-2.1.5 Roadway Setback: 2'-0" Minimum

4C-2.1.6 Use crosswalks to connect sidewalks across roadways.

4C-2.1.7 Provide handicapped access with appropriate concrete striations at intersections and crosswalks.

4C-2.2 Handrails

4C-2.2.1 Handrails shall meet ADA standards.

4C-2.2.2 Handrail designs shall be integrated with the facility design.

4C-2.2.3 Standard handrails should be factory-finished if possible, otherwise dark brown powder-coated is the preferred finish for metal handrails.

SECTION 4D LANDSCAPING

4D-1 GENERAL GUIDANCE

LANDSCAPE AT ROBINS AFB

Due to ongoing budgetary setbacks and constraints, the use of plant materials is being cut back significantly at Robins AFB. In many cases existing, well-established plants are being removed. For the time being, the use of new plant materials must be limited and judiciously selected; a long term maintenance plan must be established. Reference section 3G-2.9 for tree and shrub guidance when landscaping is required.

SECTION 4E SITE ELEMENTS

4E-1 WALLS AND FENCES

Walls and fences may be incorporated into the design of facilities to screen such items as exterior mechanical and electrical equipment, outdoor storage, and service areas. For buildings that must comply with ATFP standards, a wall or fence may be required if outdoor equipment is located in the 33 foot required unobstructed space. All screens, walls and fences shall be visually and stylistically compatible with adjacent facilities, and built in accordance with ATFP UFC 4-010-01, "Enclosures."

4E-1.1 Walls

4E-1.1.1 Walls and retaining walls must comply with the Robins Exterior COLOR PLAN.

4E-1.1.2 Suitable materials include split-face CMU, Allen Block, and brick. A combination of several materials is also suitable.

4E-1.2 Fences

4E-1.2.1 Metal Shadow-Box Fencing

- 7 feet tall for screening
- Factory-finished with Dark Bronze (Robins 62)
- Install with an 18" wide concrete mow strip

4E-1.2.2 Chain Link Fencing with or without Barbed Wire

- 7 feet tall; Used primarily for security or special purpose needs
- Use wire coated with black fused bonded vinyl in "visible" locations
- Install with 18" concrete mow-strip in grassy areas

4E-1.2.3 Ornamental Metal Fence

- 7 feet tall with spiked profile for high-profile security
- Install with a 18" wide concrete mow strip

4E-2 DUMPSTERS

4E-2.1 Dumpster Colors

- Dark Brown - Refuse/Trash
- Bright Blue - Cardboard/Recycle

4E-2.2 Dumpster Pad Design

Minimum 6" thick reinforced concrete sized to extend at least 10 feet in front of dumpster.

4E-2.3 Allowable Placement

4E-2.3.1 Dumpsters must be placed outside the ATFP 33-foot unobstructed standoff distance or unless they are secured or enclosed IAW UFC 4-010-01, Standard 3.

4E-2.4 Service Access

Access for service vehicles shall be clear and free of conflicts allowing both forward and backward movement for dumpster trucks inside the site or parking lot.

4E-2.5 Regulatory Compliance

Existing dumpsters and bins at all inhabited buildings shall be brought into compliance when general exterior facility improvements are being made.

4E-3 SITE FURNISHINGS

4E-3.1 Consistency is the most critical factor in the selection of various site elements such as benches, trash receptacles, lighting fixtures, pavilions, and street furniture.

4E-3.2 Site furnishing within a single visible area should create a unified and cohesive appearance.

4E-3.3 Recycled tan and black colored plastic is preferred for benches and picnic tables.

4E-3.4 Avoid using mismatched site furniture and site elements.

4E-4 OUTDOOR LIGHTING

Exterior lighting fixtures should be placed to exceed minimum foot-candle illumination for safety, appropriate utility, and suitable aesthetics without over-lighting an area, creating glare or light pollution, or wasting energy.

4E-4.1 Pedestrian Lighting

Fully shielding downlights that provide direct illumination and blend with the aesthetics of the area are preferred and best where pedestrian lighting is needed. These fixtures are typically set on poles 10 to 15 feet in height.

4E-4.2 Security Lighting

Partially shielded cobra-head fixtures with a maximum height of 20 feet are the most frequently used security lighting at Robins AFB.

4E-4.3 High Mast Lighting

Light-emitting diode (LED) fixtures set up to 40 feet up are used throughout the base to provide high mast broad area illumination.

4E-5 OUTDOOR SIGNAGE**4E-5.1 Standard Signs**

Standard identification and directional signage should follow guidelines found at UFC 3-120-01. Standard signs with white Helvetica-style lettering on a medium brown background are used throughout Robins AFB and can be fabricated by the Sign Shop in 78 CEG.

4E-5.2 Non-Standard Signs

Use of non-standard signage shall be limited. It should have a professional and discreet appearance. A BFS Waiver shall be submitted by the requesting agency for the non-standard signage.

4E-5.3 Building Number Signs

Building numbers shall be placed on the wall of each facility with one sign located at the main entrance and at least one other sign placed on a wall as needed for wayfinding. Signs shall be fabricated from aluminum painted dark bronze (Robins 62) with white letterforms applied to the panel. Typical signs are 15+ inches long by eight (8) inches high with four (4) inch numbers, depending on the distance and legibility from the closest adjacent roadway.

SECTION 4F INTERIOR FACILITY GUIDELINES

4F-1 INTERIOR FINISHES AND COLORS

4F-1.1 To ensure speed, economy and efficiency in keeping interior spaces fresh and up-to-date, a limited number of paint and carpet colors are used here at Robins AFB.

4F-1.2 Supplies are kept on-site for maintenance and limited in the area work, which is provided by 78 CES/CEO via TRIRIGA.

4F-1.3 Standard interior product finishes and colors shall be used unless otherwise approved. A Waiver Form is available at Appendix B.

4F-2 INTERIOR WALL INSULATION

4F-2.1 All interior walls/partitions shall include insulation. Insulation shall be mineral wool or fiberglass batt or blanket and selected based on the best option for the specific requirements. Sprayed foam insulation will be considered on a case-by-case basis.

4F-3 CEILING TILES

4F-3.1 White 2' x 2' acoustical panels are used almost universally for ceilings in administrative areas throughout the Robins AFB.

4F-3.2 Clear view tiles typically required in secure areas shall be made of class A polycarbonate.

4F-3.3 Ceiling tile shall meet the requirements of UFGS 09 51 00 Acoustical Ceilings. Follow specifier notes for Ceiling Attenuation Class (CAC), Noise Reduction Coefficient (NRC) and Light Reflection (LR) values for appropriate spaces. Match image pattern shown as closely as possible.

4F-3.4 Replacement tiles shall match existing or alternatively, all tiles in a visual area shall be replaced at the same time.

4F-3.5 If a specialty tile is used, purchase additional tiles for replacement stock.

4F-3.6 Ceiling suspension system **shall not be supported by the roof deck**. Where primary and secondary structural members are spaced more than 5 feet on center, provide intermediate supports as required for support. All supports shall be noncombustible. For PEMB, a letter shall be provided by the manufacturer listing requirements and limitations for attachment to secondary members.

4F-4 RESTROOMS

4F-4.1 All bathroom components shall be coordinated to provide a cohesive appearance. Elements shall have a coordinated color palette with a variety of textures and patterns; extreme color variations are not allowed.

4F-4.2 Solid surface countertops such as Corian® or Wilsonart are required for restrooms at Robins AFB. Integral sinks are preferred. The color shall be rain streak or equal that is compatible with other restroom elements.

4F-4.3 Solid plastic polymer bathroom stall partitions are required. Scranton Hiny Hiders, Finish: Hammered, Color: nickel or equivalent manufactured using high density polyethylene (HDPE). The color selected should complement the colors of the wall and floor tile.

4F-4.4 Wall and floor tiles should be chosen for their durability and ease of maintenance. Porcelain wall and base tile shall be Crossville Tile, Collection: Ready to Wear, color: AV311 Buttoned up or equal substitute.

4F-4.5 \1\ Floor drains shall be provided in all new restrooms and restroom renovations. \1\ Floors shall be sloped to provide positive drainage and no ponding around floor drains. Retro fit of restrooms on flat floors shall be accomplished with polymer modified setting bed mortar.

4F-4.6 \1\ Janitorial closet sinks shall be installed with faucets with Atmospheric Vacuum Breakers. \1\.

4F-5 BREAKROOMS

4F-5.1 Breakroom components shall be coordinated to provide a cohesive appearance. The functional elements shall be coordinated to create a cohesive image. A palette with a variety of textures and patterns is acceptable; extreme color variations are not allowed.

4F-5.2 Custom or premium grade breakroom cabinets shall be selected to provide high durability and ease of maintenance. The color and finish shall be factory solid wood naturally sealed or stained. White cabinets are not allowed.

4F-5.3 Solid surface countertops such as Corian® or Wilsonart are required for breakrooms at Robins AFB. The color shall be arrowroot or equal and be compatible with cabinets and walls.

4F-5.4 The backsplash area behind the countertops (and extending to the upper cabinets) shall be a hard, wipe-able surface such as tile or solid surface material. The color should be compatible with the countertops.

4F-5.5 Walls shall be painted IAW Interior Paint Color Options.

4F-5.6 Resilient flooring such as Luxury Vinyl Tile (LVT) or porcelain is the required finish surface for breakrooms. The tile shall conform to ASTM F1700 Class III; have a color, pattern and texture that is compatible with the appearance of the room/area; and be provided with a factory protective finish that enhances durability and cleanability. Use materials with a minimum of 35 percent recycled content where appropriate for use. Carpet is not allowed in breakrooms. LVT shall be glue down. Tongue and groove or snap lock versions shall not be used. Porcelain shall be Crossville Tile; Collection: Moonstruck, Color: Gemini Hon AV304, installed in brick or equal substitute.

4F-6 CARPETS AND VINYL COVEBASE COLORS

4F-6.1 Green Scheme

- Carpet: Shaw CORRELATE #6633;
- Covebase: Johnsonite 71 STORM CLOUD or Johnsonite 72 HARBOUR

4F-6.2 Blue Scheme

- Carpet: Shaw FAMILIAR #66932;

- Covebase: Johnsonite 71 STORM CLOUD or Johnsonite NAVY BLUE
- 4F-6.3** Brown Scheme
 - Carpet: Shaw COMPARE #66731;
 - Covebase: Johnsonite 71 STORM CLOUD or Johnsonite 76 CINNAMON
- 4F-6.4** Gray Scheme
 - Carpet:
 - Mohawk Opal #7559; Collection: Bending Earth; Series: Datum Tile BT284
 - Engineered Floors Template #2115; Collection: Schematic; Series: Modular 7091
 - Tarkett Direct Current #22405; Collection: Dynamic Edit; Series: Alight Edit 11613
 - Cove base shall be selected based on wall and carpet color to provide an aesthetically pleasing coordination.
- 4F-6.5** Biege Scheme
 - Carpet:
 - Mohawk Chert #7728; Collection: Bending Earth; Series: Datum Tile BT284
 - Engineered Floors Datum #2109; Collection: Schematic; Series: Modular 7091
 - Tarkett Polarity #22403; Collection: Dynamic Edit; Series: Alight Edit 11613
 - Cove base shall be selected based on wall and carpet to provide an aesthetically pleasing coordination.
- 4F-6.6** Walk-off Carpet Tile
 - Grey Scheme Carpet:
 - Mohawk Slaten Sky #7559; Collection: In the Loop; Series: BT309
 - Engineered Floors Channel #2046; Collection: Passages; Series: Modular 7037
 - Tarkett Star Gazer #60810; Collection: Modern Refinement; Series: Thread Craft 11569
 - Cove base shall be selected based on wall and carpet to provide an aesthetically pleasing coordination.
 - Biege Scheme Carpet:
 - Mohawk Stoney Pebble #7847; Collection: In the Loop; Series: BT309
 - Engineered Floors Vestibule #2041; Collection: Passages; Series: Modular 7037
 - Tarkett Warm Cashmere #60807; Collection: Modern Refinement; Series: Thread Craft 11569
 - Cove base shall be selected based on wall and carpet to provide an aesthetically pleasing coordination.

4F-7 LUXURY VINYL TILE FLOORING (COMMERCIAL GLUE DOWN ONLY)

- Mohawk Group Collection: Large and Local; Style: Large and Local Wood; Color Options: 832 Tellico, 975 Reservoir
- Mohawk Group Collection: Living Local; Style: Premium Wood; Color Options: 829 Sandy, 958 Two Tone, 949 Gorgeous Gray
- Tarkett Collection: Contour Abstract; Style: Mirage PCMI; Colors: Shoreline 10046 or Sahara 10047
- Shaw Flooring Collection: Resilient Residential; Style: 1022V Paragon Tile Plus; Color Options: 281 Shale, 5062 Cobalt

- Engineered Floors Collection: Dreamweaver; Style: Pietra; Color Options: 8019 Sandstone, 8023 Shale

4F-8 INTERIOR PAINT COLOR OPTIONS

4F-8.1 Standard paint colors are maintained In stock for quick and easy repairs in either eggshell finish for walls or glossy finish for trim.

4F-8.2 All Interior paint color options provide a suitable color-match with the available carpet and covebase colors.

4F-8.3 Interior Paint Colors - In stock

- Benjamin Moore 1051 – LAMBSKIN
- Benjamin Moore 1075 – FAIRWAY OAKS
- Sherwin Williams 7070 – SITE WHITE
- Sherwin Williams 7662 – EVENING SHADOW

4F-8.4 Interior Paint Colors - Alternate

- Gray Scheme: Lazy Gray SW6254
- Beige Scheme: Biscuit SW6112 or Maison Blanche SW7526
- Blues: Accent Blue Bracing Blue SW6242 or Accent Blue Aleutian SW6241
- White: Accent White Alabaster SW7008

CHAPTER 5 MECHANICAL ENGINEERING ELEMENTS



SECTION 5A MECHANICAL STANDARDS

5A-1 GENERAL REQUIREMENTS

5A-1.1 Existing Elements

Refer to Section 3D for subsurface requirements.

5A-1.2 Metering

Refer to Section 5F for Whole Facility Metering requirements.

5A-1.3 \1\Supervisory Control and Data Acquisition (SCADA)

Robins AFB SCADA system is manufactured by minsait ACS, Inc. of Norcross, Georgia. All Remote Transmitting Unit (RTU) provided shall be compatible to this system.\1\

5A-1.4 \1\Flange Gaskets

Applies to all flange gaskets for condensate water, make-up water, chilled water, and steam lines. Spiral wound and/or Teflon gaskets shall be used, Garlock and/or paper gaskets shall not be used. \1\

5A-1.5 Energy and Sustainability

Energy reduction and sustainable development principles shall be integrated into the mechanical system selection and design to the maximum extent that is life cycle cost effective.

5A-1.5.1 Purchase premium efficient electric motors, air conditioning and refrigeration equipment. Mechanical equipment shall be manufacturer's standard catalog products and shall conform to the latest published industry and technical society standards at the date of contract award. Underwriters Laboratories (UL) listing or third-party certification is required for all basic equipment. Use of shop or field fabricated electrical equipment assemblies that are not manufacturer's standard catalog products or do not conform to the industry and technical society standards are not acceptable.

5A-1.5.2 Purchase Energy Star and Federal Energy Management Program (FEMP) designated products when procuring energy-consuming items covered by the Energy Star program, except when purchasing such items is not cost-effective or does not meet the functional requirements of the agency.

5A-1.5.3 Integral sized electric motors should be National electrical Manufacturers Association (NEMA) PREMIUM type motors that conform to NEMA MG 1, minimum Class F insulation system. Motors with efficiencies lower than the NEMA PREMIUM standard may only be used in unique applications that require a high constant torque speed ratio.

5A-1.6 Regulatory Guidance

All utilities, including potable water, fire suppression water, piping for chilled water and hot water heating, steam and condensate, natural gas, drainage piping, etc. shall be installed following applicable current codes, i.e. International Mechanical codes, International Plumbing and Gas codes, etc.

5A-1.7 Installation Depth

The minimum depth for all new utilities shall be three (3) feet from the top of the piping to the grade elevation.

5A-1.8 Pipe Identification

Tracer wires and warning tape shall be placed on piping using #10 AWG Cu with nicked TW insulation to facilitate detection of the wire. Warning tape shall be located six (6) inch to (12) inches below grade. Provide trace wire terminal in valve boxes to perform direct contact location.

5A-1.9 Support Fastening Considerations

All mechanical systems including HVAC, plumbing, fire protection (sprinkler systems), chilled/hot water, steam, and associated equipment to be installed above ceilings or near the roof shall not be supported by the roof deck. Where primary and secondary structural members are spaced more than the allowable span for mechanical elements, provide intermediate supports as required for support. All supports shall be noncombustible. For PEMB, a letter must be provided by the manufacturer listing requirements or limits to attaching to secondary members.

5A-2 SYSTEM REQUIREMENTS**5A-2.1 Chilled Water Piping**

5A-2.1.1 Central chilled water shall be used when appropriate. Contact the Base project manager to discuss availability of central chilled water prior to design.

5A-2.1.2 New underground chilled water distribution piping, four (4) inches and larger, shall be insulated PVC carrier pipe with a high-density polyethylene (HDPE) jacket, 200 pounds per square inch (psi) pressure class at 73.4 degrees Fahrenheit (°F), SDR 21, and conform to ASTM D2241. All aboveground or exposed piping shall be insulated schedule 40 carbon steel.

5A-2.1.3 Chilled water piping smaller than four (4) inches shall be insulated Schedule 40 carbon steel pipe with an HDPE jacket.

5A-2.1.4 Provide cathodic protection for all underground steel pipe.

5A-2.2 Natural Gas Lines

5A-2.2.1 All natural gas system piping, meters, and regulators shall be installed in compliance with 49 CFR part 192, FERC, and EPA regulations.

5A-2.2.2 All underground natural gas lines shall be polyethylene type HDPE (PE 3408) as designated by ASTM D2513 with a minimum wall thickness corresponding to a standard dimensional ratio (SDR) of 11. All aboveground or exposed piping shall be ASTM A53B carbon steel.

5A-2.2.3 If pressure requirements exceed the PE 3408 capability, ASTM A53B carbon steel pipe (minimum Schedule 40) shall be used; all aboveground or exposed piping shall be ASTM A53B carbon steel.

5A-2.2.4 All underground metal piping shall be coated per the corrosion control section

and shall have cathodic protection installed.

5A-2.2.5 A waiver is required to abandon any line, if allowed, the abandoned line shall be shown on as-builts. Each pipeline abandoned in-place must be disconnected from all sources and supplies of gas; purged of gas; and sealed at the ends. As close to the main as possible. If gas to air ratio in the line is below explosive limits, the line need not be purged.

5A-2.2.6 Each tap made on a pipeline under pressure must be performed by a crew qualified to make hot taps. Each pipe coupon removed should be turned into the Civil Engineering Plumbing Shop to inspect for internal corrosion.

5A-2.2.7 Manual service line shutoff valves for any new or replaced service line must be installed in such a way as to allow accessibility during emergencies, as close to the main as possible.

5A-2.2.8 Contractor must clean and coat each pipeline or portion of pipeline that is exposed to the atmosphere. Coating materials shall be suitable for the prevention of atmospheric corrosion.

5A-2.2.9 Whenever buried pipeline is exposed, the exposed portion must be examined for evidence of external corrosion, or if coating is damaged or deteriorated. If external corrosion requiring remedial action is identified the contractor shall contact the Civil Engineering Plumbing Shop to inspect, investigate circumferentially and longitudinally beyond the exposed portion (by visual examination, indirect method, or both) to determine whether additional corrosion remedial action exists in the vicinity of the exposed portion.

5A-2.2.10 No person may operate a new segment of pipeline or return to service a segment of pipeline that has been relocated or replaced, until it has been tested to the maximum allowable operating pressure: and any leak(s) have been located and repaired. The test medium must be air or inert gas that is compatible with the material of which the pipeline is constructed, and free of debris. Each segment of service line shall be leak tested before being placed into service. Include the service line connection to the main in testing, if feasible, it must be observed for leakage at operation pressure when placed in service. The test pressure must be at-least 150% of the maximum operating pressure or 50 psi (345 Kpa), whichever is greater.

5A-2.3 Steam and Condensate

5A-2.3.1 Design basis is Thermacor DUO-THERM 505 with leak detection.

5A-2.3.2 The contractor shall have a minimum of ten (10) years' experience with working on steam line construction projects.

5A-2.3.3 The contractor must be certified by the manufacturer of the steam line distribution system for product being installed.

5A-2.4 Petroleum, Oils and Lubricants

5A-2.4.1 The designer will evaluate the use of underground fuel pipe and submit recommendations to the Project Manager or Environmental Manager, who shall make the decision on the use of underground piping.

5A-2.4.2 Design of all petroleum, oils, and lubricants (POL) systems shall be IAW Military Handbook 1022 (MIL-HDBK-1022), American Petroleum Institute (API), and other industry

standards, including all applicable NFPA regulations.

5A-2.4.3 Welders certified by the American Petroleum Institute (API) shall provide all welding outside of fuels area.

5A-2.4.4 Design shall include emergency precautions to stop fuel flow, shut down pumps, etc., including a cutoff switch in an easily accessible location.

5A-2.4.5 All pipes shall be painted with the proper POL color coded markings.

5A-2.4.6 All electrical equipment shall be explosion proof in accordance with OSHA Division 1, Class 1.

5A-2.4.7 All tanks and piping located either above or below ground shall be double walled and have cathodic protection in accordance with applicable EPA regulations.

5A-2.4.8 All *above* ground tanks shall meet the latest editions of the Environmental Protection Agency (EPA) regulations. Coordinate with Robins AFB tank manager.

5A-2.4.9 All *below* ground tanks shall meet the latest editions of the Environmental Protection Agency (EPA) regulations. Coordinate with Robins AFB tank manager.

5A-2.4.10 Tank refill access shall be readily available to tank trucks.

5A-2.4.11 Surge suppressors will be used to prevent pressure build-up in the lines.

5A-2.4.12 WARNING signs will be properly displayed.

5A-2.5 Building Automation

5A-2.5.1 Controls/Programmatic Logic Controllers (PLCs)

The Contractor may use control logic or PLCs or a combination of the two when specific control is desired as a part of an MCC or a standalone system. Many of the devices installed at Robins AFB require automation including lift stations, plant operations, motor controls and lighting controls. The Base uses Rockwell PLC language as their Design Basis. Provide surge protection of PLC at the device. If certain actuators as used in the system that have 110 volt power, provide simple surge protectors at them as well.

5A-2.5.1.1 Location: PLCs shall be located in its own air conditioned cabinet with filtered airflow or in an air conditioned room. If an air conditioned room is nearby, it is required over an air conditioned cabinet.

5A-2.5.1.2 Circuit Requirement: Provide 20 amp circuit with a commercial grade, 20 amp receptacle (TVSS/SPD with LED indicators) to power the PLC. Color shall be blue.

5A-2.5.1.3 Programming: All automation shall come fully programmed to meet the requirements set forth and/or provided as an industry standard for the purpose it was intended. Programming shall comply with the following:

- It shall be modular in design so that subroutines may be used to eliminate the need to rewrite code for specific purposes throughout the code

- Set values should be provided in a table for various uses and ease of changing
- Various limits of operation shall be considered and included in the control language. In no case shall the system go into an operation mode that it cannot recover from because system or component is operating beyond a limit. As well, system should have logic to bring certain parameters and devices operating beyond limits back within the limits
- Miscellaneous tests of equipment parameters needed to provide operational status and/or operational capability shall be included even if not specifically specified (i.e. PLC turns pump on, test that pump is running and/or in locked rotor status.)
- It should have a Fail-Safe: When multiple components are operating, determine the critical components and test for operational status. If this component fails, provide for a fail-safe state. Government can give a fail-safe state for the system; it could be that the fail-safe situation is all on or all off
- Provide a mechanism for Shut-Down in an “orderly shutdown” sequence so that no operation is left in a status that will take a large power intake to overcome a prolonged locked-rotor condition

5A-2.5.1.4 Submittals: Before project begins, submit the name of the proposed vendor. If a different vendor is proposed other than the Design Basis, provide technical information on the system and programming language and a 24/7 support protocol with reprogramming extending for one year after the project is constructed.

- Before installation, provide a block diagram laying out the functions to be controlled and identify any limits that cannot be surpassed
- Before startup, provide a copy of the actual program for review at least 14 days before startup
- Provide startup services to include any slight modification of the software to cover last minute issues
- After a week of supervised testing, provide qualified person to address issues (this can be as little as a phone call once a day lift stations and lightning systems to several hours per day on-hands training/checking the system.)
- After week of supervised testing and before final inspection, submit a copy of the software with latest changes on some compatible media. This media will be stored for backup and use in the event of some major catastrophe or required replacement of the PLC
- Before final inspection, provide a parts list of system including controls and the equipment to be operated. Of special interest will be any sensors used and probable life of said sensors

5A-2.5.2 Direct Digital Control (DDC)

5A-2.5.2.1 DDC Control Panels: If the installation of a DDC control panel is required in the project or an existing DDC control panel is in the project scope, provide one receptacle outlet at each DDC control panel.

5A-2.5.2.2 Controls and Metering: All HVAC systems on Robins AFB shall be DDC systems that are compatible and communicable with existing Base DDC systems and meets minimum control points as defined in UFC 3-410-01 appendix D. The DDC shall have the capacity to communicate with the remote DDC system

located in Building 228 (EMCS Server) for monitoring, trending, scheduling, adjusting, troubleshooting, etc.

- Meters shall be non-resettable with a local numeric display
- Employees of the control equipment manufacture or manufacturer certified contractor shall install control systems and coordinate with the 78 CEG for specific alterations pertaining to each project
- Design Basis for HVAC Direct Digital Control Systems shall be BACnet™ open protocol including Johnson Controls' Metasys® Honeywell products, Distech Controls Inc ®, or use the alternative HVAC DDC BACnet®
- The Contractor is responsible to ensure that new and existing software are programmed to function together as part of the system and to ensure that the operator can monitor, program, and change the set points, etc.
- All job specific programming collateral (logic, web graphics, program objects) shall be turned over to the Government on government approved compatible media prior to Final Inspection for possible use by government to operate and maintain these systems
- Verification of DDC control system shall be conducted prior to any contract acceptance
- New wireless/cellular DDC systems shall not be used on Robins AFB at this time

5A-2.5.2.3 DDC Systems controllers, compatible with Robins' DDC control system (EMCS) system, shall be installed on all utilities. New controllers shall be connected to the EMCS on the CE COINV2 at Bldg 228. In no case shall the connection required as part of this standard be provided through the AMRS control system.

5A-2.5.3 Non-Controllable Systems

Energy management systems shall not include any of the following items in load shedding schemes nor disconnect power from the following:

- Fire Pumps (does not include fire alarm controls systems)
- Emergency Systems (battery packs, inverter, or generator systems)
- Power to fire alarm and IDS equipment
- Elevators
- Ventilation in hazardous areas (can be controlled by fire alarm systems)
- Ventilation to exhaust hazardous gas or for fresh air requirement (fresh air can be shut down by fire alarm system)

5A-3 **MAINTENANCE REQUIREMENTS**

5A-3.1 **Access**

All mechanical systems and components shall be designed so that maintenance requirements can be met. The following shall be incorporated into mechanical designs:

5A-3.1.1 Provide access doors for all equipment requiring maintenance such as valves, dampers, smoke detectors, filters, and control components.

5A-3.1.2 Provide manufacturer's recommended service clearance and coil pull space for all equipment.

5A-3.1.3 Locate all valves, pumps, strainers, controls, sensors and other items requiring regular service in a location that allows floor level accessibility for maintenance.

5A-3.1.4 Ground mounted mechanical units are preferred. All ground units shall be mounted on a concrete housekeeping pad.

5A-3.1.5 All suspended mechanical units in hangers and high bay areas or above ceilings shall have permanent maintenance platforms and access ladders as a component of the design, where practical and feasible.

5A-3.2 Labeling

5A-3.2.1 Comply with ANSI/ASME A13.1 standards for pipe identification and marking.

5A-3.2.2 Provide snap-on plastic pipe labeling only; do not use tape or stenciling.

5A-3.2.3 Label all valves, instruments, piping, etc.

5A-3.2.4 Provide a special tag on system isolation valves identifying area served (e.g. "chilled water shutoff to AHU's 1 - 4").

5A-3.2.5 Require "valve" chart identifying all labeled items.

5A-3.2.6 Piping diagrams shall be laminated (or otherwise protected) and mounted in mechanical rooms.

5A-3.2.7 Provide a metal identification tag attached to each steam trap.

5A-3.3 As-Built Drawings

As-built drawings will be prepared for all completed systems. They shall include a list of all equipment and installed devices, and provide the name of manufacturer, model or part number, description and quantity of each system/device installed.

5A-3.4 Operations and Warranty

5A-3.4.1 Provide an Operations and Maintenance (O&M) Manual for all mechanical systems and components. Include a listing of each trap, trap capacity, type, and location.

5A-3.4.2 On ALL warranty issues: Notify 78 CEG/CEN and provide service tickets to indicate what measures were taken to correct the problem. Contractor shall submit an action plan within 24 hours of notification of warranty claim.

5A-3.4.3 Under no circumstances will any fire suppression or alarm system be left inoperative overnight without approval from the Fire Department.

5A-3.4.4 Utilize current ASME B31 piping codes for piping specifications, classifications, testing, and inspection requirements.

SECTION 5B HEATING, VENTILATION, AND AIR CONDITIONING STANDARDS

5B-1 DESIGN REQUIREMENTS

5B-1.1 Weather Location Basis

Weather data for average conditions at Robins AFB shall be based on Typical Meteorological Year (TMY) 1991-2005 Update TMY3 World Meteorological Organization (WMO) Number 722175 Robins AFB GA

5B-1.2 Design Criteria Data

Comply with American Society of Heating, Refrigerating and Engineers (ASHRAE) and Engineering Weather Data for Robins AFB.

5B-1.3 Analysis

5B-1.3.1 New facilities and facilities undergoing major and minor renovation shall be analyzed to determine the most cost effective and practical fuel source(s) and heating and cooling system types.

5B-1.3.2 The designer shall provide complete load calculations with the concept design in accordance with ASHRAE standards. Submit building heat and cooling load calculations, plus a description of the program used and copies of all input data as part of the design analysis. Input data shall be representative of the actual conditions within the space (occupants, equipment, building construction, etc.)

5B-1.3.3 The designer shall evaluate all energy conservation items that appear to have potential for savings, such as heat recovery for HVAC, service water heating, thermal energy storage, desiccant dehumidification, plastic door strips for loading docks, etc., and include those items in the design that are life cycle cost effective.

5B-1.3.4 Ensure that all operation and maintenance costs are included in the life cycle cost analysis.

5B-1.3.5 The design of all HVAC systems, including heat and cooling load calculations shall be prepared and stamped by a Registered Professional Engineer in the State of Georgia with an HVAC Specialty.

5B-1.3.6 When providing new HVAC and suspended ceilings in existing unconditioned spaces, such as when converting warehouse space to administrative space, design shall include a structural analysis to ensure the structural system can handle the additional weight of the ceiling and ductwork.

5B-1.4 System Access

5B-1.4.1 Piping for all system types shall be routed to provide the greatest accessibility possible for maintenance.

5B-1.4.2 Pipe chases shall have removable covers to allow access to the entire piping system.

5B-1.4.3 Converters, pumps, expansion tanks, and other items requiring maintenance shall be located to allow easy servicing from floor level.

5B-1.4.4 Drain valves shall be provided to allow complete system drainage; provide air vents at high points and at coils.

5B-1.5 Refrigeration

5B-1.5.1 Refrigerant. The refrigeration systems of all new HVAC equipment shall be provided in compliance with current EPA regulations.

5B-1.5.1.1 Design basis for closed flexible insulation for line sets is K-Flex Titan.

5B-1.5.2 VRF Systems. VRF systems are permitted at Robins AFB if the system meets the criteria defined in UFC 3-410-01.

5B-1.5.3 No Class I or Class II ODS. Do not provide any service or product with any specification, standard, drawing, or other document that requires the use of a Class I or Class II ODS in the test, operation, or maintenance of any system, subsystem, item, component, or process. Refer to Part 2C SPECIAL WASTES AND HAZARDS (Section 01560) for the list of products which are Class I and Class II ODS: Note new products in the Significant New Alternatives Policy (SNAP) program, under which the EPA continuously reviews alternatives to ODS to find substitutes that pose less overall risk to human health and the environment.

5B-1.5.4 Hydronic Air Handling Units (AHUs). For hydronic AHUs, the hot water heating coil shall be located downstream of the chilled water coil for humidity control.

5B-1.5.5 Humidity Control

5B-1.5.5.1 For small units, such as DX heat pumps, a supplement electric heat or heat reclaim should be installed downstream of the cooling coil to meet humidity control requirements.

5B-1.6 Steam Systems

5B-1.6.1 Existing steam systems shall be assessed by the Robins AFB Energy Manager to determine whether to reuse the steam central feed or convert to natural gas feed. Document the Energy Manager's choice in the Design Analysis.

5B-1.6.2 Where steam is used, the system shall be converted to hot water at the building entrance.

5B-1.6.3 For systems over 1000MBH, flash tank and pre-heat heat exchangers shall be evaluated to determine cost effectiveness and energy savings.

5B-1.6.4 Piping downstream of steam traps shall be sized for two-phase flow assuming zero backpressure with a minimum pipe size of one (1) inch.

5B-1.6.5 All distribution piping and ducting that is three (3) inches and smaller shall be type K copper or ASTM A53 or ASTM A120 Schedule 40 steel with all welded joints.

5B-1.6.6 Piping larger than three (3) inches shall be domestic ASTM A53 or ASTM A120 Schedule 40 steel with all welded joints. The maximum friction loss in the pipe shall not exceed

three (3) feet per 100 feet of pipe.

5B-1.7 Chilled Water and Hot Water Systems

5B-1.7.1 Chilled water, hot water, and air supply duct insulation shall be designed to ensure that the surface temperatures of the pipes or ducts (including duct and pipe chases) shall be above the dew point anywhere inside the interior space of the building to prevent condensation and mold issues.

5B-1.7.2 Provide alternate pumping operation with Dynamic Demand Controls (DDC) as redundancy for chilled water and hot water pumping stations.

5B-1.7.3 Whenever a chilled or hot water system must be shut down (whether the building is occupied or unoccupied), the Contractor shall be responsible for draining the (chilled or hot) water prior to the commencement of construction activities; the Contractor shall also be responsible to refill the water system after the completion of the work. In lieu of draining the water system, the line block method can be used.

5B-1.7.4 All exterior chilled/hot water piping shall be insulated and provided with aluminum jacket and fittings.

5B-1.7.5 HVAC Chiller Replacement Standardization received Justification and Approval from the Air Force Civil Engineer Center during 2019, and has been extended through 2029. The approved single manufacturer of all HVAC Chiller systems at Robins AFB shall be Carrier. /1/In effort to improve on cost and delivery to customer's, York, Trane, or Daiken may be used as alternates. Selection shall be based on cost and delivery while meeting all other requirements./1/

5B-1.8 Air-Handling Units (AHUs) for Ventilation, Air Conditioning and Refrigeration Systems

5B-1.8.1 Special Requirements

5B-1.8.1.1 Provide adequate operating and maintenance space including a minimum of 12" access section, or an area sized as recommended by the manufacturer.

5B-1.8.1.2 Provide pressure independent automatic control valves and associated control system for heating coils and cooling coils sized for maintenance in accordance with the manufacturer's recommendations

5B-1.8.1.3 All modular variable air volume (VAV) units shall be capable to shut down the supply air to 25% of the diffuser specified air flow rate with a minimum setting device. No Therma-Fuser™-type diffusers shall be used on DX cooling systems.

5B-1.8.1.4 Outside air intakes shall be installed above ten (10) feet or on the roofs of single story buildings in compliance with force protection requirements (UFC 4-010-01) and a minimum of ten (10) feet from any exhaust duct or plumbing vent.

5B-1.8.1.5 All residual metal from units, equipment, ducting systems, and line sets from HVAC and DDC projects shall be returned to the 78 CEG Environmental Office for recycling, after insulation is removed.

5B-1.8.2 Ductwork

5B-1.8.2.1 Internal duct insulation is prohibited IAW UFC 03-410-01.

5B-1.8.2.2 The minimum allowable thickness of ductwork insulation shall comply with ASHRAE 90.1.

5B-1.8.2.3 The ductwork shall be cleaned for Any AHU, DOAS, or Package Unit renovation project that does not include replacing the existing associated ductwork. Work shall include installing a duct access panel for future periodic inspection and cleaning.

5B-1.9 **Temperature Requirements**

Comply with ASHRAE Standard 62.1 latest edition (Ventilation for Acceptable Indoor Air Quality) to calculate the outside air requirement for the building HVAC equipment sizing. Typical space, supply air, ventilation, and temperature requirements are as follows:

Table 5B-1

TEMPERATURE REQUIREMENTS BY LOCATION					
Area	Summer		Winter		Other
	Temperature Dry Bulb	Relative Humidity	Temperature Dry Bulb	Relative Humidity	Minimum Total Ventilation Rate
Administrative	75°F	50%	70°F	30% - 50%	4-10 AC/h
	1) Install humidifiers in the AHU discharge to provide re-humidification 2) Typical conditioned supply air flow rate for variable air volume (VAV) units using Thermo-Fuser™ -type Systems ≥1 CFM/SF at full open capacity				
Classrooms	73°F	50%	70°F	30% - 50%	4-12 AC/h
	1) Basis for heat load calculation = total number of the students 2) Perimeter spaces should receive higher total ventilation rate.				
Shop Areas	82°F	50%	55°F	30% - 50%	10-50 AC/h
Mechanical Rooms	86°F	-	55°F	-	10 AC/h
	1) Install unit heaters and provide forced ventilation with thermostat control to maintain minimum temperature. 2) Mechanical rooms shall be accessible from the exterior of the building 3) Exact requirement is process driven.				
Electrical Rooms	86°F	-	55°F	-	10 AC/h
	Provide unit heaters and HVAC systems to maintain the required temperature				
COMM Closets/Rooms	78° F	30% - 50%	68°F	30% - 50%	15-20 AC/h
	Use zoned, dedicated or split core system.				
Mech/Elec Combined	86°F	-	55°F	-	10 AC/h
	1) Provide physically separate rooms in all new construction. 2) For existing combined rooms, physically separate the two areas, and provide cooling to the electrical area.				

5B-1.9.1 Table 5B-3 provides only typical temperature requirements. The User may have a need for a specific temperature requirement due to mission critical processes. The designer shall consult with CE for climate requirements for each project prior to proceeding with design, if not otherwise provided in the Task Order Statement of Work for the specific project.

5B-2 **HVAC WATER TREATMENT**

5B-2.1 General

5B-2.1.1 Equipment installation shall be based upon specific information obtained at the construction site and existing water treatment methods used at Robins AFB, including a current analysis of Base water.

5B-2.1.2 All water treatment design must be performed by a "Corrosion Specialist" that has received certification from NACE International Institute (NII) (previously known as National Association of Corrosion Engineers) and has at least five years of experience in this area of engineering.

5B-2.2 Water Systems Design**5B-2.2.1** Closed Chilled Water Systems

- 100 tons or less – Shall utilize chemical pot feeders
- Over 100 tons shall utilize either automatic or manual system as determined by Base Project Engineer

5B-2.2.2 Open Chilled Water Systems (Cooling Towers)

- Cooling Towers shall be automatic systems

5B-2.2.3 Hot Water (Closed) Systems

- 1000 MBTU/H or less shall utilize chemical pot feeders
- Over 1000 MBTU/H shall utilize either automatic or manual system as determined by Base Project Engineer

5B-2.2.4 Steam Systems

- Steam Systems shall be automatic systems
- Oxygen scavengers shall inject directly into the de-aerator tank
- Boiler water chemicals shall inject into feed water line right before the boiler drum
- Blowdown Dumping
 - At the main plant – Shall dump to industrial waste.
 - At all other locations – Shall dump to sanitary sewer.
 - Shall be run through a cooler to limit discharge temperature to 120°F to ensure compatibility with IW/SS piping
 - Shall be designed for manual blowdown of bottom drum

5B-2.2.5 Water Fountains

- Drinking fountains shall not include automatic bottle filling units. If bottle filling is desired, a manual gooseneck faucet is to be installed on the drinking fountain. If existing two bi-level fountains for ADA compliance, the gooseneck faucet is to be installed on the lower bi-level drinking fountain.
- If automatic bottle filling units are currently installed, or explicitly requested by the tenant organization, these drinking fountains shall no longer be considered real-property and will instead be considered equipment. The 78

Civil Engineer Shops shall not be held responsible for any replacement, repair, routine maintenance, part(s) procurement/delivery, or installation of drinking fountains with automatic bottle filling units. In addition, the responsibility of changing filters, or parts, serving any supplementary filtering units/systems retrofitted to drinking fountains shall be the responsibility of the tenant organization.

5B-2.3 Chemical Pot Feeders

- Shall have at least five (5) gallon capacity
- Shall have a pressure gauge on intake side of protected system
- Shall be completely serviceable from floor level
- Shall not be connected to the recirculation pump suction side – the chemical feed tank inlet and outlet can both be connected to the pump discharge side across the isolation valve
- Shall use interlocks to ensure chemicals will not feed when main system is off; e.g., on condenser pumps.
- Shall have automatic chemical feed using one of the following methods:
 - Solids controller to control boiler blow down and chemical feed based upon manual setting
 - Inject chemicals downstream of pumps

5B-3 SYSTEM COMMISSIONING OF HVAC

5B-3.1 Training

5B-3.1.1 On-site training shall be provided to instruct Government personnel in each phase involved with the sequence of operation for the system.

5B-3.1.2 Training shall be accomplished by a “certified” manufacturer’s representative and shall be conducted and completed prior to pre-final inspection.

5B-3.1.3 Training shall include the set-up, operation, and balance of the system for the respective Government shops and shall typically take between two and seven days as necessary to include the scope of the project.

5B-3.2 Testing

5B-3.2.1 The system shall be tested and balanced by an independent firm certified by the American Association of Balancing Contractors (AABC) or the National Association of Balancing Contractors (NABC).

5B-3.2.2 The Government reserves the right to spot check the Contractor. The Contractor shall be spot checked by the balancing Contractor in the presence of a Government representative.

5B-3.2.3 If 25% of the systems checked are not within the required allowance (per specifications) the balancing Contractor will return to the site and completely redo the testing and balancing.

5B-3.2.4 Testing and balancing for steam or chilled water systems shall be accomplished during the time of year when the system would typically be functional.

5B-3.2.5 All required test results, Operations and Maintenance (O&M) manuals, and schematics shall be turned over to the Government two weeks prior to the pre-final inspection.

5B-4 SYSTEM MAINTAINABILITY

5B-4.1 System Configuration

5B-4.1.1 Adequate clearances and accessibility shall be provided around all pieces of equipment for periodic maintenance, inspection, and cleaning.

5B-4.1.2 Permanent maintenance access shall be provided for all suspended mechanical equipment and any equipment requiring servicing located above ceilings to ensure that extensive material handling (e.g. A-frames) or access equipment is needed to perform maintenance and repair.

5B-4.1.3 All above ceiling utilities (cable trays, ductwork, junction boxes, utility piping, etc.) shall be accessible for a worker to reach two sides plus the service side with a minimum 3'3" (1 m) clearance or greater if required for component maintenance/disassembly.

5B-4.1.4 Equipment shall be installed so that service of one piece of equipment shall not require disturbance of adjacent equipment.

5B-4.1.5 Coils shall be fully removable without requiring demolition of any building components.

5B-4.1.6 Piping configuration at all coils shall include unions to facilitate easy removal.

5B-4.1.7 Isolation valves shall be provided for each terminal unit, zone, branch, long runs, etc. as necessary for proper isolation.

5B-4.2 Component Locations

5B-4.2.1 Mechanical equipment is not permitted on the roof.

5B-4.2.2 Only secondary items that do not require maintenance or access such as vents are permitted with approval from the Roofing Program Manager.

5B-4.2.3 Anything penetrating the roof shall be painted the same color as the roof.

5B-4.2.4 Water treatment systems for boilers/chillers shall be designed and installed to allow chemical handling at the floor level.

5B-4.2.5 Outdoor components shall be placed outside the 33 foot Clear Zone required for AT/FP on all new buildings. Any components placed inside the Clear Zone must be enclosed in accordance with UFC 4-010-01.

SECTION 5C WATER DISTRIBUTION SYSTEMS

5C-1 SYSTEM WATER SUPPLY

5C-1.1 General Information

5C-1.1.1 Any construction project that includes a modification to the Robins AFB potable water system (including additions, extensions, and repairs) shall also include preparation and submittal of a water/engineering Design Package. The Package shall be completed in accordance with the Minimum Standards for Drinking Water, Georgia Environmental Protection Division (GA EPD); signed and stamped by a Georgia Professional Engineer; and submitted for review and approval through the Environmental Management Branch of the 78th Civil Engineer Group and by GA EPD.

5C-1.1.2 All water system Design Packages shall include the following:

1. GA EPD Drinking Water Project Submittal Form
2. Drawings completed and include any data needed to design all proposed additions and modifications including disinfection procedures, as-built utility drawings, notes and details of all connections and appurtenances.

5C-1.2 Systems Analysis

5C-1.2.1 All potable water on Robins AFB has been treated. The designer shall review to determine if any additional treatment is required for consumptive use.

5C-1.2.2 If the proposed project discharges any mixture of chemicals or solid waste into the industrial or sanitary wastewater systems, the project shall be reviewed to determine if any additional chemical analysis of water is required to meet the Robins AFB, State of Georgia and US EPA requirements for industrial or sanitary waste water treatment.

5C-1.2.3 The designer shall review to see if there will be any unusual peak demand requirements, i.e. filling industrial process tanks, continuous wash processes, etc. A formal hydraulic study shall be provided.

5C-1.3 Water Supply Protection

5C-1.3.1 Installation Requirements

5C-1.3.1.1 Any underground potable water system installed in a declared environmental hot zone, or close or inside any storage areas for Petroleum, Oils and Lubricants (POL) shall be metallic. PVC is resistant to some chemicals but is not resistant to petroleum products.

5C-1.3.1.2 All water service lines, and water mains constructed using nonmetallic materials shall be installed using locating tape and locating wire. The wire will be accessible where the service turns up into the facility and in valve boxes.

5C-1.3.1.3 Minimum depth for all new underground utilities shall be three (3) feet from the top of the piping to the grade elevation.

5C-1.3.1.4 All above-ground piping that is equal to or greater than two (2) inches in diameter

shall be labeled for the type of utility with arrows showing direction of flow. Use only snap-on plastic pipe labeling which complies with ANSI 13.1.

5C-1.3.2 Cathodic Protection

5C-1.3.2.1 Cathodic protection shall be provided on all new underground steel systems and piping. Insulating devices shall be used as necessary to isolate dissimilar metal common to an electrolyte (soil, water, etc.). These systems shall be coated and/or wrapped to minimize cathodic protection current requirements.

5C-1.3.3 Public Water System Requirements

5C-1.3.3.1 Any new water main construction shall be chlorinated using AWWA standards before it is connected to the existing base distribution system. Contractors shall obtain lab tests of water quality after testing and flushing is accomplished; test results shall be provided to 78 CEG/CEN prior to connecting new water lines to the existing system.

5C-1.3.3.2 Fittings and tools used in hot tapping or connecting to existing system shall be cleaned using a 5% sodium hypochlorite solution.

5C-1.3.3.3 There shall be no potable water line installed in a manner that enters a storm sewer manhole or catch basin, or a wastewater manhole. Any such instances discovered during construction or demolition shall be amended by relocating the potable water piping outside a manhole or catch basin.

5C-1.3.3.4 The public water system shall be protected by an approved air gap separation or an approved reduced pressure principal backflow prevention device in the following situations:

- Where there is an approved auxiliary water supply, and it is not subject to any of the rules set out in this chapter.
- Where there is any material dangerous to health that is handled in a manner that could cause an actual or potential hazard to the public water system
- Examples of facilities where these conditions exist include sewage treatment plants, boiler/steam plants, production or manufacturing processes using chemicals and rinse systems, aircraft/equipment de-painting, plating/anodizing operations and hospitals.
- At the service connection where there are actual or potential uncontrolled cross connections
- On each service to any premises where it is impossible or impractical to make a complete in-plant cross connection survey because of security requirements or other prohibitions or restrictions.

5C-1.3.3.5 All wellhead areas shall be protected by a fenced control zone at least 25 feet in diameter with a locked gate. No sources of pollution shall be allowed within this area including generator storage tanks or electrical transformers. However, electrical generators may be allowed within the area. An Overall Management Zone with a 100-ft. diameter shall be established around each well.

5C-2 BUILDING WATER SUPPLY**5C-2.1 Code Compliance**

Plumbing systems will be designed in accordance with International Plumbing Codes as amended by Georgia, as well as Department of Defense and Air Force codes and other standards as listed.

5C-2.2 Installation Requirements

5C-2.2.1 Potable water will be provided from the nearest Robins AFB distribution line.

5C-2.2.2 A reduced pressure principal backflow preventer shall be provided on all new construction or renovation projects connected to potable water. Refer to 5C-3 for backflow prevention device requirements. Install a hose bibb vacuum breaker at all hose bibbs (internal or external). /1/ All bypasses shall be equipped with backflow protection. /1/

5C-2.2.3 One inch (1") thick insulation shall be provided for all hot and cold water plumbing pipes.

5C-2.2.4 Any solder used in domestic water supply system must be 90/10 or 95/5.

5C-2.2.5 Verify the requirement for drinking fountains in office and shop areas; required drinking fountains shall be refrigerated.

5C-2.3 Piping Systems**5C-2.3.1 Domestic Water Piping**

5C-2.3.1.1 Type L copper for service lines and building distribution.

5C-2.3.1.2 CPVC SDR 11 for above or below ground applications except under a slab

- CPVC pipe and fittings shall meet or exceed the requirements of ASTM D2846
- Design Basis: FlowGuard Gold® CPVC for pipe two inches (2") diameter or smaller

5C-2.3.1.3 C900 is acceptable for use for the main plumbing water pipe.

5C-2.3.1.4 All fire hydrants shall be Mueller or M&H if a Mueller is not readily available.

5C-2.3.2 Hot and Chilled Water System Components

5C-2.3.2.1 Make-up water system with reduced pressure principal backflow preventer

5C-2.3.2.2 Freeze protection for exposed piping

- Use drain-down capabilities
- Use heat tape that is thermostatic controlled based on the outside air temperature and insulation
- Use a combination of the these methods

- 5C-2.3.2.3** Drains at low points of the system and vents at high points
- 5C-2.3.2.4** Expansion tanks for water expansion and air separators for air control
- 5C-2.3.2.5** Balancing valves at discharge points of all pumps and at coils requiring metered flow
- 5C-2.3.2.6** Water treatment sampling and injection ports for all closed loops
- 5C-2.3.2.7** Water treatment capability
- 5C-2.3.2.8** Floor sinks with baskets for all condensate drain lines of air handling units' in mechanical rooms.
- 5C-2.3.3** Restroom Equipment
- 5C-2.3.3.1** All new or replacement fixtures shall be standard high efficiency plumbing fixtures. Low flow plumbing fixtures are not acceptable. Alternatives must be selected to minimize frequently recurring maintenance requirements.\1\ Minimum gallon per flush (gpf) will be as provided in the table below

Table 5C-1 . \1\

FIXTURE FLOW REQUIREMENTS		
Fixture	Desired Flow	Minimum flow
Water Closets	3.5 GPF	1.6 GPF
Urinals	1.0 GPF	0.5 GPF
Faucets	2.2 GPM	1.5 GPM

- 5C-2.3.3.2** Water closets shall be floor mounted when possible and incorporate flush valve operation.
- \1\ All wall mounted water closets shall be replaced with floor mounted, rear discharge, for new construction or whenever feasible. \1\
 - Tank type water closets shall not be provided.

5C-3 BACKFLOW PREVENTION DEVICES (BPDS)

5C-3.1 Code Compliance

5C-3.1.1 All Backflow Prevention Devices (BPDs) must be installed in accordance with current Uniform Plumbing Code® and DAFMAN 32-1067. Backflow prevention device brand shall be Watts, or Wilkins Zurn, if a Watts is not available for the configuration.

5C-3.1.2 The level of hazard for new BPDs must be determined by the RAFB Backflow Manager 78 CES/ CEOIU.

5C-3.1.3 Use only lead free materials with the drinking water system as defined by current EPA guidelines.

5C-3.1.4 All BPDs must be installed by Georgia-certified BPD technicians and be placed in locations with adequate clearance space for maintenance and repairs. Backflow prevention

devices shall be installed between 1 to 5 feet above finished floor. No backflow shall be installed in pits, valve boxes, or confined space.

5C-3.1.5 All BPDs shall be inspected and tested by the Robins AFB Backflow Manager before being placed into operation.

5C-3.2 Submittals, Notifications and Approvals

The Contractor shall coordinate with Government Project Manager to complete the following:

5C-3.2.1 Ensure Bioenvironmental Engineering has assigned the level of hazard and identified the appropriate BPD for the application prior to purchase of BPDs. Direct all inquiries to Bioenvironmental Engineering, 78 AMDS/SGPB.

5C-3.2.2 Coordinate the BPD installation location prior to installation to ensure the installation location is accessible and meets space requirements for inspection and maintenance.

5C-3.2.3 Submit a copy of BPD Test Report completed in accordance with the manufacturer's instructions for the particular device or using procedures recognized by the tester's certifying agency. At a minimum, all devices shall be tested after installation, cleaning, repair, or relocation.

5C-3.2.4 Obtain approval to use fire hydrants or to penetrate water mains. Direct all inquiries to 78 MDG/SGPD, Bioenvironmental Engineering and the Civil Engineering Plumbing Shop.

SECTION 5D COMPRESSED AIR

5D-1 GENERAL REQUIREMENTS

5D-1.1 Design Criteria

The intention of this standard is to provide criteria to achieve economical, durable, efficient, and dependable compressed air systems to support Robins AFB. Where special conditions and problems are not covered in this Base Facility Standard, industry standards will be followed. Modifications or additions to existing systems solely for the purpose of meeting criteria in this standard are not authorized.

5D-1.2 Design Analysis

The following items will be considered in the design analysis:

- Application (hospital, industrial, etc.)
- Maximum operating pressure required
- Location of air requirements in buildings
- Air usage – continuous or intermittent demand
- Operating pressure dew point requirements
- Air filtration needs at points of use
- Need for oil-free air

5D-1.3 Equipment Schedules

Equipment schedules will be shown on the drawings, including the following:

- Capacity – Cubic Feet of Free Air per Minute (CFM)
- Discharge Pressure – Pounds per Square Inch Gauge (psig)
- Minimum Motor Horsepower
- Volts, Phase, Hertz
- Applicable Temperatures (Dew Point, Inlet, Outgoing, Approach, Ambient, etc.)
- Length (Inches)/Diameter (Inches)
- Accessory List
- Spare Parts List

5D-2 ENERGY CONSERVATION

Design shall be based on an evaluation the feasibility, life-cycle cost and operational impact of each element as follows:

5D-2.1 Compressors

5D-2.1.1 Select the type and number of compressors based on peak and non-peak compressed air demands.

5D-2.1.2 Install automatic compressor controls to modulate and sequence on-line compressor operations and shut down idling compressors.

5D-2.1.3 Reduce compressor discharge pressure as low as feasible to reduce motor loads.

5D-2.1.4 Locate air-cooled compressors to most effective location to accomplish the following:

- Avoid allowing room temperature to exceed 100°F
- Recover heat from compressors to provide space heating in winter
- Take advantage of ventilation to remove heat from the plant in summer or to use for preheating industrial process water

5D-2.1.5 Select an air compressor with a pneumatic load-unload feature that, when fully unloaded, consumes approximately 15 percent of the base load horsepower.

5D-2.1.6 Use waste heat from the oil cooler to heat makeup air, or for building space heating in the winter.

5D-2.1.7 Use multistage compressors with intercoolers when economically justifiable.

5D-2.1.8 Select motors that are the premium efficiency type in accordance with the National Electrical Manufacturers Association (NEMA).

5D-2.1.9 Develop a lead/lag compressor design, deployment, and operating strategy.

5D-2.1.10 Locate air intake outside of the building or low heat area to reduce ambient air inlet temperature. This intake must be located at least ten feet above grade in accordance with AT/FP standards in UFC 4-010-01.

5D-2.1.11 Evaluate the need for a demand controller to maintain a constant pressure regardless of downstream demand fluctuations.

5D-2.2 After-Coolers

5D-2.2.1 Establish the degree of drying utilized downstream so that the final discharge air temperature of the aftercooler allows both initial and operating costs of compressed air dryers to be most economical.

5D-2.2.2 Maximize the use of duct air from air-cooled after-coolers to provide space heating in winter and to remove heat from the plant in summer. Utilize pipe coolant water to recycle heat waste where possible.

5D-2.3 Filters and Dryers

5D-2.3.1 Improve air quality only to the degree required at the point of use. If air quality requirements differ at various points of use, specify appropriate filters, or dryers in applicable branch lines.

5D-2.3.2 Determine the dew point required at each point of use to ensure the most economical operating cost. If the dryer must prevent condensation of moisture in air systems, determine the lowest temperature allowed for pipe exposure and select a dryer to achieve a system pressure dew point 20°F below this point, and select a dryer that allows dew point adjustment.

5D-2.3.3 Locate dryers where ambient temperature will not exceed 100°F to maximize drying efficiency.

5D-2.3.4 Select dryer in conjunction with after-cooler to ensure the inlet air temperature to the dryer can be as low as feasible, and not exceed 100°F. Conversely, the inlet air pressure should be as high as possible.

5D-2.4 Air Leakage

Maximum acceptable air leakage rate for a compressed air system shall not exceed ten (10) percent of the installed system flow rate.

5D-3 AIR COMPRESSORS

5D-3.1 System Design

5D-3.1.1 Total air requirements shall be based upon the sum of the average air consumption of air operated devices, not upon the total of individual maximum requirements. The requirements shall include the load factor calculated from the ratio of actual air consumption to the maximum continuous full-loaded air consumption, plus a ten (10) percent factor, and expected growth requirements for the subsequent two years.

5D-3.1.2 Either a central compressed air distribution system or a system of separate compressors located near the point of usage may be utilized. Whenever it is economically feasible, a central compressed air system shall be utilized to serve multiple points of use.

5D-3.1.3 Provide an Economic Evaluation to determine the type of system that will be most cost-effective and reliable based on such issues as economics, seasonal requirements, and operational load variations.

5D-3.2 Location and Accessibility

Compressors shall be located in clean ventilated areas of sufficient size to permit easy access for cleaning, inspection, maintenance, repair, or any necessary dismantling. Adequate aisle space is needed between items of equipment for normal maintenance as well as for equipment removal and replacement.

5D-3.3 Installation and Testing

5D-3.3.1 Protective controls such as a fault indicator and a manual reset device shall be provided to protect air compressor systems against high temperature, high pressure, and low oil pressure.

5D-3.3.2 Connection to a compressor shall be made with a flexible connection to avoid damage to components internal to the compressor due to vibration.

5D-3.3.3 Consideration must be given to critical pipe lengths of the air discharge pipe and certain lengths must be avoided to prevent resonance. The critical lengths vary with the type, size of air compressor and can be determined from air compressor manufacturers.

5D-3.3.4 All interior ducts will be designed to exhaust to the exterior of the facility; louvers shall be designed to match or be compatible with the building exterior and be located at least ten feet above ground level or otherwise comply with antiterrorism standards.

5D-3.3.5 All ducts shall be rated to withstand the heat generated.

5D-3.3.6 Initial startup shall be by the manufacturer, or a manufacturer approved vendor.

5D-3.3.7 A sound test shall be performed on all compressors and accessories after installation. Consideration to limit decibels to requirement of UFC 3-450-01 or 87 decibels shall be given.

5D-4 AIR DRYERS

5D-4.1 Selection Options

Evaluate system to justify the use and sizing of compressed air dryers.

5D-4.1.1 Use thermal mass air dryers to control condensation for normal pressure dew points of 40°F or higher.

5D-4.1.2 Desiccant dryers should be used only when pressure dew points below 30°F can be justified. Use external blower regeneration type only and located at point of use.

5D-4.2 Filters

5D-4.2.1 Pre-filters and after-filters shall be compatible with the air dryer selected and the specific air quality requirements.

5D-4.2.2 A pre-filter with an automatic condensate drain that allows a maximum pressure drop of 0.5 pounds per square inch (psi) shall be used ahead of all air dryers to remove water, oil and other undesirable particles.

5D-4.2.3 Oil separators or filters with a max pressure drop of 1.0 psi shall be used ahead of equipment sensitive to oil contamination.

5D-5 RECEIVER TANKS

5D-5.1 Design

5D-5.1.1 Construct air receivers in accordance with ASME requirements; provide an ASME National Board number.

5D-5.1.2 Pressure tanks shall be sized to provide compressed air storage for the compressed air system.

5D-5.2 Installation

5D-5.2.1 Install each receiver on an equipment pad to keep it dry.

5D-5.2.2 Provide space around the unit for drainage, inspection, and maintenance.

5D-5.2.3 Arrange all associated elements to drain back to the receiver.

5D-5.2.4 Protect all outdoor automatic condensate traps from freezing.

5D-5.2.5 No welding shall occur on the receiver tank unless the weld and welder are

certified, and the receiver tank is recertified by ASME.

5D-6 PIPING SYSTEMS**5D-6.1 Selection Options**

5D-6.1.1 Steel compressed air piping will be Schedule 40 for all sizes and will be galvanized, black steel, stainless steel, or copper.

5D-6.1.2 Stainless Steel Schedule 5 may be used if press fit style couplings are used and installation is per manufacturer's recommendations.

5D-6.1.3 Copper compressed air piping or tubing shall be Type K or Type L.

5D-6.1.4 Pipe fittings shall be same material as piping.

When copper pipe or tubing is used all joints shall be brazed.

- Brazing filler metals with melting temperatures between 1,000 degrees Fahrenheit and 1,600 degrees Fahrenheit shall be used

5D-6.1.5 Thermoplastic piping systems are not allowed for transport or storage of compressed air.

5D-6.2 Installation

5D-6.2.1 The maximum allowable pressure drop shall be five (5) percent from the compressor to the most distant point of use.

5D-6.2.2 The system should be arranged as a closed loop to allow for more uniform air distribution to consumption points and to equalize pressure in the piping.

5D-6.2.3 Separate services requiring heavy air consumption and at long distances from the compressor unit should be supplied by separate main airlines.

5D-6.2.4 Pipes shall be installed parallel with the lines of the building, with main and branch headers sloping down toward a dead end.

5D-6.2.5 Compressed air pipe shall be pitched so that any liquids flow towards a drain point or to a receiver tank.

5D-6.2.6 A safety valve or valves shall be placed in the pipeline when an isolation valve, or other flow restricting device, is placed in the discharge line between the compressor and after cooler or receiver.

5D-6.2.7 Branch headers from compressed air mains will be taken off at the top to avoid picking up moisture.

5D-7 AIR DROPS AND CONNECTORS

5D-7.1 Air drops shall terminate approximately four feet above floor and shall have a valve drain cock, strainer, and automatic drain.

5D-7.2 A pressure-regulating valve shall be provided at the point of use to maintain operating pressure where necessary.

5D-7.3 A shut off valve shall be provided at every air drop and shall be within reach without need of equipment or ladder.

5D-7.4 Quick disconnects shall be a safety type. They shall be selected by the end user and be compatible with other quick disconnects already in use.

5D-8 AUTOMATIC DRAIN VALVES

Automatic condensate drains used for receiver tanks and equipment shall be (design basis) Drain-All® brand.

SECTION 5E FIRE SUPPRESSION

5E-1 GENERAL GUIDANCE

5E-1.1 Oversight

5E-1.1.1 Plan Preparation

5E-1.1.1.1 The designer is fully responsible for all water supply analyses required for each project, including performing water flow tests, fire pump tests, etc. in accordance with Criteria Reference Documents. The Civil Engineering Plumbing Shop will assist the project A/E and/or Contractor in performing the tests and will provide previous flow test data when available. All the fire water flow tests shall be performed in the presence of Plumbing/Utilities Shop personnel.

- A preliminary sprinkler suppression system design including a plan showing sprinkler head locations, shall be provided no later than the preliminary (60%) design stage.
- Hydraulic calculations shall be provided no later than the first final (80%) design stage.

5E-1.1.1.2 Shop Drawings shall conform to the requirements established for working plans as prescribed in NFPA 13 and contract specifications. A registered Fire Protection Engineer with a minimum of 5 years' experience dedicated to fire protection engineering shall prepare and stamp all fire suppression system related hydraulic calculations, shop drawings, product data, and as-builts. The Designer of Record Fire Protection Engineer shall review and approve all final shop drawings and product data prior to installation. For extension of existing systems, shop drawings and calculations may be performed by an individual holding NICET IV certification.

5E-1.1.2 Installation

5E-1.1.2.1 For Mass Notification Systems (MNS), the installing firm shall coordinate with 78 ABW\SCOV-PWCS during any installation of MNS. Contractor shall have 78 ABS\SCOV-PWCS present during the installation and startup of the MNS transceiver (if part of project). Contractor shall have NICET III certified individual onsite during installation.

5E-1.2 Overview

5E-1.2.1 Fire alarm control units and mass notification control units with associated equipment, etc. shall be common off the shelf items by the manufacturer. Refer to Section 6C-10 through 12 for fire alarm and mass notification requirements.

5E-1.2.2 New wireless fire alarm systems shall not be used on Robins AFB at this time. In buildings with multiple control panels, all panels shall be the same brand and manufacturer and be networked together so all panels function together as one system.

5E-2 SUPPRESSION SYSTEM DESIGN

5E-2.1 System Components

5E-2.1.1 All clapper valve assemblies (wet, dry, deluge, pre-action, etc.) and trim must be Reliable or Tyco brand maybe used as a secondary option. All fire suppression systems should be installed with a Double Check Valve Assembly (DCVA) backflow prevention device. The only exception to the installation of a backflow prevention device is when the fire suppression system is fed from a dedicated, fire water, water tank and there is adequate protection at the pump house, before the pumps. Refer to 5C-3 for backflow prevention device requirements.

5E-2.1.2 Provide additional fire hydrants if existing hydrants are not accessible within 300 feet. Refer to 5C-2.3.1.5 for fire hydrant requirements.

5E-2.1.3 On all new supply air systems with design capacity of 2,000 CFM or greater, smoke detectors shall be included on the design for both the supply and return side of the system (IMC and NFPA 90A).

5E-2.1.4 Provide steel Schedule 40 or heavier pipe for all fire suppression systems. AWWA C-900 PVC is acceptable for underground water supply piping. Do not use any type of plastic, CPVC, PVC or polybutylene pipe in any fire protection piping systems.

5E-2.1.5 Flexible stainless steel sprinkler head piping is not allowed in new construction; the use of flexible stainless steel sprinkler head piping is allowed in renovation and remodel situations where four (4) or fewer sprinkler heads will need to be relocated to accommodate new or relocated walls. The flexible piping must be FM approved, UL listed and meet NFPA 13 guidelines.

5E-2.1.6 All system piping that is equal to or greater than two inches (2") in diameter shall be identified and labeled every 20 feet using snap-on plastic (only) that indicates "Sprinkler" and shows "Arrows" pointing in the direction of flow.

5E-2.1.7 Paint all exposed piping in inhabited spaces to match with the existing surrounding walls. In all other locations, the piping shall be painted in red. Do not paint sprinkler heads.

5E-2.1.8 Provide freeze protection for all fire suppression piping in attic areas, above suspended ceilings, and any other unheated spaces. Connect the freeze protection circuit to the fire alarm panel to provide a "trouble signal" if the freeze protection system becomes inoperative.

5E-2.1.9 Electronic equipment shall not have halon protection. Use wet pipe water suppression with early detection and shutdown of equipment.

5E-2.1.10 Fire Pumps are discouraged. If used, feed from another building or place a sign on the transformer feeding the building warning 78 CEG not to disconnect the transformer during a fire.

5E-2.1.11 The use of water motor gongs at each riser is no longer required.

5E-2.2 Design Requirements

Where NFPA 13 uses the term ordinary group 1 or ordinary group 2, the density, k-factor, hose stream and duration must be IAW the ordinary classification listed in Tables 5E.1 and 5E.2.

Table 5E-1

Hazard Classification per NFPA 13		SPRINKLER DESIGN DEMAND AND MINIMUM K-FACTOR (GPM/FT ²)/FT ²							
		Ceiling Height up to 30 ft.		Ceiling Height >30 - 45 ft		Ceiling Height >45 - 60 ft		Ceiling Height >60 - 100 ft	
		Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Light	Design	0.1/1500	0.1/1500	0.2/2500	0.2/3500	0.2/2500	0.2/3500	12@7 psi	N/A
	K-Factor	5.6	5.6	11.2	11.2	11.2	11.2	25.2	N/A
Ordinary	Design	0.2/2500	0.2/3500	0.2/2500	0.2/3500	0.2/2500	0.2/3500	12@7 psi	N/A
	K-Factor	8.0	8.0	11.2	11.2	11.2	11.2	25.2	N/A
Extra	Design	0.3/2500	0.3/3500	0.3/3600	0.3/4600	0.5/3000	0.5/4000	12@7 psi	N/A
	K-Factor	11.2	11.2	11.2	11.2	11.2	11.2	25.2	N/A

Table 5E-2

Hazard Classification per NFPA 13	HOSE STREAM DEMAND AND DURATION		
	Hose Demand		Duration minutes
	Ceilings 60 ft or less	Ceilings greater than 60 ft.	
Light	250	500	60
Ordinary	250	500	60
Extra	500	500	90

5E-2.3 Overhead Sprinkler System for Hangar Bays

5E-2.3.1 Hydraulic Design

Hydraulically design the sprinkler systems to provide 0.2 gpm/ sq. ft. [8.0 liters per minute per square meter (L/min/sq. m)] over the hydraulically most demanding 5,000 sq. ft. (464.5 sq. m) in the hangar bay.

5E-2.3.2 Sprinkler Systems

Provide upright quick-response sprinklers at the roof or ceiling level with a temperature rating of 175°F (79.4°C).

5E-2.4 Sprinkler System for Light Hazard Spaces

5E-2.4.1 Temperature Rating

In light hazard compartments, provide quick-response sprinklers with an ordinary temperature rating unless justification is provided clearly identifying that the ceiling within the compartment will experience maximum ambient temperatures that are above the maximum allowable for ordinary temperature rated sprinklers.

SECTION 5F WHOLE FACILITY METERING

5F-1 GENERAL REQUIREMENTS

5F-1.1 Metering shall be installed in all facilities. Repair projects shall add meters where not currently installed. Existing meters that do not meet the current requirements shall be replaced.

5F-1.2 If there is more than one service for a particular building, a meter shall be provided for each service. Generators and fire pump electrical services can be excluded.

5F-1.3 Utility meters, compatible with Robins' Advanced Metering Infrastructure (AMI) system, shall be installed on all utilities. Meters shall be connected to the Automatic Meter Reading System (AMRS) on the CE COINE. Metering shall not be provided through control systems.

5F-1.4 Contractor shall provide meter bases and meters.

5F-2 INTERFACE WITH VIRTUAL CE LAN

5F-2.1 Connectivity

Each electrical meter installed shall have the capability to tie physically into the base Virtual CE LAN, also known as the CE-COINE (Community of Interest Network Enclave). Other pulse meters shall be connected to the pulse inputs of the electrical meters. Coordinate programming of the meters network with the Energy office to validate communication settings and connect to AMRS. Contractor shall provide MAC address to be issued the IP address. Pulse splitters shall be installed at all locations where meters are to send signal to multiple locations.

5F-2.2 Connection Requirements

Final connection from the network switch patch panel and programming of the network connection can only be accomplished by 78 ABW/SC or their Contractor. Contractor shall include any costs charges by the 78 ABW/SC Contractor to connect the meters to the Base communications system.

5F-2.3 CAT 6

CAT 6 cable shall be extended from the meter to the nearest point for connection to the CE-LAN. If the distance from the metering point to the CE-LAN is greater than 295 ft, provide a Mod Bus TCP (Direct Ethernet).

5F-2.4 Installation

5F-2.4.1 Inside the building, existing communications trays or j-hooks may be used. All work must be coordinated with 78 ABW/SC through the AF Project Manager/ Construction Manager.

5F-2.4.2 Outside of the facility the CAT 6 cable shall be routed underground or overhead at a height of at least eight (8) feet if near a building. Cable placed underground shall be run in PVC; cable placed in exposed locations, shall be run in Rigid Metal conduit.

5F-2.4.3 New conduit, communications wireways and j-hooks may be installed by the

Contractor or in some cases, the 78 ABW/SC Contractor services should be obtained to accomplish the work.

5F-2.4.4 11A pulse splitter shall be installed on meters that require connection to both the electrical meter and the control system. The system shall provide a separate pulse to the electric meter and control system. 11\

5F-2.5 Surge Protection

If CAT 6 cable is used from the meter to the CE-LAN, provide a surge protector within three (3) feet of the building penetration before the patch panel connection. If fiber is chosen as the transfer media, media converters will be required to convert copper to fiber and back to copper before it is connected to the CE-LAN.

5F-2.6 Central Collection Point

Metering interfaces and electronic data from each installed meter shall tie to the CE Virtual LAN at the designated central collection point. Coordinate contact with the Energy Office through the AF Project Manager/ Construction Manager to obtain current guidelines and requirements.

5F-3 ELECTRICAL CONNECTION

5F-3.1 Electrical Meter

Locate the electrical meter at the secondary side of the transformer. Mount meter in a metering cabinet mounted on a stand/pole located approximately four (4) feet from the transformer.

5F-3.2 Mounting Requirements

The mounting pole shall be a three-inch galvanized pole or comparable unistrut construction. The pole shall be buried at a minimum depth of 24 inches with six (6) inches of surrounding concrete and should be tall enough to allow for the placement of the meter enclosure at a height of four (4) to six (6) feet from the bottom of the enclosure. As an option for transformer(s) located closer than 10 feet from the building, the meter base may be attached to the exterior building wall.

5F-3.3 Electrical Service

The Electrical Contractor shall provide a 1½-inch rigid metal conduit from the transformer to the metering cabinet. For new installations provide PVC conduit through and under the pad to the pole, then convert to rigid steel. For existing locations, route from side of transformer just above the pad.

5F-3.4 Test Block

5F-3.4.1 Three Phase, Y Connections

Provide a 10-pole test switch in the bottom of the cabinet allowing for the testing of the meter.

5F-3.4.2 Single Phase and Delta Connections

If current transformers (CT's) are utilized, provide a test switch with the number of poles required.

5F-3.4.3 Single Phase Connections

Single phase connections shall utilize a 200 Amp inline meter and do not require test switches.

5F-3.5 **Meter Base (and associated Devices and Wiring)****5F-3.5.1** Three Phase, Y or Delta Connections

Provide current transformers (CT's) and M-2392 socket base.

5F-3.5.2 Single Phase Inline Meters

5F-3.5.2.1 Provide a residential meter base for amperages less than 200 Amps.

5F-3.5.2.2 For amperages greater than 200 Amps, provide CT's and socket base.

5F-3.5.2.3 Route multi wire metering cable from CTs to the meter test block.

5F-3.6 **Meter and Meter Electronics****5F-3.6.1** Single or Three Phase Facility Feed

Provide a Schneider Electric PM8000 for new installation and to replace the Schneider ION 8650 C with onboard I/O Board Option B (3 Form A Digital inputs).

5F-3.6.2 Transformers

5F-3.6.2.1 When CTs are required, use standard sized CTs that closely match the amperage rating for the circuit to be metered.

5F-3.6.2.2 Potential transformers (PT's) are not normally required.

5F-3.6.2.3 For 4160 volt and 12,470 volt circuits that are required to be metered, provide CT's and PT's of correct ratings.

5F-3.6.3 Labeling

5F-3.6.3.1 Provide labels in the cabinet where the meter is installed.

5F-3.6.3.2 The first label shall indicate the voltage of the system being metered.

5F-3.6.3.3 The second label shall indicate the multiplier of the meter including CT, PT, and meter constants.

5F-3.6.3.4 Labels shall be at least one inch high and firmly attached to the backboard in the cabinet (not glued).

5F-3.7 Transmitted Data**Table 5F-1**

Parameters for Electrical Transmitted Data	
Minimum Sending Time	15 minutes
Maximum Sending Time	6 seconds
Minimum Data Required	Date, time, readings in multiples of kWh

5F-4 NATURAL GAS CONNECTION**5F-4.1 Location and Pressure**

5F-4.1.1 The natural gas meter and the parallel line required for maintenance shall be installed at the point where the gas line enters the facility.

5F-4.1.2 Existing natural gas pressure can vary between 50 to 80 psi depending on the location. Regulate the pressure to 40 psi for installation of required meters.

5F-4.2 Regulators

5F-4.2.1 Provide a regulator to drop the gas pressure to required pressure utilized in the facility. Mount the regulator before the meter.

5F-4.2.2 Provide two regulators when a large pipe size is used [greater than two (2) inches on line side or over three (3) inches on load side] and there is more than a 40 psi pressure drop from the main gas line to the pressure in the line entering the facility.

5F-4.2.2.1 Set the first regulator before the meter to drop the pressure 30 psi or more. Select this meter to operate at the pressure of its environment.

5F-4.2.2.2 Set the second regulator to adjust to the operating pressure of the building. This pressure should be 5 to 10 psi with each unit dropping the pressure to its operational level.

5F-4.3 Meter and Meter Head

5F-4.3.1 Provide a natural gas meter to operate at the regulated pressure. The meter shall be a diaphragm meter with pulse capability and shall be connected to the Automatic Meter Reading System (AMRS) on the CE COINE. The output shall be run in conduit to the closest electrical meter and attached to its input.

5F-4.3.1.1 Provide for manual readings in addition to the electronic readings.

5F-4.3.1.2 Provide a metal tag connected to the meter by a small chain indicating the volume of the visual readings and the value of the pulses from the meter. For pulses, always give the value to convert each pulse into 100 cubic feet.

5F-4.3.2 Transmitted Data

The meter shall send pulses (Contractor to set pulse per metering unit) of gas to the electrical

meter internal board. The electrical meter shall then transmit data via its LAN connection to the central collection system.

Table 5F-2

Parameters for Natural Gas Transmitted Data	
Minimum Sending Time	Pulses only
Maximum Sending Time	Pulses only
Minimum Data Required	Date, time, readings in multiples of cubic feet

5F-5 WATER CONNECTION

5F-5.1 Location and Pressure

5F-5.1.1 Install a water meter to operate at the regulated pressure, inside the mechanical room where the water main enters.

5F-5.1.2 Water pressure can vary between 40 to 60 psi on the base depending upon the location.

5F-5.2 Meter and Meter Head

5F-5.2.1 Install a water meter to operate at the regulated pressure. \1\ The meter shall meet the following requirements:

- Pulse kit must be able to produce a two-wire (Form A) pulse output.
- Water meter or attached pulse kit must include a visual register or dial.
- All new meter assemblies shall include upstream strainers.
- All meter labels shall be white on black phenolic.\1\

5F-5.2.2 Contractor shall provide a metering head on the water meter to send pulses via the CE Virtual LAN to the central collection point.

5F-5.2.3 Provide for manual readings in addition to the electronic readings.

5F-5.2.4 Provide a metal tag connected to the meter by a small chain indicating the volume of the visual readings and the value of the pulses/data from the meter. For pulses, always give the value to convert each pulse into multiples of gallons.

5F-5.3 Transmitted Data

Meter shall send pulses (Contractor to set pulse per metering unit) of water usage to the electrical meter internal board. The electrical meter shall then transmit data via its LAN connection to the central collection system.

Table 5F-3

Parameters for Waters Transmitted Data	
Minimum Sending Time	Pulses only
Maximum Sending Time	Pulses only
Minimum Data Required	Date, time, readings in multiples of gallons

5F-6 STEAM CONNECTION

Steam meters shall be connected to the CE COIN and AMRS through the closest electrical meter.

5F-6.1 Location, Temperature and Pressure

5F-6.1.1 Steam is metered at the main steam production plants only. If additional metering is required, this requirement will be identified by 78 CEG.

5F-6.1.2 Temperature and pressure of steam is 358 degrees Fahrenheit (°F) at 125 psi.

5F-6.2 Smart Unit

5F-6.2.1 If a steam meter is required for a new plant or repair of an existing meter, the meter shall have the ability to gather points of data (pressure, flow rate converted to volume and temperature) to produce readings of multiples of BTUs.

5F-6.2.2 Provide for manual readings in addition to the electronic readings.

5F-6.2.3 Provide a metal tag connected to the meter by a small chain indicating the value of the visual readings and the value of the pulses/data from the meter. For pulses, always give the value to convert each pulse into multiples of BTUs.

5F-6.3 Transmitted Data

Table 5F-4

Parameters for Steam Transmitted Data	
Maximum Sending Time	15 minutes
Minimum Sending Time	6 seconds
Minimum Data Required	Date, time, readings in multiples of BTUs

5F-7 CHILLED WATER CONNECTION

Chilled water meters shall be connected to the CE COIN and AMRS through the closest electrical meter.

5F-7.1 Location and Pressure

5F-7.1.1 Chilled water will only be metered at the main production plants that serve more than one facility.

5F-7.1.2 When a chilled water meter is required at alternate location, use an ONICON F3500 Magnetic Flow Meter plus two temperature sensors plus System 10 BTU computer.

5F-7.1.3 Temperature is less than 50 degrees Fahrenheit (°F) for the supply and return.

5F-7.1.4 At each building to be metered, two meters must be installed, one for the incoming line and one for the outgoing line. The difference between the meter readings shall show water loss, Temperature difference, and energy usage associated with chilled water usage in the facility.

5F-7.2 Smart Unit

5F-7.2.1 The meter shall have the ability to gather points of data (flow rate converted to volume and temperature) to produce readings of multiples of BTUs.

5F-7.2.2 Provide for manual readings in addition to the electronic readings.

5F-7.2.3 Provide a metal tag connected to the meter by a small chain indicating the value of the visual readings and the value of the pulses/data from the meter. For pulses, always give the value to convert each pulse into multiples of BTUs.

5F-7.3 Transmitted Data

Table 5F-5

Parameters for Chilled Water Transmitted Data	
Maximum Sending Time	15 minutes
Minimum Sending Time	6 seconds
Minimum Data Required	Date, time, readings in multiples of BTUs

5F-8 RENOVATION AND DEMOLITION

5F-8.1 Renovation

If a renovation project includes work involving an existing meter or an existing building requires a new meter, the Contractor shall do the following:

1. Protect existing meters
2. Replace existing meters that are still required and are more than 10 years old
3. Provide new meters for buildings in accordance with these standards
4. All removed meters shall be turned into the Energy Office

5F-8.2 Demolition

5F-8.2.1 All meters included in building demolition projects shall be turned into the Energy Office.

5F-8.2.2 Cabinets and test blocks must be turned in with electrical meters.

CHAPTER 6 ELECTRICAL ENGINEERING ELEMENTS



SECTION 6A ELECTRICAL GUIDELINES

6A-1 GOVERNANCE

6A-1.1 Regulatory Guidance

The Base Facility Standard (BFS) establishes the minimum acceptable requirement on Robins AFB. In some cases, it is more stringent than the National Electrical Code (NEC), Unified Facility Criteria (UFC) or other referenced document. Typically, the most stringent rules should be used.

6A-1.1.1 During renovation and other construction work that involves existing equipment, be aware that many applications for equipment have been installed before the requirements of this standard. When existing equipment does not meet current standards, have 78 CEG make a recommendation for replacement or retaining in place.

6A-1.2 Applicable Codes

The following list are the codes applicable to electrical work here at Robin AFB.

6A-1.2.1 UFC 3-501-01 Electrical Engineering

This UFC structures the rest of the UFC's, where applicable, including but not limited to, UFC 3-550-01 Exterior Electrical Power Distribution; UFC 3-520-01 Interior Electrical Systems; UFC 3-580-01 Telecom Building Cabling Systems Planning and Design; UFC 3-530-01 Interior and Exterior Lighting Systems and Controls; UFC 3-520-05 Stationary Battery Areas; UFC 3-540-01 Engine-Generator Systems for Backup Power Applications; and UFC 3-575-01 Lighting and Static Electricity Protection Systems.

6A-1.2.2 National Electric Code (NEC)

The National Electric Code (NFPA 70) is the main electrical reference from NFPA, but all NFPA codes are applicable, including but not limited to NFPA 25, 72, 110, and 111.

6A-1.2.3 The Institute of Electrical and Electronics Engineers (IEEE)

For standard practices and disputes, IEEE is the standard reference for coming to solution.

6A-1.3 Installation

6A-1.3.1 Standardized rules for all work shall prevail unless an exception should be made to accommodate special conditions at Robins AFB or requirements for long-term maintenance.

6A-1.3.2 All electrical systems including conduit, junction boxes, lights, equipment, etc. to be installed above ceilings or near the roof **shall not be supported by the roof deck**. Where primary and secondary structural members are spaced more than the allowable span for electrical elements, provide intermediate support as required for support. All support shall be noncombustible. For PEMB, a letter shall be provided listing limits and capacities for attachment to secondary members prior to being allowed.

6A-1.3.3 All new conduits shall be ¾-inch minimum.

6A-2 EQUIPMENT PADS**6A-2.1 Pad Requirement**

6A-2.1.1 Most equipment such as air switches, transformers, walk-in enclosures, switchboards, etc. requires an equipment pad for placement.

6A-2.1.2 Exceptions: Precast concrete polymer pads are an acceptable alternative. On a case-by-case basis, equipment may be mounted via alternative methods that keep it off ground.

6A-2.2 Pad Size and Layout

Size pads to extend beyond each and/or all equipment to be placed upon the pad. If more than one piece of equipment is placed on the pad, provide the following minimum spacing:

6A-2.2.1 Transformers and/or air switches with doors facing each other: 10 feet

6A-2.2.2 Air switch non-door side and any other piece of equipment: 3 feet

6A-2.2.3 Transformer non-door side + any other equipment except an air switch: 2 feet

6A-2.2.4 Secondary equipment can be placed as close as one (1) foot when no access to the back of the panel or disconnect is required.

6A-2.2.5 The placement of pad mounted equipment shall adhere to the following setbacks.

Table 6A-1

Pad Setback Guidelines	
Adjacent Elements	Distance (ft)
Building – Non-Combustible	15
Building – Combustible Construction	50
Doorway	4
Flammable Containers	4
Gas/Fuel Dispenser	30
Natural Gas Regulator/Meter	10
Roadway Edge	10
Roadway Point of Intersection	30

6A-2.3 Exterior Pad Construction

Exterior transformers and other electrical equipment shall be set and bolted onto poured-in-place concrete or precast pads. Cast-in-place and pre-cast pads shall be designed and constructed with adequate size, thickness, reinforcement, and can be validated capable of supporting the intended weight. Provide a block-out in pad on the secondary side for future expansion. Bottom of block-out shall be grout sealed.

6A-2.4 Exterior Pad Expansion

6A-2.4.1 If new or additional equipment is being placed on an existing pad and a twelve (12) inch minimum distance to edge of the pad will no longer exist, the pad may be enlarged instead of being replaced.

6A-2.4.2 Any side of pad that needs to be extended shall be extended a minimum of one (1) foot.

6A-2.4.3 Extensions or additions to the pad shall be connected using dowels and be finished at a height level with the existing pad.

6A-2.5 Distance to Manholes or Handholes from Equipment**Table 6A-2**

Distances to Manholes or Handholes	
Nearby Elements	Minimum Distance (ft)
Edge of Aprons, Taxiways, Runways	15
Any Hydrant, Lateral, or Control Pit	50
Fueling Points	200
Edge of Roadways	8-10

6A-2.6 Interior Housekeeping Pads

6A-2.6.1 Any floor mounted distribution equipment shall be supplied with a housekeeping pad. Pad shall be at least four (4) inches above finished floor. These pads do not have to be poured in place, and alternative solution may be approved on a case-by-case basis.

6A-2.6.2 Size pads to extend beyond each and/or all equipment to be placed upon the pad. If more than one piece of equipment will be placed on the pad, provide a minimum spacing of three (3) feet between the two pieces of equipment. The pad shall extend at least six (6) inches beyond sides of equipment. If more than one piece of equipment is a different size, make the pad one rectangle with the largest piece of equipment determining the required width and length.

6A-2.7 Utility Equipment Stand

Utility switches or controls that require a support structure for initial installation shall be attached to equipment stands that have been set and bolted onto typical concrete equipment pads. These stands should be fabricated using a Unistrut-type metal framing system that is sized to hold the equipment and withstand wind speeds of approximately 116 MPH. The equipment stand assembly shall be grounded.

6A-2.8 Utility Poles

Utility poles shall be used for temporary purposes only, unless approved by the AHJ. If used in a permanent manner, the pole(s) shall be metal or concrete.

6A-3 UTILITY BOLLARDS**6A-3.1 Placement**

6A-3.1.1 Bollards shall be required in traffic areas only, protecting from direction(s) of potential traffic. Bollards shall be 12 inches from the closest point of the equipment/pad.

6A-3.1.2 Manholes are exempt from this protection as long as the round lid (that is traffic rated) is level with the ground.

6A-3.1.3 If overall linear distances for utility bollards is greater than 15 feet, then equally space bollards at a distance of 5 feet.

6A-3.2 Design

Utility Bollards shall be constructed using a six (6) inch steel pipe, primed and painted bright yellow. The interior of the pipe shall be filled with concrete; add grout and wash at the top to create a smooth rounded surface. The bollard shall be placed in the ground at a depth of at least 32 inches with a minimum six (6) inch thick encasement of concrete for the full depth. Height shall be 48 inches tall. Metal posts, columns and bollards that come in contact with or are embedded in concrete shall be coated with an epoxy system. The final dry thickness of coats shall be six (6) mm. A prime coat shall be applied to bollard prior to installation.

6A-4 UNDERGROUND UTILITY PLACEMENT

6A-4.1 Underground Electric Cable

Direct buried cable shall not be used on Robins AFB. All cable run underground shall be placed in PVC encased in concrete.

6A-5 ELECTRICAL CLOSETS

6A-5.1 Industrial and Shop Areas

6A-5.1.1 Electrical distribution equipment may be wall/floor mounted in industrial/shop areas.

6A-5.1.2 Place distribution equipment along a wall as much as possible and locate so that the normal length of feeder/branch circuits is less than 300 feet from the distribution equipment.

6A-5.2 Administrative Areas

6A-5.2.1 Electrical closets within the facility shall be separate rooms with no other trades (including janitorial) sharing the closets and shall be large enough for all equipment scheduled to fit with proper spacing between the equipment. Electrical closet doors shall contain a lock.

6A-5.2.2 Electrical closets shall be placed in the middle of loads served by the distribution equipment so that branch circuits will be less than 300 feet in length.

6A-5.2.3 If there is no main electrical room in the building, add walls or utilize an existing room for the main electrical room. If room is extremely limited, use a walk-in enclosure.

6A-5.3 Dedicated Equipment Space

6A-5.3.1 There shall be no foreign objects above or below the equipment in this dedicated space, except lights, sprinkler piping (not a sprinkler head), other piping with no valves and suspended ceilings.

6A-5.3.2 Conduits and control equipment are not considered foreign objects.

6A-5.3.3 A transformer cannot be located below a panelboard.

6A-5.3.4 The minimum area requirement for placement of electrical equipment will be 30 inches or the width of equipment whichever is greater.

6A-5.3.5 For equipment mounted side-by-side, the full width is the width from the left side of the leftmost equipment to the right side of the rightmost equipment. Equipment installed within two (2) feet of each other shall be considered side-by-side.

6A-5.4 Electrical Room Doors

6A-5.4.1 Doors must provide a minimum of three (3) feet wide to provide access to the electrical equipment and at least 96 inches in height to allow for future movement of equipment in and out. If several pieces of equipment are located inside the space, either use double doors that will open for the entire length of the equipment or provide minimum working clearance in the room.

6A-5.4.2 Locate doors providing access to electrical rooms centrally in the middle of long equipment, not at the end of a long piece of distribution equipment. If two pieces of equipment are set facing one another, place a door at each end of the equipment. Electrical room doors shall be equipped with panic hardware.

6A-5.5 Existing Electrical Equipment

When replacing or working on existing electrical equipment that is located in hangars, warehouse, workspace, or admin areas; it should be evaluated if it is worth isolating.

6A-5.6 Sign Required

Contractor shall place a sign either on a wall or hanging from the ceiling that is immediately visible when the door is open to the electrical room or closet. The sign can be mounted on the backside of the door. If double doors are provided, the sign will be put on the door that will swing open.

6A-5.7 Removal of Electrical Room(s)

6A-5.7.1 If an electrical room or closet is being relocated or replaced, remove all electrical equipment, conduit, etc. from the walls, floor and ceiling.

Figure 6A-1



6A-6 STANDARD PLAN AND OPERATIONS REQUIREMENTS

6A-6.1 One Lines

6A-6.1.1 Complete a one-line drawing of each electrical unit or system following standards established by the National Electric Safety Code (NESC®) published by the Institute of

Electrical and Electronics Engineers (IEEE) . Use upper and lower case letters (not all caps) that have a 14 point size when printed at least 11 X 17 inches and laminated. Place the copy near the unit or system. If the equipment is outside, place the on-line inside the access door.

6A-6.1.2 Provide instructions with the one-line showing reference points by number. Specifically address normal and emergency shut-down procedures, start-up procedures from emergency situations. Identify and label all system components, individual fixtures and circuits.

6A-6.1.3 Provide a facility map adjacent to the one-line showing the system plus normal and emergency lighting fixtures labeled to match the one-line.

6A-6.1.4 If the facility only has battery pack fixtures, provide the map only.

6A-6.1.5 Contractor shall provide copies of each one-line and associated instruction for approval before they are placed.

Table 6A-3

ONE-LINE DRAWING GUIDELINES		
Unit	System	Elements to Include
Fire Pump (Electrical)	Power System	Source of power (transformer)
Fire Pump (Engine)	Fuel System	- Tank size and feed, including the all valves and normal operating position - The solenoid and bypass valves, including normal operating position for valves - Direction generator is mounted - Oil level check point, oil fill point, oil filter and oil drain point
Fire Pump or Radiator (Built In or Attached)	Water Piping System	- Radiator, fill opening, drain plug, thermostat, point of connection showing "to-engine" line and the "return" line - Location of the water jacket heater
External Fuel Tank	Fuel System	- Tank size, valve and fuel filter locations - Open and closed position of the valves and direction of movement

6A-6.2 Shop Drawings

6A-6.2.1 Shop drawings shall consist of a complete list of equipment and materials. This includes manufacturer's descriptive and technical literature, catalog cuts, and installation instructions.

6A-6.2.2 Include certified test data stating the maximum recommended anode current output density and the rate of gaseous production if any at that current density.

6A-6.2.3 Shop drawings shall also contain complete wiring and schematic diagrams and any other details required to prove that the system has been coordinated and will function properly as a unit.

6A-6.2.4 Include corrosion recommendations for changes of methods, equipment sizes, and installation criteria.

6A-6.3 As-Built Drawings - Electrical

6A-6.3.1 Provide “as built” drawings of all electrical systems, components and equipment including, but not limited to the following: all cable routes, outlet locations, patch panel positions identification markings and communication room/closet locations, as well as site drawings showing the route of all OSP cable, manhole and duct systems installed.

6A-6.3.2 All elements shall be labeled according to their function with a unique identifier code. Telecommunications system labeling, management records, and drawings must comply with the latest TIA/EIA Directive.

6A-6.4 Operating and Maintenance Instructions

6A-6.4.1 Provide operating instructions outlining the step-by-step procedures required for system start-up and operation. The instructions shall include the manufacturer's name, model number, service manual, parts list and brief description of all equipment and their basic operating features.

6A-6.4.2 Furnish maintenance instructions listing routine maintenance procedures and possible breakdowns and repairs. The instructions shall include diagrams for the system as installed and instructions in making structure to reference electrode measurements.

6A-6.5 Spare Parts Data

After approval of shop drawings and not later than pre-final inspection, furnish spare parts data for each different item of material and equipment specified. The data shall include a complete list of parts, special tools and supplies, with current unit prices and at least three sources of supply.

SECTION 6B MEDIUM TO LOW VOLTAGE

6B-1 GENERAL GUIDANCE

6B-1.1 No Overhead or Direct Buried Cable

Direct buried cable shall not be used on Robins AFB.

6B-1.2 Directional Boring

Directional boring (jack and bore) to cross under roads, parking lots, airfield aprons, taxiways and runways, bodies of water, environmentally sensitive areas and historical preservation areas requires approval from 78 CEG/CEN.

6B-2 DUCT BANK

6B-2.1 Overview

6B-2.1.1 Spares

Always provide at least one spare conduit in all underground duct banks with the exception of air switches. Furnish nylon pull strings in all spare conduits equivalent to Greenlee #430 with 210 pounds tensile strength.

6B-2.1.2 Main Lines

Main lines run from main breaker in substation through manholes to the end of the line. Install 4-each - five (5) inch PVC (Sch. 40 or Type DB) concrete-encased for new main lines.

6B-2.1.3 Switch Laterals

Air switches are placed near manholes to facilitate ties. Switch laterals run from manhole to air switch. Install 4-each five (5) inch PVC (Sch. 40 or Type DB) concrete-encased for new main lines.

6B-2.1.4 Transformer Laterals

Install 2 each – four (4) inch PVC (Sch. 40 or Type DB) concrete-encased for lines from manhole through handholes to transformer.

6B-2.2 Arrangements

6B-2.2.1 Top of concrete encased duct bank shall be 30 inches below finished grade.

6B-2.2.2 Use sweeping bends if only one turn of 90 degrees or less.

6B-2.2.3 Minimum spacing between conduits shall be three (3) inches at closest point. Use duct bank spacers on a five (5)-foot interval to maintain spacing. Stake braces to keep conduit from floating.

6B-2.2.4 Provide a minimum 3 inches of concrete cover on all sides of duct bank.

6B-2.2.5 Use 3000 psi concrete for duct banks.

6B-2.2.6 No 15 kV duct bank shall be routed under or through a building to another location.

6B-2.2.7 No 15 kV conduit shall be routed exposed to air or inside buildings above ground level.

6B-2.2.8 Place a magnetic tape 12 inches above each duct bank for the entire length of the duct bank with the words, "CAUTION: HIGH VOLTAGE."

6B-3 MANHOLES

6B-3.1 Guidelines

6B-3.1.1 Use minimum size 8 feet x 8 feet x 7 feet deep.

6B-3.1.2 Provide appropriate quantity of cast-in-place inserts on each inside wall based on new and existing conditions. Unused end bells shall be capped or plugged in to prevent water intrusion.

6B-3.1.3 Provide stainless steel cable racks for the number and routing of cables in the manhole. Cables shall be looped around the manhole and not go directly from incoming conduit to outgoing conduit. Provide sweeping bends for conductors at corners of manhole with a minimum radius of 12 times diameter of cable.

6B-3.2 Placement and Spacing

6B-3.2.1 Place no more than 450 feet apart.

6B-3.2.2 For turns of 90 degree or more, place a manhole at the turn.

6B-3.2.3 A manhole shall be provided at each switch location. Connect to manhole with one five (5) inch duct entering each switch compartment – a total of four (4).

6B-3.3 Metal Covers

6B-3.3.1 Provide circular metal covers, not removable tops.

6B-3.3.2 Provide minimum clear opening of 32 inches.

6B-3.3.3 Provide H20 load rating for top.

6B-3.3.4 Metal covers shall be placed level with the ground or surface that they are placed in. Bricks can be used to raise the ring from the top of the manhole to allow for level placement.

6B-3.4 Restricted Elements

The following are not allowed in manholes:

- Load junctions
- Separable splices (bolt-T connectors)
- T-splices and Y-splices.
- Power distribution equipment, including transformers and switches.

6B-4 HANDHOLES**6B-4.1 Guidelines**

6B-4.1.1 Handhole may or may not have predrilled holes. If predrilled inserts are used, factory installed end caps shall be provided for each opening.

6B-4.1.2 Handholes may be used only for lateral runs of #2 or 4/0, 15 kV cable only. All splices for extending length of cable shall be made in a handhole for the smaller cable.

6B-4.1.3 Do not place a handhole in a roadway, alleyway, or parking lot. Use a manhole instead.

6B-4.1.4 If more than four (4) runs are needed, do not use a handhole, use a manhole instead.

6B-4.1.5 Handholes shall be 4 foot X 4 foot X 4 foot deep, interior dimensions, for up to four runs. All sides and bottom shall be concrete or strong polymer.

6B-4.1.6 All conduit entering the handhole shall be sealed around to prevent water seepage, but all conduits shall remain open to allow moisture/water to flow into the handhole.

6B-4.1.7 Tier rating of handholes shall be Tier 15 for normal applications. For existing handholes located within three (3) feet of roadways, alleyways or parking lots, handholes shall have a Tier 22 rating.

6B-4.2 Placement and Spacing

6B-4.2.1 Handholes shall be used for turns of 90 degrees or more.

6B-4.2.2 Place handholes at a maximum of 450 foot spacing.

6B-4.3 Clearance

- Maintain 50 feet from edge of aprons, taxiways, runways
- Maintain 50 feet from any hydrant lateral control pit
- Maintain 200 feet from a fueling point
- Maintain 8 to 10 feet from edge of roadway to midway to the manhole/handhole

6B-5 CABLE**6B-5.1 Cable Type**

6B-5.1.1 All cables for use on exterior electrical systems at Robins AFB shall be 15 kV, single copper conductor, EPR (MV-105), copper tape shielded, 133% insulation with PVC jacket.

6B-5.1.2 Main runs from main breaker in to air switches shall be 3#500 MCM with 1#4/0 XHHW, 600 volts neutral.

6B-5.1.3 Lateral runs from switch to transformer for transformers 2000 kVA and greater shall be 3#4/0 AWG with 1#4/0 XHHW, 600 volts neutral.

6B-5.1.4 Lateral runs from switch to transformers less than 2000 kVA shall be 3#2 AWG with 1#2 XHHW, 600 volts neutral.

6B-5.1.5 All cables for 4160 volts use shall be 5 kV, single copper conductor, EPR (MV-105), copper tape shielded, 133% insulation with PVC jacket with a minimum size of #8 AWG.

6B-5.2 Splices

6B-5.2.1 "T" Splices

"T" splices are not allowed.

6B-5.2.2 In-Line Splices

- Splices that extend the length of the cable shall be made only in manholes and handholes with prior approval from 78 CEG/CEN.
- Splices shall not be made-up in manholes and handholes and then pulled into the conduit.
- Provide bleeder wire for each splice bonded to neutral. Do not bond directly to ground. Neutral shall be bonded directly to ground.
- Tape splices are preferred at Robins AFB when performed by experienced splicers using methods and materials provided by the 3M 5717-TAPE-KIT or 3M 5719-TAPE-KIT, Preferred splice kits are listed in the Design Basis below.

6B-5.2.3 Design Basis

6B-5.2.3.1 500 MCM: Prysmian Elspeed® Compact Splice Kit 15SFJCe-C-GB424-500CR (133% insulation level) or 3M Cold Shrink QS-III Splice Kit 5515A-500-CU, tape shield, wire shield, UniShield, 15 kV, Standard

6B-5.2.3.2 4/0 AWG: 3M 5719-TAPE-KIT, Prysmian Elspeed® Compact Splice Kit 15SFJCe-C-GB424-4/0CU (133% insulation level) or 3M Cold Shrink QS-III Splice Kit 5514A-4/0-CU, tape shield, wire shield, UniShield®, 15 kV, Standard.

6B-5.2.3.3 #2 AWG: 3M 5717-TAPE-KIT, Prysmian Elspeed® Compact Splice Kit 15SDJCe-C-GB424-2CU or 3M Cold Shrink QS-III Splice Kit 5513A-2-CU, tape shield, wire shield, UniShield®, 15 kV, Standard

6B-5.3 Terminations

6B-5.3.1 Use 200 Amp, 15 kV class load-break elbow connector with capacitance test point for pad mounted transformers.

6B-5.4 Termination per Cable Type

- 500 MCM cable: Prysmian PCT15M3-CF, 3M 5636, or equivalent
- 4/0 cable: Prysmian PCT15M3-CF, 3M 5635, or equivalent
- #2 cable: Prysmian PCT15M1-CF, 3M 5633, or equivalent

6B-6 AIR SWITCHES**6B-6.1 Design Basis**

6B-6.1.1 Use S&C PMH-10 (pad-mounted gear) with the following features:

- 4-way, air type
- Live front, rated 600 Amps
- Gang switched. No mechanical interlocks
- Switches shall be factory painted Brown, Robins AFB #48

6B-6.1.2 Furnish with the following options:

- Dual-purpose front barrier. Barriers shall be provided between sections that will allow work in one section while other sections are being energized
- Grounding stud in at least two compartments
- 18-inch carbon steel base spacer, non-compartmented to match enclosure

6B-6.2 Placement and Spacing

6B-6.2.1 Placement of air switch shall be in an area level and clear with 10 feet in front of the two sides with doors and three (3) feet on other sides.

6B-6.2.2 Beside roadways, place the air switch at least 10 feet from the edge of the roadway.

6B-6.2.3 Near intersections of roadways, place the air switch at least 30 feet from the points of intersection. Point of intersection shall be closest point of paved/concrete road at the intersection.

6B-6.3 Lock and Key

Furnish six (6) padlocks and one key blank for each new switch installed, replacement of existing will utilize locks previously removed. Use locks manufactured by Best Access Systems, lock number 11B720L with core number 8A59. Keys provided shall be blank and uncut, also manufactured by Best Access Systems.

6B-6.4 Fault Indicator System**6B-6.4.1 Main Runs**

Fault indicator is required for each phase of 500 MCM cable that is installed. Re-use existing if present and functional. If none present install new. System shall be load current trip and reset type manufactured by Schweitzer Engineering Laboratories, Inc. with Inrush Restraint to prevent false indication during reclosing operations in situations when the inrush current exceeds the nominal trip value.

6B-6.4.2 Main Run Specifications

- Nominal trip value shall be 600 Amps.
- Minimum automatic current reset is 3 Amps.
- Typical Reset Time is 25 seconds at 10 Amps and above.

- Maximum Fault Current of 25 kA for 10 cycles at 60 Hz.
- Mounting shall be on the wire of each phase. Attach in accordance with manufacturer's instructions.
- UV-stabilized polycarbonate outside covering.
- Part number is 3CRV0600IR.
- Unit comes in single phase and three phase versions.
- Place one unit in each used section of the air switch.
- Mount "eye" closest to side panel of each section above the 18" section at the bottom of the air switch.

6B-6.4.3 Lateral Runs to Transformers:

Provide a fault indicator system for each section that feeds transformers when cabling is installed in the air switch. Re-use existing if present and functional. If none present install new. Provide a new unit (if not present) in each section of air switch that feeds transformers if cabling is replaced/installed by project. System shall be load current trip and reset type manufactured by Schweitzer Engineering Laboratories, Inc. with Inrush Restraint to prevent false indication during reclosing operations in situations when the inrush current exceeds the nominal trip value.

6B-6.4.4 Lateral Run Specifications

- Typical Reset Time is eight (8) hours after power is restored.
- Maximum Fault Current of 25 kA for 10 cycles at 60 Hz.
- Mounting shall be on the wire of each phase. Attach in accordance with manufacturer's instructions.
- UV-stabilized polycarbonate outside covering.
- Part number is 3TRV06008N.
- Unit comes in single phase and three phase versions.
- Place one unit in each used transformer section of the air switch.
- Mount "eye" closest to side panel of each section above the 18" section at the bottom of the air switch.

6B-7 TRANSFORMERS

6B-7.1 Pad mount Standard

Pad mount transformers shall be used. Anything other than a pad mount transformer shall not be used without a waiver.

6B-7.2 General Guidelines

6B-7.2.1 Each transformer shall be connected to an air switch.

6B-7.2.2 No transformer looping is allowed.

6B-7.2.3 Oil filled transformers shall use nonflammable oil.

6B-7.2.4 Transformers shall have a winding temperature rise of 65 degrees, OA class.

6B-7.2.5 Transformers shall be factory painted Brown, Robins AFB #48 or to match the main color of the adjacent facility.

6B-7.2.6 A separate primary transformer shall feed each facility or building. Exceptions must be approved by 78 CEG.

6B-7.3 Size Guidelines

6B-7.3.1 Transformers with secondary voltage of 240V or 208V shall not exceed 500 kVA.

6B-7.3.2 Transformers with secondary voltage of 480V shall not exceed 2500 kVA.

6B-7.4 Placement and Spacing

- Secure the transformer to the pad at two (2) points minimum
- Maintain clear space of 10 feet in front and three (3) feet on the sides
- Maintain clear space of 50 feet from buildings and structures of combustible construction
- Maintain clear space of 15 feet from buildings and structures of non-combustible construction
- Maintain clear space of 10 feet from edge of roadway

6B-7.5 Lock and Key

6B-7.5.1 For new transformer installed provide one padlock and one key blank. Use locks and keys manufactured by Best Access Systems, lock number 11B720L with core number 8A59. Keys provided shall be blank and uncut.

6B-7.5.2 For replacement transformers reuse existing lock and key. If lock and key are damaged or misplaced, refer to 6B-7.5.1 for replacement.

6B-7.6 Fusing

6B-7.6.1 Each transformer shall have a current limiting backup fuse or “fuse link” installed in the oil tank. This fuse shall be in series with bayonet fuses.

6B-7.6.2 Current sensing fuses shall be provided in a bayonet arrangement and shall be rated approximately 200% of the primary full load Amps of the transformer. Dual sensing or dual element fuses shall not be used.

6B-7.6.3 For large transformers (2000 and 2500 kVA) provide a bayonet arrangement with high-ampere overload fuse.

6B-7.6.4 Provide one set of current sensing fuses in packaging placed inside the high voltage compartment attached to the door.

6B-7.6.5 Provide one two inch (2”) spare conduit from secondary compartment to outside of pad and cap.

6B-7.7 Transformer Features

Transformers shall have the following features:

- Dead front construction
- Loop-feed construction with universal bushing wells. Install primary cable feed on side A with 9 kV Lightning/surge arresters on side B

- Parking stands
- Load break connectors with capacitance test point
- Load-break on-off primary switch
- Fuses
- External tap changer with four 2½ % high voltage taps, two above and two below rated voltage
- Oil level gauge
- Oil temperature gauge
- Pressure relief valve
- Oil drain valve with plug and sufficient clearance for access to drain plugs
- Full height isolating barriers between high voltage and secondary section
- Spades with two holes terminations
- Secondary spade support
- Oil site glass not permitted

6B-8 WALK-IN ENCLOSURES

6B-8.1 Exterior walk-in enclosures shall be factory painted Brown, Robins AFB #48 or to match the main color of the adjacent facility. Design enclosures to meet all applicable requirements of this Facility Standard, and applicable UFCs.

6B-8.2 Thermally insulate the walk-in housing.

6B-8.3 Provide ventilation fans, lights, receptacles, and heating and air conditioning. Provide power from a small panel and/or step down transformer as required.

6B-8.4 When provided as a single unit, the same manufacturer shall manufacture the walk-in enclosure and switchgear.

6B-8.5 Provide separate walk-in enclosures for 480 volts and 208 volts services.

SECTION 6C LOW VOLTAGE

6C-1 METERING

6C-1.1 Switchboards 1000 Amps and Greater

Provide main breaker metering: Use an electronic multi-meter in the main switchboard instead of ammeters. This meter is for use in viewing and operation of the main switchboard, not for metering consumption of the facility.

6C-1.2 Functions

The meter shall provide the following data:

- Amps of each phase
- Voltage of each phase
- Energy (kWh, MWh)
- Real Power (kW, MW)
- Total Power (kVA, MVA)
- Frequency (Hz)

6C-2 SURGE PROTECTION DEVICES (SPDs)

6C-2.1 Required Locations

6C-2.1.1 At the main service entrance in each building. Each SPD must be resettable with phase indicator lights. Type 2 or 3 must be protected by a breaker in the equipment that it serves. If installed before the main breaker, unit must be Type 1.

6C-2.1.2 At each generator serving the facility, SPDs shall be located at the first distribution equipment fed by the generator.

6C-2.1.3 At the upstream panel of any mainframe or server-type computers.

6C-2.1.4 At the power feed for each of the following:

- Fire alarm systems
- Communication systems
- Security systems
- Television systems
- Intercom systems

6C-2.1.5 At entrance/exit points to/from buildings where communication systems are located

6C-2.1.6 At entrance/exit to/from buildings where fire alarm circuits are located

6C-2.1.7 On each side of double-ended switchboards

6C-2.2 Placement Guidelines

6C-2.2.1 SPD units may be located integrally with switchboards, but shall be external to

panelboards.

6C-2.2.2 SPD may be wired in a line-to-ground or line-to-neutral configuration. If there is no neutral in the circuit, wire as line-to-ground configuration.

6C-2.2.3 Up to 200 Amp service or panelboard shall be rated at 60 kA mode with 180 kA/phase peak surge current.

6C-2.2.4 400-600 Amp service or distribution panelboard shall be rated at 180 kA mode with 240 kA/phase peak surge current.

6C-2.2.5 Over 600 Amp service or switchboard shall be rated at 200 kA mode with 600 kA/phase surge current.

6C-2.2.6 SPD shall be rated for 125% of nominal voltage for 240 volts and below and 120% of nominal voltage above 240 volts to 480 volts.

6C-3 STEP-DOWN (DRY-TYPE) TRANSFORMERS

6C-3.1 Use dry-type general purpose transformers for step-down of voltage within the facility. Maximum size shall not exceed 300 kVA. Minimum size shall be 30 kVA. All step-down (dry-type) transformers shall be copper cored, alluminium will not be allowed.

6C-3.2 Sizing of overcurrent protection for the primary and/or secondary of the transformer shall be no less than 125% of its rated kVA nor more than 200% of its rated kVA.

6C-3.3 Efficiency of step-down transformers shall be at least 97%.

6C-3.4 Use 220°C insulation system not to exceed an 115°C rise capable of carrying continuously 115 percent of nameplate kVA without exceeding insulation rating at a maximum of 40°C temperature rise.

6C-4 SWITCHBOARDS

6C-4.1 Switchboard construction with front access breakers are the required method for ease of operation and maintenance. If floor-space is an issue, then back-to-back mounted switchboards may be used. Switchboards shall be mounted on a housekeeping pad.

6C-4.2 Distribution sections shall have the same depth as the main service section.

6C-4.3 Main or tie circuit breakers of 2000 Amps or greater shall meet the following criteria:

- Provide 100% rated, draw-out type.
- Provide adjustable settings for long trip (LT), short trip (ST), and Instantaneous (GF).
- Be electrically operated with backup manual operation.

6C-4.4 Main or tie circuit breakers 1000 to 1800 Amps shall meet the following criteria:

- Provide 100% rated, solid state type breaker.
- Provide adjustable settings for LT, ST, and GF.

6C-4.5 Feeder circuit breakers shall meet the following criteria:

- Provide 80% rated, insulated-case or molded-case
- Provide solid state trips with digital integral ammeter display with LT, ST and instantaneous trip functions. Trip setting shall be capable of independent adjustments

6C-4.5.1 Provide one each spare of the two most used size of feeder breakers. Trips shall be fully functional and ready for adjustment when the future load may be added.

6C-4.5.2 Provide two empty feeder spaces. Spaces shall have all provision for future breakers such as, blank covers, bus extensions, mounting brackets, CT's and wiring required for various trips preinstalled.

6C-4.5.3 Main buses shall be fully rated and non-tapered copper bus. The vertical sections shall be sized for the load connected via feeder breakers, but in no case shall be less than half the rating of the main bus.

6C-4.5.4 All phase, neutral and grounding bus bars shall be copper. This is applicable whether they are mounted horizontally or vertically.

6C-5 MOTOR CONTROL CENTERS (MCC)

6C-5.1 MCC Construction

6C-5.1.1 MCC's shall be NEMA Class I construction with stand-alone front access or back-to-back depending on application and will be mounted on a housekeeping pad. (Use only NEMA ratings and UL listed equipment when available.)

6C-5.1.2 MCCs shall be equipped with a main breaker located in its own section.

6C-5.2 Feeder "Buckets"

6C-5.2.1 Each shall be equipped with an operating handle to clearly indicate whether the breakers are in the "ON", "OFF" or "TRIPPED" position and with provisions for padlocking in the "OFF" position. The three main configurations are:

- Motor Circuit Protector (MCP): When the motor starter is in the "bucket", use a MCP incorporating heater elements, thermal magnetic or instantaneous trip circuit breaker with separate adjustable overloads.
- Molded-Case Circuit Breaker: When the starter or controller is located external to the MCC, use a thermal-magnetic circuit breaker to protect the feeder wires.
- Fused Disconnect: Use only this arrangement when the motor or device served has a manufacturer's requirement for fused protection of the device.

6C-5.2.2 Each shall be a drawout type removable from the front, without need for rear access or disturbing other units in the MCC and include the following features:

- Positive guide rail system to ensure alignment of connection to vertical bus.
- Drawout units with shutters that close when the unit is withdrawn to isolate the vertical bus.

- Bus closing plugs for all unused openings in the vertical bus barriers.
- Mechanically interlocked units with a door to prevent opening/removal while in the energized position.
- Provisions for padlocking in a position which is disconnected from the vertical bus and a means of lockout/tagout of the disconnecting means for that circuit.
- Control push-buttons, indicating lamps, "Manual (Hand)-Off-Automatic" switches, and similar control devices required for the particular load and shall be mounted on the unit compartment door. Any safety control devices; low or high pressure cutouts, high temperature cutouts or motor overload protective devices, etc. shall remain connected in the motor control circuit in both the manual and automatic positions.

6C-5.3 General Requirements

6C-5.3.1 Each "bucket" shall have the same short-circuit rating as the main breaker or at least equal to the actual short-circuit available at the location.

6C-5.3.2 All phase; neutral and grounding bus bars shall be copper. This is applicable whether mounted horizontally or vertically.

6C-5.3.3 Three-phase horizontal bus bars shall be 600, 800, 1200, 1600, 2000 or 2500 Amps as required.

6C-5.3.4 The three-phase vertical bus in each vertical section shall have continuous current rating not less than 600 amperes and connected to the horizontal bus by bolting.

6C-5.3.5 Copper grounding bus shall be full width at the bottom of the MCC. Provide a full clamp type copper alloy lug for No. 2/0 AWG stranded copper cable at each end of the bus for connection to the grounding system.

6C-5.3.6 The neutral bus, if applicable, shall be fully rated continuous throughout the MCC.

6C-5.3.7 All control power required for operation of devices in MCC shall be provided from within the "bucket". Provide in each "bucket" a fused control transformer with adequate volts-ampere capacity for control functions. 120VAC power from a distribution panelboard or other external source shall not be used for control power.

6C-5.4 Spare Parts

6C-5.4.1 Provide one spare for each combination of "buckets" that feed the same type of motor load with similar type controls for three or more units.

6C-5.4.2 Compartments for spare requirements shall be complete with buses, hinged doors, and draw-out units but without load terminal connections.

6C-5.4.3 Compartments for future combination motor-control units shall be complete with hardware, buses, and hinged doors ready to receive future draw-out units.

6C-5.4.4 Other spare spaces provided by manufacturers shall be complete with buses and screwed-on front cover plates.

6C-5.5 Labeling

- Provide white or other light-color plastic marking strips, fastened by screws to each terminal block, for wire designations.
- Mark the wire number by permanent ink.
- Provide reversible marking strips to permit marking on both sides or furnish two marking strips with each block.
- Provide marking strips that accommodate two sets of wire numbers.
- In addition to the normal labeling of the MCC name and each “bucket” or circuit, provide each draw-out unit with nameplate mounted on the removable unit in a location that is visible when unit is in place. This nameplate will assist when several buckets may need to be removed for servicing at the same time.

6C-6 DISTRIBUTION PANELBOARDS 600 AND 800 Amps**6C-6.1 Construction Requirements**

6C-6.1.1 Distribution type power panelboard construction shall be used.

6C-6.1.2 The main circuit breaker shall be a solid-state trip type with integral digital ammeter display and adjustable short time pickup, adjustable delay bands and instantaneous pickup.

6C-6.1.3 Feeder circuit breakers shall be 80% rated Molded-Case bolted or I-Line type thermal magnetic breakers. Breakers shall contain adjustable magnetic trip on all 200 Amp and larger breakers when available.

6C-6.1.4 Breakers shall have the same short-circuit rating as the main breaker or at least equal to the actual short-circuit available at the location.

6C-6.1.5 All phase; neutral and grounding bus bars shall be copper. This is applicable whether mounted horizontally or vertically.

6C-6.1.6 Phase buses shall be full size their entire height. Buses shall be provided for the normal height of breaker space in panels.

6C-6.2 Spare Parts

6C-6.2.1 Provide one (1) each spare of the two (2) most used size of feeder breakers.

6C-6.2.2 Provide two (2) empty spaces.

6C-7 PANELBOARDS 200 TO 400 Amps**6C-7.1 Construction**

6C-7.1.1 Branch circuit breakers shall be 80% rated, Molded-Case bolted type.

6C-7.1.2 Branch breakers shall have the same short-circuit rating as the main breaker or at least equal to the actual short-circuit available at the location.

6C-7.1.3 Minimum size breaker shall be 20 Amps.

6C-7.1.4 All phase, neutral and grounding bus bars shall be copper. This is applicable whether mounted horizontally and vertically.

6C-7.1.5 Phase buses shall be full size their entire height. Buses shall be provided for the normal height of breaker space in panel.

6C-7.2 Spare Parts

Provide spare circuit breakers to fill the ampacity of the panel.

6C-8 FIRE ALARM and MASS NOTIFICATION SYSTEM (MNS)

6C-8.1 General

6C-8.1.1 Follow UFC 3-600-01 and UFC 4-021-01. Below are specific requirements for Robins AFB.

6C-8.1.2 Provide autonomous control unit (ACU) with fire alarm control unit.

6C-8.1.3 Provide a local operation console for the MNS.

6C-8.1.4 Provide battery backup for MNS.

6C-8.1.5 All modifications to mass notification NAC circuits shall be Class A. Mass notification NAC circuits for new facilities and additions shall be determined at the task order level.

6C-8.1.6 Provide an interface radio transceiver and antenna that will communicate with the base-wide "Big-Voice" system meeting the Base (78 ABW/SC) requirements. \1\ Robins AFB currently uses components manufactured by Federal Signal Safety and Security Systems to interface with the Mass Notification System (MNS). \1\

6C-8.1.6.1 Use Transceiver from Federal Signal.

6C-8.1.6.2 Pre-recorded messages to use for programming Base Mass Notification System (BMNS) interface can be obtained from Federal Signal.

6C-8.1.6.3 Mass notification system shall be capable of receiving messages from the Federal Signal basewide system.

6C-8.2 Installation Guidelines and Occupancy Standards

6C-8.2.1 Buildings that are uninhabited or have special occupancies or hazard ratings as define by the Life Safety Code®, International Building Code (IBC), Air Force Instructions (AFI) and United Facility Criteria (UFC) may require only Fire Alarm or only Mass Notification Systems (MNS) or both. 78 CEG/CEN is the AHJ for this decision. \1\ Unless otherwise defined by code, Building shall be considered occupied with 13 full time personnel and has 13,000 sq feet of occupied space. \1\

6C-8.2.2 Exterior area-wide fire alarm boxes/systems are not required. There can be some fire devices installed outside a building.

6C-8.2.3 Outside MNS exists on Robins AFB and are not included in this standard. The building system shall interface and be operated by the wide-area mass notification system.

6C-8.3 Wiring Methods

6C-8.3.1 Wiring

6C-8.3.1.1 Wiring shall be used in accordance with NFPA 70, NFPA 72, and as recommended by the manufacturer of the Fire Alarm System and shall be solid copper.

6C-8.3.1.2 New wireless fire alarm systems shall not be used on Robins AFB at this time.

6C-8.3.1.3 Actual size of conductors shall be determined by voltage drop calculations, as recommended by the manufacturer, and UFC 3-600-01.

6C-8.3.1.4 All field-wiring colors shall be the same throughout the circuit to which it is connected. Develop a color scheme and show on shop drawings, such as different colors for each circuit.

6C-8.3.1.5 All wiring shall either terminate at the fire alarm control panel, remote power supply, other cabinets, or device.

- All devices must utilize screw terminals.
- Pull all conductors splice free.
- The use of wire nuts, crimped connectors, or twisting of conductors is prohibited.
- Do not use terminal strips in the field wiring, such as in-between devices.

6C-8.3.2 Raceways

6C-8.3.2.1 Fire Alarm and Mass Notification System (MNS) wiring shall be installed in an overhead metallic raceway system. No Waivers. Acceptable metallic conduit raceways shall consist of the following:

- Rigid Metallic Conduit (RMC) or Intermediate Metal Conduit (IMC):
 - May be used where subject to wet applications and hazardous locations.
 - Should be used through fire walls to a point four (4) feet on either side. Fill any opening around conduits with fire rated caulking.
 - RMC and IMC shall be painted red if factory coating is not available.
- Electrical Metallic Tubing (EMT):
 - Shall be used for the raceway inside buildings unless otherwise not permitted by NFPA 70 (such as in hazardous locations).
 - EMT shall be factory coated red.
- Flexible Metallic Conduit (FMC):
 - Shall be permitted where flexibility is required (such as ceiling mounted devices on acoustical tile ceilings, inside existing concrete masonry walls, and on or going to ductwork).
 - Flexible conduits to devices shall be limited to six (6) feet unless special permission is granted.
 - Flexible conduit does not have to be painted.
- Liquid Tight Flexible Metallic Conduit (LTMC):

- Shall be used for connections to devices on sprinkler risers.

6C-8.3.2.2 Detection: Separate raceways shall be provided for the Signaling Line Circuit (SLC) loop from other wiring.

6C-8.3.2.3 Notification: Separate raceways shall be provided for the Notification Appliance Circuit (NAC) circuits from other wiring. Notification circuits (such as strobes, speakers, or horn circuits) may be allowed to share the same raceway only if all NAC circuits supply devices in the same area or group of rooms.

6C-8.3.2.4 Circuit conductors to/from the control panel for multiple areas shall not be combined in the same raceway (i.e. Provide separate raceways for each area for entire run to the control panel.)

6C-8.3.3 Conduit

- Conduit installed underground outside building perimeter shall be PVC SCH 40.
- PVC shall not be used above ground or penetrate smoke/fire walls. The minimum size of conduit shall be ¾ inch

6C-8.3.4 Junction Boxes

6C-8.3.4.1 Paint all junction boxes and covers red in unfinished areas. Flexible conduit does not have to be painted.

6C-8.3.4.2 If exposed in finished areas, junction boxes and covers may be painted to match color of wall.

6C-8.3.4.3 For junction boxes in finished areas, Contractor shall provide the words, "Fire Alarm" on the inside cover of the junction box.

6C-8.3.4.4 For ceiling mounted devices, provide a junction box near the device and install flexible metallic conduit to each device junction box. Do not loop between devices with flexible conduit.

6C-8.3.5 Component Wiring Requirements

6C-8.3.5.1 Do not loop wiring thru the backbox of a device unless the wiring terminates in that device.

6C-8.3.5.2 Termination at a device shall be a complete break in the wire, do not loop the wire around the screw.

6C-8.3.5.3 Do not connect notification devices to the style 6 wiring loop using addressable modules. Indicating appliance circuits shall be connected directly to the Fire Alarm Control Panel (FACP) terminals or to expansion power supply panels.

6C-8.3.5.4 Indicating appliance circuits shall be connected directly to the Fire Alarm Control Panel (FACP) terminals or to expansion power supply panels.

6C-8.3.5.5 Devices that have pigtails and no terminal strips are not acceptable.

6C-8.3.5.6 If mini- addressable modules are used, they shall have built on terminal strips.

6C-8.3.5.7 Surge Protection Device (SPD): Install metal-oxide varistor (MOV)-type surge arresters on both ends of wiring that enters and returns from the building.

6C-8.3.5.8 Special Robins AFB Requirements (Fire Alarm only or combined Fire Alarm and Mass Notification): All modifications to existing fire alarm SLC and NAC circuits must be Class A. Fire alarm SLC and NAC for new facilities and additions shall be determined at the task order level.

6C-9 FIRE ALARM CONTROL SYSTEM

6C-9.1 Fire Alarm Control Panel (FACP)

6C-9.1.1 Specifications

6C-9.1.1.1 Fire alarm control panel must be an addressable Notifier® panel. Exception - For FACP's in facilities less than 5,000 square feet, Fire-Lite® Alarms are an option with approval of 78 CEG/CEN. Software, connecting cables and proprietary equipment, necessary for the maintenance, testing, and programming of the equipment must be furnished to the 78th CES/CEOFA upon completion of work.

6C-9.1.1.2 Panels shall be red in color.

6C-9.1.1.3 FACP's shall be an analog/addressable, site programmable and have the following capabilities:

- Event storage that shall remain in memory until the memory is downloaded or cleared manually.
- Control panel resetting shall not clear the memory from being retrieved.
- An integral LCD 80 character (minimum) alphanumeric display shall be part of the system.

6C-9.1.2 Location

6C-9.1.2.1 Main control panels shall be located inside an environmentally conditioned space. MNS panels shall be located in the same area as the fire alarm panel. When the control panel is placed in the main electrical room or electrical closet, provide independent air conditioning equipment controlled by temperature regardless of the building air conditioning control system.

6C-9.1.2.2 All critical components for the system shall be located inside a dust free and conditioned space not to exceed 80 degrees Fahrenheit. This shall include any circuitry boards in the control panels, amplifiers, remote or amplifiers, batteries for any part of the system, radio transmitters, etc.

6C-9.1.2.3 Locate the notification appliance circuit extender panels in electrical rooms/closets associated with the system. This would be a secondary alternative to the electrical room or closet listed above.

6C-9.1.2.4 All control, extender and auxiliary fire alarm panels should be located at five (5) feet above finished floor measured to the centerline of the panel.

6C-9.1.3 Back-Up

6C-9.1.3.1 Provide secondary emergency power capable of sustaining the system under supervisory conditions for 48 hours and all alarm devices for an additional 15 minutes. Refer to UFC 3-600-01 for additional guidance.

6C-9.1.3.2 Provide sealed-type batteries as specified by the manufacturer to ensure that the entire control panel and its parts are UL listed and will remain under warranty.

6C-9.1.4 Circuits

6C-9.1.4.1 All fire alarm SLC and NAC circuits class shall be determined at the task order level.

6C-9.1.4.2 All circuits shall be supervised.

6C-9.1.4.3 Each extender panel, other subpanels, etc., shall be individually addressed and monitored for trouble conditions.

6C-9.1.4.4 Provide a factory installed Digital Alarm Communicator Transmitter (DACT) capable of Contact ID Format, compatible with the radio transceiver.

6C-9.1.4.5 All new panels and sub-panels in the facility must transmit Contact ID in addition to monitoring for General Alarm, General Trouble, and General Supervisory.

6C-9.1.4.6 In buildings with multiple control panels, all panels shall be the same brand and manufacturer and be networked together so all panels function together as one system.

6C-9.2 **Radio-Type Transmitter (Fire Alarm)**

6C-9.2.1 Each fire alarm system must communicate with the base fire alarm system.

6C-9.2.2 The AES Radio Transmitter (7788F) shall be mounted within three feet of Fire Alarm Control Panel (FACP) it serves.

6C-9.2.3 Alarm Installer will provide all connections between the alarm panel and the AES Radio Transmitter. 78 CEG Alarm Shop personnel will program the system cipher code into the radio.

6C-9.2.4 The Fire Alarm Control Panel (FACP) shall transmit Contact ID thru the AES Radio System.

6C-9.2.5 In addition to Contact ID, provide hardwired inputs from the alarm control panel to the AES inputs as follows:

- Zone 1: General Alarm
- Zone 2: General Trouble
- Zone 3: General Supervisory
- Zones 4-7: Not Used
- Zone 8: AES Tamper Switch

6C-9.2.6 Mount a tamper switch in the radio transmitter cabinet, connected to the AES

input Zone 8.

6C-9.2.7 Multiple building Fire Alarm Control Panels (FACPs) networked together will only require one transmitter. In the event the number of points exceed the capability of the main FACP, more than one transmitter shall be installed.

6C-9.2.8 Use outdoor type antennas mounted on the exterior of the facility for the AES radio with surge protective devices, cables and all associated mounting hardware for the antennas.

6C-9.2.9 Provide conduit from the transmitter to a point close to the outside radio antenna. This conduit is not required to be painted red outside the facility and shall be painted to match the color of the facility.

6C-9.3 Detection Devices

6C-9.3.1 Smoke Detectors

6C-9.3.1.1 Use only addressable smoke detectors.

6C-9.3.1.2 Locate required smoke detectors above the Fire Alarm Control Panel (FACP) within 12 inches of ceiling, if possible.

6C-9.3.1.3 Spacing of smoke detectors shall allow for a 10% overlap in coverage.

6C-9.3.2 Duct Smoke Detectors

6C-9.3.2.1 Provide in the air supply systems as required by NFPA 90A. Refer to UFC 3-600-01 for additional guidance. Any system moving 2000 CFM or greater shall have a smoke detector installed in the return and the supply air ducts.

6C-9.3.2.2 Locate downstream of the air filters and upstream of any branch ducts.

6C-9.3.2.3 Shall be same manufacturer as the alarm control panel and fed from the 24 volt DC fire alarm panel, not from the HVAC controls.

6C-9.3.2.4 Shall send a supervisory signal to the main FACP. Provide remote test switches and remote light emitting diodes (LEDs) for each smoke detector.

6C-9.3.2.5 Shall interface with the unit it is serving and automatically shut down that unit (only) if the presence of smoke is determined. If the distance from the duct smoke detector to the interface (control unit, starter, DDC controller, etc.) is greater than three (3) feet, provide an addressable relay module within three (3) feet of the interface.

6C-9.3.3 Heat Detectors

6C-9.3.3.1 All areas that are not protected by an automatic wet pipe sprinkler system should contain heat detectors unless an exception is granted by the Fire Department.

6C-9.3.3.2 Rating of heat detector shall be 135°F to 174°F.

6C-9.3.3.3 Spacing of heat detectors shall allow for a 10% overlap in coverage.

6C-9.3.4 Manual Pull Stations

6C-9.3.4.1 Locate manual pull stations within five (5) feet of each exterior exit door and each door into an exit stairway.

6C-9.3.4.2 Provide double action type manual pull stations with mechanical reset features with the use of a key.

6C-9.3.5 Flow Indicators

6C-9.3.5.1 Provide Vein Type Flow Switch.

6C-9.3.5.2 Flow switch shall have a 0-90 second field adjustable delay.

6C-9.3.6 Addressable Monitoring Modules

6C-9.3.6.1 Single type monitor modules shall be used at each point that is not inherently addressable.

6C-9.3.6.2 Provide a light on the front cover of device to indicate the active status of this point.

6C-9.3.6.3 Do not use addressable dual monitoring modules.

6C-9.3.7 Dry Pipe Sprinkler System

6C-9.3.7.1 Use of dry-pipe systems shall be limited in use.

6C-9.3.7.2 Provide monitoring of high and low pressure on dry pipe sprinkler systems on a per riser basis.

6C-9.3.8 Tamper Switches

6C-9.3.8.1 Provide a supervisory tamper on all valves that could affect correct operation.

6C-9.3.8.2 Post Indicator Valves (PIV) located outside the facility shall not be monitored. 78 CEG shall provide a lock on these units.

6C-9.3.9 Fire Water Instrumentation

6C-9.3.9.1 Provide Vein Type Flow Switches with 0-90 second field adjustable delay.

6C-9.3.9.2 Single type monitor modules shall be used at each point that is not inherently addressable. Provide a light on the front cover of device to indicate the active status of this point. Do not use addressable dual monitoring modules.

6C-9.3.9.3 Provide monitoring of high and low air pressure on dry pipe sprinkler systems on a per riser basis.

6C-9.3.9.4 Provide a supervisory tamper on all valves that could affect correct operation

6C-9.3.9.5 Post Indicator Valves (PIV) located outside the facility shall not be monitored (78 CEG shall provide a lock on these units.)

6C-9.4 Notification Systems

6C-9.4.1 Do not provide a water motor gong or alarm.

6C-9.4.2 Provide clear strobes at all locations inside the building to meet the accessibility requirements for persons with hearing disabilities. Follow UFC 3-600-01 for audible and visible notification appliances.

6C-9.4.3 Provide visual notification in common areas, employee workspaces and public use areas. This standard defines “employee workspaces” as administrative space, including individual office spaces.

6C-9.4.4 Provide one visual notification in each mechanical, electrical, and telecommunication room located centrally in the room.

6C-9.4.5 Provide horns for audible notification. \1\ Sound shall be measured at .8 on the CIS scale. \1\ Horns are not required in individual offices or restrooms.

6C-9.5 Releasing Systems

6C-9.5.1 Releasing Control Panels – Refer to UFC 3-600-01. Provide a separate control panel from the building fire alarm control panel and shall be the same manufacturer. Releasing control panel must be addressable Notifier® panel. Exception - For FACPs in facilities less than 5,000 square feet, Fire-Lite® Alarms are an option.

6C-9.5.1.1 Panels used for control and/or release of fire suppression systems must be FM Approved for releasing service and shall be a separate panel from the building fire alarm system and shall be same manufacturer as the fire alarm control panel.

6C-9.5.1.2 Panel is to be located adjacent to the system it controls, but not in the hazardous area served.

6C-9.5.2 Wiring Methods

6C-9.5.2.1 Provide a surge protection device on incoming power to the control unit.

6C-9.5.2.2 Provide separate raceways for the releasing system.

6C-9.5.2.3 Mark the raceways for the releasing system with three (3) inch yellow band every ten (10) feet.

6C-9.5.2.4 Provide a keyed disconnect switch for each riser next to the releasing alarm control panel. Switches shall disconnect the wiring to the solenoids without the use of any software programming.

6C-9.5.2.5 Electronic solenoids used for release of the suppression system must be FM Approved for intended use.

6C-9.5.3 Detection Devices

6C-9.5.3.1 Shall be chosen to optimize the deluge system and shall be connected to the deluge panel, not the central fire alarm control panel.

6C-9.5.3.2 Shall be manually activated by pulling one of the releasing system pull stations.

6C-9.5.4 Manual Pull Station

Shall be different from normal fire alarm pull stations. Pull station will be yellow in color and shall be labeled "Releasing System."

6C-9.6 **Fire Pump Monitoring**

Upon activation of the fire pump controller, the FACP shall send a general alarm throughout the building, if it is not already in alarm.

6C-9.7 **Remote Annunciation Panels**

Provide a remote annunciation panel at the main entrance to facilities greater than 1000 square feet in size that have fire alarms. This panel shall be recessed mounted and may be a color to blend with the surrounding.

6C-10 **COMBINED FIRE ALARM AND MASS NOTIFICATION SYSTEM**

6C-10.1 **General**

6C-10.1.1 A single manufacturer shall provide the combination local fire alarm/mass notification control panel, which shall consist of the following components: fire alarm and mass notification controls, digital amplifiers, integrated autonomous control unit (ACU), addressable monitor modules, addressable relays, and remote power supplies for NAC circuits. Local fire alarm/mass notification control panel must be an addressable Notifier® panel.

6C-10.1.2 When a mass notification system is required, Contractor shall provide a combined system using one control unit for both systems. It shall not be combined with or be an integral part of a security or energy monitoring and control system (EMCS) or other system.

6C-10.2 **Radio-Type Transceiver (MNS)**

Fire Alarm and MNS require separate radio transmitters on Robins AFB. The fire alarm transmitter is used for transmission of signals to the Fire Department. The MNS interface transceiver is used to receive MNS messages from the Command Post. Refer to "Radio-Type Transmitter (Fire Alarm)" for description of the fire alarm transmitter. Both interface types are required with a Combined Fire Alarm and Mass Notification System. Maintain minimum of 10 feet separation between the fire alarm radio antenna and the MNS radio antenna to avoid crossing radio signals.

6C-10.2.1 Provide an interface radio transceiver and antenna that will communicate with the BMNS meeting the Base (78 ABW/SC) requirements. Robins AFB currently uses the UVIC UltraVoice® Indoor Controller with an UltraVoice® Audio and Relay Module (UARM) manufactured by Federal Signal Safety and Security Systems to interface with the Mass Notification System (MNS).

6C-10.2.2 Contractor shall purchase the Transceiver from Federal Signal area representative and state that the system is for Robins AFB.

6C-10.2.3 Contractor shall procure the radio that fits within the transceiver separately from Macon Communications Inc area representative. Request that the radio be shipped directly to

78 ABW/SCOV for setup and programming. This unit should be ordered as soon as the submittal is approved by the Government in order to alert 78 ABW/SCOV that the project is ongoing. Call 78 ABW/SCOV-PWCS when the radio is required for installation and prior to testing (478-926-8104.)

6C-10.2.4 Pre-recorded messages to use for programming BMNS interface can be obtained from Federal Signal Corporation.

6C-10.2.5 Provide a short length of PVC conduit for the cables to exit the wall. Seal opening on the outside of the facility.

6C-10.2.6 Transceiver shall not be placed in finished spaces or any space that takes away from the user's functional space.

6C-10.2.7 Contractor shall include all programming, setup and field work necessary at the jobsite and the head-end for the radio interface to communicate with the Command Post. \1\ Contractor shall coordinate with Federal Signal to have system programmed and commissioned on the BMNS. \1\

6C-10.3 Notification

6C-10.3.1 Visual

The combined system shall use separate visual notification: Fire alarm notification shall use white/clear strobes marked "FIRE"; combined fire alarm and mass notification shall also use white/clear strobes but shall be marked "ALERT". Both strobes shall be placed together in common areas, employee workspaces and public use areas.

6C-10.3.1.1 For new systems, combined fire alarm and mass notification shall use white/clear strobes, marked "ALERT" and LED text signs. When working in facilities that already contain both clear (Fire) and amber (MNS) strobes, match existing notification devices.

6C-10.3.2 Audible

6C-10.3.2.1 The combined system shall use the same speakers for both fire alarm and mass notification.

6C-10.3.2.2 Use only digital amplifiers.

6C-10.3.2.3 All spaces where mass notification is required, including individual offices, shall have speakers as needed to provide acceptable intelligibility.

6C-10.3.2.4 For interior use in administrative spaces, speakers should not be tapped above ½ watt in low ceiling areas of 10 feet or less unless a special exception is allowed. (Most spaces in low ceiling areas of 10 feet or less will use either ¼ watt or ½ watt.)

6C-10.3.2.5 15 watt rated loudspeakers with adjustable taps are recommended in large industrial areas. Lower ceiling industrial areas may use 8-watt speakers with adjustable taps depending on design and layout. Set tap settings to provide desired audibility levels.

- 6C-10.3.2.6** Speakers should not be used at a tap setting more than half of the maximum allowed wattage. Use speakers with adjustable taps.
- 6C-10.3.2.7** In open spaces with drop ceilings, use ceiling mounted speakers evenly spaced throughout for a uniform sound distribution.
- 6C-10.3.2.8** For speaker circuits, use of 70-volt systems is encouraged to reduce voltage drop for large facilities.
- 6C-10.3.2.9** Provide speakers outside buildings when there are areas that occupants frequent, especially next to entrance/exit doors.
- 6C-10.3.2.10** \1\ Contractor shall verify that sound level is 0.8 CIS and provide report certifying sound level. Report shall be submitted and reviewed by the PWCS Office. System shall not be accepted until report is approved by the PWCS Office. \1\

6C-10.4 HVAC Shutdown

HVAC equipment shall be capable of manual shut down. This shall be initiated by a push button from the Local Operating Consoles (LOC) or an alternate location that is readily accessible IAW AT/FP guidance.

6C-10.4.1 Upon activation of the push button in the LOC, Autonomous Control Units (ACU) shall shut down all heating, ventilating, and air conditioning (HVAC) equipment in the facility, fire doors (if present), including shutting down outside exhaust and intake vents.

6C-10.4.2 Due to the complexity of shutting off various HVAC equipment, compressors, ventilation fans, exhaust and intake vents, dampers, smoke dampers and fire dampers, Contractor may provide separate panel(s) or addressable relay modules to shut the items down. Each control unit or module shall have a surge protection device. Units shall be operated by the activation of a push button or switch in the ACU or LOCs.

6C-10.4.3 Shut off of all A/C equipment shall be a part of the air conditioning control system to allow the compressors to cycle down before unit is being de-energized.

6C-10.4.4 Combination fire alarm and mass notification system shall supervise the wiring from the push button in each LOC and ACU to the addressable relay module located within three (3) feet of the interface point (motor starter, shunt trip breaker, relay, DDC local device near the equipment being shut down, etc.).

6C-10.4.5 If the DDC system is used to automatically shut off HVAC equipment, it must not be able to override the shut off under any situation until the notification is stopped by the Fire Department at the main combined panel.

6C-10.5 Received Messages

Mass notification system shall be capable of receiving messages from the Federal Signal basewide system.

6C-10.6 Local Operating Console (LOC)

6C-10.6.1 An LOC is usually contained in a small, wall-mounted enclosure and that can be used by Security Forces and local building occupants during emergency operations. Refer to UFC 4-021-01 for locations of Local Operating Consoles. The unit shall be recessed into the finished wall and have a thumb lock to keep the enclosure closed. The enclosure shall have a clear Plexiglas cover on the front. All pre-recorded buttons, microphone, etc. shall be located behind the Plexiglas.

6C-10.6.2 The LOC shall allow users to push buttons to obtain the mass notification messages with associated strobes and sounds with a single button used for each message or to speak situationally through the microphone provided during emergencies

6C-10.6.3 The LOC shall be same manufacturer as the combined system.

6C-10.6.4 In no case shall the combined fire alarm and mass notification panel be used as an LOC. The main control panel is locked and not accessible to anybody except the Fire Department or Alarm Shop.

SECTION 6D GROUNDING

6D-1 GENERAL GUIDANCE

6D-1.1 Construction

6D-1.1.1 Ground rods shall be $\frac{3}{4}$ inch in diameter and 10 foot in length. Material shall be copper-clad steel, solid copper or stainless steel.

6D-1.1.2 Exothermic welds shall be used for all connections to ground rods.

6D-1.1.3 The top of the ground rod will be a minimum of two (2) feet underground, except in test wells.

6D-1.2 Locations

6D-1.2.1 Provide a ground rod in the bottom of each manhole/handhole driven so that only three (3) inches to six (6) inches above the floor is accessible. Install a #6 bare copper conductor around the inside of manhole/handhole along the mid-height and connect to the ground rod. Interconnect grounds in manhole/handhole to overall ground system.

6D-1.2.2 Provide ground rods and interconnections to all pad mounted equipment including fuel storage tanks, generators, fences, bollards, transformers, switches, substations, and enclosed circuit breakers.

6D-1.3 Test Wells

6D-1.3.1 There shall be at least one test well for the grounding electrode of a building.

6D-1.3.2 Ground rods for test points shall be driven one (1) foot below grade.

6D-1.3.3 An enclosure with a flip-off top shall provide access to the rod. If this enclosure is in a paved area, the lid shall be traffic rated.

6D-1.3.4 For facilities with lightning protection, provide a test well at each down conductor.

6D-1.4 Ground Rings

Ground rings are to be used as specified by UFC and by application. If ground rings are used then follow this guidance:

6D-1.4.1 Conductor shall be routed around facility three (3) to eight (8) feet from the facility and shall follow the outline of the facility.

6D-1.4.2 Ground rings shall be installed one (1) to two (2) feet from equipment pads.

6D-1.4.3 Ground rods are required as follows:

- At changes in direction
- At test wells placed at the end of each down conductor for lightning protection systems (LPS)
- At least every 100 feet of length for LPS

6D-1.5 Ground Bus

A ground bus bar shall be a minimum five (5) inch by ¼ inch copper bar at least two (2) feet in length and use the following guidance:

6D-1.5.1 Bar shall be mounted on insulated extensions and shall be readily accessible in the electrical room. Installation above equipment requiring one to stretch over the equipment to inspect or work on the bus bar is unacceptable.

6D-1.5.2 All ground wires shall be routed either in PVC conduit or in air to the ground bus bar. If the copper conductor is run through concrete or masonry, enclose in PVC to protect conductor from the concrete.

6D-1.5.3 Compression type connectors for conductors shall be used with double-hole lugs. Both bolts for the double lugs shall be bolted and torqued to the bus bar.

6D-1.5.4 Provide laminated plates to identify the particular system or item bonded by the wire or tags connected to the wire itself.

6D-1.5.5 Due to testing requirements, this ground bus bar should be located close to the exterior door.

6D-1.5.6 Provide 12 sets of two (2)-hole predrilled and tapped holes for connection of grounding wire termination device.

6D-1.6 Communications Grounding

All new Communications Rooms shall have grounding as followings:

6D-1.6.1 Provide a four (4) inch by ¼ inch by two (2) foot ground bar in each Communication Room. Provide 10 sets of two (2)-hole predrilled and tapped holes for connection of grounding wire termination device.

6D-1.6.2 A separate conductor shall be run from each Telecommunication Room back to the Main Communications Room; one conductor shall be provided from the Main Communications Room to the Main Facility Service Ground. These conductors shall be a green insulated 3/0 copper wire. See *UFC 3-580-01 Figure 2-4 Telecommunications Grounding and Bonding Infrastructure*.

6D-1.7 Grounding for Fences

6D-1.7.1 Fences that are electrically continuous with metal posts extending at least 24 inches into the ground require no additional grounding. Fences that are incased in concrete shall be grounded by means described previously in this section.

6D-1.7.2 The following fences shall be grounded:

- Fences that enclose transformers and substations
- Fences for POL facilities
- Fences for munitions facilities
- Fences under overhead power lines
- Manual or motorized gates

SECTION 6E LIGHTNING PROTECTION SYSTEMS (LPS)

6E-1 LPS REQUIREMENTS

All new facilities, additions and renovations are required to comply with the 78 CEG Lighting Protection System Guidance, adopted 2 April 2019.

6E-1.1 Existing Buildings, Renovations and Additions

The following buildings are required to have LPS in place. Lightning protection must cover the entire facility even though only part of facility requires LPS. If there is no LPS, a system shall be added; if one of these buildings with LPS is expanded, this system must be expanded.

Table 6E-1

EXISTING BUILDINGS THAT REQUIRE LPS									
2	113	177	231	371	758	809	982	1370	20119
37	125	180	236	377	759	812	991	1371	20128
39	137	189	242	551	768	826	992	1500	20166
80	140	190	314	552	769	827	1000	2039	
85	141	196	315	553	780	905	1002	2062	
95	147	197	317	557	781	908	1003	2074	
97	152	207	318	640	795	923	1004	2083	
98	153	210	322	645	796	941	1008	2108	
99	162	211	352	675	797	943	1021	2251	
100	165	220	356	676	798	944	1162	2324	
106	166	228	363	755	799	946	1168	2328	
110	169	229	370	756	808	956	1169	8369	

6E-1.1.1 Projects that place equipment, vents, or metal structures within or without a facility must include LPS inspection to make sure that item does not negate LPS and is protected by LPS. If LPS is touched in any way by the Contractor (damage, addition to building or new side flash connection provided), the Contractor shall test the entire LPS and provide 3rd Party Inspection of the LPS.

6E-1.1.2 When an existing facility that has LPS, but is not required to have LPS, is remodeled or expanded, complete a cost analysis to determine if it is more economical to remove system than to upgrade and/or expand the system. When any LPS is removed, remove it completely, including down conductors, to a point underground.

6E-1.1.3 Type I SPD shall be provided on each building with LPS.

6E-1.2 New Buildings

New buildings must be analyzed to determine if LPS is required using the Simple Risk Analysis for Robins AFB.

6E-1.3 Allowable Systems

6E-1.3.1 Conventional Systems are required at Robins AFB. Alternate systems will require a waiver with full cost-benefit analysis.

6E-1.3.2 No new Early Streamer Emission (ESE) Lightning Protection Systems are permitted at this time, but existing systems must be maintained. Parts should be available from Prevelectron by National Lightning Protection Corporation. Contractor shall always check the ground readings and report them to the Government when working on one of these systems.

6E-1.4 Rolling Ball

The AE designs shall conduct a rolling ball coverage for their designs.

6E-1.4.1 Coverage shall pass the 150 foot diameter rolling ball test for most facilities and have an appropriate foot spacing integral, and a maximum of 15 inches distance from edge of roof and a corner of roof.

6E-1.4.2 Coverage shall pass the 100 foot diameter rolling ball test for munition facilities and have an appropriate spacing integral and a maximum of 15 inches distance from edge of roof and corner of roof.

6E-1.5 Connections

6E-1.5.1 Above Ground: Most connections can be bolted and compression fitted. Bollards and other heavy metal objects shall be bonded by welding or exothermic weld.

6E-1.5.2 Below Ground: All connections below ground shall be bonded by exothermic weld.

6E-2 SPECIFIC APPLICATIONS

6E-2.1 Aircraft Control Navigation Aids

Provide LPS for any structure(s) housing equipment for Instrument Landing System (ILS) and/or Tactical Air Navigation (TACAN) facilities with at least two air terminals.

6E-2.2 Airfield Lighting Circuits

This protection shall be provided in the form of a ground ring routed adjacent to all of the lighting circuits on the airfield.

6E-2.3 Communications (COMM) Rooms > 500 SF or COMM Towers

Lightning protection shall be provided for the entire facility when it contains a COMM room greater than 500 square feet.

6E-2.3.1 Install the ground rods at least 20 feet apart. Provide #6 bare ground wire between all metal objects that are located within six (6) feet of the communication cable.

6E-2.3.2 For a tower, extend a 20 foot grid around the base of the tower to facilitate bonding to ground rods. If the tower is within 16 feet of any other ground ring, attach to it underground. In the event there is a metal tray between the tower and the communications facility, use a #6 bare wire to attach the metal tray to one of the down conductors.

6E-2.3.3 Route any/all communication grounds to the closest ground point bus in one of the communication rooms. Use 1/0 bare ground wire from outside towers, etc.

6E-2.4 Control Tower

6E-2.4.1 Provide an LPS with air terminals on roof and down conductors on each corner of facility on the outside of the facility to the ground ring.

6E-2.4.2 Air terminal shall be a minimum of 10 inches above any item on a roof including antenna(s).

6E-2.4.3 Do not use the steel columns in the control tower for the down conductor.

6E-2.5 Flat Roof Buildings

6E-2.5.1 Space system such that it meets the required rolling sphere test.

6E-2.5.2 Bond metal frames of doors (personnel and rollup) and any metal posts used for door stops to the ground ring.

6E-2.5.3 Provide one flexible strap from the metal frame to the door itself. If it is a double door, this flexible strap must be provided for each side of the door.

6E-2.5.4 Down conductors shall be routed external on the outside walls.

6E-2.6 Hazardous Areas > 500 SF

Lightning Protection shall be provided for the entire facility, not just the area deemed hazardous.

6E-2.6.1 Bond metal objects within the hazardous areas and within six (6) feet of a LPS down conductor to that down conductor.

6E-2.6.2 Bond metal frames of doors (personnel and rollup) to the ground ring.

6E-2.6.3 Provide one flexible strap from the metal frame to the door itself. If it is a double door, this flexible strap must be provided for each side of the door.

6E-2.6.4 Down conductors shall be routed external on the outside walls.

6E-2.7 Metal Buildings

Metal buildings (PEMB, shelter, and canopies) are considered sufficiently protected against lightning strikes if the steel columns are grounded, and the structural members qualify as continuous.

6E-2.8 Munitions Facilities

Provide LPS on all facilities used for the development, manufacturing, testing, handling, storage, inspection, holding or maintenance of ammunition or explosives.

6E-2.8.1 Use either a conventional or catenary system for munition facilities less than 3,000 square feet. The Air Force recommends use of catenary systems for munition facilities over 3000 square feet. Complete a cost analysis between catenary and conventional to determine the best option.

6E-2.8.2 Note that munition facilities have a 100 foot diameter rolling ball requirement that

reduces the terminal spacing.

6E-2.8.3 Facilities within 40 feet of a munition facility must be connected to the same ground ring and lightning protection provided for that facility as well.

6E-2.9 Petroleum, Oil and Lubricants (POL) Facilities

6E-2.9.1 When various parts of the POL farm are within 100 feet of each other, interconnect LPS ground systems underground.

6E-2.9.2 Provide air terminals on each roof, even shelters, as well as any objects 10 feet above the ground, including tanks.

6E-2.10 Weapon System Electronic Facilities

Provide LPS consisting of mast or catenary style LPS for radars, antennae, and electronic equipment vans when permanently installed.

6E-2.10.1 Locate and arrange protection equipment so that it does not obstruct or interfere with operation of radar.

6E-2.10.2 If more than one facility listed on the “required LPS” list is located within 50 feet of another listed facility, interconnect the grounding systems.

6E-3 SIMPLE RISK ANALYSIS

Figure 6E-1

TOLERABLE LIGHTING FREQUENCY CALCULATION FOR ROBINS AFB

Assess the value of Items 5 through 10 to complete the Risk Analysis and determine the Tolerable Lighting Frequency for any facility at Robins AFB.



TOLERABLE LIGHTING FREQUENCY CALCULATION

$$\text{SCORE} = (\text{Item 5} \times \text{Item 6}) + (\text{Item 7} \times \text{Item 8} \times \text{Item 9} \times \text{Item 10})$$

If Score is > 20,000, then LPS is required.

Item 5 Lightning Density

Use the value 5 taken from NFPA 780

Item 6 Collection Area

$$(\text{Area of Facility} \div 10,000) + (6 \times \text{Height of Facility})$$

Item 7 Construction

- 1 Metal Structure and Metal Roof
- 15 Non-Metallic Structure and Metal Roof
- 20 Non-Metallic Structure and Non-Metallic Roof

Item 8 Contents

- 1 Low Value
- 20 Standard Value or ADMIN Area
- 50 High Value
- 100 Exceptional Value or Flammable Liquids or Computers or Electronics
- 150 Houses Planes-
- 200 Exceptional Value or Utility System
- 1000 Munitions

Item 9 Occupancy

- 1 Unoccupied
- 15 Normally Occupied
- 100 Risk of Panic or Difficult to Evacuate or Public Meeting Area

Item 10 Lightning Consequence

- 1 Continuity of Facility Services Can Continue Elsewhere
- 25 Continuity of Facility Required at Same Location
- 50 Mission Failure
- 100 Whole Base Failure

SECTION 6F COMMUNICATIONS

6F-1 GENERAL

6F-1.1 Plans and Designs

All plans/designs for the construction projects that require communications must be reviewed and approved by the Base Communications and Information Systems Officer (BCSO) or the designated representative. The Communications Directorate (SC) Plans and Programs Branch (78 ABW/SCXP) is SC's focal point for construction design review and approval. 78 ABW/SCXP should be included in all planning, design, and review meetings. Coordinate contact with ABW/SCXP through the AF Project Manager/ Construction Manager.

6F-1.2 Proposals and Contract Documentation

The information provided in this document and standards identified in this document, will be incorporated in all RFP and RD, scopes of work, and contracts for construction or renovations projects requiring communications elements.

6F-1.3 Certified Professionals

All communication design, installation, termination, and testing shall be performed by certified telecommunication professionals and technicians. Contractor helpers shall not pull cable in horizontal pathways.

6F-1.4 Acceptance Inspections

All communications Outside Plant (OSP) and Inside Plant (ISP) installed by the construction contractor or their sub-contractors must be permanent link tested (a channel test alone is not sufficient). Passing permanent link cable test results and "as-built" drawings must be provided to 78 ABW/SCXP for all OSP and ISP before Beneficial Occupancy Date. Include 78 ABW/SCXP in all acceptance inspections.

6F-1.5 As-Built Drawings

Provide "as built" drawings in AutoCAD, VISIO or Adobe.pdf format to the BCSO representative showing, but not limited to: all cable routes, outlet locations, identification markings, and communication room/closet locations, as well as site drawing showing the route of all OSP cable, manhole and duct systems installed. Include all OSP and ISP cable test reports as part of the package.

6F-1.6 Conflicts

The BCSO is responsible for all base communications and is the final authority on any communications issues or conflicts.

6F-2 COMMUNICATIONS (COMM) ROOMS / SPACES

All construction projects will include the appropriate Communications Rooms/spaces or correct shortfalls in existing rooms/spaces as part of the project. These areas must meet UFC and other required criteria. \1\ The minimum COMM Room size at Robins AFB and for DoD buildings is ten (10) feet six (6) inches by nine (9) feet, or a size that is approximately 1.1

percent of the area being served whichever is larger. \1\ In multi-story buildings, a minimum of one COMM space should be located on each floor, vertically aligned on successive floors. \1\ Serve all information comm outlets from the TR located on the floor. \1\ Areas being converted to administrative space shall include a CER/TR.

6F-2.1 Communications Equipment Room (CER)

Provide a main CER for each new facility and additional CERs for every 10,000 square feet of serving area or in facilities that house substantial IT equipment. The CER shall be sized IAW UFC-3-580-01 and TIA-568-C-1.1 with sufficient room to house the communication equipment required to support the facility's occupants and missions and accommodate multiple or separate networks if this is needed. The CER shall include the following: backboard, cable management, racks, cabinets, cross connects, power, \1\ HVAC, lighting \1\, grounding, etc. \1\ Only 78 ABW/SC approved communications equipment may be installed in CERs. Non NIPRNET, SIPRNET, or commercial network equipment shall not share rack space, cabinets, pathways, or power with 78 ABW/SC systems unless written approval is obtained from 78 ABW/SC. Projects requiring additional systems must provide dedicated cabinets, racks, patch panels, and power. \1\

6F-2.2 Telecommunications Room (TR)

Provide Telecommunications Rooms in new and existing facilities. The TRs must be dedicated spaces, not shared with other functions such as electrical rooms, mechanical rooms, \1\ or storage rooms, and shall not be used to store any non-communications materials. Clear access to all communications cabinets and racks must be always maintained. \1\ They should be located centrally in the area being served and within a maximum copper cable distance of 295 feet from the patch panel through the structured cabling system to the furthest outlet. See UFC-3-580-01 Appendix B for sample TR layouts.

6F-2.3 Communications Equipment Locations (CEL)

In small, non-administrative facilities with minimal communications, a CEL with a locking cabinet may be acceptable if coordinated and approved by 78 ABW/SC. Three feet of space shall be left on all sides of the cabinet. The cabinet must be located in a climate controlled area and must include power, grounding, distribution and cable management. If a climate controlled area is not feasible, the CEL must be a climate controlled cabinet. A communications backboard meeting UFC 3-580-01 standards may be required.

6F-2.4 Architectural Requirements for Communications Rooms

All CERs, TRs, and CELs shall meet the following requirements:

6F-2.4.1 Climate Control

Dedicated climate control shall maintain 64-78 degrees Fahrenheit, 30-55% relative humidity and positive atmospheric pressure year-round.

6F-2.4.2 Treatment

Comm room/space floors, walls and ceilings shall be treated to minimize dust. Finishes shall be light in color to enhance room lighting. Floors shall have anti-static properties (no carpet/ no wax tiles).

6F-2.4.3 Plywood Backboards

Install 4-feet width by 8-feet height by 3/4-inch thick fire-retardant treated plywood backboards on three walls and near conduit entrance for terminations of exterior copper cable. Ensure manufacturers fire rated stamp remain visible. If plywood is not fire retardant treated, paint plywood with two coats of white latex fire-retardant paint.

6F-2.4.4 Doors, Locks and Windows

Comm room door should swing outward and not inwards in the comm room with minimum door width of 36-inches. Comm room door shall be cipher lockable or door key should be cored with room #18 key for comm access only. Use room #17 key for comm locations in non-comm only area such as mechanical room. Comm room shall not have any windows. If comm room entrance door is on the exterior of the building, ensure lighting above the door is installed for easier access during dark hours. 11 All communications rooms shall be left clean and free of debris upon completion of construction or installation activities. Contractors and DoD personnel shall remove trash, packaging, cable clippings, tie wrap remnants, and all other materials from the space. 11

6F-3 **ELECTRICAL POWER REQUIREMENTS FOR COMMUNICATIONS ROOMS**

All CERs, TRs and CELs must have adequate electrical power with the following minimums:

6F-3.1 **Panel Requirements**

Provide a small 60-Amp, 120/240 volts or 120/208 volts panel in the communication equipment room and each telephone closet. Place a 6 to 16 Snap-On breaker panel in the room. Feed all power requirements in the CER, TR and CEL from this panel including convenience outlets. Power for this panel shall be from a source as close to the main service entrance as possible, but the feed shall not be from a UPS source. Provide a surge protection device on the power side of panel.

6F-3.2 **Receptacle Requirements**

Provide a minimum of two (2) dedicated 20-Amp NEMA 5-20 duplex receptacle power outlets in each CER and TR and provide two (2) dedicated un-switched 20-Amp NEMA 5-20 duplex receptacle power outlet six inches from the bottom of equipment rack on/in each cabinet. Provide additional outlets if required to meet equipment loads or where there are multiple networks. Install dedicated 20-Amp NEMA 5-20 duplex receptacle power outlets inside standing or wall mounted cabinets at CELs. If indicated in project or requested by 78 ABW/SC, provide L5-30 outlets.

6F-3.2.1 For construction, addition and renovation designs, plans, and contracts, *except USACE MILCON* projects, location of the Government furnished racks shall be provided to the Contractor upon request. Route conduits overhead and down to the point indicated and place the receptacle as free standing to be connected to the rack later. Provide three (3) feet of weather-type flex conduit at the transition from the ceiling to the downward conduit run, to allow flexibility of locating the outlet on the rack and two (2) feet of weather-type flex conduit at the transition to the outlet.

6F-3.2.2 Each equipment outlet will be on a separate branch circuit from the panel inside

the room. Each receptacle shall be controlled only by its breaker in the panel.

6F-3.2.3 Provide additional 120-VAC convenience outlets (one on each of three walls) for maintenance and housekeeping.

6F-3.2.4 If a backup generator or Uninterrupted Power Supply (UPS) is provided for the facility or part of the facility, include CERs and TRs electrical loads in their design unless a separate UPS is provided solely for the CERs and TRs.

6F-3.3 Grounding

Provide grounding for all new and renovated CER and TR in accordance with this document. Provide one dedicated earth ground bonded at the central building ground bonding point in accordance with TIA/EIA standards. A separate conductor shall be run from each room back to the main communications room, and one conductor to the facility ground. Communications grounding shall not be connected to electrical grounding systems.

6F-3.4 Entrance Conduit

Install a minimum of two (2) four (4)-inch entry conduits with pull strings from the nearest communications manhole to the main communication space (CER, TR or CEL) for new facilities or existing facilities being modified. At least one 4-inch conduit will have 3 each 3-inch, 3-cell inner-duct installed and all empty conduits shall have pull strings installed. If a building being renovated does not have the minimum entry conduits, install additional four (4)-inch conduit as described above. Include the appropriate number of hand-holes based on distance requirements. The distance between handholes/manholes shall not exceed 500 feet. \1\ Schedule 80 conduit shall be used for all directional boring installations, and Schedule 40 conduit shall be used for all open cut trench installations unless otherwise required by UFC or directed by 78 ABW/SC. \1\

6F-3.5 Infrastructure Cabling

All construction, additions and renovations will include an inside plant telecommunications distribution system as part of the design. The distribution system will include the entry conduits and at least two (2) four (4)-inch conduits from the CER or main TR to each satellite TR or CEL. A dedicated cable tray may be used for this purpose, but this tray shall not be used as a pathway for horizontal cables to outlets. Use MaxCell® (or equivalent) ducts inside the conduits and inner ducts in cable trays. Copper and fiber can be placed in the same cable tray as long as fiber is run in an inner duct.

6F-3.6 Telecommunications Distribution Systems

Provide outlet boxes and stubbed up conduits where telephone, data, or cable TV connectivity is required. Provide dedicated comm poles (where applicable) separate from the power poles for access to system furniture. Dual-channeled power poles are acceptable. For administrative areas, provide an outlet box adjacent to each power receptacle.

6F-3.7 Local Area Network

For Local Area Network (LAN) connectivity on MILCON projects, the Contractor will provide a minimum twelve (12) strands of individual 9/125 micron single mode fiber optic cable (FOC) to the nearest Information Transfer Node (ITN) identified by the BCSO's representative. Install the FOC in MaxCell®. The MILCON Contractor will terminate both ends of the FOC in rack

mounted fiber distribution panel using SC-type connectors. Additional FOC is required when the facility has multiple networks.

6F-3.8 Telephone Dial Tone

For telephone dial tone and circuits on MILCON projects, the Contractor will provide a minimum 25 pairs of copper outside plant cable to the nearest remote telephone equipment identified by the BCSO representative. The size of the cable required shall be identified by BCSO representative.

6F-3.9 Rack and Cabinet Configuration

6F-3.9.1 Unless noted otherwise, the standard rack/cabinet configuration shall be as follows:

- Fiber LIU(s)
- 2U of horizontal cable management
- If required, patch panel(s) for telephone copper tie cable with 2U of horizontal management between panels for multiple panels
- 48 or 24 port CAT 6 patch panel
- 2U of horizontal cable management
- 1U for GFGI switch
- Repeat all three of above for quantity of patch panels needed
- Provide double-sided vertical management on each end and between each rack.

6F-3.9.2 Open racks may be used in dedicated communication rooms only. Free standing cabinets shall be used in all other spaces. Wall mounted racks are not to be used unless an exception is granted from the BCSO for a specific application.

6F-3.9.3 Patch Cables for outlet to end devices cables shall be provided to SC by the Construction Contractor.

6F-3.9.4 Provide sufficient ports for each outlet to be wired into patch panel plus 20% spare.

6F-3.10 Copper Voice, Voice Over IP (VOIP) and Data Horizontal Cables

All data and voice horizontal cables will be Category (CAT) 6 unless otherwise coordinated with 78 ABW/SCXP.

6F-3.10.1 All horizontal CAT 6 cables will have blue insulation.

6F-3.10.2 Terminate all horizontal CAT 6 cables to the same patch panels and label at each end. (There is no need to separate voice and data into different patch panels.)

6F-3.10.3 Jacks will not be labeled as voice or data since both are treated as data. Labeling shall be IAW UFC-3-580-01. Provide at minimum Patch Panel – Port Number in labeling. If there are more than one comm room in the facility and more than one rack in the comm room, label as Comm Room Number – Rack Number – Patch Panel – Port Number.

6F-3.10.4 Do not install cross-connects on copper cables before running to the racks.

Terminate all copper cable backbone on patch panels in each CER/TR without cross-connects at the backboards.

6F-3.11 Terminations

6F-3.11.1 All copper terminations will be in accordance with latest TIA/EIA Directive. Robins AFB utilizes TIA/EIA 568-B color coding specifications for CAT 6 terminations.

6F-3.11.2 All Fiber Optic Cabling will be terminated using SC connectors unless otherwise indicated in the design or where there are multiple networks. For multiple networks use the following:

- NIPRNet (unclassified network) \1\Aqua\1\ Cable with SC connectors
- SIPRNet (classified network) Red Cable with SC connectors
- SCI Network Yellow Cable with LC connectors

6F-3.12 Outlets

The Contractor shall provide a dual-port outlet with CAT 6 wire at each telecommunications outlet via the outlet box, conduit stub up, j-hooks and cable tray and take it back to the rack in the CER and/or TRs. Coordinate with customer on furniture type to ensure wall mounted comm outlets are not blocked with the furniture backing are easily accessible.

6F-4 COMMUNICATIONS FOR MINOR PROJECTS

In most cases premise wiring for minor construction and renovations is \1\installed\1\ by the 78 ABW/SC Base Telecommunications Contractor (BTS) \1\ upon work order submitted by and funded by the user/customer for FSRM projects. \1\ When planning occupancy dates, provide a minimum of 20 working days after the construction, renovation and system furniture installation is totally completed, for BTS to complete the communications wiring. On the rare occasion where plans for projects/contracts deviate from this scenario, activities must be approved by the BCSO. If approved, the installing Contractor must adhere to all criteria listed in this standard.

6F-5 FAMILY HOUSING

6F-5.1 The designer must provide a complete structured telecommunications system in accordance with the latest [TIA/EIA Directive](#) for Air Force family housing units. Residential Telecommunications Cabling Standard Telephone outlets must consist of 4-pin/4- position non-keyed CAT 3 or better modular USOC RJ-11 jacks. CATV outlets must be "F"-type jacks. Locate jacks in the kitchen, living room, family room, and all bedrooms adjacent to a 120-VAC, 60-Hz (or host country standard voltage and frequency as applicable) duplex electrical receptacle. Telephone and CATV outlets must be wall-mounted. Locate outlets or provide additional outlets to enable maximum furniture placement flexibility.

6F-5.2 Use Category (CAT) 6 Horizontal Cables for Government communications.

SECTION 6G INTRUSION DETECTION SYSTEMS

6G-1 DESIGN AND ACQUISITION

6G-1.1 Equipment Designation

An Intrusion Detection System (IDS) is typically considered to be EQUIPMENT, except when the system requires a REAL PROPERTY platform to support the sensors. This fact combined with changing guidance on system usage and maintenance has created some conflicts.

6G-1.2 Coverage Determination

Determining which assets require IDS coverage is the first step in the design process and ultimately the responsibility of the mission/facility user along with responder 78 SFS. The equipment needed will depend on the nature and location of the asset, in combination with other factors that influence the ability to detect, delay and respond to the asset in an emergency. These issues are addressed in AFI 31-101, Integrated Defense. Design guidance is provided in UFC 4-021-02 Electronic Security Systems. The goal of the assessment is to focus IDS coverage where it is required at a facility while avoiding frivolous investment to cover low-security areas. The Contractor and Project Manager should begin coordination with both the owner and Security Forces along with COMM if IDS is being considered.

Excerpt from AFI 32-1032, 2015, Para. 3.5.7.5. Intrusion Detection System (IDS), Integrated Base Defense Security System (IBDSS), and Remote Targeting Engagement Systems (RTESs). An IDS or IBDSS attached to or connected to a building, that transmits a signal to an alternate monitoring location is classified as an **equipment** item. IDSs installed within a facility that do not transmit a signal outside the facility are **RPIE (real property)** (e.g., a ringing alarm that does not transmit a signal). An RTES is an equipment item. Cameras, radar, scanners, and card readers are equipment items. If a system requires installation of a platform to support the sensors (e.g. fencing, gates, posts, slabs, etc.) and/or allied support (e.g. power, conduit, etc.), the platform component(s) and/or allied support are considered real property. The real property components of these systems should be funded, installed, maintained, and sustained with FSRM-type funds. If any components are not considered to be real property per the criteria above, they are equipment items, and the user or security unit responsible for the procurement, installation, and sustainment.

6G-1.3 System Acquisition

Procuring IDS is the responsibility of the command owning the resource (i.e. asset owner). Submit a request in TRIRIGA to start the acquisition process. The request will be routed to the Intrusion Detection Committee, including representatives from Security Forces, Base Civil Engineer and Communications (COMM) to ensure compatibility with existing systems and components. Special acquisition rules are in place for IDS placement for PL 1-4 resources.

6G-1.4 Premise Control Unit (PCU)

6G-1.4.1 New Systems

The Premise Control Unit (PCU) for new IDS Systems must be selected from the Air Force's approved list. There are currently two primary providers: Vindicator® and Advantor Systems. These systems shall be established with training and long-term maintenance contract through

the Air Force coordinated system. New systems are not maintained by Base personnel.

6G-1.4.2 Enhanced or Upgraded Systems

6G-1.4.2.1 Most existing Premise Control Units (PCUs) at Robins AFB are Honeywell Model VISTA-128BP or VISTA-250BP. If it is not possible to rebuild an existing system or create separate zones with new and existing systems, a new Honeywell System may be used.

6G-1.4.2.2 Since long term maintenance by 78 CEG cannot be guaranteed, any installation of a VISTA system shall also include provisions for alternate system components, long term maintenance and on-site training.

6G-1.5 **Installation and Maintenance**

6G-1.5.1 Base Civil Engineer Alarm Shop Responsibilities

The following activities are the responsibility of the Base Civil Engineer Alarm Shop:

- Providing power to the unit
- Inspecting and activating the transceiver
- Installing real property elements like conduit, posts, etc.
- Deactivating the transceiver

6G-1.5.2 Security Forces Responsibilities

The Security Forces Electronic Security System (ESS) Program Managers are responsible for the following:

- Compliance with operational duties and responsibilities of the IDS
- Testing plans.
- Training plans and training records.
- Validation of Standards and Evaluation to include test banks, checklists and plans.
- Ensuring local ESS requirements are addressed in Security Forces Operating Instructions and the Installation Defense Plan (IDP).

6G-1.5.3 Primary Power

6G-1.5.3.1 Provide 120 volts AC service.

6G-1.5.3.2 Transform primary power through a hard wired two-winding isolation transformer and step down to 16.5 volts AC for system operation.

6G-1.5.3.3 Use a dedicated circuit to power the IDS from a panelboard within the controlled area.

6G-1.5.3.4 Lock the breaker to prevent accidental "turn off".

6G-1.5.3.5 Label the circuit breaker in that panel board as follows: "IDS Do Not Turn Off."

6G-1.5.3.6 Place a surge protection device upstream of the control unit.

6G-1.5.3.7 Use rigid conduit to install the Intrusion Detection System (IDS).

6G-1.5.4 Electronic Security System (ESS) Certification

6G-1.5.4.1 Prior to being activated, an IDS must receive ESS Certification as a mean to validate the adequacy of the system and its operations, including the following:

- Correct annunciation
- Correct assessment
- Vulnerability of IDS to covert intrusions
- False and nuisance alarm rates
- Availability and reliability of alternate power support
- Access delay and denial
- Adequacy of operating instructions, procedures, checklists and local policy and guidance on the ESS operations and program management

6G-1.5.4.2 The Security Forces Electronic Security System (ESS) Program Managers can suspend an alarm account if it is deemed unreliable or non-compliant. In this scenario security for the alarmed area will be turned over to the owner/user; Security Forces will not be responsible for maintaining alarms or security for the area until alarm issues are corrected and verified by the ESS Program Managers.

6G-1.6 **Warranty**

6G-1.6.1 Service Organizations

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of one year after acceptance.

6G-1.6.2 Service Time

During the one year period the installing company shall provide 24 hour repair service of the Intrusion Detection System.

6G-1.6.3 Response Time

The Contractor shall respond within four hours of notification that repairs are needed to the affected Intrusion Detection System.

6G-1.6.4 Qualifications of Responder

The responding alarm technician must be qualified to service the Intrusion Detection System.

6G-2 SYSTEM REQUIREMENTS**6G-2.1 AES-Intellinet® Radio****6G-2.1.1 Communications**

IDS shall communicate with main receiver on base via an AES 7788-8 transceiver with an AES-7094 IntelliPro® Digital Dialer Interface for communication with main receiver on base. COMM is responsible for completing connections with the subsystems of the IDS

- 6G-2.1.1.1** Communications link to the AES shall be supervised.
- 6G-2.1.1.2** AES-IntelliNet® communications interface devices shall be provided for the Premise Control Unit (PCU).
- 6G-2.1.1.3** Sensor device interfaces shall be by polling loop, except as specified otherwise.
- 6G-2.1.1.4** Premise Control Unit to central alarm reporting Digital Receiver shall be digital, asynchronous, or multiplexed data.
- 6G-2.1.1.5** The Premise Control Unit primary communication shall be the AES-IntelliNet® radio mesh network system. Backup communication shall be monitored telephone lines.
- 6G-2.1.1.6** The format used to communicate to the Base Central Station shall be contact ID.
- 6G-2.1.1.7** Premise Control Unit shall be capable of communication by means of a 128 Bit AES Encryption process certified by National Institute of Standards and Technology (NIST) to a Digital receiver with a built-in Encryption Alarm Router.

6G-2.1.2 Operations

The AES-IntelliNet® radio must operate on the base IDS frequency and have the IDS Cipher code installed. The IDS Cipher code is installed only by the Base Civil Engineering Alarm Shop personnel.

- 6G-2.1.2.1** The AES Radio shall be installed only by an AES authorized dealer.
- 6G-2.1.2.2** An outside antenna shall be installed to facilitate communications to the Robins Central Monitoring Station.
- 6G-2.1.2.3** A Network Connectivity (NetCon) reading of five (5) or less is required by Underwriters Laboratories (UL). No installs with a NetCon of six (6) and seven (7) will be accepted or connected to the Base AES system.
- 6G-2.1.2.4** The AES Radio shall be installed by UL 2050 guidelines and must meet the following requirements:
 - The AES radio must be tan and factory finished paint.
 - The AES radio must have a tamper switch install and connected to zone one on the input board of the radio.
 - The AES radio shall have an AES-IntelliPro® installed and connected to the Premise Control Unit telephone connection.

- The IntelliPro® shall be programmed for contact ID.
- The Premise Control Unit shall have a telephone line connected to the IntelliPro® and monitored for “telephone line cut”.
- The AES-IntelliPro® has an “off-line” voltage output that shall be monitored by a zone on the Premise Control Unit. This zone shall be programmed to be non-bypassable in the Premise Control Unit.
- The AES radio has a relay output for “antenna cut” this must be monitored by a zone on the Premise Control Unit and programmed as a 24-hour alarm type.
- All cabinet tampers installed on Premise Control Unit equipment shall be connected to a zone input on the AES Radio.
- All knock-outs not used by the install shall be plugged.
- The AES radio shall be powered by a hardwired transformer installed in a tampered cabinet.
- The AES radio main AC power should be the same as the Premise Control Unit.

6G-2.2 PCU Requirements

6G-2.2.1 The PCU areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones and user names.

6G-2.2.2 The PCU, user interfaces, zone input devices, relay output devices, and the signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.

6G-2.2.3 The PCU shall support zone input connections, system Security Control Pads, system zone expansion modules and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/ or wireless zone expansion equipment for at least 128 zones.

6G-2.2.4 The PCU shall be capable zone expansion and Security Control Pad data buses that exceed 10,000 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.

6G-2.2.5 The PCU shall provide a seamless capability to provide a minimum 20 addressable relays, which can be located at any connection location upon a zone expansion bus. Size of panel shall be determined from the rule-of-thumb of two zones for each device (even number alarm point) and (odd number for tamper point).

6G-2.2.6 PCU relay outputs shall have the capability of being triggered by or because of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.

6G-2.2.7 PCU relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated zone input.

6G-2.2.8 The PCU shall support user interaction using a Security Control Pad and be completely programmable either locally from a Security Control Pad or remotely through a standard dial-up.

6G-2.2.9 The PCU shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.

6G-2.2.10 The PCU shall be capable of monitoring a maximum of 128 individual zones and controlling output relays.

6G-2.2.11 User/Authorization Level Capacity shall be capable of operation by 150 unique Personal Identification Number (PIN) codes with each code having one of nine user profiles. This allows for limitation of certain functions to authorized users. The operation of all Security Control Pads shall be limited to authorized users.

6G-2.2.12 The PCU shall support a maximum of 16 Security Control Pads with alphanumeric display. Each Security Control Pad shall be capable of arming and disarming any system area based on a pass code authorization. The Security Control Pad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.

6G-2.2.13 Communication between the PCU and all Security Control Pads (SCP) and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all Security Control Pads, zone expanders, output expanders, and other power consuming detection devices.

6G-2.2.13.1 If (at any time) a Security Control Pad does not detect polling, the alphanumeric display shall indicate distinct alphanumeric messages.

6G-2.2.13.2 The Security Control Pad shall include self-test diagnostics enabling the installer to test all Security Control Pad functions.

6G-2.2.13.3 The Security Control Pad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, Security Control Pad displays, and central station reports.

6G-2.2.13.4 The Security Control Pad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.

6G-2.2.14 The PCU shall support sub-control partitions.

6G-2.2.14.1 A minimum of eight (8) Class B zones shall be available on the system. The system shall have the capacity for eight (8) zone expanders or single zone expanders. All Class B zones shall be two-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 300ms duration.

6G-2.2.14.2 Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority and Key Switch Arming.

6G-2.2.14.3 The digital SLCS bus shall be operational at a maximum wiring distance of 10,000 feet from the control panel on unshielded, non-twisted cable. This distance may be extended when a bus repeater module is installed.

6G-2.2.14.4 Provide Security Control Pad audible indication of device activation. An audible chime shall sound when select devices activate in order to alert personnel of

access into an area during normal access times. The audible chime may be activated when a magnetic switch is activated at a main entrance leading into an un-secured area during working hours.

6G-2.3 Detection

6G-2.3.1 Intrusion Detection

Sense and respond with visible and audible signals the activation of detection sensors.

6G-2.3.2 Tamper Detection

Tamper protection can be physical protection, line supervision, encryption, and tamper alarming of enclosures and components. Each tamper loop requires a dedicated sensor zone in the control communicator. Do not use one tamper loop for an entire building since it would be difficult to trace the violated device or box. Instead, zone tamper loops by areas and devices to more conveniently locate a violated device or area. All tamper points shall be labeled with an odd number.

6G-2.3.3 Tamper Requirements

All intrusion detection, access control, assessment systems, and their associated data transmission media must be protected commensurate with the classification of asset being protected.

- All intrusion detection sensors and access control readers must have tamper resistant enclosures and integral tamper protection switches.
- All enclosures, cabinets, housings, and boxes, having hinged doors or removable covers that contain processors or connections must have tamper protection switches.

6G-2.3.3.2 Tamper signals must be monitored continuously (24 hours) whether the system is in the access or secure mode of operation and shall be annunciated to be clearly distinguishable from intrusion detection alarms.

6G-2.3.3.3 Tamper switches on doors, which must be opened to make normal maintenance adjustments to the system and to service the power supplies, shall be normally closed, automatic-reset type.

6G-2.3.3.4 Tamper switches shall have the following features:

- Inaccessibility until the switch is activated
- Under electrical supervision at all times, regardless of the protection mode in which the circuit is operating
- Spring-loaded and held in the closed position by the door or cover protected
- Wired to break the circuit when the door or cover is disturbed
- Have fail secure capability, including, but not limited to the capability to monitor communication link integrity and to provide self-test. When diminished functional capabilities are detected, the system shall provide annunciation of the fault. Fail secure alarms shall be annunciated to be clearly distinguishable from other types of alarms

- Have line fault or as a minimum, fault isolation at the systems level and the same geographic resolution provided for intrusion detection. Communication links of the Intrusion Detection System shall have an active mode for line fault detection. The system shall be either a static system or a dynamic system. In a static system, the "no-alarm" condition shall always be represented by the same signal, which shall be different than the signal originally transmitted. The dynamic system shall represent "no-alarm" with a signal which continually changes with time

6G-2.3.4 Types of Detection

The Contractor shall submit shop drawing detailing the location, coverage area and type of coverage for the application:

6G-2.3.4.1 Door and Window Open Detection

- Balanced Magnetic Switch (BMS): May be surface mounted or recessed.
- Recessed Balanced Magnetic Switch: May have a gap up to 1/2 inch (3/8 inch in steel).

6G-2.3.4.2 Glass Breakage Sensors

Sensors shall detect window breakage by responding to sonic or vibration frequencies that accompany breaking glass.

6G-2.3.4.3 Utility Opening Protection

The correct protection method is dependent on two variables: the nature of the intrusion threat (e.g., physical penetration, electrical, electro- optical) and the characteristics of the utility inlet opening (e.g., discharge water, office air duct, electric conduit).

6G-2.3.4.4 Object Protection for Safes and Vaults

- Capacitance proximity sensor: Shall detect changes in the established capacitance to ground of a protected object. When the protected object is touched and a ± 20 pF (variable) change in the capacitance is detected, an alarm shall be generated. Circuits measure the ratio between the charging current and the resultant rate of change of voltage with time.
- Vibration vault sensor: Shall sense short duration, large amplitude signals like those produced in attacks from explosions, hammering or chiseling, as well as long duration, small amplitude signals like those produced in attacks from torches, thermal lances, drills, grinders or cutting discs.
- Vibration sensors: Shall sense and selectively amplify signals generated by forced penetration of a protective structure.

6G-2.3.5 Interior Volumetric (Space) Sensors

- Passive Infrared (PIR) Sensors: Shall detect intruder presence by monitoring the level of infrared energy emitted by objects within a protected zone.
- Dual Technology Sensors: Shall provide sensor combining passive infrared and microwave sensors designed and manufactured specifically to be mounted in a single enclosure.

- Microwave Sensors: Shall detect intruder presence by transmitting electromagnetic energy into a protected zone, receiving direct and reflected energy, and monitoring frequency shift between transmitted and received signals.
- Audio Sensors: Shall consist of microphones that detect audio information and transmit signals to an audio amplifier in a central control unit.
- Photoelectric Sensors: Shall detect intruder presence by establishing a series of infrared beams and detecting beam disruptions.

6G-2.3.6 Duress Alarms

- Hardwire Duress Alarms: Shall be capable of being secretly activated by the foot or hand of an average adult in both standing and seated positions. Alarms shall not be visible or audible from the sensor.
- Radio Frequency Duress Alarms: Shall consist of a compact and lightweight transmitter enclosed in a case that can be easily worn at the waist on a belt.
- Security Control Pad Activated Duress Alarms: Shall consist of programmable Security Control Pad activated push buttons or a Security Control Pad activated Duress code, a user code programmed as a duress code.

SECTION 6H AUXILIARY POWER

6H-1 GENERATOR PLACEMENT AND SIZE

6H-1.1 Usage

6H-1.1.1 \1\Generators shall be designed, installed, and accepted in accordance with UFC 3-540-07, UFC 3-540-01, AFMAN 32-1062, and NFPA 110 (7.13). \1\

6H-1.1.2 All generators must be approved by AFCEC, and all AFCEC approvals will be processed through 78 CEG. The approval process takes approximately four months. The design basis for generators shall be Cummins.

6H-1.2 Size

The Contractor shall provide a submittal of the generator with the vendor's sizing software. Information for loading the generator will be taken from the one-line. Two items must be addressed: startup inrush current and demand load. Manufacturers of generators incorporate various amounts of copper wiring in the alternator, two different means of control (permanent magnet generators or self-excited DC generators) and other reasons for different sizes to take care of motor inrush current. If the inrush current cannot be controlled, another manufacturer should be chosen. Getting a larger generator than the one approved will require re- approved by AFCEC. This approval process may take four months or more.

6H-1.2.1 \1\Safety

Include sloped steps with handrails in accordance with OSHA 1910.25(c) as well as an OSHA compliant platform (catwalk) if needed for maintenance and operations of lifted generators and automatic transfer switches. \1\

6H-1.3 Supervisory Control and Data Acquisition (SCADA)

Provide SCADA only when specifically identified in project. Provide a Remote Transmitting Unit (RTU) at the generator set for the Base's SCADA System. The RTU shall be compatible and capable of interfacing with the SCADA system at Robins AFB, which was manufactured by Advanced Control Systems (ACS), Norcross, Georgia. The RTU shall have a battery back- up and radio control. Unit shall transmit the following points to the central base monitoring system: start/stop; volts/phase; Amps/phase; kW, kVAR; breaker status as open/close; water temperature and oil pressure.

6H-2 ENVIRONMENTAL REQUIREMENTS

6H-2.1 Sulfur Content

Each compression ignition internal combustion engine must be optimized to run on diesel fuel containing a maximum of 15 ppm of sulfur content.

6H-2.2 Emission Requirements

Projects that will put generators into operation (new or replacement units) will require manufacturer's certification that all Federal Standards for the performance of Stationary Compression Ignition Internal Combustion Engines (CI ICE) for the specific application

(emergency/standby or non-emergency/power generation) are met, including all requirements in 40 CFR 60 Subpart III and 40 CFR 63 Subpart ZZZZ. This certification (EPA Certification of Conformity) must be submitted and approved by the CO and 78 CEG/CEIEC Air Quality Program Manager prior to ordering and delivery of the unit.

6H-3 COMPONENTS

6H-3.1 Main Breaker

Provide a main breaker with the generator. Breaker shall be sized a minimum of 125% of the generator rated capacity and no more than 200% of the rated capacity.

- For 2000 Amps and greater, use large draw-out breakers with solid state tripping units.
- For 1800 Amps to 900 Amps, use insulated-case or molded-case breaker with solid state tripping units.
- Breakers 1000 Amps and above shall have ground fault protection.
- For 800 Amps or less, the breaker shall be a standard molded case breaker.

6H-3.2 Control Panel

6H-3.2.1 Outputs

Control panel for the generator shall provide the following outputs and provide a single point that personnel can determine the overall operational status of the generator.

- On-off: Provide a means of turning the generator on-off. In the “off” position, it will not auto-start. In the “on” position, the generator will respond to the Automatic Transfer Switch (ATS) and crank up and run as the ATS signals it.
- The controller will also allow the generator to be cranked and run without engagement from the ATS for maintenance purposes.
- No controls or software shall be installed to automatically run the generator at specified intervals; any such controls that exist, shall be deactivated.

6H-3.2.2 Smart Overload Protection & Arc Energy Protection

Control panel shall be capable of digital control with phase monitoring. Control logic should shed load when any phase current exceeds 110% of generator standby rating based on the alternator time current curve. Digital control should have the ability to regulate current in any phase exceeding 300% of the generator standby rating.

6H-3.2.3 Gauges

Gauges/readings can be an electronic screen with means to select between the different readings. The following gauges shall be included:

- Oil pressure and water temperature
- Exhaust temperature
- AC metering – Volts, Amps, Hertz
- Phase selector switch (3 phase)

- Hour meter (non-resettable)

6H-3.3 Auxiliary Panel**6H-3.3.1 Requirements**

6H-3.3.1.1 Provide a 60 Amp panel (10-12 circuit) to feed all accessories of the generator. Power source shall be the first distribution panelboard downstream of the Automatic Transfer Switch (ATS) or tap off of the load side terminals of the ATS depending upon the location of the generator to the first distribution switchboard or panelboard.

6H-3.3.1.2 The source of this power should be included in the circuits fed by the generator if practical. A package unit where the power source is the ATS load terminals will be accepted. Coordinate the voltage of the ATS with the voltage requirements of the battery charger. If the battery charging current is greater than 75 Amps, provide a three (3)-phase charging circuit. Charger shall provide a trickle charge to the batteries. Charger must also match the voltage of the batteries.

6H-3.3.1.3 Provide one circuit for supplemental water heating during non-operational periods. Maintain 120°F.

6H-3.3.1.4 Provide other circuits for various accessories to the generator as required.

6H-3.3.1.5 Any requirement for fuel pumps/fuel tank control and alarm panels/etc. may be fed from this panel.

6H-3.3.1.6 Provide at least 2-20 Amp one (1)-pole spare breakers.

6H-3.3.1.7 Provide one 20 Amp breaker feeding 1-20 Amp weatherproof receptacle mounted under the panel.

6H-3.3.2 Location

6H-3.3.2.1 Locate panel close to the generator. If there is room, it can be located within the enclosure of the generator. (This is not usually possible for generators that are 100 kW and smaller.) Alternately, use brackets and mount the panel within five (5) feet of the generator or if the building wall is within 10 feet of the generator, the panel may be mounted on the building wall.

6H-3.3.2.2 Panel shall be NEMA 3R when it is located outside or inside of the generator enclosure. In some rare instances that a building is provided to house the generator, the panel shall be NEMA 1.

6H-3.4 Radiator

6H-3.4.1 Provide a radiator that is integral to the prime mover skid package.

6H-3.4.2 When a generator is to be installed inside or within three (3) feet of fences/structures that block airflow, provide a pass-through ventilation system. The exhaust opening shall be the same size or larger than the radiator screen and shall be placed immediately in front of and aligned with the radiator. Provide louvers and bird screen for the opening. Offsets may be provided if ductwork is provided to direct airflow through the opening.

6H-3.5 Exhaust Piping**6H-3.5.1 Muffler**

6H-3.5.1.1 The generator shall have a muffler designed to limit the noise to the local noise standard requirements.

6H-3.5.1.2 If the generator is installed inside, the muffler shall be mounted horizontally and shall have heat shielding material installed to keep the temperature rise in the room at a minimum. Under the heat shielding material, calcium silicate shall be installed around the muffler in the same manner as around exhaust piping.

6H-3.5.1.3 If the generator is installed outside, the muffler may be mounted horizontally or vertically.

6H-3.5.1.4 If the muffler is outside or on top of or inside a NEMA 3R enclosure insulation is not required.

6H-3.5.2 Piping

6H-3.5.2.1 Exhaust piping shall be routed from the generator to the muffler to a point outside the facility.

6H-3.5.2.2 Provide a minimum of 1" of calcium silicate insulation around piping with binders on nine (9)-inch centers. Then place a two (2)-inch calcium silicate insulation around the one (1)-inch insulation just applied with all seams and joints staged so they do not match. Place binders on nine (9)-inch centers.

6H-3.5.2.3 Include a penetration spacer at the point of wall penetration. Immediately upon exiting a wall, the pipe shall be turned upwards. Install lengths of pipe so that the top of the pipe is at least two (2) feet above the highest point of roof within 10 feet of the pipe. Provide a brace from the pipe attached to a point just below roof level. Avoid roof penetrations if possible. If roof penetration cannot be avoided, provide design for penetration and roof installation around the pipe.

6H-3.5.2.4 When exhaust point from muffler is within 10 feet of a facility, route the piping from the muffler upwards to at least two (2) feet above the highest point of roof. Provide a brace from the pipe attached to a point just below roof level. No insulation is required on the piping.

6H-3.5.2.5 When exhaust point is more than 10 feet from a facility, route the piping from the muffler pointed away from building. If the muffler is less than 10 feet high, route the pipe upwards to a point on the wall at least 10 feet above ground level, then point away from building.

6H-3.5.2.6 If the generator is installed in a courtyard or alleyway with high roof lines on at least two sides, provide piping to reach a point two (2) feet above the roof height close to the generator.

6H-3.5.2.7 Do not locate exhaust piping exhaust point within 20 feet radius of any supply/return air vent on adjacent buildings.

6H-3.5.2.8 Provide spacers so that the exhaust piping is no closer than six (6) inches to

structure when it is routed up a wall or other structure.

6H-3.5.3 System

6H-3.5.3.1 Each exhaust system from the generator shall be topped with a flap. The flap shall be equal or larger diameter than the piping and shall be gravity operated to close. The operating mechanism shall be free enough to allow the flap to open at least to a 45 to 60 degree angle during exhaust flow.

6H-3.5.3.2 Provide a temperature sensor in the exhaust system with a gauge in the control panel.

6H-3.6 Automatic Transfer Switches (ATS)

6H-3.6.1 Design

6H-3.6.1.1 Automatic transfer switches (ATS) must be rated for the full short-circuit rating available at the connection point. The contribution to short-circuit rating from the generator must also be considered.

6H-3.6.1.2 ATS shall be four-pole (switched neutral) for three-phase systems and three-pole for single phase systems.

6H-3.6.1.3 ATS shall be service entrance rated and load-break rated.

6H-3.6.1.4 Internal maintenance bypass capability shall be provided for all transfer switches.

6H-3.6.1.5 ATS rated 1000 Amps or over shall have ground fault protection installed.

6H-3.6.1.6 If the ATS is part of a large switchboard with the operation of electrically operated breakers instead of a normal standalone ATS, the indicator lights shall indicate open/closed breakers and correct position associated with normal and emergency operation.

6H-3.6.1.7 Provide a closed or open transition transfer switch depending on application.

6H-3.6.1.8 Provide a "test" switch so that the generator can be tested from the ATS with the normal power source still operational and transfer after the generator is up to speed.

6H-3.6.2 Requirements

6H-3.6.2.1 The ATS must be capable of load switching, periodic short circuits, or abnormal environmental conditions must not degrade its performance below acceptable levels. The ATS continuous duty capability should be achievable with minimal maintenance and the ATS contact temperature rise must be well below that established for an 8-hour rated device.

6H-3.6.2.2 Provide a mimic bus graphic to the ATS with indicator lights indicting normal and emergency operation.

6H-3.6.2.3 Provide a lockable switch to "disable" the ATS and generator. This switch shall be labeled "Emergency/Maintenance OFF" and shall be capable of being locked-

out/tagged out during maintenance of downstream equipment and distribution systems from the generator. "Test" switch will not be operational in this "Emergency/Maintenance OFF" position. Note that this switch will prevent the generator from coming on and transferring the load, but the normal power source will still be present in the ATS.

6H-3.6.2.4 It is recommended that the Generator and Automatic Transfer Switch (ATS) be manufactured by the same company, if possible, if not ASCO ATS's are preferred.

6H-3.6.3 Diagnostic Tools

6H-3.6.3.1 Electronic Service Tools (InPower)

Electronic service tools should be made available to include service tools required to troubleshoot, diagnose, and program/ repair digital components. Service tools should have a minimum two year registration authorization with the ability to re-register when expired.

6H-3.6.3.2 Service Level Training (PowerCommand Service Training for Government)

Training should be made available upon request for digital control systems. Training should meet the level of training provided to the manufacturer's field service technicians.

6H-4 **ABOVE GROUND FUEL TANKS**

6H-4.1 **Fuel for Stand-By Power Generation**

Diesel is the fuel of choice for stand-by power generation at Robins AFB. Use of natural gas (NG), liquid petroleum gas (LPG), or bio-diesel fuels is not permitted. Primary fuel tanks shall be placed above ground, separate from the generator and located no closer than 10 feet from any building or structure. Below ground storage tanks are not permitted. Day tanks may be used adjacent to transformers or generators when supplemental pumps are required to feed the diesel from the tank to the generator or if the diesel in the primary tank is used for other purposes or when designated by the manufacturer of the equipment.

6H-4.2 **Fuel Tanks**

6H-4.2.1 Tank Design

6H-4.2.1.1 Fuel tanks shall be sized to provide a 72 hour running time for the generation at 100% rated load.

6H-4.2.1.2 Fuel tanks shall have double steel walls with interstitial concrete filler that complies with the following specifications. Provides secondary containment, leak monitoring, spill containment and overfill protection

- Provides lockable containment for filling operations
- UL 2085 listed – *Protected Aboveground Tank for Flammable and Combustible Liquids*
- Inner Tank shall be fabricated from minimum 3/16 inch steel and UL-142 listed – *Steel Aboveground Tank for Flammable and Combustible Liquids*
- Provides a minimum two-hour fire rating
- Fittings and protrusions are stainless steel

- Design Basis: EnviroVault™ tanks with six (6) inches of lightweight concrete between the inner and outer tanks
 - Tank shall be factory painted white
- 6H-4.2.1.3** Provide permanent automated fuel polishing system for storage tanks over 500 gallons.
- 6H-4.2.2** Fuel Tank Alarm Panel
- 6H-4.2.2.1** A separate alarm panel shall be provided for each fuel tank with the following indicators:
- High Fuel Level red alarm lamp (labeled High)
 - Low Fuel Level red alarm lamp (labeled Low)
 - Tank Leak red alarm lamp (labeled Leak)
 - Push To Test pushbutton
 - Push To Reset pushbutton
 - Push To Silence Alarm Horn pushbutton
 - 90dB audible alarm horn
- 6H-4.2.2.2** Include an interstitial leak monitoring system to monitor tank leakage from the tank into the secondary compartment.
- 6H-4.2.3** Fuel Pumps
- 6H-4.2.3.1** If the fuel line length from the tank to the generator is more than 25 feet in length or if the fuel line is routed to a height of six (6) feet or more, provide fuel pumps as required. Typically, the vendor shall determine if the generator fuel pump will handle the head and suction required to pump the fuel from the tank. For this calculation assume that the tank is less than 1/3 full and include any differences in elevation from the generator to the tank.
- 6H-4.2.3.2** Controls shall interlock so that the pump will be energized during the start/run cycle of the generator and shutoff with the generator. At other times, pumps shall not run.
- 6H-4.2.4** Piping Methods
- 6H-4.2.4.1** Fuel Lines may be either threaded black steel or High-Density Polyethylene Line Pipe (HDPE). Steel piping joints may be welded joints and should have a threaded union at strategic locations so that piping can be disconnected in sections for work on the piping system. HDPE piping should comply with ASTM F2619 "Standard Specification for High Density Polyethylene (PE) Line Pipe" or API 15LE, "Specification for Polyethylene (PE) Line Pipe".
- 6H-4.2.4.2** Provide a ball cut-off valve on each of the supply and return fuel lines next to the point that the pipe exits/enters the tank. This valve shall be steel, or HDPE as required for the piping used. Brass or other metal valves are not acceptable.
- 6H-4.2.4.3** Fuel line solenoid valves are required.
- 6H-4.2.5** Safety

6H-4.2.5.1 If the top of the tank is greater than 42 inches above finished grade (including mounting means), include sloped steps with handrails IAW OSHA 1910.25(c) as well as an OSHA compliant platform to use when working or inspecting the top of the tank.

6H-4.2.5.2 If the top of the tank is greater than six (6) feet above finished grade, provide an OSHA compliant rail system around the edge of the tank.

6H-4.2.5.3 Fuel tanks shall be equipped with the following safety devices:

- A visual indication of fuel level
- Automatic control of low and normal level of fuel into the tank
- A secondary automatic shut off of fuel delivery into tank at the 95% fill level
- Low level alarm in the event of failure of fuel supply system
- Grounding via #4 bare copper wire to the frame of the generator (both tank and fuel cooler)
- Normal vent pipe to outside that reaches a point that is 10 to 14 feet above ground level
- Pressure lifted emergency vent cap
- Anti-siphoning devices to prevent siphoning of fuel back into the tank

6H-4.2.6 Signage

Place the sign shown in Figure 6H.1 with DS2 fuel symbol on all four sides of the fuel tank, in addition to any markings provided by the tank manufacturer: Use the following sizes:

- < 900 gallons 2' x 2'
- ≥ 1,000 gallons 2' x 3'
- ≥ 10,000 gallons 3' x 3'

6H-4.3 Day Tanks

6H-4.3.1 Design

Day tanks shall be double walled or shall have a containment area no less than five (5) gallons and no more than 50 gallons.

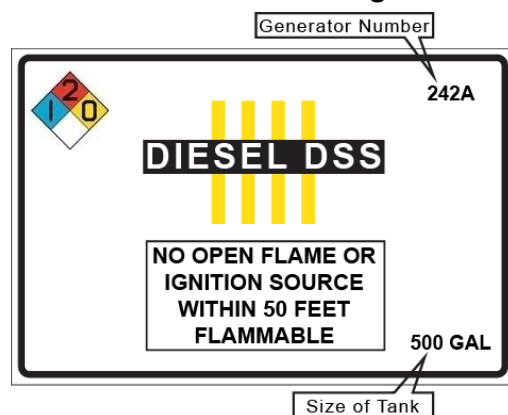
6H-4.3.2 Operations

6H-4.3.2.1 Unless pumps are provided in the fuel system, provide small fuel pumps for the day tanks (supply and return). Pumps should be cable of matching and overcoming the fuel demand of the generator. The return pump should be designed to return 100% of excess fuel (i.e. 100% of fueling rate).

6H-4.3.2.2 Pumps shall be interlocked with the generator so that they will not operate until the start and run cycle of the generator.

6H-4.3.3 Signage

Figure 6H-1



Provide signage as indicated for fuel tanks. Use 2 X 2 feet size unless the side of the day tank is a smaller dimension, then match the dimension of the day tank (or available space).

SECTION 6I CORROSION CONTROL

6I-1 SERVICES OF CORROSION ENGINEER

Association for Materials Protection and Performance (AMMP) certified corrosion engineer/specialist will design and specify all corrosion control systems. The corrosion engineer shall insure that the corrosion control system is suitable and sufficient for the application.

6I-2 PROTECTIVE COATINGS

The corrosion engineer will evaluate and investigate the use of protective coatings for underground and above ground metallic structures and utility systems and determine the best methods and materials for surface preparation, primer coatings and protective coatings.

6I-3 CATHODIC PROTECTION SYSTEMS

The corrosion engineer will evaluate and investigate the use of cathodic protection systems and determine the best methods and materials for the requirement. Systems can be either galvanic, impressed current or hybrid depending on application and total life cycle costs. The goal is to provide suitable protection at the lowest life cycle cost.

6I-4 SYSTEMS REQUIRING PROTECTION

All utility lines and equipment shall be protected against corrosion. Utility systems include:

- Electrical lines
- Metal components of utility systems
- Metal posts, columns and bollards in contact with or embedded in concrete or soil
- Metallic parts in concrete pits
- Petroleum, oil, and lubricants (POL) tanks and lines
- Exterior and interior components of water tanks
- Natural gas lines
- Steam and condensate lines
- Domestic water lines
- Industrial wastewater lines and lift stations
- Sewer lines and lift stations
- Chilled and hot water lines

SECTION 6J LIGHTING

6J-1 GENERAL

6J-1.1 Light Source

Light sources at Robins AFB shall be LED for all new construction and retrofits. Do not mix various light source's color temperatures within a single building to minimize maintenance and the chance of visual confusion. The correlated color temperature (CCT) used in most offices is 3000K for light sources. Lighting shall be in accordance with UFC 3-530-01.

6J-1.2 Photometric Data

Provide a photometric analysis for each zone using the geometry of the work areas and the proposed lighting design. Data should include spot illumination, average, and high and low areas within each zone overlaid on a floorplan of the areas.

6J-1.3 Switching Control

All sensors shall be hardwired.

6J-2 DESIGN REQUIREMENTS

6J-2.1 Hangar Guidance

Design for a maintained level of 75 foot-candles. This requirement is just for the hangar area. All other areas inside the hangar shall be designed in accordance with the general guidance.

6J-2.2 Warehouse Guidance

Design for maintained level of five (5) foot-candles in cross isles, 10 foot-candles in main isles and 20 foot-candles in loading and unloading areas.

6J-2.3 Interior Sports Guidance

All interior sports lighting shall be based on Class of Play Type III per the Illumination Engineering Society (IES).

6J-3 MOUNTING LUMINAIRES

Luminaires are composed of a light source reflector, shade, lens, refractor, mounting hardware and an electrical connection. Single light source (SLS) luminaires include a power control unit to power the light source; fluorescent and high intensity discharge luminaires include a ballast to operate the light source; induction luminaires utilize a generator; and low voltage luminaires require a transformer. Where feasible 2x4 fixtures are preferred.

6J-3.1 Safety Requirements

6J-3.1.1 Safety Chains

If the fixture has only one method of attachment (i.e. a single conduit, a single rod or pipe with power cord wrapped around it, etc.), also provide a safety chain. If the fixture has two or more methods of support (flex conduit and cord wiring is not considered a support), a safety chain is

not necessary. Fixtures in hangars and warehouses within 50 feet of larger rollup or hangar doors shall have a safety chain attached, regardless of the number of supports, because of the likelihood of heavy winds. Safety chains shall not allow the fixture to drop more than one (1) foot.

6J-3.1.2 High Fixtures

For hangars/warehouses and other areas with heights over 19 feet, lights shall be installed above cranes, infrared heaters, storage racks, planes and other items AND access to the fixtures must be provided for maintenance purposes. This access is required for all fixture types, including Light-Emitting Diodes (LEDs). Contractor may use one of the methods below:

6J-3.1.2.1 Provide a quick disconnect (where application permits by code for the environment) with a receptacle/plug assembly so that the fixture may be reached for disconnection and then carried to the floor for maintenance.

6J-3.1.2.2 Place fixtures in between racks so that they can be reached by lift.

- Maintain a six (6) foot by six (6) foot clear area that any type of lift will be able to access each fixture.
- Note that access for the lifts into the room/area of the extremely high fixtures may require wide/high doors or other physical accommodation.

6J-3.1.2.3 Provide a fixture lowering device.

6J-4 RENOVATION AND DEMOLITION

6J-4.1 Renovation

6J-4.1.1 No replacement lamp kits or luminaire replacement kits shall be used. Either the fixtures are to be relamped with existing lamp types or replaced with new fixtures. A variance may be requested and approved by 78 CEG.

6J-4.1.2 If the ceiling is being replaced during renovation, replace the light fixtures and associated wiring.

6J-4.1.3 If switching is disturbed during renovation, replace it. Switching control does not have to be upgraded from existing level unless so identified in project.

6J-4.1.4 Solar lights are not allowed except in limited circumstances as approved by 78 CEG.

6J-4.2 Demolition

6J-4.2.1 If use of an area is being changed, remove fixtures (and associated wiring and /or conduit) back to the panel and recycle.

6J-4.2.2 Follow all recycling guidance provided by Environmental (Chapter 2)

SECTION 6K AIRFIELD NAVAIDS

6K-1 ROBINS AFB INVENTORY

Robins AFB has a Category I Airfield with the following facilities:

- Airfield Rotating Beacon
- Obstruction Lights
- PAPI on North and South Approach
- Approach Light System (ALSF-1) on South/North Runway 15/33
- High Intensity Runway Lights (HIRL)
- Threshold Lights
- Runway End Lights
- Runway Distance Markers (RDM)
- Arresting Gear Markers
- Wind Indicators (Cones)
- Taxiway Edge Lights
- Taxiway End Lights
- Taxiway Guidance Signs
- Runway Guard Lights (WIGWAG) on Taxiway F1

6K-2 POWER SERVICE

6K-2.1 Major Parts of the Lighting Circuit

6K-2.1.1 Constant Current Regulator (CCR) (power source in Vault)

6K-2.1.2 Primary Circuit Cable (5 kV). #6 for Taxiway (6.6 Amps circuits) and #6 for runway (20 Amp circuits)

6K-2.1.3 Isolation Transformers

6K-2.1.4 Lights. All runway and approach lights are incandescent. All taxiway lights and signs are LED lights.

6K-2.2 Operation

6K-2.2.1 A constant current is delivered along the entire loop on the primary side of the isolation transformers.

6K-2.2.2 The magnitude of the voltage along the series circuit depends on the number and size of connected lighting loads.

6K-2.2.3 The circuit is considered high voltage on the primary side, which typically may be several thousand volts (5 kV cable is used), and low voltage on the secondary side or load side of the isolating transformers, which typically is less than 30 V.

6K-2.2.4 The isolation transformer provides an effective short for the primary circuit in the event of a lamp failure, which would open the secondary circuit.

6K-2.3 Cable

6K-2.3.1 Runway and Taxiway: Use FAA L-824 Type C cable (XLP insulated at 5 kV) single conductor, stranded with L-823 connectors. Use #6 size conductor.

6K-2.3.2 Grounding Wire: Use #6 AWG, XHHW, 600 volts with green insulation.

6K-2.3.3 For the secondary side of the isolating transformers as well as the circuit adapters: Use two-conductor #10, XHHW, 600V insulation.

6K-2.3.4 Control Cables:

6K-2.3.4.1 For 120 VAC control systems: Use multi-conductor, 600 volts, 12 AWG copper rated for direct earth burial.

6K-2.3.4.2 For lower voltage control circuits: Use multi-conductor, stranded 19 AWG copper with 300 volts polyvinyl insulation suitable for wet or dry locations.

6K-2.4 Approach Lights

6K-2.4.1 Pre-Threshold Bar: Consists of two (2) barrettes in aviation red lights of five (5) lights on 3.5-foot centers with the innermost lights located not less than 75 feet, and not more than 80 feet, from the system centerline.

6K-2.4.2 Terminating Bar: Consists of two (2) barrettes in aviation red lights located symmetrically about and perpendicular to the system centerline at Station 2+00. Each barrette consists of three (3) lights on five (5)-foot centers with the outermost lights located 25 feet from the system centerline.

6K-2.4.3 1000-Foot Crossbar: Consists of two (2) barrettes in aviation white lights located symmetrically about and perpendicular to the system centerline at Station 10+00 and in line with the centerline barrette at that station. Each barrette consists of eight (8) lights on five (5)-foot centers with the outermost light located 50 feet from the system centerline.

6K-2.4.4 Centerline Lights: Consist of a series of barrettes in aviation white lights located at 100-foot intervals along the system centerline, from Station 1+00 to Station 15+00. Each barrette consists of five (5) lights spaced at 3.5-foot centers, centered on and perpendicular to the system centerline. Centerline lights installed on elevated supports may be spaced at 40.5 inches if needed to fit standard support hardware.

6K-2.4.5 Sequenced Flashing Lights (SFL): Consists of a series of flashing lights located on the system centerline at each station beginning at Station 10+00 and continuing to the end of system. The lights shall flash a bluish-white light at a rate of twice per second in sequence from the outermost light station toward the threshold. SFL may be mounted a maximum of four (4) feet below the steady burning lights or be displaced a maximum of five (5) feet into the approach along the system centerline to avoid visual or physical interference between light units when in-pavement lights are used.

6K-2.4.6 Intensity Control: Shall consist of five (5) steps for steady burning lights and three (3) steps for SFL.

6K-2.4.7 Obstruction Clearances: Shall consist of a light plane or planes where the lights of the system are located and used for determining obstruction clearances for the approach

lights. The side boundaries of the light plane are 200 feet on each side of the runway centerline extended. The end boundaries are at the threshold and 200 feet before the start of the approach system. Use the 1000-foot crossbar and angle the light plane at 0 to 2 percent up towards the start of the system.

6K-2.4.8 Light Plane Obstructions: No objects may penetrate the light plane except for ILS components and components of airfield lighting systems that are fixed by their function. The required clearance above private and military roads is 10 feet.

6K-2.4.9 Configuration Adjustments: May be accomplished due to construction limitations without a waiver as follows:

6K-2.4.9.1 The System Centerline may be offset laterally a distance of not more than two (2) feet.

6K-2.4.9.2 Light Stations may be moved to avoid roads, buildings, railroads, or other obstacles. Distribute the difference uniformly so the spacing between adjacent light stations is kept at 100 feet plus or minus 10 feet and the system length is maintained.

6K-2.4.10 In-Pavement Fixtures: Shall be used for locations in paved overruns, in displaced thresholds or where they are subject to damage by jet blast. No part of the unit shall extend more than one (1) inch above surrounding pavement. All other fixtures must be elevated and capable of being aimed as required.

6K-2.4.11 Elevated Fixtures: Shall be elevated on frangible, low-impact resistant, or semi-frangible supports depending on the required mounting height as follows:

6K-2.4.11.1 Zero (0) to six (6) feet shall be frangible.

6K-2.4.11.2 Six (6) to 40 feet shall be low impact resistant.

6K-2.4.11.3 40 plus feet shall be semi-frangible.

SECTION 6L TRAFFIC SIGNAL CONTROL SYSTEMS

All installation traffic signals, signs, and pavement markings will be in substantial conformance to Federal Highway Administration's (FHWA) "Manual on Uniform Traffic Control Devices for Streets and Highways" (MUTCD) (<http://mutcd.fhwa.dot.gov>). Variances in the design and application of installation traffic control devices from the standards contained in MUTCD must be approved by 78 CEG. Other UFCs and Georgia Department of Transportation requirements may apply. If there is a conflict, normally use the more stringent requirement. The specifications shall require all materials and equipment to be current production items.

6L-1 TRAFFIC SIGNAL COMPONENTS

6L-1.1 Power Requirements

The nominal operating voltage for traffic lights shall be 120 volts.

6L-1.2 Control Units

6L-1.2.1 Traffic control units shall be installed on preformed polymer concrete box pads (such as those manufactured by Quazite®) with an integral opening that will accommodate all necessary connections, controllers, safety locks, etc.



Traffic Signal Control Unit
With UPS Back-Up

6L-1.2.2 In addition to the controller and other units installed in the control unit, there will also be a drawer and tray installed that will house the 8.5-inch X 11 inch manuals for the light system.

6L-1.2.3 All wiring shall terminate at terminal blocks in the control unit and at devices. Two (2) secured, color-coded, 36-inch long 600 V, 20 AWG minimum, jacketed wires, rated for service at +105°C, are to be provided.

6L-1.3 Poles and Arms

6L-1.3.1 Steel poles and mast arms for traffic signals shall be a round, tapered, conical shape.

6L-1.3.2 A base plate of proper size and shall accommodate four (4) anchor bolts and telescope onto the shaft.

6L-1.3.3 The pole shall be designed to support two mast arms so that two poles only will be required in each intersection.

6L-1.3.4 The pole shaft shall have a reinforced box mast arm attachment, which matches the arm flange plate. With each mast arm pole there shall be provided one (1) pole top.

6L-1.3.5 A wiring hand-hole shall be provided approximately 12 inches above the base plate with tapped grounding lug.

6L-1.3.6 Mast arms shall be attached to the pole with connecting hardware and shall be designed to eliminate sagging. With each arm there shall be provided the appropriate size and cap with arm mounting hardware.

6L-1.4 Vehicle Signals

6L-1.4.1 Vehicle signal heads shall be modular type constructed primarily on non-metallic components that can be arranged in different combinations to provide displays in accordance with the "Manual on Uniform Traffic Control Devices".

6L-1.4.2 Each vehicle signal shall consist of one or more signal faces. Each signal face shall consist of one or more signal sections that will fit rigidly and securely together to prevent the entrance of dirt or moisture and prevent the rotation or misalignment of the individual sections. Vehicle signal heads shall have 12-inch lenses for all indications and shall be equipped with tunnel visors. Backplates with slots for wind to penetrate at least five (5) inches wider than the head shall be equipped with a bright yellow retroreflective border at least two (2) inches in width. Lights shall be LED type.



Traffic Signal Pole with Two Mast Arms
And Pedestrian Signal

6L-1.5 Pedestrian Signals

6L-1.5.1 The pedestrian signal button shall be highly vandal resistant, and pressure activated with essentially no moving parts. The button shall be able to withstand heavy impact or a direct blow.

6L-1.5.2 The appropriate controller for the pedestrian signal shall be provided as a component of the control unit.

6L-1.5.3 Provide footing, pole, and hardware for mounting the pedestrian signals.

6L-1.5.3.1 The pedestal pole shall be 10 feet in height above grade. The shaft shall be manufactured of aluminum alloy of four (4)-inch (Schedule 40) pipe size. One end shall be threaded and shall screw into the top of a cast aluminum base.

6L-1.5.3.2 The base shall be square in shape, 14-1/4 inch in height, and shall be made of aluminum.

6L-1.5.3.3 A removable, locking access door shall be provided.

6L-1.5.3.4 The entire assembly when carrying signals shall be capable of withstanding 115 mph wind loads without failure.

6L-2 SEQUENCE OF OPERATIONS

Operation protocols will be based on location as designated by 78 CEG.

6L-2.1 Normal Daytime Operations – All Roads

- No left turn: Red to green to yellow and back to red.
- Left turn: Red to left turn to green to yellow and back to red.
- Work with 78 CEG to determine the exact/variable period for left turn signals, yellow signals, and green signals. Red signal length will depend upon the other signal lengths.
- Always sequence turn signal (if exists) before green. Do not provide turn signal if no vehicles are detected in turn lane both ways. Do not provide turn signal after green.
- All lights shall be coordinated through the master control.

6L-2.2 Normal Nighttime Operations – Main Roads

- No left turn: Red to green to yellow and back to red.
- Left turn: Red to left turn to green to yellow and back to red.
- Always provide turn signal (if exists) before green. Do not provide turn signal if no vehicles are detected in turn lane both ways. Do not provide turn signal after green.
- Stay green until vehicles are detected on crossroad, then cycle. For Robins Parkway provide a blinking yellow light from 1800 to 0500 hrs.

6L-2.3 Normal Nighttime Operations – Minor Roads

- No left turn: Red to green to yellow and back to red.
- Left turn: Red to left turn to green to yellow and back to red.
- Always provide turn signal (if exists) before green. Do not provide turn signal if no vehicles are detected in turn lane both ways. Do not provide turn signal after green.
- Stay red until vehicles are detected on main crossroad, then cycle. For roads intersecting Robins Parkway provide a blinking red light from 1800 to 0500 hrs.

APPENDIX A FORMS

The following forms are included in this publication of the Robins Air Force Base Base Facility Standards.

A-1	ELECTRICAL FORMS
A-1.1	Electrical Safety Documentation
A-1.2	Lightning Protection System (LPS) Data

**APPENDIX
DATA FORM**

BFS Form A-1.1

Electrical Safety Documentation

Project #: _____

Project Title: _____

A-E/ Contractor Contract #: _____

1. Number of persons performing work: _____
2. Date of NFPA 70E Training (include copy of certificate): _____
3. Purpose of Task involved: _____
4. Hazardous nature involved: _____
5. Limit of Approach: _____
6. Explain safe work practice to be used: _____
7. PPE – Hazard Risk Category: 1= 4 cal/cm², 2 = 8 cal/cm², 3 = 25 cal/cm², 4 = 40 cal/cm².
Circle the Hazard Risk Category that applies (use the table on the reverse side to determine rating required.) Any rating 3 and above must also be accompanied with Hazard/Risk Evaluation using form from [NFPA 70E, Annex F](#).
8. What insulating materials and tools will be involved? _____

9. Explain precautionary techniques being use? _____

10. Electrical diagram provided: YES or NO
11. List of Electrical Equipment being examined or worked on (include equipment details): _____

12. Additional information or data: _____

Use blank sheets for continuation of any item.

BFS Form A-1.2

Lightning Protection System (LPS) Data

Diagrams/drawings/pictures depicting locations of LPS components (e.g., air terminals, grounding rods, down conductors, etc.) must be attached.

Section I - General Information

1. Facility Number	2. Dimensions (L x W x H)	3. Type of LPS ☐ Integral ☐ Mast ☐ Catenary		4. Meets requirements? ☐ Yes ☐ No	
5. Ground ring electrode installed? ☐ Yes ☐ No	5.a. Material	5.b. Size	5.c. Depth	5.d. Distance	
6. Ground rods installed? ☐ Yes ☐ No	6.a. Diameter	6.b. Length	6.c. Depth	6.d. Material	6.e. Quantity
7. Zone of protection met? ☐ Yes ☐ No	7a. Drawings included? ☐ Yes ☐ No		8. Surge suppression installed? ☐ Yes ☐ No		8a. Type of Surge Suppression
9. Resistance check accomplished? ☐ Yes ☐ No	9a. Within acceptable limits? ☐ Yes ☐ No		10. Protrusions < 3/16" protected? ☐ Yes ☐ No		10a. Protrusions ≥ 3/16" bonded?

Section II - Down Conductor (DC) Specifications

11. Size	12. Material	13. Quantity	14. Bend Radius ≥ 8"? ☐ Yes ☐ No
15. Spacing	16. Protected? ☐ Yes ☐ No	16a. Material	16b. Bonded? ☐ Yes ☐ No

Section III - Air Terminal (AT) Specifications

17. Height	18. Supported ☐ Yes ☐ No	19. Diameter	20. Type ☐ Solid ☐ Tubular
21. Distance from Edge	22. Perimeter Spacing	23. Internal Spacing	24. Material

Section IV - Catenary/Mast Specifications

Overhead Wire Specifications	25. Size	26. Material	27. Length	28. Height	29. Distance
Non-Metallic Mast Specifications	30. Height	31. Distance	32. DCs Per Mast	33. Number of Masts	
Metallic Mast Specifications	34. Height	35. Distance	36. Grounds Per Mast	37. Number of Masts	
Guy Wire Specifications	38. Used as down conductor? ☐ Yes ☐ No		38a. Size	38b. Material	
Side Flash Specifications	39. Meets distance from masts? ☐ Yes ☐ No		40. Meets distance from overhead wire? ☐ Yes ☐ No		

Section V - Remarks

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