ROBINS AIR FORCE BASE

BASE FACILITY STANDARD

APPROVED FOR PUBLIC RELEASE

30 SEPTEMBER 2019

ROBINS AIR FORCE BASE (RAFB)

BASE FACILITY STANDARDS

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Change No.	Date	Location
1	1 Oct 2019	This document has been substantially re-written and should be reviewed in its entirety.
2		
3		

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. The guidance provided in this document applies to all new construction and renovations carried out by all Mission Partners at Robins AFB.

The goal of this 2019 Edition of the Base Facility Standards is to fine-tune the document's presentation and focus on information that is most critical to the operations and climate here at Robins AFB. The technical content has been substantially reviewed and updated; sources have been checked and references have been revalidated. Safety data has been consolidate in Chapter 1 and the Criteria Reference Documents have been combined into a single Appendix for quick review and easy use. Forms have also been consolidated into an Appendix for quick access. Thanks go to the many subject matter experts that provided their time and expertise to make this happen.

Please contact the Editor, Base Facility Standards with all recommendations for updates, corrections or changes.

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ROBINS AIR FORCE BASE

CHAPTER 1

SPECIAL PROGRAMS

Aerial Photography of Robins AFB provided through GeoBase.

SECTION 1A

SPECIAL PROGRAMS

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 primary responsibility of the 78 CEG/CENME office.

1A-1.2.1.1 Planimetric Data: Airfield, Roads, Sidewalks, Buildings, Geodetic, Hydrography, Landform, Pedestrian and Land Status.

1A-1.2.1.2 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

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

1A-1.3 Any questions regarding the overall responsibility of the GIS content should be directed to the GeoBase Office before work on the project is initiated.

SECTION 1B

SPECIAL PROGRAMS

SAFETY PROVISIONS

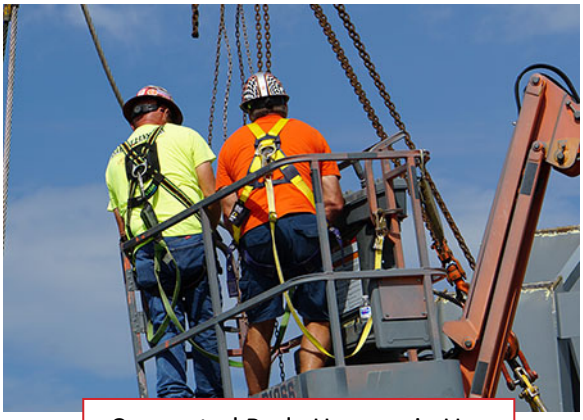
1B-1 SAFETY PLAN REQUIRMENTS

A detailed project-specific Industrial Safety and Health Requirements Plan i.e., Safety Plan, as required by OSHA IAW AFI 91-202 and AFPAM 91-210 and outlined in Appendix C of each Construction Contract or Task Order at Robins AFB, shall be submitted for review and approval by the 78 ABW Safety Office. The Contractor shall be prohibited from starting construction activities until the Safety Plan has been approved and all aspects of the Plan are in place.

1B-2 FALL PROTECTION

1B-2.1 System Requirements

All projects shall incorporate certified fall protection systems unless noted otherwise in the Contract or Delivery Order.



Connected Body Harness in Use

1B-2.2 Fall Protection Systems for Roof Projects

The fall protection system for roof projects, shall be designed to include perimeter systems for each applicable roof section and roof access penetrations (i.e. access hatches) in order to minimize fall distances, arresting forces, rescue time and the chance for human error. Additionally, the system shall be designed to provide rescue access to the worker in the event of a fall. These elements shall be engineered to work together to arrest a worker's fall.

1B-3 ELECTRICAL SAFETY

Electrical safety shall be an integral component of the Safety Plan.

1B-3.1 Safety Meeting and Briefings

1B-3.1.1 Host Responsibilities

1B-3.1.1.1 The host (i.e. Robins AFB/78 CEG personnel dealing with AEs and Contractors) will inform the contract employees of known hazards covered by NFPA 70E that are related to the work to be accomplished when conducting preliminary surveys, inspections, etc.

1B-3.1.1.2 Together, host and contract personnel shall complete Electrical Safety Form (*See Appendix B*). This form shall be included as one element of the Project Safety Plan and be reviewed at the prescribed meetings and briefings.

1B-3.1.1.3 Meetings and briefings may be on-site and shall be documented. AE and/or Contractor shall prepare the written report (hand written is acceptable) and 78 CEG will be given copy at the conclusion of the inspection, survey, etc. before the parties leave for the day.

1B-3.1.2 Contractor Responsibilities

1B-3.1.2.1 All projects (regardless of project cost) should have job briefings/on-site meetings at least daily or as conditions change. These briefings shall be documented and take place when any new type of work is started, including (but not limited to) the following:

- First day on project for any personnel and first day after more than two days off the job.
- Work in immediate area of energized wiring.
- Work on transformers exterior or interior
- Renovations of areas where “all” electrical circuits have not been de-energized.
- Work near rotating equipment that may become energized.

1B-3.1.2.2 In addition to job briefings, the Contractor shall schedule weekly safety meetings for projects over $200,000 in total project cost. These meeting should include all contractors, Sub-Contractors and 78 CEG/CEN construction inspection personnel. Supervisory personnel are to facilitate meeting with knowledgeable individuals to conduct training on specialized topics, including (but not limited to) the following:

- All aspects of planned work
- Site hazards
- Safety precautions to be followed
- Special precautions
- Energy source controls (especially with multiple sources of energy in one area)
- Personnel protective equipment (PPE)
- Planned exits free from obstructions from work area to a safe distance from construction site.

1B-3.2 Work Site Safety

Notify management if there are unsafe conditions. Maintaining acceptable work site safety involves proper behavior, good housekeeping, maintenance of protective measures and avoiding unsafe actions.

1B-3.2.1 Lockout and Tagout Precautions

1B-3.2.1.1 Contractors are required to turn off all circuits before working on them. To make sure that these circuits remain off, place lockout/tagout devices on the upstream overcurrent device/disconnecting means.

1B-3.2.1.2 In the event a normally open switch is closed to provide alternate power to a part of the exterior electrical system or building system, provide a lockout/tagout device

1B-3.2.1.3 Provide a caution tag with any lockout device. This tag shall include the project number, point-of-contact and phone number of the individual who completed the device lockout. Typically this is an electrician will place a lock that only he/she has a key to open.

1B-3.2.2 Stray Electric Voltage Testing

1B-3.2.2.1 Always test for live electrical currents before working on distribution equipment of any type. A device that changes color or gives an audio tone upon detection is sufficient.

1B-3.2.2.2 After placement of the device make sure that voltage is not present on the load side of the device locked out.

1B-3.2.2.3 Before providing temporary grounding of conductors/equipment, test to make sure there is no voltage present.

1B-3.2.2.4 Before entering into a manhole (or reaching into a handhole), make sure that there are no stray voltages present. Mount the testing device on a line tool and move it around close to the cables on all four sides of the manhole/handhole.

1B-3.2.3 Personal Protective Clothing (PPE)

Use the protective clothing and apparatus appropriate for the task at hand, including such items as the following:

- Hard Hats
- Safety Glasses / Goggles
- Hearing Protection
- Steel Toed Shoes
- Leather Gloves
- Hazard Rated Arc Flash Suit

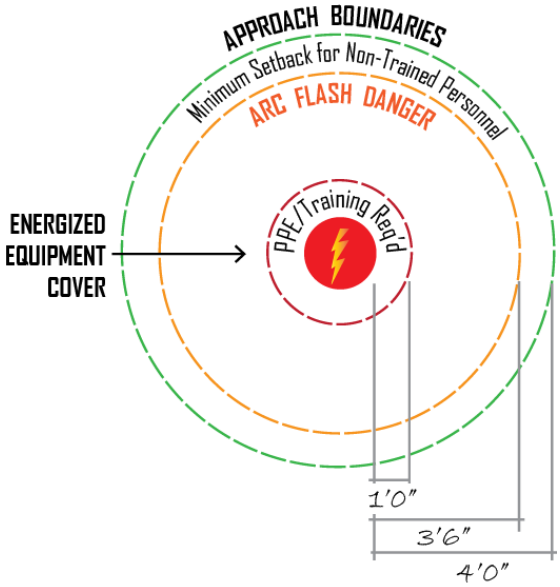
1B-3.2.4 Temporary Protective Grounding

Use temporary grounding to protect workers engaged with de-energized electrical lines maintenance and to protect lines and equipment during maintenance.

1B-3.2.5 Arc Flash

Arc Flash is a phenomena that occurs in high and low voltage electrical systems; it can occur regardless of the age or condition of the equipment. Determine the level where work is being done and prepare for the expected (and the unexpected), especially near a substations where 20 kA is available or on the load side of 2500 kVA transformers where over 53 kA may be available.

FIGURE 1B.1



1B-3.3 **Medium and Low Voltage Safety**

1B-3.3.1 Warning Devices

Locate warning devices such as barriers, warning signs, traffic cones and lights at approaches to clearly define work areas, excavations, open manholes, parked equipment and other hazards. Take special precautions for any areas where reduced visibility occurs, such as night operations or in fog. Immediately remove warning devices after removal of hazards and equipment.

1B-3.3.1.1 Ensure that Government personnel are kept at least 10 feet from any construction inside a building.

1B-3.3.1.2 Keep warning barricades such as cones and tape, five (5) feet from excavation areas and dirt piles. Note that a protective barricade may be placed closer than this since it provides both a warning and physical protection.

1B-3.3.1.3 Protection barricades must have a withstand rating of at least 200 pounds in any direction with minimal deflection.

1B-3.3.1.4 Never enter an excavation deeper than four (4) feet that does not have a safe access-way. A safe access-way is one which has been inspected by a competent person before allowing entrance and does not have equipment working next to the edge.

1B-3.3.1.5 Do not disrupt utility lines that may be present, marked or unmarked. Determine whether the line is in use or abandoned before demolition. If marked, any needed repairs should be assessed; the Contractor shall be responsible to repair damages created as a consequence of the work activity at no additional cost to the Government.

1B-3.3.2 Flagmen

1B-3.3.2.1 Provide flagmen if there is any doubt about whether the warning devices being used provide adequate controls, such as in areas with obstructed view by vehicular traffic or during high traffic hours such as mornings, lunchtime and quitting time.

1B-3.3.2.2 Flagmen must wear brightly colored and highly reflective vests.

1B-3.3.3 Number of Workers Required

1B-3.3.3.1 Jobs requiring only one electrical worker include the following:

- Work on systems in an electrically safe work condition with nominal voltages of 600 volts or less.
- Routine electrical measurements on energized systems with nominal system voltages of 600 volts or less.
- Routine operation of switchboard and panel breakers if the Contractor can demonstrate that conditions at the site allow this work to be performed safely.
- Routine electrical measurements or switching using gloves and live-line tools if the worker is positioned out of reach or possible contact with energized parts.

1B-3.3.3.2 Jobs requiring two electrical workers include the following:

- All medium voltage work requires two workers minimum, including installation, removal or repair work when working on or near lines or parts energized at 600 volts or more.
- Any work where the covers of equipment are removed.
- Any work within the interior of equipment where live parts may be energized.

1B-3.3.3.3 Jobs requiring three electrical workers include the following:

All activities within confined spaces require at least three workers; including one worker in the confined space; one on the surface providing assistance or operating certain equipment, such as air moving equipment; and one with first-aid and CPR training in the immediate vicinity of the activity. All three people shall have confined space training and each shall have the authority to stop/recall the person in the confined space. If any danger or perceived danger is present, then no worker shall enter the confined space until a plan has been developed.

1B-3.3.4 Pumping a Manhole or Handhole

1B-3.3.4.1 Manholes are considered confined spaces.

1B-3.3.4.2 If manhole/handhole contains water, it shall be pumped out before entering. Water must not be allowed to enter storm drains. Pumping onto the ground adjacent to the manhole is allowable.

1B-3.3.4.3 Before entering any confined space such as a manhole/handhole, test to make sure that the oxygen level is between 19.5% and 23.5%. If the oxygen level is below this level or other types of gas, such as methane, carbon-dioxide, etc. are present, ventilate the hole before entering.

1B-3.3.4.4 Removal of water or removal of duct plug may allow gases (dangerous or non-dangerous) to enter the manhole/handhole and deplete the oxygen level. Once water is removed, retest oxygen level.

1B-3.3.5 Minimum Illumination

- Ensure the working area has adequate illumination.
- Areas above suspended ceilings may be illuminated by handheld or body mounted lighting.
- Provide temporary lighting where natural or installed artificial illumination is not sufficient.

- When using existing lighting or part of existing lighting, make sure that it is not controlled by motion sensors or timed devices. Disconnect if found to be controlled.

1B-3.3.6 Elevated Spaces

- Ensure that ladders are installed with a slope of four to one (4:1) per OSHA 1926.1053
- Ensure that ladders are solidly placed and have a level footing
- Ensure that the proper weight class of ladder is used for personnel
- Always provide necessary bags, etc. for lifting tools to work site. Do not carry heavy objects up the ladder

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. 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

SPECIAL PROGRAMS

PRE-ENGINEERED METAL BUILDINGS

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-1.3 Roof Panel Configuration

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)	16” 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)
- 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.

1C-1.5 Finishes

Structural Steel Frames and Columns/Posts - Preferred Finish: Hot-dipped galvanized. Alternate Finish: Primed 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. As an alternate for primed and painted, hot-dipped galvanized finish may be substituted.

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.

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

SPECIAL PROGRAMS

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.

ROBINS AIR FORCE BASE

CHAPTER 2

SECTION 1560

ENVIRONMENTAL REQUIREMENTS

Protected Wetland Area

SECTION 2A

ENVIRONMENTAL REQUIREMENTS

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.

2A-2 ENVIRONMENTAL TRAINING

All contractor personnel working on Robins AFB who perform activities on the installation are required to complete training applicable to their job duties in accordance with all federal, state, local and DoD requirements. **It is the responsibility of the Prime Contractor to ensure that all Sub-Contractors, vendors, and employees complete this training prior to beginning work on Robins AFB. Notification of training completion shall be sent to the Contracting Officer (CO) to be maintained in the contract file for tracking purposes.** Failure to provide documentation of Environmental Management System (EMS) Training may result in termination of the contract. The following table identifies regulatory requirements and the associated training requirements. All training can be acquired via Environmental Management, 78 CEG/CEIE, at (478) 926-9645, or via email: 78ceg.cev.FrontOfc@us.af.mil.

TABLE 2A.1

Required Environmental Training (for Contractors)		
Media	**Title**	**Applicability**
Air Quality	Air Compliance Paint Boot Supervisor/ Operator	Paint/De-paint operations associated with Title V Permit
Environmental Management System (EMS)	General EMS Awareness Training	All Contractors • Computer Access Cards: Advanced Distributed Learning Service (ADLS) database: https://golearn.adls.af.mil/kc/rso/login/ADLS_login.asp

TABLE 2A.1

Required Environmental Training (for Contractors)		
Media	**Title**	**Applicability**
		• No Computer Access Card: Contractors must register for an account through The Environmental Awareness Course Hub (TEACH), the Air Force training database: https://usaf.learningbuilder.com/account/login/?ReturnUrl=%2f (Note: TEACH may not supported by Internet Explorer; recommend using Chrome.)
Edible Oils	Edible Oil Training	(Restaurant) Managers of edible oil storage containers
Hazardous Waste	Level 1	Level 1: Expert level; Has the ability to train others (Unit Environmental Coordinator (UEC), 90 day-Hazardous Waste Accumulation Sites (HWAS), Transportation, Storage, and Disposal Facility (TSDF) Employees
Hazardous Waste	Level 2	Level 2: General awareness; Anyone handling hazardous waste/placing into drums Workers and Initial Accumulation Pont (IAP) Managers
POL, Fuels and Storage Tanks	Spill Prevention Control & Counter-measures (SPCC)	Managers of fuel storage tanks, mobile refuelers and those who are involved with dispensing, transferring, or handling any bulk* POL products
Stormwater	Stormwater Pollution Prevention Workshop/Training	Personnel who design, install, maintain, and/or repair stormwater controls Personnel who store and handle chemicals/materials that could become contaminants in stormwater discharges; Personnel who conduct and document Permit-required monitoring, inspections, and corrective actions.
*** The term "bulk" is used to identify containers that can hold equal to or greater than 55 gallons of liquid.**		

2A-3 NO NOTICE INSPECTIONS

All contracts performed on Robins AFB are subject to no-notice inspections by the associated regulators and officials. 78 CEG/CEIE will conduct no-notice inspections to ensure compliance with all Environmental Requirements; no-notice inspections are also conducted by federal and state regulators. Any findings from such inspections will be documented in writing and forwarded to the Contracting Officer (CO) by the inspector. The CO will follow-up with the Contractor on all findings of non-compliance reported by the inspector. A finding may result in the issuance of a work stoppage by the CO until documentation of compliance is submitted and accepted by both 78 CEG/CEIE and the CO. Self-inspections are required for processes with environmental impacts.

2A-4 SUBMITTALS AND REGULATORY COORDINATION

The Contractor and Project Designer shall work together to identify submittals that apply to each project and to provide additional submittals, notifications and approval documents as required or as directed by the Contracting Officer. Additional details are provided in subsequent sections.

TABLE 2A.2

SUBMITTALS CHECKLIST (CHRONOLOGICAL)						
Inspect or Para		Description		Submittal Timeframe		Check Mark
	1	Air Permit Data		9 months prior to construction start date		☐
	2	Underground Storage Tank Removal		45 days after NTP		☐
	3	Erosion, Sediment, and Pollution Control Plan		60 percent design package		☐
	4	Post Construction Stormwater Management Plan and Calculations		60 percent design package		☐
	5	Post Construction Operation and Maintenance Plan		60 percent design package		☐
	6	Landscaping Plan		60 percent design package		☐
	7	Solid Waste Disposal Plan		10 days prior pre-con. conf.		☐
	8	Hazardous Waste/Hazardous Material List		Prior to starting work		☐
	9	GA EPD Asbestos Abatement or Demolition Project Notification Form		15 days prior to starting work		☐
	10	Asbestos Removal Info		As required		☐
	11	Lead Compliance/Training/Sampling		Prior to starting work		☐
	12	Use of fire hydrant/penetrate water mains		Prior to start of work		☐
	13	Notice of Intent – NPDES Permit		14 days prior to site work		☐
	14	Permits/Fees Copies – NPDES Permit		14 days prior to site work		☐
	15	Notify 78 CEG/CEIE of Digging, "Dig Permit"		Beginning of project, before digging		☐
	16	Special Waste Acceptance Application (SWAA)		5 days prior to dumping		☐
	17	Backflow Device Location (BFD)		Prior to installation		☐
	18	Backflow Prevention Device Test Report		After BPD installation		☐
	19	Commencement Notice		Prior to dumping		☐
	20	Landfill License		Prior to dumping		☐
	21	Waste Shipment Tracking		Monthly by the 5th		☐
	22	Waste Management Report Landfill Receipts		Monthly by the 5th and prior to final payment		☐
	23	Refrigerant Technician Certification		Prior to starting work		☐
	24	Refrigerant Appliance List		Within 7 days		☐
	25	Refrigerant Maintenance Repair Log		Within 7 days		☐
	26	Refrigerant Equipment Certification		Within 7 days		☐

TABLE 2A.2

SUBMITTALS CHECKLIST (CHRONOLOGICAL)						
	27	Refrigerant Purchase Documentation		Within 7 days		☐
	28	Generators		Prior to order		☐
	29	Pest Control License		Prior to pest control		☐
	30	Lead Compliance/Training/Sampling		(Prior to starting work) At the end of the project		☐
	31	Pesticide List		At end of project		☐
	32	Notice of Termination – NPDES Permit		After final stabilization at site		☐

SECTION 2B

ENVIRONMENTAL REQUIREMENTS

WASTE AND HAZARDOUS MATERIAL MANAGEMENT

2B-1 DISPOSAL OF WASTE AND EXCESS MATERIAL

The Contractor shall manage, dispose of and recycle all waste and excess materials in compliance with all Federal, State of Georgia and local laws; and follow all special methods and procedures as they apply to the different waste streams, including non-hazardous and hazardous waste materials and the full range of special waste materials and products. The Contractor shall take a proactive, responsible management role and require all Sub-Contractors, vendors, and suppliers to participate in this effort.

2B-2 DEPARTMENT OF DEFENSE ACTIVITY ADDRESS CODE (DODAAC) ACCOUNT

Payment for regulated waste turned in to 78 CEG/CEIER for disposal will be made through either the property/building organization's Department of Defense Activity Address Code (DODAAC) account or the Contractor's DODAAC account (if it exists and is active/valid). Since all hazardous wastes must be disposed of through DLA-DS, a valid DODAAC is essential to prevent contract operation delays. This step must be completed prior to requesting waste containers and labels. Authorization to use the organizations DODAAC also indicates there are sufficient funds available to pay for waste disposal generated from the project.

2B-3 NON-HAZARDOUS SOLID WASTE DISPOSAL METHODS

Non-hazardous solid waste that is dispositioned for disposal shall be removed from the Base in accordance with applicable Federal, State of Georgia and local codes and requirements. It shall be broken down into individual types, i.e., asphalt, concrete, wood, brick, etc. to facilitate recycling of recovered materials. Every effort shall be made to divert waste from any landfill by reusing or recycling materials. For construction and demolition wastes, a minimum of sixty (60) percent by weight of the total project solid waste shall be diverted away from a landfill. See the Code of Federal Regulations (CFR) 261.2 for the complete legal definition non-hazardous solid waste. Direct all non-hazardous solid waste inquiries to 78 CEG/CEIEC Solid Waste Program Manager, (478) 327-9283.

Use one or more of the following methods to divert or dispose of non-hazardous solid waste. All materials not disposed in a sanitary landfill must be kept segregated at the project site, away from those materials that are allowed only in a sanitary landfill.

2B-3.1 Re-Use - Diversion

Waste shall be given, sold or donated for re-use (to be used in its original form). Salvaged materials shall not be used in projects unless approved by the CO. Materials defined as "recovered materials" are excluded from regulation as solid wastes.

2B-3.2 Recycling - Diversion

Waste material not suitable for reuse but having value as a recyclable material, shall be recycled by the Government whenever practical and economically feasible. Materials destined for recycling must meet the definition of non-hazardous wastes under federal/state solid waste regulations. To coordinate removal/collection of materials for recycling, please contact QRP Manager/Operations Manager at (478) 327-3976 or the Scrap Metal Yard Manager at (478) 283-6542.

2B-3.2.1 Recyclable metal materials such as scrap metal, wire, motors, etc. shall remain the property of the government and will be recycled through the Robins AFB Qualified Recycling Program (QRP).

2B-3.2.2 Other construction and demolition (C&D) wastes that are part of the Base Qualified Recycling Program, include but are not limited to wood, paper, used oil and cardboard. These will be recycled through the Robins AFB Qualified Recycling Program (QRP).

2B-3.2.3 Wastes that are recyclable, but not part of the Base Qualified Recycling Program, include, but are not limited to concrete, asphalt, etc. should be recycled by the Contractor at an alternate location. A copy of the recycling invoice shall be provided to 78 CEG/CEIEC as a record to ensure wastes are being properly disposed and to ensure that recycling data is properly documented.

2B-3.3 Sanitary Landfill - Disposal

All solid waste may be disposed in a sanitary landfill properly licensed by the State of Georgia. A licensing certification issued by the Georgia Solid Waste Management Act, O.C.G.A. 12-8-is required for locations other than the Houston County Landfill, and should be provided to the 78 CEG/CEN Project Manager.

2B-3.4 Inert Waste Landfill - Disposal

Materials not likely to cause production of leachate of environmental concern may be disposed of in an inert waste landfill. These materials are limited to earth and earth-like products, concrete, cured asphalt concrete, rock, bricks, yard trimmings and land clearing debris such as stumps, limbs and leaves. Alternately, these wastes may also be disposed of in a sanitary landfill or be recycled according the rules of the State of Georgia

2B-3.5 Construction/Demolition Site - Disposal

Materials should be recycled where practical. To coordinate removal/collection of scrap materials, please contact QRP Manager/Operations Manager at (478) 327-3976 or the Scrap Metal Yard Manager at (478) 283-6542.

2B-3.6 Solid Waste Disposal Outside of Georgia

No solid waste can be disposed of outside the State of Georgia without prior written approval of the Contracting Officer (CO). The Contractor shall provide sufficient information as determined by the CO to allow verification of compliance with the law.

2B-4 NON-HAZARDOUS SOLID WASTE DISPOSAL REQUIREMENTS

2B-4.1 Demolition Notification

The Contractor must prepare a Demolition Notification for GA Environmental Protection Division (EPD). At least 15 days prior to starting work and prior to submittal to the GA EPD the document shall be submitted to the Contracting Officer and the 78 CEG/CEN Project Manager for review. The 78 CEG/CEN Project Manager will forward the document to the 78 CEG/CEIEC Solid Waste Program Manager and submit the final copy with copy of any payment made to Georgia Environmental Protection Division (EPD).

2B-4.2 Solid Waste Handling Permit

All persons engaged in solid waste handling, including solid waste collection and transportation, or operations of solid waste handling facilities or disposal sites, shall have a solid waste handling permit or permit by rule letter. The provisions of Georgia Environmental Protection Division (GA EPD) regulations concerning proper handling of solid waste and applicable prohibitions shall govern. All material and equipment not turned in to the Government is considered property of the Contractor and must be properly removed by the end of the project.

2B-4.3 Disposal Plan for Solid Waste or Inert Waste

The Contractor shall provide a Solid Waste Disposal Plan stating how all materials leaving Robins AFB shall be disposed of and recycled. Information shall include actions that will be taken to reduce solid waste generation, specific approaches to be used in recycling/reuse of materials and waste management and storage information. Provide a copy of the information or the Solid Waste Disposal Plan to the Contracting Officer (CO) and to the 78 CEG/CEN Project Manager. The 78 CEG/CEN Project Manager will forward to 78 CEG/CEIEC prior to review and approval.

2B-4.3.1 Disposal Plan

The following shall be included:

1) The identity of each landfill and recycler to be used.
2) A copy of all landfill permits unless the Houston County Landfill is used.
3) A copy of the Solid Waste Handling Permit or Permit-by-Rule Letter, issued by GA EPD, which allows the Contractor to handle solid wastes, including solid waste collection and transportation.
4) A copy of Daily Waste Disposal and Recycling Log that accounts for each load of materials that leaves Robins AFB, including the following:
   - The load number
   - The bill of sale number/date or other record for recycling

- Evidence of proper disposal or recycling such as dump tickets from a licensed sanitary landfill, a manifest, bill of sale, or other record
- Name of the contract employee who verified that the material was disposed of properly
- Details of how verification was accomplished

2B-4.4 Special Waste Acceptance Application (SWAA)

2B-4.4.1 Special Waste Acceptance Application (SWAA) Requirement

A Special Waste Acceptance Application (SWAA) is required for disposal if the presence of lead based paint, asbestos, other non-hazardous Special Waste or hazardous materials is suspected. (*See Appendix B*.) The Contractor will coordinate the SWAA and lab results with the 78 CEG/CEIEC Solid Waste Program Manager who will in-turn coordinate the SWAA with the Houston County Landfill. The 78 CEG/CEIEC Solid Waste Program Manager is the signing authority as the generator on the SWAA form.

2B-4.4.2 SWAA Process / Waste Shipment Tracking Document

The document shall be accomplished as follows:

1) Complete the top and middle portion of the SWAA form and attach it to the results of the tests/lab analysis, as noted.
2) Submit the package to the 78 CEG/CEIEC Solid Waste Program Manager for approval and signature.
3) 78 CEG/CEIEC will email the completed form to Houston County's landfill consultant for disposal acceptance/approval and for issuance of Special Waste Profile Number. Allow a minimum of three working days for SWAA form processing and issuance of the Special Waste Profile Number.
4) After the SWAA is issued back to the Contractor via email, complete the Waste Shipment Tracking Document by placing the Special Waste Profile Number at the top of the form and certifying that no hazardous waste has been introduced into the waste while in their custody. This document must accompany all loads of asbestos (or other identified waste) to the landfill.
5) The Contractor shall submit the waste tickets obtained from Houston County Landfill to the 78 CEG/CEIEC Solid Waste Program Manager.

Note: The SWAA and the Waste Shipment Tracking Document must be included in contract documents.

2B-4.5 Waste Management Report

2B-4.5.1 Waste Management Requirement

The Contractor shall prepare a Waste Management Report and submit it to the 78 CEG/CEN Project Manager by the 5th of each month during project activities and prior to the final payment. (*See Appendix B*.) The data will be maintained as part of the contract documents file and forwarded to the 78 CEG/CEIEC Solid Waste Program Manager. Prior to final payment, 78 CEG/CEIEC Solid Waste Program Manager must have received all monthly waste tracking reports. Attach a copy or duplicate of the Waste Shipment Tracking Document for each load transported for disposal and recycling.

2B-4.5.2 Required Report Documentation

The Waste Management Report shall include the following:

1) Documentation of the weight of reused, recycled and disposed materials generated by the project each month based on an total accumulation from the start of each month to the end of each month including:
   - Weight tickets for material disposed of in a sanitary or C&D landfill
   - The weight of material disposed of in other types of landfills that do not have weight scales, based on a good faith estimate
2) The weight of material reused and or recycled based on a good faith estimate
3) A copy of the Landfill License or Permit-by-Rule Letter issued by GA EPD, if Houston County Landfill is not the disposal location
4) A copy of the written Notice of Commencement of Operation as given to the GA EPD by the landfill
5) The method of disposal for the material generated from the project
6) The cost to landfill or divert or recycle materials

2B-5 HAZARDOUS WASTE DISPOSAL

2B-5.1 Hazardous Waste Defined

Hazardous Waste is waste that meets the requirements provided at 40 CFR 261.3 and includes (but is not limited to) the following items:

- Paints, sealants, solvents, rags or any other hazardous material(s) unless a Safety Data Sheet (SDS) or laboratory sampling indicates the item is not hazardous waste
- Project waste, including lead-based paint removed from walls, contaminated soil, sludge from tank cleaning, etc.
- High-intensity discharge (HID) and fluorescent lamps and tubes or switches containing mercury. Labeled containers must be requested prior to job start
- Batteries used in emergency and exit lights that contain lead. There is no cost associated with recycling or disposal of batteries

2B-5.2 Hazardous Waste Disposal Procedures

The regulatory status and disposal requirements of all hazardous waste generated on Robins AFB is coordinated by the 78 CEG/CEIER Hazardous Waste Program Manager. The Contractor must provide all data necessary to make this determination and coordinate any activities requiring large quantities of disposal to this office prior to beginning work. The Contractor shall manage all materials in compliance with Federal, State of Georgia and local laws.

2B-5.2.1 All items considered to be hazardous or universal wastes and generated on Robins AFB must be containerized and labeled. Containers must be suitable for shipping in accordance with Department of Transportation (DOT) guidelines. Labels and containers can be obtained prior to job start from Building 359. Disposal shall be coordinated through 78 CEG/CEIER at Building 359.

2B-5.2.2 Fluorescent lamps/tubes may be placed in the original boxes the tubes came in or in boxes designed to prevent breakage. Take care not to break any universal waste lamps/tubes. If any are broken, they must be treated as spilled hazardous waste and turned-in to Building 359 immediately.

2B-5.2.3 Roll-off boxes needed to contain waste for large projects must be requested at least two (2) weeks in advance.

2B-5.2.4 Hazardous waste accumulate under either the satellite accumulation rules (less than 55 gallons total, no time limit, 3 day limit to turn-in full drums) or 90-day rules (no quantity limit, use up to 90 days in the field, other 40 CFR 262.17 requirements apply) should be kept in appropriate containers and turned-in when full or approaching time limit(s).

2B-6 ASBESTOS CONTAINING MATERIALS

At Robins AFB, many facilities contain asbestos construction materials. At any work site containing asbestos materials, the asbestos must be removed and site abatement must be completed. The Contractor is responsible for complying with all Federal, State and Local rules and regulations, including the following:

TABLE 2B.1

Environmental Permits for Materials Containing Asbestos	
Air Quality	29 CFR 1910.1101
Hazardous Waste	40 CFR 61.145
Natural Resources	40 CFR 61.150
Natural Resources	40 CFR 763
Stormwater	Rules for the State of Georgia, Chapter 391-3-1-.02(9)(b)7
Stormwater	Rules for the State of Georgia, Chapter 391-3-14
Wastewater	Rules for the State of Georgia, Chapter 391-3-4
	AFOSH Standard 161-21
	AFI 32-1052

2B-6.1 Site Work or Building Demolition with Asbestos

2B-6.1.1 If there is no known asbestos in the project area, proceed as normal.

2B-6.1.2 For areas with known asbestos, comply with notifications and regulatory requirements prior to beginning any site work or building demolition (i.e. making building modification that includes the removal of a load-bearing wall).

2B-6.1.3 If asbestos is identified after a project's Notice to Proceed (NTP), STOP WORK and CONTACT THE Contracting Officer. Identify the area of construction where the asbestos is suspected. Do not perform work in any area that contains or involves asbestos if it was not written in the contract. Do not proceed with project activities until authorized by the Contracting Officer (CO).

2B-6.1.4 If any asbestos is accidentally damaged, notify the CO and the 78 CEG/CEOER Toxic Operations Officer at (478) 327-8518 immediately. The Contractor shall perform any required repairs or debris removal if areas not included in the Contract are damaged at no additional cost to the Government

2B-6.1.5 Do not use any products containing asbestos.

2B-6.2 Asbestos Training Certification

All handling, removal and disposal of asbestos materials, as well as the subsequent clean-up of the affected environment shall be conducted by prequalified persons who have received appropriate training and associated experience.

2B-6.3 Asbestos Abatement Plan

The Contractor shall provide a written Asbestos Abatement Plan to the 78 CEG/CEN Project Manager and the 78 CEG Toxic Operations Officer for review and approval prior to start of work. At a minimum, the Asbestos Abatement Plan will include the following:

1) Description of scope of work to be performed
2) A list of the procedures that will be utilized to ensure compliance with all rules and regulations
3) A copy of the asbestos Training Certificates for each employee that will be involved in the removal and handling of asbestos
4) A copy of Respiratory Protection and Medical Surveillance Program that will be in place during removal and abatement activities
5) Copies of all notifications, GA EPD approvals and landfill disposal receipts and waste shipment tracking forms provided to the Contracting Officer

2B-6.4 Work Start Notification

The Contractor shall provide notification to Georgia Environmental Protection Division (GA EPD) at least ten (10) working day prior to the start of any work involving asbestos. The GA EPD Asbestos Abatement or Demolition Project Notification Forms for asbestos renovation, encapsulation or demolition are available at the following website: http://epd.georgia.gov/asbestos-notification-requirements or coordinate with 78 CEG/CEIEC Solid Waste Program Manager or the 78 CEG/CEN Project Manager.

2B-6.5 Asbestos Disposal

If asbestos wastes are generated from project activities, permission for landfill disposal is required and waste must be dispositioned through the Special Waste Acceptance Application (SWAA) process. The 78 CEG/CEIEC Solid Waste Program Manager will coordinate the SWAA and be the signing authority as the generator on the SWAA form.

2B-7 LEAD BASED PAINT (LBP)

At Robins AFB all painted surfaces, including painted surfaces covered by other materials such as wall paper, may contain varying levels of lead. For this reason a LBP determination must be completed for all projects, including but not limited to major abatement projects; housing or childcare facilities; and maintenance, repair and minor construction projects. The Contractor is responsible for complying with all Federal, State and Local rules and regulations, including, but not limited to the following:

TABLE 2B.2

Environmental Permits for Materials with Lead Based Paint	
LBP Poisoning	40 CFR 745
Solid Waste	Rules for the State of Georgia, Chapter 391-3-4
Hazardous Waste	Rules for the State of Georgia, Chapter 391-3-11
LPB Hazard	Rules for the State of Georgia, Chapter 391-3-24

2B-7.1 Site Work or Building Demolition with LBP

2B-7.1.1 The Contractor shall take precautions to protect contract and government employees from exposure to lead dust hazards during construction demolition projects in accordance with 29 CFR 1926.62, Occupational, Safety and Health Administration (OSHA) "Lead in Construction" Standard.

2B-7.1.2 Lead based paint abatement work shall only be performed in the areas shown by the required specifications and shall be completed in accordance with Unified Facilities Guide Specifications (UFGS). Lead-Based Paint Applications, Certificates and Notifications can be obtained on-line via https://epd.georgia.gov/lead-based-paint-forms

2B-7.2 LBP Training

LBP removal may only be conducted by persons who have received appropriate training and who are knowledgeable in the removal, handling and disposal of LBP material.

2B-7.3 LBP Abatement Plan

A written LBP Abatement Plan prepared IAW OSHA Standard 29 CFR 1926.62 must be provided to the 78 CEG/CEN Project Manager and the 78 CEG Toxic Operations Officer. At a minimum, the LDP Abatement Plan will provide the following:

1) Description of work to be performed
2) Identification of specific work procedures being followed to achieve compliance with rules and regulations
3) Selected methods for controlling exposure to lead at the project site
4) A description of each activity where lead is emitted
5) Copies of Training Certificates showing that Contractor personnel involved in removal and handling of lead based paint have received training in accordance with OSHA Lead Standards
6) Copies of the Medical Surveillance Program Information, Air Monitoring Data and a Schedule of Implementation for this protocols.
7) Results of Air Sample Testing (from the end of the project) that was provided to the Contracting Officer to demonstrate worker safety.

2B-7.4 LBP Disposal

2B-7.4.1 The disposal of all debris containing lead paint shall be handled as hazardous waste unless testing indicates low or no lead content. A SWAA must be prepared for all wastes known to have any hazardous components. 78 CEG/CEIEN must review all LBP analysis results.

2B-7.4.2 If LBP is suspected in the waste generated from project activities, a Toxic Characteristic Leaching Procedure (TCLP) test shall be performed by a certified lab approved by the State of Georgia.

- If there is no presence of lead based paint (or other hazardous material), the waste may be disposed at a Subtitle D permitted facility, such as the Houston County Landfill. No SWAA is currently required.
- If the TCLP indicates lead toxicity is above 0.1 mg/L but less than 5 mg/L, the waste may be disposed at a Subtitle D permitted facility, such as the Houston County Landfill. In this case, a SWAA is required.
- If the TCLP indicates lead toxicity is greater than 5 mg/L, the waste shall be disposed of as hazardous waste in a Subtitle C permitted facility. A SWAA is required. Note: The Houston County Landfill is not a Subtitle C permitted facility.

Houston County Landfill

2B-7.4.3 Any waste containing LBP must be collected in DOT approved drums. These can be provided by the Contractor or obtained from Building 359. The drums shall be sealed and labeled as "Non-Hazardous Waste" for special wastes or "Hazardous Waste" depending on lab results. All labels can be generated in Building 359. Drums labeled as "Non-Hazardous Waste" can be disposed via the landfill with an approved SWAA; drums labeled "Hazardous Waste" shall be taken to Building 359 for disposal.

2B-8 POLYCHLORINATED BIPHENYLS (PCBS)

2B-8.1 PCBs Defined

Polychlorinated Biphenyls are hazardous wastes found in commonly used products and construction items, including, but are not limited to, the following items:

- Ballasts and capacitors for fluorescent and High Intensity Discharge (HID) lighting
- Plastics, such as plastic insulation from wire or cable; radio, television and computer casings; vehicle parts; or furniture laminates
- Preformed or molded rubber parts and components
- Applied dried paints, varnishes, waxes or other similar coatings or sealants
- Caulking
- Asbestos

2B-8.2 Products Containing PCBs

2B-8.2.1 Do not use equipment or components containing PCB's.

2B-8.2.2 Prior to the start of any demolition, renovation, or digging, the Contractor shall determine if PCB containing materials are in the area of construction. If any materials suspects to contain PCBs are discovered, or if lab results indicate PCB-containing materials, the material shall be managed as PCB hazardous waste.

2B-8.3 Disposal of Products Containing PCBs

1) Establish a valid DODAAC account for any project or activity that contains PCB materials.
2) Notify 78 CEG/CEIER Hazardous Waste Support at (478) 926-1176 that a project area contains PCB materials.
3) Download and complete DD Form 1348. Have a 78 CEG/CEIE representative sign the DD Form 1348. The completed DD Form 1348 must accompany all transport of PCB waste.
4) Place products containing PCBs into either their original containers (if approved) or use labeled, suitably sized DOT-approved containers obtained from 78 CEG/CEIER Hazardous Waste Support. See 49 CFR 173.202 for more details. Typical container sizes are 1, 5, 10, 30 and 55 gallons. Containers should be sealed within 30 days.
5) Contact DLA-DS, (478) 926-5162 within 30 days for direct pick-up and disposal. If DLA-DS is not available to pick up PCB containing materials, notify 78 CEG/CEIER Hazardous Waste Support at (478) 926-1176 for alternate disposal procedures.
6) Do not keep any of the full or partially full containers at the construction site for more than 30 days.

2B-8.4 Special Instructions for Disposal of Lighting Ballasts and Capacitors

2B-8.4.1 Fluorescent lighting ballasts and High Intensity Discharge (HID) lighting capacitors must be managed and disposed of as toxic waste, unless the label states they do not contain PCB's. Ballasts and capacitors with no markings are assumed to contain PCB.

2B-8.4.2 Intact fluorescent lamps and tubes may be placed in their original boxes, marked with an accumulation start date and handled as Universal Waste – Lamps. These boxes shall be turned in for disposal to 78 CEG/CEIER at Building 359.

2B-8.4.3 Any broken HID capacitors or fluorescent ballasts must be treated as spilled hazardous material and must be disposed as toxic waste. Contact 78 CEG/CEIER, (478) 926-1176 for disposal instructions.

2B-9 HAZARDOUS MATERIALS (HAZMAT)

2B-9.1 HazMat Defined

The term HazMat includes all items (including medical supply items, but excluding drugs in their finished form and pharmaceuticals in individually-issued items) covered under Emergency Planning and Community Right-to-Know Act (or other federal, state, or local) tracking requirement, the OSHA Hazard Communication (HAZCOM) Standard, and all Class I and Class II ODS. It does not include munitions or hazardous waste.

2B-9.2 HazMat Exceptions

The OSHA HAZCOM Standard [29 CFR 1910.1200(b)(6)(ix)] excludes "Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for

the purpose intended." OSHA further states in a 14 April 2005 interpretation letter that office cleaning products utilized with the same frequency and duration as that of a normal consumer would fall under the HAZCOM Standard exemption for consumer products in 29 CFR 1910.1200(b)(6)(ix). Based on the OSHA HAZCOM Standard exemption, consumer products that are used at Robins AFB in such a way that the duration and frequency of use are the same as that of a consumer are not required to be included in the employer's HAZCOM program. If unsure if the item meets the exemption, contact the HazMat Cell (78CEG.cev.hazmat@us.af.mil).

2B-9.2.1 Lead Acid Batteries

OSHA determined that lead acid batteries are hazardous chemicals because of their potential chemical exposure risks and physical hazards. As a result, lead acid batteries are classified as hazardous materials (HazMat) and do not fall under the article exemption because they have the potential to leak, spill or break during normal conditions of use.

2B-9.2.2 Aerosol Products

All aerosol products are classified as HazMat.

2B-9.3 Ozone Depleting Substances (ODS)

For the purposes of Air Force policy, the following products are considered ODS [AFI 32-7086, Hazardous Materials Management, Table 4.2]:

2B-9.3.1 Class I ODS Products

1) Halons: 1011, 1202, 1211, 1301, and 2402
2) Chlorofluorocarbons (CFCs): CFC-11, CFC-12, CFC-13, CFC-111, CFC-112, CFC-113, CFC-114, CFC-115, CFC-211, CFC-212, CFC-213, CFC-214, CFC-215, CFC-216 and CFC-217 and the blends R-500, R-501, R-502 and R-502
3) Carbon Tetrachloride, Methyl Chloroform and Methyl Bromide
4) Materials that use one or more of these Class I ODSs as minor constituents do not meet the Air Force definition of a Class I ODS.

2B-9.3.2 Class II ODS Products

Hydrochlorofluorocarbons (HCFCs): HCFC-21, HCFC-22, HCFC-31, HCFC-121, HCFC-122, HCFC-123, HCFC-124, HCFC-131, HCFC-132, HCFC-133, HCFC-141b, HCFC-142b, HCFC-151, HCFC-221, HCFC-222, HCFC-223, HCFC-224, HCFC-225ca, HCFC-225cb, HCFC-226, HCFC-231, HCFC-232, HCFC-233, HCFC-234, HCFC-235, HCFC-241, HCFC-242, HCFC-243, HCFC-244, HCFC-251, HCFC-252, HCFC-253, HCFC-261, HCFC-262, HCFC-271

2B-9.4 HazMat Usage

2B-9.4.1 "Hazardous Material Purchase Request for Contractors"

Contractors must complete and submit an Air Force Form 3952 "Hazardous Material Purchase Request for Contractors" (or the electronic equivalent through the Air Force Standardized Tracking System) prior to transporting any hazardous material onto Robins AFB. Contact the HazMat Cell 78CEG.cev.hazmat@us.af.mil to request the form. AF Form 3952 is also required to gain access to Air

Force Standardized Tracking System Contractors used to monitor and maintain compliance with the Robins AFB Hazardous Material Management Plan and AFI 32-7086. A copy of the plan can be obtained by contacting the HazMat Cell (78CEG.cev.hazmat@us.af.mil)

2B-9.4.2 Contractor Requirements

2B-9.4.2.1 All HazMat must be authorized by stock number prior to use. Stock numbers are tracked in the Air Force Standardized Tracking System.

2B-9.4.2.2 The Contractor shall comply with the applicable requirements of Sections 608 and 609 of the Clean Air Act (42 U.S.C. 7671g and 7671h) as each (or both) applies to the work being done. [FAR Part 52.223-12, Refrigeration Equipment and Air Conditioners].

2B-9.4.2.3 The Contractor shall provide weekly documentation of HazMat storage and usage during the performance of the contract via written documentation provided to the HazMat Cell OR through the Air Force Standardized Tracking System

2B-9.5 Class I ODS Usage

Contractors may not provide any service or product with any specification, standard, drawing or other document that requires the use of a Class I ODS in the test, operation or maintenance of any system, subsystem, item, component or process, or provide any specification, standard, drawing or other document that establishes a test, operation or maintenance requirement that can only be met by use of a Class I ODS unless the requiring activity has obtained prior approval from the Senior Acquisition Official (SAO) IAW Air Force Federal Acquisition Regulation Supplement (AFFARS) Part 5352.223-9000, Elimination of Use of Class I Ozone Depleting Substances (ODS).

2B-9.6 Class II ODS Usage

2B-9.6.1 Contractors may not modify any existing weapon or facility system scheduled to remain in the Air Force inventory beyond 1 January 2020 that requires or adds requirements for Class II ODS in their operations or maintenance unless the requiring activity has obtained prior approval from Senior Acquisition Official (SAO) IAW Air Force Federal Acquisition Regulation Supplement (AFFARS) Part 5352.223-9000, Elimination of Use of Class I Ozone Depleting Substances (ODS).

2B-9.6.2 Contractors may not install Real Property air conditioning and refrigeration equipment that requires or adds requirements for Class II ODS unless the requiring activity has obtained prior approval from the Base Civil Engineer (BCE). [AFI 32-7086, Hazardous Materials Management].

2B-9.7 Disposal of HazMat and Ozone Depleting Substances (Class I and Class II ODS)

2B-9.7.1 Each HazMat container must have an Air Force-approved bar code tracking label affixed, with the exception of inseparable kits, which are required to have one label per kit. The tracking label shall be generated from the Air Force Standardized Tracking System and must be for the same manufacturer, same product and same size item. Substitutions are not allowed.

2B-9.7.2 HazMat that has been broken down into smaller “child” containers from the original “parent” container must have a packaging label affixed in addition to the bar code tracking label. If the Contractor does not have access to a government-furnished computer and cannot access the Air Force

Standardized Tracking System, the Contractor must coordinate with the HazMat Cell the printing of bar code labels for all HazMat items.

2B-9.7.3 The Contractor shall label products that contain or are manufactured with ODS in the manner and to the extent required by 42 United States Code (U.S.C.) 7671j(b), (c), and (d) and 40 CFR Part 82, Subpart E, as follows:

WARNING
Contains (or Manufactured with) *_____, a substance that harms public health and environment by destroying ozone in the upper atmosphere.

** The Contractor shall insert the name of the substance(s). [Federal Acquisition Regulation (FAR) Part 52.223-11, ODS].*

2B-9.8 Submittal Requirements for Hazmat Usage

2B-9.8.1 HAZCOM Program

The Contractor must submit a written HAZCOM Program to the Contracting Officer when hazardous materials or chemicals are to be used or demolished. This Program shall include the following information:

1) List of each work activity or process required to use or demolish hazardous materials or chemicals.
2) List of hazardous materials or chemicals used.
3) Safety Data Sheet (SDS) for each hazardous material or chemical used. The SDS must be the most current SDS available from the manufacturer. SDSs from third party SDS sites are not allowed.
4) A copy of the HazMat Listing and a separate Air Force Form 3952 for each hazardous material that will be brought on base during the performance of the contract.
5) Written procedures for handling of any hazardous waste generated.

2B-9.8.2 Submittal Checklists

The Contractor shall provide the following information to the CO and HazMat Cell as applicable:

1) The name, address, telephone number and technician certification of each person who will service, repair, maintain and/or dispose of any equipment containing and/or using a refrigerant (Class I ODS, Class II ODS, or non-ozone depleting substance).
2) A list of appliances included that have a capacity of 50 pounds or more of a Class I or Class II refrigerant, plus the following information for each appliance:

    - The type of appliance, i.e., commercial refrigeration appliance, industrial process refrigeration appliance, comfort cooling appliance, or other type of refrigeration appliance
    - The location of each appliance
    - The manufacturer, serial number, or other method of identification

- The amount of the full charge of refrigerant, the type of refrigerant used, and the date full charge was determined

3) Records, work logs, service tickets, invoices and supporting documentation for maintenance, service, repair, and/or disposal of base appliances containing 50 pounds or more of a Class I or Class II refrigerant, showing the following:

- The date and type of service performed, i.e., repair, maintenance and/or disposal
- The date any leak was discovered
- A complete, detailed description of any service performed, including the location or any leak
- The amount of refrigerant added and recovered at the completion of each service performed
- Dates and results of the successful initial and follow-up verification tests
- The name and signature verification of the technician who performed the work

4) For any equipment used to recover or recycle refrigerants on base, provide the following:

- A copy of any invoice or other record documenting the purchase or rental of such equipment, including the type of equipment, the manufacturer's name, the equipment model number, year manufactured and any associated serial number
- A copy of the equipment certification sent to US Environmental Protection Agency (EPA)

5) For evacuating refrigerant from appliances with a full charge of more than five (5) and less than 50 pounds of refrigerant for purposes of disposal of that appliance, provide records and documentation containing the following:

- The company name, location of the appliance, date of recovery, and type of refrigerant recovered for each appliance
- The total quantity of refrigerant, by type, recovered from all disposed appliances in each calendar month
- The quantity of refrigerant, by type, transferred for reclamation and/or destruction, the person to whom it was transferred, and the date of transfer

6) For any purchases or acquisitions of refrigerant used for any service on base, provide the following:

- Copies of records, including, but not limited to, receipts, invoices, purchase orders or bills of lading showing the name, address and telephone number of each person, agent or business entity that the purchased refrigerant
- DODAAC Account
- After contract award, work with 78 CEG/CEIER Hazardous Waste Disposal/Turn-in personnel, (478) 926-1176, to discuss how to obtain containers and container labels. The Contracting Official Technical Representative must apply or update a DODAAC through the Air Force DODAAC manager at https://dodaac.wpafb.af.mil/.

SECTION 2C

ENVIRONMENTAL REQUIREMENTS

AIR QUALITY

2C-1 GENERAL

2C-1.1 Air Quality Management

The Contractor will perform value engineering for each project requiring specification or installation of equipment for control of regulated air pollutants. These analyses will ensure that the proposed control technology meets air quality compliance requirements. New sources require utilization of Maximum Achievable Control Technology to reduce emissions of hazardous air pollutants.

2C-1.2 Open Burning

Open burning operations are prohibited on base and shall not be used. Open burning is any outdoor fire which emits products of combustion directly into the open air without passing through a stack, chimney or duct.

2C-1.3 ODS Use Restricted

Ozone Depleting Substances (ODS) are restricted from use. Comply with procedures herein.

2C-1.4 Generators

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 are met. This certification must be submitted and approved by the CO and 78 CEG/CEIEC Air Quality Program Manager prior to ordering and delivery of the unit.

2C-2 SUBMITTALS, NOTIFICATIONS AND APPROVALS

The following submittals, notifications and approvals are required to maintain compliance:

2C-2.1 Air Permit – Emission Sources

According to GA EPD Rules for Air Quality Control, Chapter 391-3-1-.03, a Title V Air Quality Permit is required to begin any construction or modification of any facility that may result in air pollution. The Contractor shall submit any required data to complete the permit application form as early in the planning process as possible, at least nine months prior to the construction start date. Since an approved permit to construct is mandatory prior to start of construction, the Contractor shall not install the equipment until the permit has been approved and Government approval of the Contractor's submittal has been obtained. Contractor shall anticipate at least nine months from air source data submittal for this to occur. Direct all inquiries to the 78 CEG/CEIEC Air Program Manager.

2C-2.2 Notification

Notify the 78 CEG/CEIEC Air Program Manager of any decommissioning or replacement of sources/equipment that emit air pollution.

SECTION 2D

ENVIRONMENTAL REQUIREMENTS

PESTICIDES

2D-1 GENERAL REQUIREMENTS

2D-1.1 Pesticide Use

2D-1.1.1 The Contractor shall use only United States (US) Environmental Protection Agency (EPA) approved pesticides, insecticides, fungicides, herbicides, etc.,

2D-1.1.2 The Contractor must ensure proper delivery, storage, handling and disposal of all chemicals and abide by the principles of Integrated Pest Management, implementing physical methods to control pests as the primary strategy.

2D-1.1.3 Chemical methods of control should only be used as a last resort, and the chemicals used should be the most environmentally benign available.

2D-1.1.4 Pesticides, insecticides, fungicides, and herbicides are classified as HazMat and must be managed as HazMat.

2D-1.2 Licenses

The Contractor must possess a Pest Control Operator's License valid in the State of Georgia.

2D-2 REQUIREMENTS FOR USE

The Contractor shall coordinate with the CO and 78 CEG/CEIEC Natural Resources Program Manager prior to commencing any work activities using pesticides, etc. Coordination with Base Entomology Shop, 78 CES/CEOIE shall be provided by 78 CEG/CEIEC. Submit the following items:

1) A copy of the Georgia Pest Control Operator's License
2) A list of all chemicals to be used and the amount (pounds) of active ingredients
3) Verification that the chemicals are approved list of products for Robins AFB
4) A final Report when work has been completed summarizing pesticide usage.

SECTION 2E

ENVIRONMENTAL REQUIREMENTS

STORAGE TANKS

2E-1 GENERAL

Aboveground storage tanks are preferred to underground storage tanks (USTs). Installation of USTs should be a last resort and requires approval by 78 CEG/CEIEC Tank Program Manager.

2E-2 NOTIFICATIONS

The Contractor shall notify 78 CEG/CEIEC Tanks Program Manager about the presence of any tanks, oil/water separators (OWS) and associated piping in any construction area located at Robins AFB, whether or not the project itself is associated with direct tank removal, replacement or additions.

2E-3 TANK INSTALLATION REQUIRMENTS

1) Notify the CO and 78 CEG/CEIEC Tanks Program Manager prior to starting installation of tanks. Submit the following information:
   - Manufacture of tank
   - Date of manufacture
   - Size of tank (in gallons)
   - Model and serial number of tank
2) Provide signage and markings on the new tank in accordance with AFI 23-204, RAFB Tank Signage Guidance (July 2015) and Military Standard 161H.

2E-4 TANK REMOVAL OR CLOSURE

1) Notify the CO and 78 CEG/CEIEC Tanks Program Manager at least 45 days prior to starting the scheduled removal of tanks to allow time for 78 CEG/CEIEC to coordinate permitting with GA EPD.
2) UST closure shall be accomplished in accordance with Georgia Rules 391-3-15-.11 and 40 CFR 280.70-74.
3) The removal process must be completed within 90 days once it has been started.
4) Cleanup shall be completed in accordance with 40 CFR 280.60-67 and Georgia Rules 391-3-15-.09.
5) Additional information can be found at US EPA Rules: http://www.epa.gov/OUST/ustsystm/close.htm

2E-5 SEPTIC TANKS

The installation of septic tanks or systems is not allowed on Robins AFB.

SECTION 2F

ENVIRONMENTAL REQUIREMENTS

WETLANDS

2F-1 GENERAL

Wetlands delineation has been completed on base and wetland boundaries are currently identified with markers. However, markers can be missing or not readily visible and wetlands often do not contain water throughout the year, so delineation may not be apparent. When in doubt, verify that the site in question is or is not a wetland by contacting 78 CEG/CEIEC.

2F-2 GUIDANCE

2F-2.1 Designated wetlands shall not be filled, dredged or disturbed in any way.

2F-2.2 Comply with water and land protection sections of the Base Facility Standard to prevent construction site sediments and runoff from entering wetlands.

Wetlands Area at Robins AFB

SECTION 2G

ENVIRONMENTAL REQUIREMENTS

PLANT AND WILDLIFE THREATENED AND ENDANGERED SPECIES

2G-1 PROTECTED PLANTS

One state-protected species of plants occurs on Robins AFB, as well as eight other plant species considered to be rare.

2G-2 PROTECTED ANIMALS

Many wildlife species are found on base and most are protected by law, including birds, bats, land turtles, non-venomous snakes and game species such as deer. Rare wildlife species such as Bald Eagles and Wood Storks are occasionally seen on base.

2G-2 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 CO. The CO shall contact the 78 CEG/CEIEC Natural Resources Program Manager to determine the best solution for each problem.

SECTION 2H

ENVIRONMENTAL REQUIREMENTS

PRESERVING HISTORICAL AND ARCHAEOLOGICAL RESOURCES

2H-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 twelve culturally affiliated Native American tribes. Specific facilities and archaeological sites were identified, including the following:

TABLE 2H.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	

2H-2 COORDINATION

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

2H-3 DISCOVERIES

When cultural resources are inadvertently discovered during construction, project personnel are directed to avoid the site of discovery and immediately contact the 78 CEG/CEIEC Cultural Resources Program Manager. All work in the area of 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.

2H-4 ARCHAEOLOGICAL FINDS

Archaeological Finds are artifacts, ecofacts 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 2I

ENVIRONMENTAL REQUIREMENTS

OMIT

SECTION 2J

ENVIRONMENTAL REQUIREMENTS

PROTECTION OF WATER AND LAND RESOURCES

2J-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.

2J-2 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*.

2J-3 STORMWATER MANAGEMENT DURING CONSTRUCTION

2J-3.1 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).

2J-3.2 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, 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 Water Quality Program.

2J-3.3 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

2J-3.4 Notification of Changes – National Pollutant Discharge Elimination System (NPDES) Wastewater Permit

The Civil Engineering Environmental Water Quality Manager shall be notified of any of the following planned changes:

2J-3.4.1 Physical alterations or additions to any facility that meet the following criteria:

2J-3.4.1.1 Any change that may be identified as a new discharge source IAW 40 CFR 122.29(b)

2J-3.4.1.2 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)

2J-3.4.1.3 Any change that may result in a significant modification to the Government's sludge use or disposal practices

2J-3.4.2 Changes to any facility or activity that may result in noncompliance with the Wastewater Permit

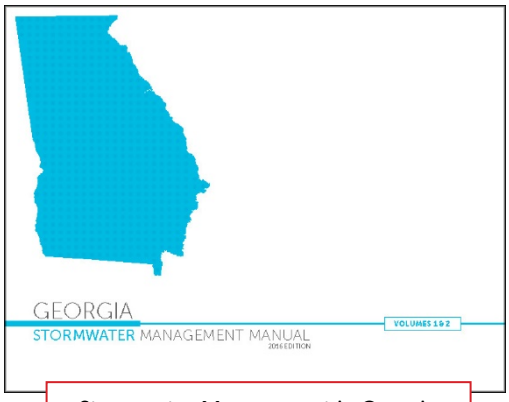
2J-3.4.3 Expansion or increase in production capacity

2J-3.4.4 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

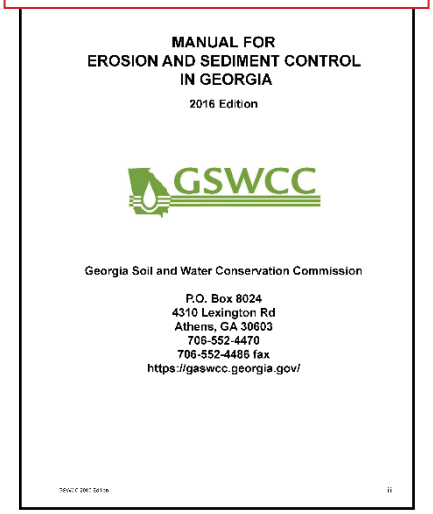
2J-3.5 Best Management Practices (BMPs)

2J-3.5.1 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 and general site housekeeping will require implementation of specific best management practices (BMP) to prevent stormwater contamination.

2J-3.5.2 The Contractor shall implement procedures and practices to eliminate or minimize stormwater pollution during construction activities in accordance with the Engineering Technical Letter (ETL) 14-1: Construction and Operation and Maintenance Guidance for Storm Water Systems. For information on BMPs contact the 78 CEG/CEIEC Water Quality Program Manager.



Stormwater Management in Georgia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EROSION AND SEDIMENT CONTROL
IN GEORGIA
2016 Edition

GSWCC

Georgia Soil and Water Conservation Commission

P.O. Box 8024
4310 Lexington Rd
Athens, GA 30603
706-552-4470
706-552-4486 fax
https://gaswcc.georgia.gov/

2J-3.6 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]

2J-3.6.1 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.

2J-3.6.2 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.

2J-3.7 Notice of Intent (NOI)

2J-3.7.1 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.

2J-3.7.2 The Contractor will create an account in the Georgia EPD Online System (GEOS) for Permitting, Compliance and Facility Information. The 78 CEG/CEIE Water Quality Program Manager shall be listed as "Preparer(s)" under the GEOS account in order to coordinate review and approval with GA EPD.

2J-3.7.3 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.

2J-3.7.4 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.

2J-3.8 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.

2J-3.8.1 Rainfall Event Inspections

2J-3.8.1.1 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.

2J-3.8.1.2 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.

2J-3.8.2 Sample Analysis Reports

2J-3.8.2.1 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.

2J-3.8.2.2 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.

2J-3.8.2.3 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).

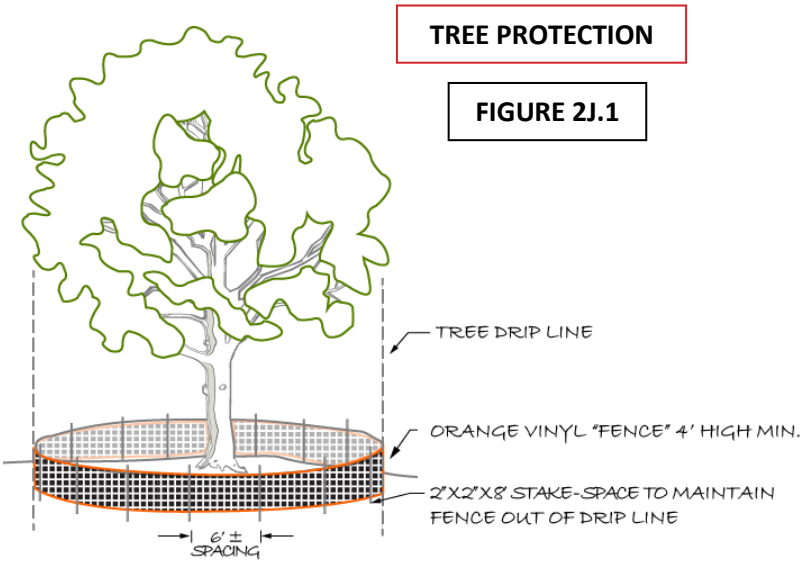
2J-3.9 Tree Protection and Landscape Maintenance

2J-3.9.1 Tree Protection

2J-3.9.1.1 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 CO. The Contractor shall not allow vehicles to be routinely parked within the drip zone of trees which are designated for protection, nor will equipment be staged under these trees.

TREE PROTECTION

FIGURE 2J.1



- MAINTAIN FENCE BY REPAIRING OR REPLACING DAMAGED FENCE.
- DO NOT REMOVE FENCE PRIOR TO LANDSCAPING OPERATIONS.
- DO NOT STACK OR STORE MATERIALS OR EQUIPMENT W/IN FENCED AREA

2J-3.9.1.2 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.

2J-3.9.1.3 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 it is inappropriate to give away forest resources which have significant value.

2J-3.9.2 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.

2J-3.9.3 Restoration of Landscape Damage

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.

2J-3.9.4 Soil Stabilization

Stabilization of permanent steep slopes shall be accomplished as soon as possible to establish vegetation. Apply mulch (no more than 2-3 inches in depth) immediately after finished grading is completed, regardless of season, and delay seeding and fertilizing until the season most favorable for germination. Pay special attention to the timing of project completion and soil conditions to ensure permanent vegetation can be established.

TABLE 2J.2

Groundcover for Permanent Soil Stabilization				
Method	**Timeframe**	**Type of Grass Recommended**	**Allowed Grade**	**Application**
Seeding	March thru August	Hulled Bermuda or Centipede.	<30%	23 lbs/acre. Apply 1" Wheat Straw
	September thru February	Mixture Winter Rye and Un-Hulled Bermuda or a Tall Fescue variety	<30%	23 lbs/acre. 10 parts Rye :1 part U/H Bermuda Apply 1" Wheat Straw
	Not Authorized	Brown Top Millet		
Sod	March thru August	Bermuda or Centipede	<40%	Lay in staggered pattern. Backfill edges.
	September thru February	Rye may be used as Temporary Groundcover		
Hydro-Seed		Bermuda	>40%	1 lb. Bermuda + 25 lbs Paper Mulch / 2000 sq. ft. + Hydro-Seed Tackifier as prescribed

2J-3.10 Project Closure

2J-3.10.1 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.

2J-3.10.2 Document Retention

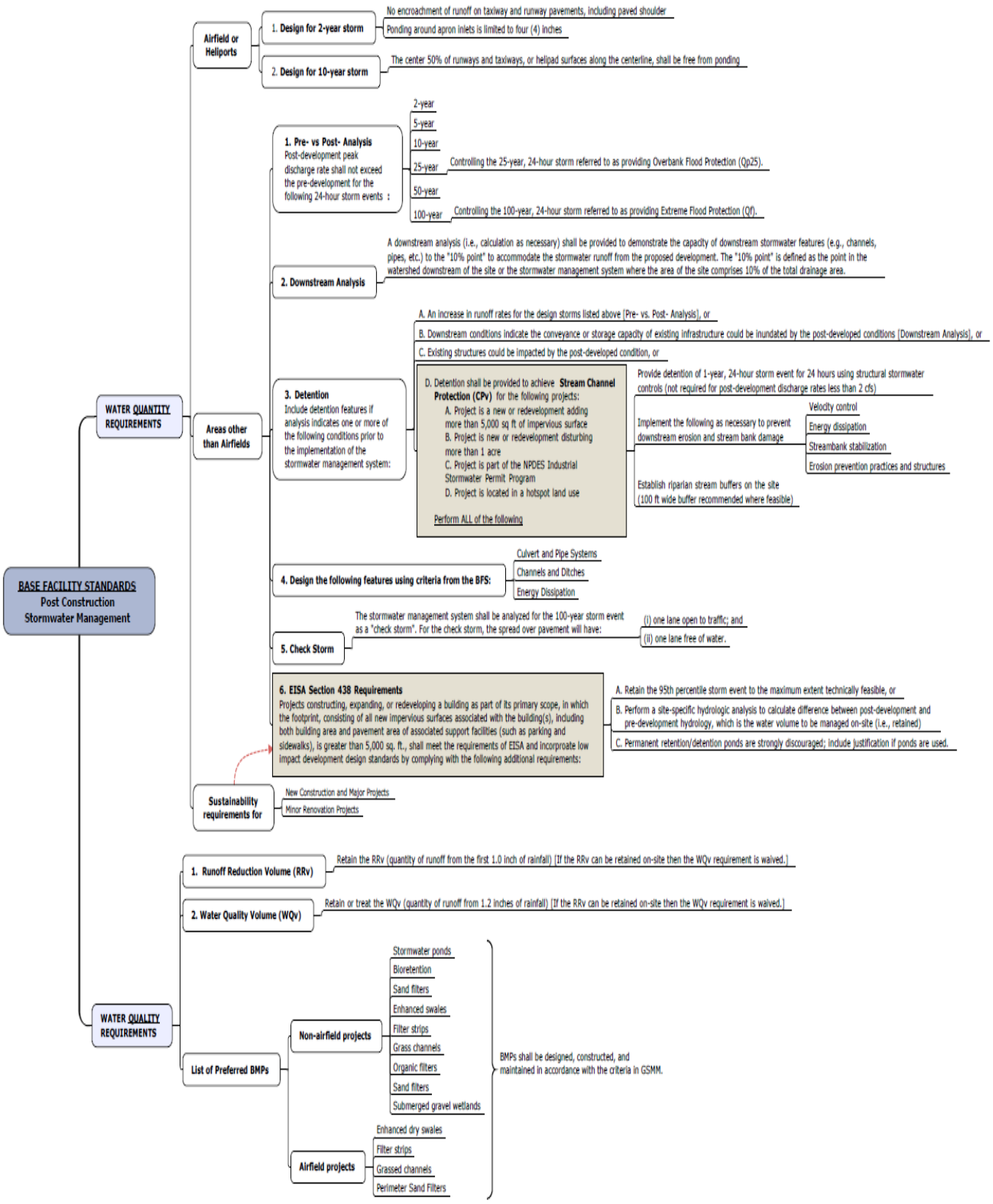
All records required by NPDES shall be maintained for a period of three (3) years from the date the NOT is submitted. Copies of these documents shall be provided to 78 CEG/CEIEC Water Quality Program Manager.

2J-4 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 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.3.

FIGURE 2J.3

POST CONSTRUCTION STORMWATER FLOW CHART



2J-4.1 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]

2J-4.1.1 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]

2J-4.1.2 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]

2J-4.1.3 Preferred Best Management Practices (BMPs)

TABLE 2J.4

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

2J-4.2 Water Quantity Requirements

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

2J-4.2.1 Airfields and Heliports Projects [FAA AC 2-2.4.1]

2J-4.2.1.1 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]

2J-4.2.1.2 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]

2J-4.2.2 Areas other than Airfields [FAA AC 2-2.4.3 and 2-2.5]

2J-4.2.2.1 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]

2J-4.2.2.2 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]

2J-4.2.2.3 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]

2J-4.2.2.4 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."

2J-4.2.2.5 General Design Guidance:

TABLE 2J.5

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

TABLE 2J.6

Flooding Depths for Inlets in a Closed Pipe System	
Roadway 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 Outlet	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 that the LDM criterion.*

2J-4.3 Allowable Discharges

2J-4.3.1 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

2J-4.3.2 Discharges necessary to protect public health and safety are allowable when specified in writing by 78 CEG/CEIEC Water Program Manager.

2J-4.3.3 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.

2J-4.3.4 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.

2J-4.4 Prohibited Activities

2J-4.4.1 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.

2J-4.4.2 Illicit Connections

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

2J-4.2.2.1 (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.

2J-4.4.2.2 Installing connections conveying non-stormwater discharges to the stormwater conveyance system or allowing such a connection to continue.

2J-4.4.3 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.

2J-4.4.3.1 The Contractor shall maintain appropriate and adequate cleanup equipment and materials onsite for containment of potential spills.

2J-4.4.3.2 Immediately report all spills to the Base Fire Department, 778 CES/CEX, and emergency number 911. Report all emergency information, including name, telephone number, location of spill, and type and amount of material spilled.

2J-4.4.3.3 Notify the CO of the spill immediately following initial reporting to the Fire Department and 911.

2J-3.8.3.4 The Contractor is responsible for the cleanup of material(s) spilled as well as any soil, grass, etc. that has absorbed spill materials.

2J-4.4.3.5 Ensure complete and thorough clean-up of materials spilled by testing water and/or soil (full analytical tests are required).

2J-4.4.3.6 No spill residue shall be transported off Robins AFB without specific approval from the CO.

2J-4.4.3.7 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.

2J-4.4.3.8 Under no circumstance should anyone attempt to handle a spill situation that they have not been trained to handle.

2J-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 **TABLE 2J.7**

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.	LDM 2.1.1, 6.2 GSMM 2.4.2.6(2)

STORMWATER MANAGEMENT PLAN CHECKLIST **TABLE 2J.7**

SECTION	SECTION TITLE	CONTENTS	REFERENCE
		❑ Existing Conditions Table including acreage, soil type (including infiltration 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 runoff flows through prior to the 10% point. ❑ Narratives addressing supporting calculations associated with the 10% rule.	LDM 6.5 GSMM 2.4.2.6(6)

TABLE 2J.7

SECTION	SECTION TITLE	CONTENTS	REFERENCE
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

ROBINS AIR FORCE BASE

CHAPTER 3
STRUCTURAL AND CIVIL ENGINEERING ELEMENTS

Road Construction on First Street in 2016

SECTION 3A

STRUCTURAL & CIVIL ENGINEERING ELEMENTS

STRUCTURAL REQUIREMENTS

3A-1 GENERAL STRUCTURAL REQUIREMENTS

3A-1.1 All structural design work necessary to construct a new facility, or 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 At Robins AFB the structural designer of record may delegate responsibility of structural designs for systems or component parts of a structure to a qualified delegated engineer on Design-Bid-Build Projects Only. (No delegation is allowed on Design Only Projects.) For delegated projects, both the engineer of record for the structure AND the delegated engineer must comply with the requirements of UFC 3-301-01 AND a design package shall be prepared, signed, sealed and submitted as part of the design submittal. This package shall include, but not be limited to, calculations, specifications, plans, details and design of system or component parts. Alternately, the structural designer may utilize a manufacturer as a design basis for design development. The following are examples of systems that may be delegated:

- Prefabricated wood components
- Cast-in-place post-tensioned concrete structural systems
- Precast, pre-stressed concrete components
- Open web steel joists and joist girders
- Pre-engineered metal buildings
- Specialty foundation systems
- Structural steel connections
- Cold-formed steel joist/stud/truss framing and pre-fabricated components
- Seismic design of nonstructural components
- Proprietary track for under-hung cranes and monorails
- Autoclaved aerated concrete
- ATFP analysis (and/or testing) for building components

3A-2 SPECIAL STRUCTURAL REQUIRMENTS

3A-2.1 Stability

Wind loads shall be analyzed and designed for a minimum exposure of Category “C” IAW ASCE/SEI 7-10, Chapter 26.

3A-2.2 Risk Factor

Wind analysis and design shall be based on Risk Category "III" as described in ASCE/SEI 7-10, 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

The project shall be designed for any special floor loading requirements planned for mezzanine 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, computer or foundation drain lines.

3A-3.2 All foundations shall be stepped down to an elevation below the bottom of pipe invert elevation, or the pipe relocated.

3A-3.3 The safety factor used for Overturning, Sliding and Uplift shall be a minimum of 1.50.

3A-4 ANTENNAS AND OTHER EXTERIOR USER EQUIPMENT

3A-4.1 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-4.2 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

STRUCTURAL & CIVIL ENGINEERING ELEMENTS

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 of 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 4) 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:
   - Sidewalks and walkways
   - Parking lot striping
   - Road cuts
   - Curbs, gutters, culverts and pads sufficient to comply with stormwater and drainage requirements
   - Runways, taxiways, aprons, overruns, and shoulders
6) Bridges and fences
7) Existing natural site features, including:
   - Existing State Waters and Streams with any prescribed buffers
   - Designated Wetlands
   - 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:
   - Railroads

- Existing industrial and sanitary wastewater piping, manholes, valves, and lift stations
- Storm piping and structures, drainage ditches/swales, headwalls, and ponds
- Gas distribution and service lines
- Water lines and valves
- Communication lines
- Electrical lines
- Cathodic protection cables and equipment
- Heat service or steam lines
- Chilled water lines
- POL facilities, including pipelines, valves, etc.
- Fire hydrants
- 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.

Concrete Pour over Structural Framework for F-15 Static Display

SECTION 3C

STRUCTURAL & CIVIL ENGINEERING ELEMENTS

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
- Certification for all plan elements by a State of Georgia Licensed Professional Engineer

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-1.3 Any construction project which includes a modification (additions, extensions, repairs) to the Robins AFB potable water system shall follow guidelines identified within this document.

3C-2 WASTEWATER TREAMENT 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, and 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.

3C-3.2 Any structure that is built to surround the lift station will 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 Advanced Control Systems 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 lines located underneath any proposed new facility shall be removed and relocated.

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

SECTION 3D

STRUCTURAL & CIVIL ENGINEERING ELEMENTS

SUB-SURFACE INVESTIGATION

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 engineers with verifiable experience in the principles of engineering associated with soil mechanics.

3D-1.2 Work to be completed by an engineer with experience in soil mechanics may include the identification and classification of soil and rock, field exploration, testing, instrumentation, laboratory testing, distribution of stresses including pressures on buried structures, analysis of settlement and volume expansion, seepage and drainage, and slope stability and protection.

3D-1.3 Site data provided as part of the general bidding package is based on best available record drawings and may contain inaccuracies. Actual locations of underground utilities and structures must be determined and included as part of the Site Design Drawings prior to the issuance of a Dig Permit.

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 Dig Permits are issued only on Monday mornings at 0800 in Building 1555.

3D-2.1.2 The Contractor and technical representative for the project are required to meet with Civil Engineering utility personnel to coordinate and verify all excavation requirements.

3D-2.1.3 The Contractor will be given instructions on how to prepare and properly complete the Dig Permit at this time.

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-2.1.6 Dig Permits are reviewed and issued on Monday mornings starting at 0800 in building 1555. Contact Customer Service for permit applications and other details at 478-327-7447.

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.

3D-3 PRESERVING HISTORICAL AND ARCHAEOLOGICAL RESOURCES

When cultural resources are inadvertently discovered during construction, project personnel are directed to avoid the site of discovery and immediately contact 78 CEG Environmental Branch. Work can resume only after an investigation is completed. 78 CEG Environmental Branch will send a qualified representative to the site to record and evaluate the resource, and determine any necessary mitigation.

SECTION 3E

STRUCTURAL & CIVIL ENGINEERING ELEMENTS

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 REQUIRMENTS 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

STRUCTURAL & CIVIL ENGINEERING ELEMENTS

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.

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 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-2.2.5.6A 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 Slices 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.

3G-2.2.7 Backflow Prevention Equipment

3G-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.

3G-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.

3G-2.2.7.3 Include freeze protection.

3G-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

The Contractor shall provide a one year warranty after acceptance by the government.

3F-4.1.1 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-4.1.2 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

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

3F-4.3.1 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-4.3.2 Piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule

3F-4.3.3 Step-by-step procedures required for system startup, operation and shutdown.

3F-4.3.4 Routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides

ROBINS AIR FORCE BASE

CHAPTER 4

ARCHITECTURAL COMPATIBLITY STANDARDS INSTALLATION FACILITY STANDARDS (ACS/IFS)

a component of

ROBINS AIR FORCE BASE FACILITY STANDARDS

SECTION 4A

ARCHITECTURAL COMPATIBILITY STANDARDS

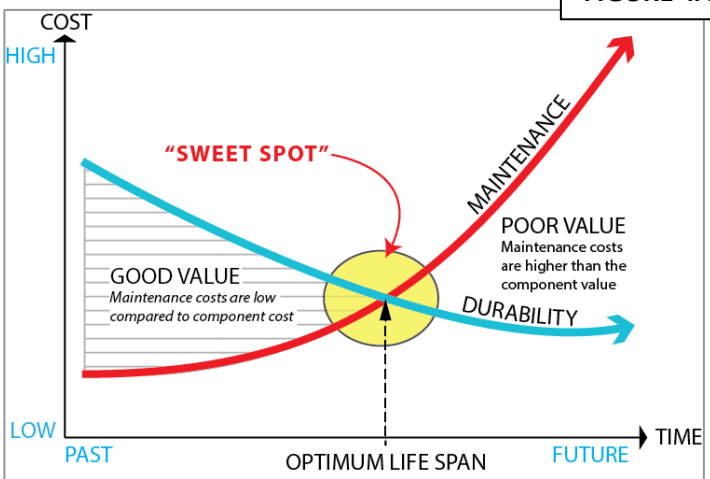
SPECIFICATIONS, REGULATIONS & STANDARDS

4A-1 ARCHITECTURAL COMPATIBLITY STANDARD AND THE INSTALLATION FACILITY STANDARD

As we build and maintain this valuable resource called Robins Air Force Base (AFB), identifying construction priorities becomes a tougher challenge each year. We are directed to abide by rules, laws and guidelines that are not only complex, but seem to be contradictory. At the onset of every project we are asked to reconcile regulatory mandates with costs and budgets, and balance them with functional requirements, funding availability and long term durability. Adding Life-Cycle-Cost (LCC) into our lexicon, has improved our basis for decision making, but lengthened the list of elements that must be reviewed for each project.

The goal of this Architectural Compatibility Standard / Installation Facilities Standard (ACS/IFS) is to identify competing components and develop standard procedures to provide balance and efficiency as each construction project is completed. Along with these are Best Practices for Robins AFB, and "heads up" issues that must be addressed based on the specific needs of our current and future missions here in Middle Georgia's physical environment and micro-climate, combined with our current knowledge of opportunities, resources and constraints.

FIGURE 4A.1



LIFE CYCLE COST ANALYSIS

ACS/IFS

The **Architectural Compatibility Standards** has morphed into the **Installation Facility Standards** as part of the enterprise-wide **Air Force Corporate Facilities Standards (AFCFS)** established to optimize mission success while balancing available resources.

The three major objectives of the AFCFS and IFS are as follows:

1. Define Air Force standardized acceptable facility quality standards.

2. Reinforce AF criteria and policy requiring lower initial costs, life-cycle costs, energy use and water use.

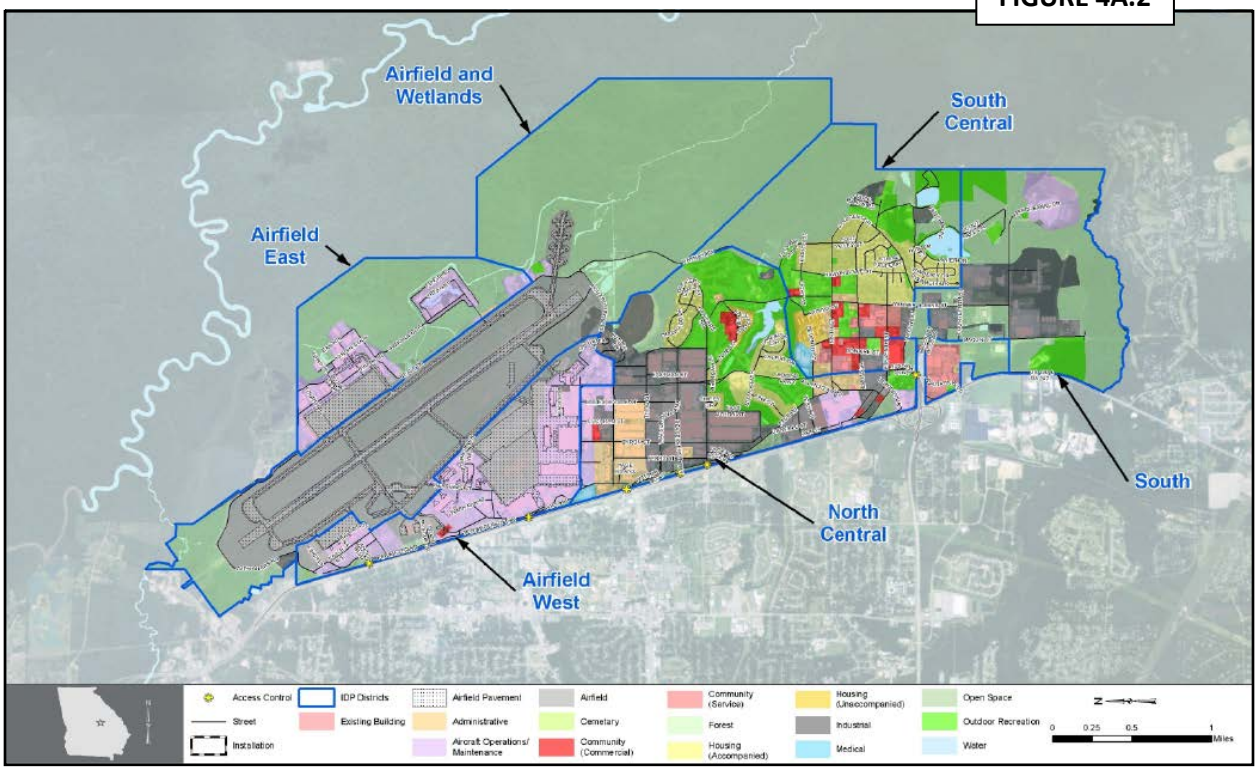
3. Provide a hierarchy of acceptable material quality performance standards including acceptable ranges of facility visual quality, durability and use of resources.

*See **Air Force Corporate Facilities Standards (AFCFS)** at http://afcfs.wbdg.org*

4A-2 INSTALLATION DEVELOPMENT PLAN

The Robins AFB Installation Development Plan (IDP) was approved in August 2015 and updated again in 2017. It was developed through a comprehensive planning process that addressed mission capabilities, sustainability potential and opportunities for enhanced readiness and modernization. The IDP addresses many of the issues and protocols discussed within the Architectural Compatibility Standard (ACS) and serves as a tool for integrating a range of issues into facility projects and base-wide improvements.

FIGURE 4A.2



Installation Development Plan

4A-3 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.
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 2015 International Building Code (IBC 2015) except as 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.
8) All facilities shall meet the requirements of the Base Facility Standards and the Architectural Compatibility Standards / Installation Facilities Standard (ACS/IFS), i.e. this document.
9) If there is a conflict between applicable codes and regulations, normally use the more stringent requirement.
10) If there is a conflict between the military criteria and other directives or codes, use the military requirements.
11) In general, use the most up-to-date resource available. Appendix A provides an extensive list of applicable Criteria Reference Documents.
12) Use Unified Facilities Guide Specifications (UFGS) as the source for DoD technical specifications for facilities and infrastructure components.
13) LEED 2009/LEED v4 have been discontinued.

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/

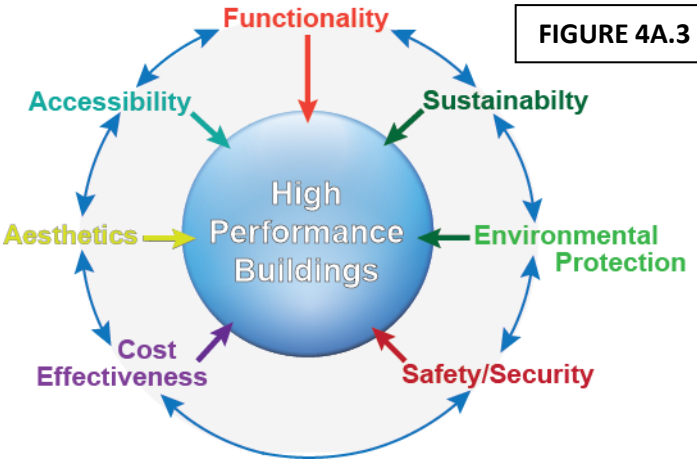


FIGURE 4A.3

14) 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).

CADD Standard

FIGURE 4A.4

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.

Facilities at Robins AFB
Commissary built 2009
ADMIN Building built 1944
ADMIN Building built 2012

4A-4 SUSTAINABILITY

4A-4.1 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-4.2 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.

LEED GUIDANCE FEBRUARY 2017 **FIGURE 4A.5**

AFCEC BATTLE READY...BUILT RIGHT

A-GRAM AGRAM 17-01 February, 2017

Change to AF New Construction and Major Renovation Certification Requirements

Purpose

This A-Gram provides guidance on the AF switch **from** using Leadership in Energy and Environmental Design (LEED) Silver certification, as required by the Air Force Sustainable Design and Development (SDD) Implementing Guidance Memorandum (Jun 2011); **to** third-party certification using the DoD version of Guiding Principles (GPs) Compliance certification of either the 1) US Green Building Council (USGBC)/ Green Business Certification Inc. (GBCI), or 2) Green Building Initiative (GBI) rating systems, for all applicable projects as described herein.

Discussion

BACKGROUND:
Current public laws and executive orders require all new Federal facilities to meet a comprehensive set of requirements commonly referred to as the Federal High Performance and Sustainable Building (HPSB) GPs. These requirements have been consolidated into UFC 1-200-02, *High Performance and Sustainable Building Requirements*. The Department of Defense Sustainable Buildings Policy Memorandum (10 Nov 2013) states "A building that meets the UFC (1-200-02) requirements shall be considered compliant with the requirements of law and the Guiding Principles." Additionally, the memo requires DOD Components to "... establish an auditable process to ensure applicable new buildings and major renovations meet requirements as defined in the UFC. The auditable process shall include green-building certification ..."

The AF has utilized the USGBC LEED rating system as a third-party validation of meeting project sustainability goals since 2001. While the intent of the HPSB GP requirements align somewhat with the LEED rating system, LEED Silver certification does not constitute compliance with the Federal requirements and UFC 1-200-02. In an effort to reduce confusion about project sustainability goals, advance compliance with the Federal requirements, streamline HPSB GP compliance and tracking requirements, and identify a third-party certification that can be used for all new construction and major renovation projects, the AF reviewed newly developed USGBC/GBCI and GBI Guiding Principles Compliance rating systems and determined they can better serve as indicators of HPSB GP compliance.

APPLICABILITY:
The third-party certification requirements contained herein apply to AF construction activity as follows:
1. All new buildings larger than 5,000 SF, with construction costs greater than $3M
2. All renovations to an existing building larger than 5,000 SF with construction costs greater than $3M and 50% estimated replacement costs
3. To the extent practical for:
   a. Buildings not on AF installations in the United States and its territories
   b. Building supporting contingency operations
   c. Non-permanent buildings
   d. Projects marked as "austere" on the DD Form 1391

THIRD-PARTY CERTIFICATION REQUIREMENT:
Effective immediately, the USAF will discontinue use of LEED certification of new buildings and major renovations. Projects already registered for certification under LEED 2009 will continue with the process, and will achieve LEED Silver certification. All projects that have not yet registered for certification will register for Guiding Principles Compliance certification using the DoD version of either USGBC/GBCI or the GBI rating systems, and shall achieve verification of meeting the Federal requirements as detailed in UFC 1-200-02.

CONTACT: **Paula Shaw, P.E., LEED AP, AFCEC/CFTS**
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JBSA-Lackland, TX 78236-9853

FIGURE 4A.6

★ ★ ★ ★ ★ ★

3RD PARTY CERTIFICATION

All projects for new facilities or renovations greater than 5,000 SF will register for certification for **Guiding Principles Compliance Certification** using the DoD version of the **USGBC/GBCI** or the **GBI** rating systems, and shall achieve verification of meeting the Federal requirements as detailed in **UFC 1-200-02.**

For the **U.S. Air Force** (USAF), the term "**sustainability**" means the capacity to continue the mission without compromise.

It is the ability to operate into the future without decline in either the mission or the natural and man-made systems that support it.

We must create sustainable installations in order to accomplish these goals.

4A-5 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-5.1 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-5.2 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.

Medical Facility Built 1967

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.

The United States Access Board was established in 1973 as an independent federal agency that functions as a coordinating body among federal agencies and provides technical assistance and enforcement for accessibility standards that cover federally funded facilities. The "ADA" was established to combine the Architectural Barriers Act (ABA) of 1968 and the Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act of 1973, as amended.

The sections that apply to public accommodations and commercial facilities, consist of the Title III regulations at 28 Code of Federal Regulations (CFR) part 36, subpart D, and the 2004 ADAAG at 36 CFR part 1191, appendices B and D. When requirements between the two differ, use 28 CFR part 36, subpart D. The latest revision of the "ADA" is called the **2010 ADA Standards for Accessible Design (ADAAG).** It is available at www.ADA.gov.

See www.access-board.gov for a copy of **Guide to the ADA Standards**

4A-6 ANTITERRORISM/FORCE PROTECTION (AT/FP)

4A-6.1 Standoff Distances

The physical standoff requirement established by AT/FP standards has been simplified.

Note: Robins AFB is located inside a CONTROLLED PERIMETER for all AT/FP rules.

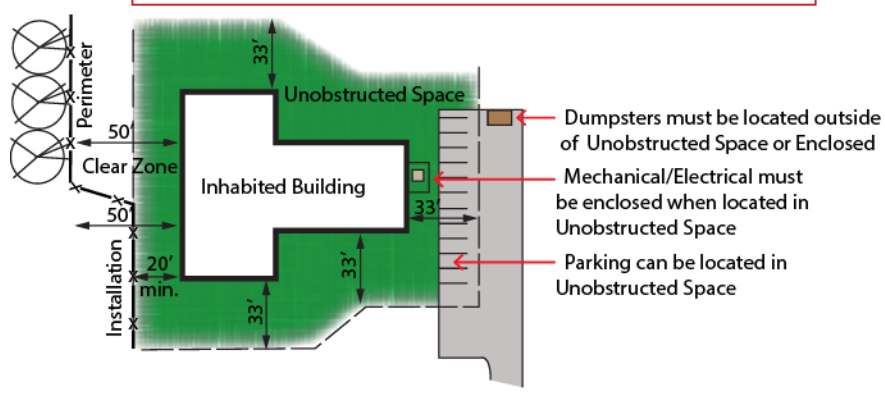
Std. 1 – Provide a minimum standoff at the perimeter of 50 feet, including at least a 20 foot clear zone inside the perimeter and 30 feet of clear zone that may be either inside or outside the perimeter.

4A-6.2 Unobstructed Space

Std. 2 – Provide an unobstructed distance around each facility that extends at least 33 ft. or to the perimeter fence IAW Std. 1. Unobstructed space is not dependent on threat explosive weights, levels of protection or building construction. Parking is now allowed in the unobstructed space.

FIGURE 4A.7

UNOBSTRUCED SPACE & STANDOFF REQUIREMENT



There should be no opportunity to conceal an object within the unobstructed distance. Obstructions such as mechanical equipment, electrical equipment, trash containers or landscaping features may be permissible if a six (6) inch device placed there would be visible from at least one direction.

4A-6.3 Enclosures

When trash containers, fuel tanks, electrical or mechanical equipment are located within the unobstructed space and provide the opportunity for concealment, they must be enclosed.

Alternate 1 Enclosure – Use 9 gauge chain-link fence at least 7 feet high; no top enclosure is required.

Alternate 2 Enclosure – Use metal stockade-style fence on all four sides, plus an opaque top enclosure with a pitch of at least 1 vertical to 2 horizontal.

All enclosures shall be secured. Allow a minimum of three feet between the fence and the equipment or provide clear space as recommended by the manufacturer.

If these enclosure alternatives are unsuitable for a high visibility building, an alternate enclosure may be approved by the 78 CEG/CEN Project Manager.

SECTION 4B

ARCHITECTURAL COMPATIBILITY STANDARDS

EXTERIOR FACILITY STANDARDS

4B-1 DESIGN ANALYIS NARRATIVE

Robins AFB *Architectural Compatibility Standards / Installation Facility Standards* must be followed regardless of the size and scope of proposed improvements. When any project is being developed, include the following information as part of the **Design Analysis Narrative** submittal, as follows:

4B-1.1 Project Design Statement

A brief overview to explain the purpose of the proposed project and identify any special or extenuating project requirements.

4B-1.2 Finish and Color Schedule for Exterior Materials

This information can be provided as a list or spread sheet and may include product samples to identify compliance with the ACS/IFS.

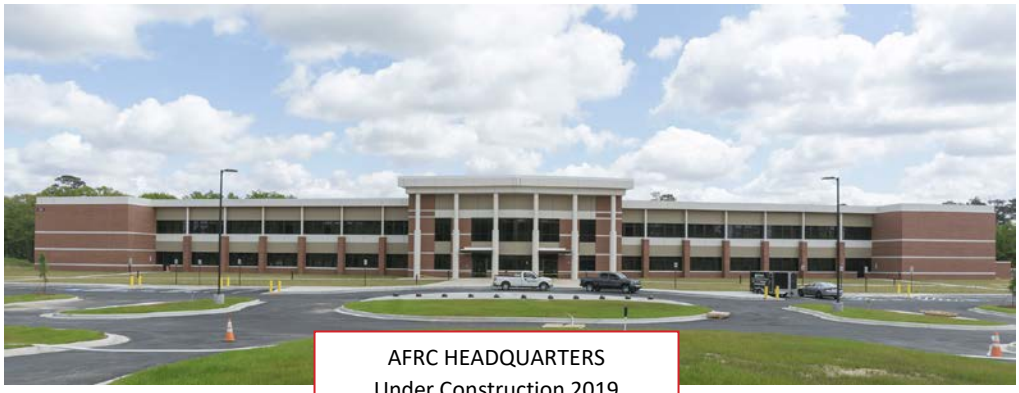
4B-1.3 Statement of Compatibility

4B-1.3.1 Demonstrate how the exterior design elements of the proposed structure are compatible with the character of nearby existing facilities. Information regarding the facility function, structural mass, shape, height, configuration, color and texture should all be provided.

4B-1.3.2 Address the project within the context of historically and architecturally significant elements as they apply to Robins AFB.

4B-1.3.3 Show how the project will be integrated into the overall physical, site context so that it achieves, maintains and emphasizes a positive exterior visual environment for Robins AFB.

4B-1.3.4 Note specific design guidance for the project or provisions of the ACS that is relevant to the review.



AFRC HEADQUARTERS
Under Construction 2019

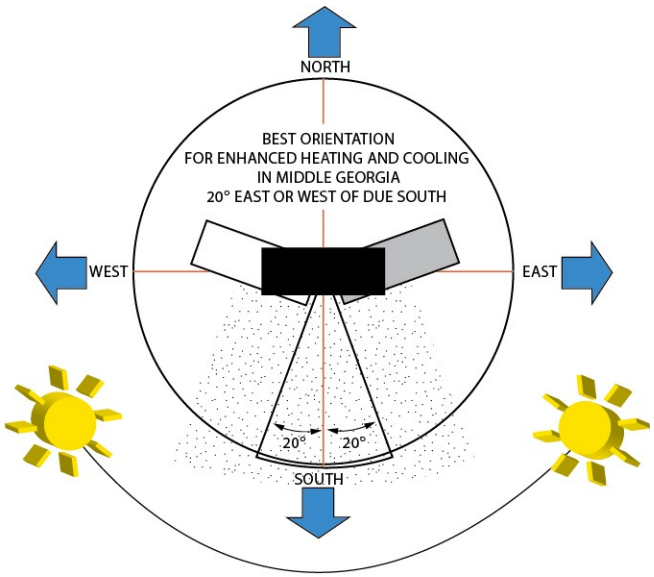
4B-1.4 Statement of Sustainability

4B-1.4.1 Identify specific building design elements such as use of a cool roof or factory finishes on construction materials that will achieve sustainability goals and enhance constructability, ease of maintenance or improve life cycle costs.

4B-1.4.2 Point out specific provisions that are part of the Site Planning and landscape interface that will accomplish such goals as optimizing energy efficiency, enhancing seasonal comfort levels, improving safety for site users or improving vehicular or pedestrian circulation.

FIGURE 4B.1

OPTIMUM FACILITY ORIENTATION



4B-2 ARCHITECTURAL CHARACTER

4B-2.1 Design Guidelines

FIGURE 4B.2

DESIGN RULES @ 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-2.2 Historical Exemptions

- There are no automatic exemptions from the ACS/IFS for buildings or structures at Robins AFB.
- When renovating or modifying buildings that have been historically exempt, follow the provisions of the ACS/IFS as much as possible.
- If the provision of the ACS/IFS are impractical, request a Waiver from 78 CEG/CEN. *See Appendix B.*

4B-3 EXTERIOR COLOR PLAN

FIGURE 4B.3

ARCHITECTURAL COMPATIBILITY STANDARDS

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.

4B-3.1 Design Guidelines

FIGURE 4B.4

EXTERIOR COLOR RULES @ 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 complement existing structures.
4. If a building is "two-toned," the darker color (or the heavier material) should be on the bottom.

78 ABW HEADQUARTERS
Built 1982

Operations Facility
Built 2011

4B-4 OUTSIDE WALLS AND FINISHES

FIGURE 4B.5

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.

4B-4.1 Brick

4B-4.1.1 Brick is the preferred exterior cladding for high-profile administrative facilities.

4B-4.1.2 Use running bond as the primary brick layout pattern, except for accent runs.

4B-4.1.3 Use a brick color and type that most closely matches the adjacent structures. Note: Most of the brick colors on existing facilities are no longer manufactured.

4B-4.1.4 The default color for mortar and joint finishes is natural or gray.

4B-4.2 Concrete Masonry Units (CMU) or Cast Stone Masonry Units

4B-4.2.1 Use Standard 8” x 12” x 16” CMUs (in most cases).

4B-4.2.2 Match CMU product color to Robins Exterior COLOR PLAN (regardless of texture/finish).

4B-4.2.3 Minimize use of Grey Block in EXPOSED locations. Exterior Grey Block shall be painted IAW Robins Exterior COLOR PLAN.

4B-4.2.4 Match mortar to CMU color.

4B-4.3 Concrete / Pre-Cast Concrete / Concrete Aggregate Panels

Color match all concrete building components with the Robins Exterior COLOR PLAN.

4B-4.4 Exterior Insulation Finish System (EIFS)

4B-4.4.1 Limit placement of EIFS to at least six inches above grade.

4B-4.4.2 Use with brick or CMU wainscot in heavily traveled or high-impact areas.

4B-4.4.3 Color match to Robins Exterior COLOR PLAN.

BUILDING EXTERIOR PROTOTYPES

FIGURE 4B.6

Warehouse
Built 1955

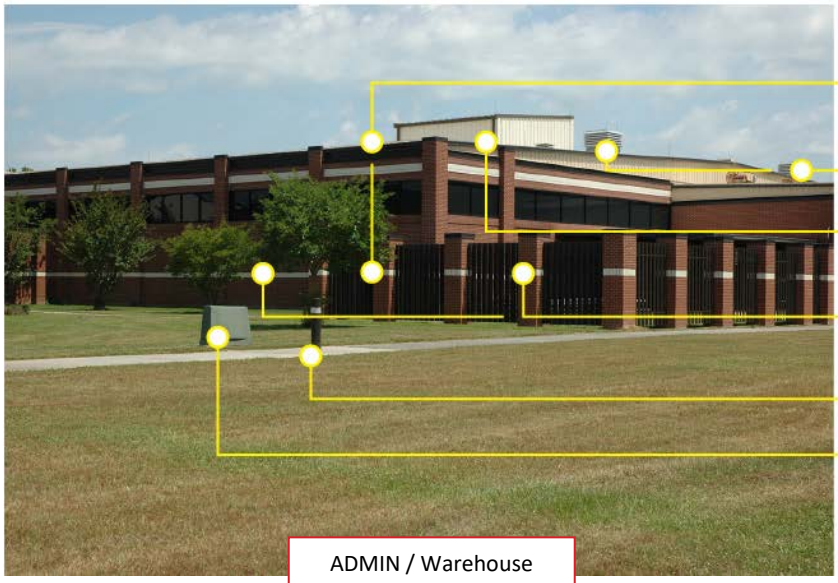
BUILDING 282

ROBINS 42 on CMU primary wall & exterior pipes

ROBINS 62 on fascia, gutters & doors, clerestory windows safety design roof access

ROBINS 48 on CMU foundation, handrails, safety bollards

Metal addition is color-matched to main building



ADMIN / Warehouse
Built 1960

BUILDING 2078

Bricks clad outer structure & brick fence provide cohesive color & design

Roof vents visually recede

ROBINS 42 on metal walls is visually less obvious

Accent stripes in light tone align to visually connect building & fence

Bollard lights coordinate with design

Utility box appearance is minimized

4B-4.5 Metal

4B-4.5.1 All metals shall be factory-finished with manufacturer's standard paint colors to match the Robins Exterior COLOR PLAN as closely as possible.

4B-4.5.2 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-4.5.3 Metal gratings and floor plates shall have appropriate corrosion protection.

Storage Facility
Built 2008

4B-4.5.4 All pad mounted transformers, exterior pad mounted switchgear cabinets, etc. shall be factory-finished to match the Robins Exterior COLOR PLAN whenever practicable <u>or</u> they should be factory-finished in light gray or light green.

4B-4.5.5 Handrails shall be painted to match the Robins Exterior COLOR PLAN.

4C-4.6. Wood Framing, Sheathing and Decking

Paint any exposed material IAW the Robins Exterior COLOR Plan.

4B-5 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

4B-5.1 Cool Roofs

INTERESTING ROOF FACTS

- "Cool roofs" are designed to stay cooler by reflecting more sunlight and absorbing less heat.

Cool Roof Measurement: Solar Reflectance Index (SRI)

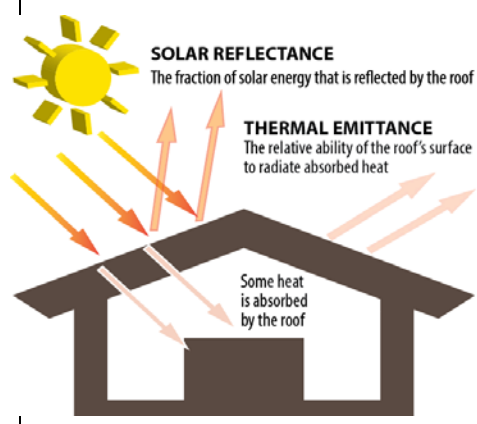
- SRI is a gauge from 0-100, with 0 being most likely to absorb and radiate heat (such as a tar roof) and 100 being the most reflective (least likely to get hot), such as a roof painted bright white.

Cool Roof Measurement: Thermal Emittance

- Thermal Emittance is the ability to emit thermal radiation. It is measured on a scale of 0 to 1.
- A COOL ROOF DOESN'T HAVE TO BE WHITE. Reflective coatings or special material applications can be utilized to increase the solar reflectance and thermal emittance of a roof.

FIGURE 4B.7

COOL ROOF PROPERTIES



4B-5.2 Allowable Roof Types

4B-5.2.1 Standing Seam Metal

4B-5.2.2 Single-Ply Membrane

4B-5.2.3 Built-Up Roofing (BUR)

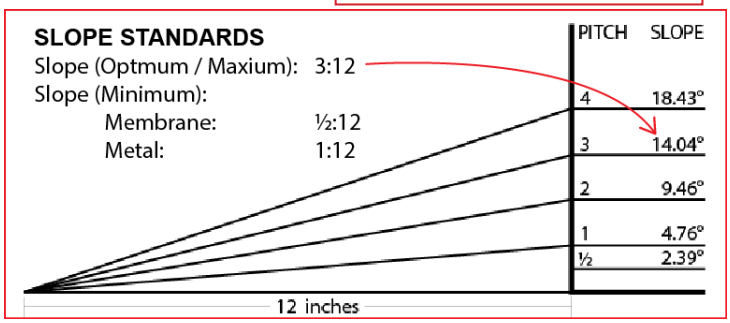
Requires 78 CEG/CEN approval.

4B-5.3 Warranty Required

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.

FIGURE 4B.8

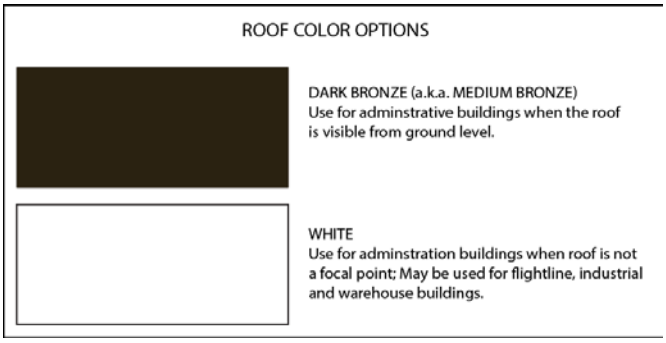
ROOF SLOPE STANDARDS



4B-5.4 Roof Colors

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

FIGURE 4B.9



4B-5.5 Standing Seam Metal Roofs

4B-5.5.1 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-5.5.2 Roof Profile Options

Design Guideline 1: Match existing roof profile.

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

4B-5.5.3 Design Basis

Use Polyvinylidene Fluoride (PVDF) Reflective Coatings (Kynar 500® or Hylar 5000™), plus insulation. *See* Double-Lok® Roofing Systems.

4B-5.5.4 Configuration Options

4B-5.5.4.1 SIMPLE Standing Seam Metal ROOFS (with no valleys):

- Structural panels 360° mechanically seamed
- 24” Maximum Panel Width
- 3” Minimum Nominal Seam Height; Flat pans not allowed

4B-5.5.4.2 ARCHITECTURAL Standing Seam Metal ROOFS (may contain valleys):

- Structural panels 360° mechanically seamed
- 16” Maximum Panel Width
- 2” Minimum Nominal Seam Height; Flat pans not allowed

4B-5.5.5 Trim and Accessories

4B-5.5.5.1 For trim, flashing or roof curbs EXPOSED to view – Match roof and/or building trim color.

4B-5.5.5.2 For hatches, roof curbs, etc., NOT EXPOSED TO VIEW – Match roof and/or adjacent wall color.

4B-5.5.5.3 For vents and other functional components – Match roof and/or provide visual screening.

4B-5.5.5.4 Kynar 500® or Hylar 5000™ PVDF factory-applied finish REQUIRED for all metal components.

4B-5.6 Single-Ply Membrane Roofs

4B-5.6.1 Design Requirements

4B-5.6.1.1 The Single Ply Roofing Industry (SPRI), identifies three major categories of single ply membranes: thermoplastics, thermosets and modified bitumen. The preferred type of single-ply membrane roofing at Robins AFB is thermoplastic; the most common thermoplastic membrane is PVC (polyvinyl chloride).

4B-5.6.1.2 Single Ply Polyvinyl Chloride (PVC) Roofing Membranes preferred

4B-5.6.1.3 Mechanical fasteners required; ballasted and fully-adhered systems are rarely allowed.

New PVC Roof at
ADMIN Facility built 1955

4B-5.6.1.4 Minimum Thickness 60 mils

4B-5.6.1.5 Minimum Slope ½:12

4B-5.7 Design Basis

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

4B-5.8 Fascias, Gutters and Downspouts

4B-5.8.1 Use continuous metal fascia that is scaled to match the roof.

4B-5.8.2 Typical Height: 8 inches minimum / 14 inches maximum.

4B-5.8.3 Color Match fascia and gutters on sloped roofs to roof color.

4B-5.8.4 Color Match downspouts and architectural details to adjacent walls OR paint ROBINS 62 to contrast.

4B-5.8.5 Use underground piping to carry water away from foundations whenever possible. Alternately, use concrete splash blocks.

4B-5.8.6 Avoid the use of interior roof drains and open scuppers.

4B-5.9 Roof Vents and Elements

4B-5.9.1 Roof penetrations are allowed only on new roofs. Avoid if possible. If required, minimize, consolidate and organize roof penetrations on the least visible side of the building.

4B-5.9.2 Make mechanical vent sizes and shapes consistent with architectural elements.

4B-5.9.3 Color Match roof vent pipes and other elements to roof color.

4B-5.9.4 Minimize the negative visual effects of any rooftop mechanical units with screening or dormers and/or Color Match.

New Metal Roof Installation at HANGAR Built 1956

4B-5.9.5 Avoid roof-mounted antennas.

4B-5.10 Identification Sign Required

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

- Material: ¼" REYNOBOND MATERIAL WITH VINYL
- Size: 16" high x 20" long
- Color: Background – Federal Standard 595B Color, STANDARD BROWN - #10100
- Letters: Block-Style, Arial Font, Vinyl – FED-STD 595A Color, WHITE - #17875
- Date: Get correct date 20 years in the future from 78 CEG/CEN
- Section: Get Section No. from 78 CEG/CEN

FIGURE 4B.10

4B-6 DOORS AND WINDOW

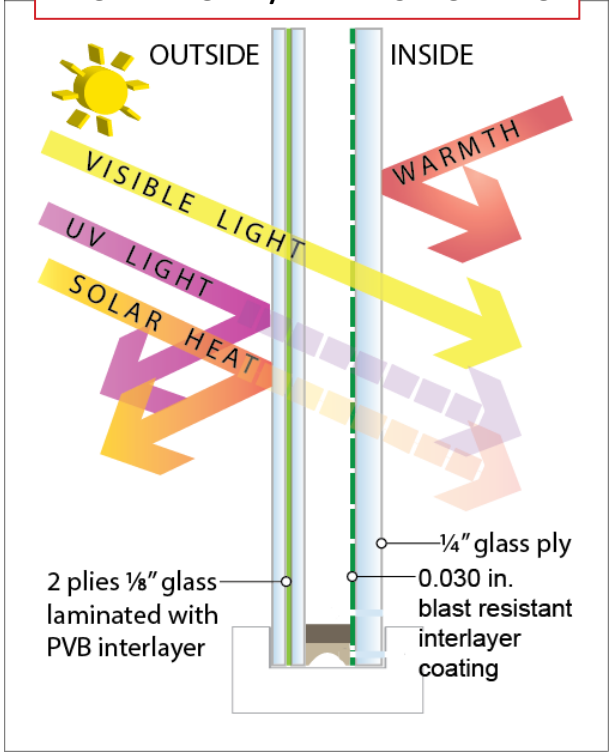
4B-6.1 Glazing

4B-6.1.1 All windows and doors shall meet requirements for security, energy efficiency, safety and maintenance ease as required.

4B-6.1.2 Exterior windows and skylights in buildings that must comply with AT/FP Standard 10 shall provide no less than ¼-inch (6-mm) laminated glass consisting of two nominal 1/8-inch (3-mm) annealed glass panes bonded together with a 0.030-inch (0.75-mm) interlayer of material designed for blast resistance. For insulated glass units, the laminated glass shall be the innermost pane as a minimum. Provide a glazing frame bite in accordance with ASTM 2248.

FIGURE 4B.11

HIGH ENERGY AT/FP WINDOW GLAZING



4B-6.1.3 Fragment resistant film is not allowed as part of a window retrofit system.

4B-6.1.4 For exterior doors requiring glazing, follow the glazing guidelines outlined above.

4B-6.1.5 All exterior doorways that open into inhabited areas of buildings that must comply with AT/FP regulations shall open outwards.

4B-6.1.6 Bronze tinted glass is not required, but may be used.

4B-6.1.7 Mirrored, spandrel and plastic glazing are not allowed.

4B-6.2 Color Options

4B-6.2.1 Trim for doors and windows shall be factory finished to match the Robins Exterior COLOR PLAN with Robins 62 or Robins 48.

4B-6.2.2 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-6.2.3 Sealants applied adjacent to windows and doors shall match the frame color.

4B-6.2.4 Wood exterior doors shall NOT be used.

4B-6.3 Exterior Hardware

- Hinges: Stainless Steel on primary and heavy-duty doors Hardware: Stainless Steel, Brushed Chrome or Bronze.
- All hardware components must match and create a unified look.

4B-6.4 Locks

4B-6.4.1 All door hardware shall be compatible with the Base Master Keying System. Contact the Lock Shop at 478-497-8948 for information.

4B-6.4.2 All new or replacement keying systems shall have seven-pin, small-format interchangeable cores (IC) made by BEST Locks (owned by Stanley Security Solutions, Inc.).

4B-6.4.3 The Key Plan must be presented to the Lock Shop at least four (4) weeks prior to acceptance of Beneficial Occupancy.

4B-6.4.4 New BEST cores shall be shipped to the following address:

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

Entrance Doors
ADMIN/Warehouse built 1956
ADMIN Facility built 1995
ADMIN/Warehouse built 1957

We want our facilities to be HEALTHY, COMFORTABLE, SAFE and EFFICIENT

Fire Operations Facility built 2008

Parking on the Flightline

ADMIN Facility built 1955

Historic Forest dedicated 1998

SECTION 4C

ARCHITECTURAL COMPATIBILITY STANDARDS

VEHICULAR CIRCULATION & PARKING

4C-1 AT/FP REQUIREMENTS FOR ROADS AND PARKING

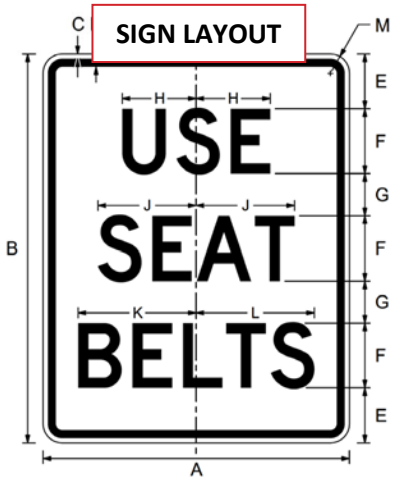
4C-1.1 **Std. 2** – Parking in the 33 foot standoff is allowed except when restricted at higher FPCONs.

4C-1.2 **Std. 3** – Drive-Up and Drop-Off areas are no longer restricted.

4C-1.3 **Std. 4** – Access roads near facilities are no longer restricted.

FIGURE 4C.1

SIGN LAYOUT



4C-2 PARKING DESIGN GUIDELINES

4C-2.1 Use 90 degree parking configuration as much as possible.
Parking Stall Size: 9' wide x 18.5' long (minimum).

4C-2.2 Maintain two-way movement as much as possible. Avoid dead end parking lots.

4C-2.3 Asphalt is the standard material for parking lots.

4C-2.4 Use concrete for heavy vehicles areas, loading and unloading, and where fuel spills may occur.

4C-2.5 Use 4" white striping to mark parking lots.

4C-2.6 Adhere to ADA standards.

4C-2.7 Parking labeled FPCON Handicap can be used by everyone when Normal Alert levels are in place.

4C-2.8 Requests for reserved parking must be submitted by the respective parking warden to CE Customer Service via TRIRIGA.

Parking for HANGARS Built 1992 - 1993

4C-3 PEDESTRIAN CIRCULATION

4C-3.1 Sidewalks

Sidewalks Connect our Facilities

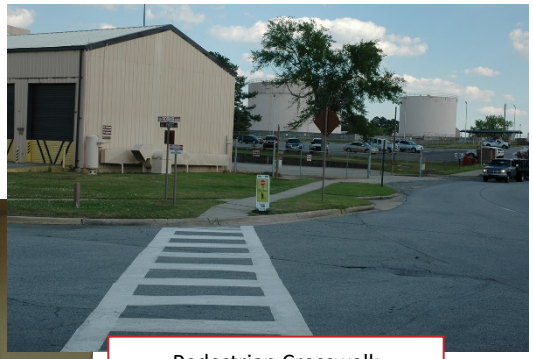
4C-3.1.1 Sidewalks shall be constructed in conjunction with all new facility and exterior remodel projects.

4C-3.1.2 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-3.1.3 Minimum Width: 4’-0” (Typical) Preferred Width: 5"0" (or Wider)

4C-3.1.4 Construction Material: Natural Colored Concrete (Typical); Solid Pavers or Permeable Pavers should be selected in colors complimentary to facility color.

4C-3.1.5 Roadway Setback: 2’-0” Minimum



Pedestrian Crosswalk

4C-3.1.6 Use crosswalks to connect sidewalks across roadways.

4C-3.1.7 Provide handicapped access with appropriate concrete striations at intersections and crosswalks.

4C-3.2 Handrails

Handrails are ADA compliant

4C-3.2.1 Handrails shall meet ADA standards.

4C-3.2.2 Handrail designs shall be integrated with the facility design.

4C-3.2.3 Standard handrails should be factory-finished if possible, otherwise dark brown powder-coated is the preferred finish for metal handrails.

SECTION 4D

ARCHITECTURAL COMPATIBILITY STANDARDS

LANDSCAPING

4D-1 SOIL STABILIZATION

Manage construction sites to ensure appropriate timing of seed and sod application. Coordinate with erosion control activities.

4D-1.1. Seeding

-- March/April through August:

Use hulled Bermuda or Centipede Grass; Brown Top Millet is not authorized

-- September through February/March:

Use a mixture of Winter Rye and unhulled Bermuda, or Tall Fescue variety

4D-1.2 Sodding

-- March through August only Use Bermuda or Centipede Grass

4D-1.3 Maintenance

4D-1.3.1 All grass must be maintained at a height of no more than six (6) inches.

4D-1.3.2 All grounds must be routinely maintained in a neat and orderly condition.

4D-2 TREE SELECTION GUIDANCE

4D-2.1 Provide tree shading or shade canopy for parking areas.

4D-2.2 Plant trees as windbreaks on the northwest side of buildings.

4D-2.3 Use trees that don't product messy fruit or grow too fast in high-profile locations.

4D-2.4 Use indigenous or well-adapted plant materials.

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.

Trees are a Legacy Resource

4D-3 SHRUBS AND GROUNDCOVER SELECTION GUIDELINES

4D-3.1 Limit planting to areas where long-term maintenance is planned and established at the time of planting.

4D-3.2 Select plant materials that have a maximum mature size that is no larger than the planting area provided.

4D-3.3 Do not plant shrubs that must be (excessively) pruned on a recurring basis.

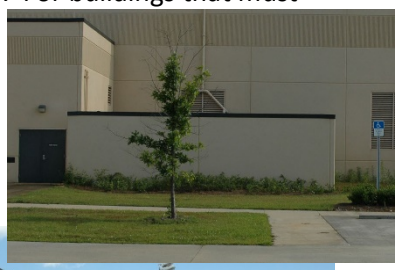
SECTION 4E

ARCHITECTURAL COMPATIBILITY STANDARDS

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 AT/FP 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 AT/FP Std. 2, para. 3-3.5 for "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 <u>Metal Shadow-Box Fencing</u>

- 6 - 8 feet tall (Typical) for screening; Seven (7) feet tall for AT/FP
- Factory-finished with Robins 62 or Robins 48 to match adjacent facility

Wall & Fence Options

4E-1.2.2 <u>Chain Link Fencing with or without Barbed Wire</u>

- 4 - 8 feet tall; Used primarily for security or special purpose needs
- Seven (7) feet tall for AT/FP or security requirements
- Use wire coated with brown or black fused bonded vinyl in "visible" locations
- Install with 12" or 18" concrete mow-strip in grassy areas

4E-1.2.3 <u>Ornamental Metal Fence</u>

- 6 - 8 feet tall with spiked profile for high-profile security
- Install with a 12" or 18" wide concrete mow strip

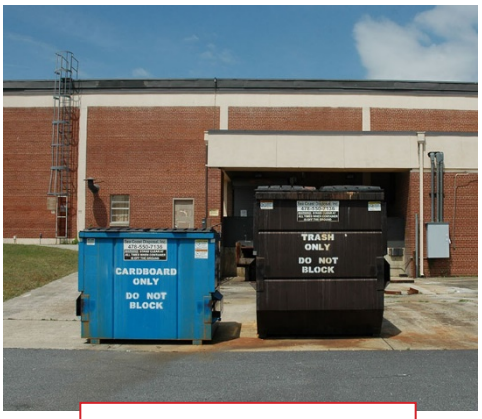
4E-2 DUMPSTERS

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.



Dumpster Placement

4E-2.3 Allowable Placement

Location must be placed outside the AT/FP 33-foot unobstructed standoff distance or alternately, the dumpster shall be secured or enclosed IAW UFC 4-010-01, Std. 1 and Std. 2.

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.

Dumpster Placement

4E-3 OUTDOOR EQUIPMENT CABINETS

4E-3.1 Locks for Equipment Boxes

Provide a Best Lock Corporation padlock for all pad mounted transformers, utility and equipment boxes, etc. Use lock number 21B720L-R with core number 8A59, 1½" short shank.

4E-3.1 Equipment Placement

4E-3.1.1 All transformers, utility and equipment boxes etc. shall be pad mounted.

4E-3.1.2 All pad mounted equipment shall be placed outside the AT/FP 33-foot unobstructed standoff distance or alternately, the equipment shall be secured or enclosed IAW UFC 4-010-01, Std. 1 and Std. 2.

4E-3.1.3 Padmounted equipment cabinets shall be grouped together and organized in a neat and orderly fashion.

4E-3.1.4 Equipment cabinets and enclosures shall be painted to match the Robins Exterior COLOR PLAN with Robins 48 whenever possible. Factory-finished light-colored grays and greens are also acceptable.

Equipment Placement w/ Fence Enclosures adjacent to Buildings

No Fence Enclosures are required for Equipment away from Buildings

4E-4 SITE FURNISHINGS

4E-4.1 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-4.2 Site furnishing within a single visible area should create a unified and cohesive appearance.

4E-4.3 Recycled tan and black colored plastic is preferred for benches and picnic tables.

4E-4.4 Avoid using mismatched site furniture and site elements.

4E-5 OUTDOOR LIGHTING

Exterior lighting fixtures should be placed to provide maximum safety, appropriate utility and suitable aesthetics without over-lighting an area, creating glare or light pollution, or wasting energy.

4E-5.1 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-5.2 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-5.3 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-6 OUTDOOR SIGNAGE

4E-6.1 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-6.2 Use of non-standard signage shall be limited. It should have a professional and discreet appearance.

Standard Building ID Sign

SECTION 4F

ARCHITECTURAL COMPATIBILITY STANDARDS

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.

COLOR BOARD SAMPLE **FIGURE 4F.1**

4F-2 CEILING TILES

4F-2.1 White 2' x 2' acoustical panels are used almost universally for ceilings in administrative areas throughout the Robins AFB. At least two selections are maintained in-stock to replace damaged or soiled tiles.

4F-2.2 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.

FIGURE 4F.2

Acoustical Ceiling Tile

4F-2.3 Ceiling tiles shall be maintained in clean, unbroken condition.

4F-2.4 Replacement tiles shall match existing or alternatively, all tiles in a visual area shall be replaced at the same time.

4F-2.5 If a specialty tile is used, purchase additional tiles for replacement stock.

4F-3 RESTROOMS

4F-3.1 All bathroom components shall be coordinated to provide a cohesive appearance. Elements s shall have a coordinated color palette with a variety of textures and patterns; extreme color variations are discouraged.

4F-3.2 Dispensers for paper towels, tissue and hand soap are typically provided by the Cleaning Contractor. Do not include these items as part of the Construction Contract.

4F-3.3 Solid surface countertops such as Corian® or Wilsonart are recommended for restrooms at Robins AFB. Integral sinks are preferred. The color should be a white or neutral color that is compatible with other restroom elements.

4F-3.4 Solid plastic polymer bathroom stall partitions are recommended such as AccuTec Bathroom Stalls or Hadrian® Toilet Partitions manufactured using high density polyethylene (HDPE). The color selected should complement the colors of the wall and floor tile.

4F-3.5 Wall and floor tiles should be chosen for their durability and ease of maintenance. In most cases, ceramic tile will be used. Dark grout is preferred.

4F-4 BREAKROOMS

4F-4.1 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 discouraged.

4F-4.2 Custom or premium grade breakroom cabinets shall be selected to provide high durability and ease of maintenance. The color and finish shall be factory applied wood or color. White cabinets are not recommended.

4F-4.3 Solid surface countertops such as Corian® or Wilsonart are recommended for breakrooms at Robins AFB. The color should be compatible with cabinets and walls.

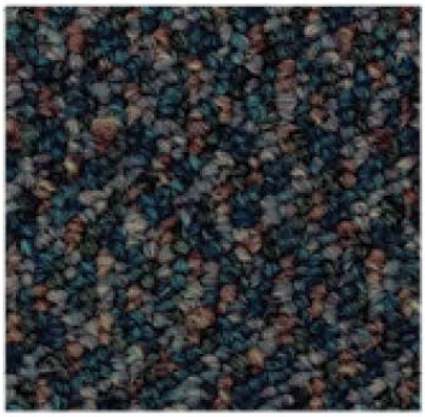
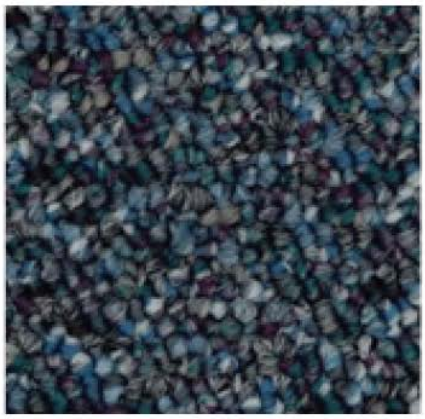
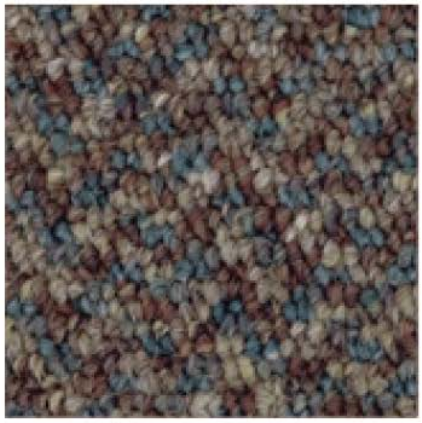
4F-4.4 The backsplash area behind the countertops (and extending to the upper cabinets) shall be a hard, wipe-able surface such as tile or solid surface material. The color should be compatible with the countertops.

4F-4.5 Walls shall be painted IAW Interior Paint Color Options.

4F-4.6 Resilient flooring such as Luxury Vinyl Tile (LVT) is the preferred 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 recommended for breakrooms.

ARCHITECTURAL COMPATIBILITY STANDARDS **FIGURE 4F.3**

CARPET & COVEBASE COLORS

	STANDARD CARPET COLORS	STANDARD VINYL COVEBASE COLORS
GREENS	 Shaw CORRELATE #6633	Johnsonite 71 STORM CLOUD Johnsonite 72 HARBOUR
BLUES	 Shaw FAMILIAR #66932	Johnsonite 71 STORM CLOUD Johnsonite 18 NAVY BLUE
BROWNS	 Shaw COMPARE #66731	Johnsonite 71 STORM CLOUD Johnsonite 76 CINNAMON

ARCHITECTURAL COMPATIBILITY STANDARDS

INTERIOR PAINT COLORS

4F-6 INTERIOR PAINT COLOR OPTIONS

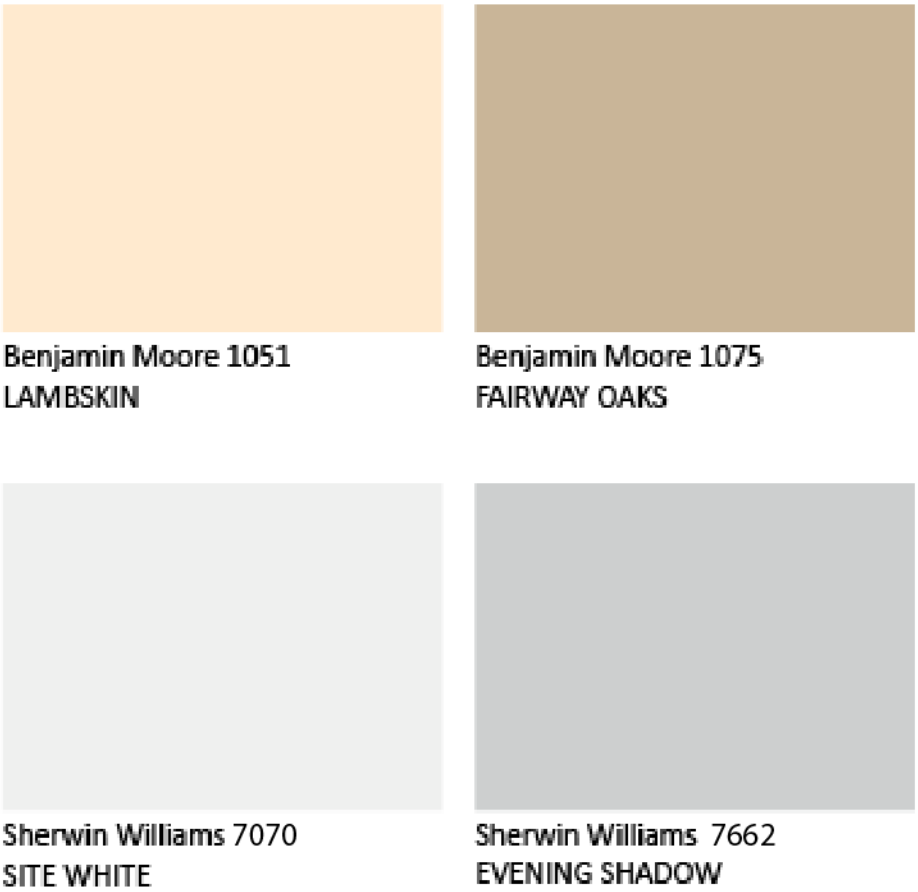
4F-6.1 There are currently four standard Interior PAINT COLOR OPTIONS at Robins AFB.

4F-6.2 Standard paint colors are maintained In Stock for quick and easy repairs in either eggshell finish for walls or glossy finish for trim.

4F-6.3 All Interior PAINT COLOR OPTIONS provide a suitable color-match with the available carpet and covebase colors.

FIGURE 4F.4

INTERIOR PAINT COLORS - IN STOCK



ROBINS AIR FORCE BASE

CHAPTER 5

MECHANICAL ENGINEERING ELEMENTS

Underground Utilities under Construction 2017

SECTION 5A

MECHANICAL ENGINEERING ELEMENTS

MECHANICAL STANDARDS

5A-1 GENERAL REQUIREMENTS

5A-1.1 Registered Professional

The design of all mechanical systems shall be provided by a Registered Professional Engineer in the State of Georgia that has passed the appropriate written examination(s) administered by the Council of Examiners for Engineers and Surveyors (NCEE).

5A-1.2 Existing Elements

Available plans of the existing utility distribution lines will be provided by the Base Civil Engineer. The Project Design Engineer or the Design-Build Contractor shall be responsible to verify the location of all underground utilities that are part of the project plans.

5A-1.3 Metering

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.

5A-1.4 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-1.4.1 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-1.4.2 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-1.4.3 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-1.5 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-1.6 Installation Depth

The minimum depth for all new utilities shall be three (3) feet from the top of the piping to the grade elevation; the maximum depth shall be seven (7) feet to the top of the piping.

5A-1.7 Pipe Identification

Tracer wires and warning tape shall be placed on plastic and CPVC, PVC, PE and ABS 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.

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.

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 tracer wire and warning tape for locating buried PVC piping.

5A-2.1.5 Provide cathodic protection for all underground steel pipe.

5A-2.2 Natural Gas Lines

5A-2.2.1 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.

5A-2.2.2 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-2.2.3 All underground metal piping shall be coated per the corrosion control section and shall have cathodic protection installed.

5A-2.2.4 Install tracer wires and warning tape on the lines using #10 AWG Cu with nicked TW insulation to facilitate detection of the wire with pipe locators.

5A-2.3 Steam and Condensate

The designer shall evaluate the feasibility of using the central utility steam system and submit a recommendation to the Project Manager, who shall make the decision to use (or not to use) the central system.

5A-2.4 Petroleum, Oils and Lubricants

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-2.4.1 Design of all petroleum, oils, and lubricants (POL) systems shall be IAW Military Handbook 1022, American Petroleum Institute (API), and other industry standards, including all applicable NFPA regulations.

5A-2.4.2 Welders certified by the American Petroleum Institute (API) shall provide all welding outside of fuels area.

5A-2.4.3 All pumps, valves and piping accessories shall be rated for fuels being handled.

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 Metals used as part of the system shall not react with fuel.

5A-2.4.6 All pipes shall be painted with the proper POL color coded markings.

5A-2.4.7 All electrical equipment shall be explosion proof in accordance with OSHA Division 1, Class 1.

5A-2.4.8 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-2.4.9 All *above* ground tanks shall meet the latest editions of the Environmental Protection Agency (EPA) regulations, including the following:

- Tanks shall be diked in accordance with EPA requirements.
- Pea gravel backfill shall be used to fill around tanks.

5A-2.4.10 All *below* ground tanks shall meet the latest editions of the Environmental Protection Agency (EPA) regulations, including the following:

- Pumps for ground tanks shall have leak detectors for piping pressure loss.
- Underground tanks shall be anchored so that flotation will not occur.

5A-2.4.11 Tank refill access shall be readily available to tank trucks.

5A-2.4.12 Surge suppressors will be used to prevent pressure build-up in the lines.

5A-2.4.13 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 preferred 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 complex HVAC systems shall be designed as Direct Digital Control (DDC) systems that are compatible and communicable with the existing Base DDC system headends. The DDC shall have the capacity to communicate with the remote DDC system located in Building 1555 (Base Civil Engineering Control Center) for monitoring, trending, scheduling, adjusting, troubleshooting, etc.

- Meters shall be non-resettable with a local numeric display.
- Employees of the control equipment manufacturer 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® or Honeywell products OR use the alternative HVAC DDC LonWorks®.
- 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 at the completion of the project for possible use by government to operate and maintain these systems.
- Verification of DDC control system shall be conducted prior to any contract acceptance.

5A-2.5.3 Non-Controllable Systems

No energy management systems shall 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.

5A-3.2 Labeling

5A-3.2.1 Comply with ANSI A13.1 – 2015 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.

FIGURE 5A.1

PIPE MARKING GUIDE

Fluid Service	Color and Letter Sample	Background Color	Letter Color
Fire Quenching Fluids	Letters	Safety Red	White
Toxic and Corrosive Fluids	Letters	Safety Orange	Black
Flammable and Oxidizing Fluids	Letters	Safety Yellow	Black
Combustible Fluids	Letters	Safety Brown	White
Water - Potable, Cooling, Boiler Feed	Letters	Safety Green	White
Compressed Air	Letters	Safety Blue	White
To be Defined by User	Letters	Safety Purple	White
Tobe Defined by User	Letters	Safety White	Black
To be Defined by User	Letters	Safety Gray	White
To be Defined by User	Letters	Safety Black	White

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-3.3.1 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-3.3.2 On ALL warranty issues: Notify 78 CEG/CEN and provide service tickets to indicate what measures were taken to correct the problem.

5A-3.3.3 Under no circumstances will any fire suppression or alarm system be left inoperative overnight without approval from the Fire Department.

TABLE 5A.2

ASME B31 PIPING CODE COMPARISON			
ITEM	**POWER PIPING ASME B 31.1 -1998**	**PROCESS PIPING ASME B 31.3 -1996**	**BUILDING SERVICES PIPING ASME B 31.9 -1996**
Piping Classifications Low Temp Chilled Water (0-40°F Chilled Water (40-60°F) Condenser Water (60-110°F) Low Temp Heating Water (110-250°F) High Temp Heating Water (250-450°F) Low Pressure Steam (15 psig and less) High Pressure Steam (Above 15 psig)	No classifications required by this code. The code deals with and governs all piping under its jurisdiction the same.	 D N N - Except Boiler Ext. Piping B31.1 applicable N N - Except Boiler Ext. Piping B31.1 applicable	No classifications required by this code. The code deals with and governs all piping under its jurisdiction the same.
Hydrostatic Pressure Testing	Test Medium – Water, unless subject to freezing Non-Boiler External Piping and All Other Services - 1.5 times the design pressure but not to exceed the maximum allowable system pressure for a minimum of 10 minutes.	Test Medium – Water, unless subject to freezing Category D or N Fluid Service 1.5 times the design pressure but not to exceed the maximum allowable system pressure for a minimum of 10 minutes.	Test Medium – Water, unless subject to freezing Non-Boiler External Piping and All Other Services - 1.5 times the design pressure but not to exceed the maximum allowable system pressure for a minimum of 10 minutes.
Examination, Inspection and Testing Requirements	The degree of examination. Inspection and testing, and the acceptance standards must be mutually agreed upon by the manufacturer, fabricator, erector, or the contractor and owner.	The degree of examination. Inspection and testing, and the acceptance standards must be mutually agreed upon by the manufacturer, fabricator, erector, or the contractor and owner	The degree of examination. Inspection and testing, and the acceptance standards must be mutually agreed upon by the manufacturer, fabricator, erector, or the contractor and owner
Nondestructive Testing	Ultrasonic Eddy Current Liquid Penetrant Hardness Tests	Ultrasonic Eddy Current Liquid Penetrant Hardness Tests	Ultrasonic Eddy Current Liquid Penetrant Hardness Tests

SECTION 5B

MECHANICAL ENGINEERING ELEMENTS

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

Robins AFB is located in ASHRAE Climate Zone 3A.

TABLE 5B.1

Mean Coincident (Average) Values					
Dry Bulb Temperature (T)	**Design Value (F°)**	**Wet Bulb Temperature (F°)**	**Humidity Ratio (gr/lb)**	**Wind Speed (mph)**	**Prevailing Direction (NSEW)**
1.0% Occurrence	95	76	108	7.5	W
99.0% Occurrence	28	26	16	5.5	NNW

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 preliminary design in accordance with ASHRAE standards. Submit building heat load calculations, plus a description of the program used and copies of all input data as part of the design analysis.

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 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.

Documentation and Engineer PE certification in Georgia to verify the capacity of the structural components shall be included in the design analysis.

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 with either R410a or R134a refrigerant (*See AFPAM 32-7089*).

5B-1.5.2 VRF Systems. No Variable Refrigerant Flow (VRF) systems are allowed at Robins AFB. *See Engineering and Construction Bulletin No. 2018-10, Figure 5B.2 for background*.

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 the building which requires the outside air capacity that is equal to or greater than 20% of the total air handling unit capacity, a dedicated outside air conditioning units shall be provided for humidity control and comfort of building occupants.

5B-1.5.5.2 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.

FIGURE 5B.2

US Army Corps of Engineers

ENGINEERING AND CONSTRUCTION BULLETIN

No. 2018-10 **Issuing Office:** CECW-EC **Issued:** 08 Aug 18 **Expires:** 08 Aug 20

SUBJECT: HVAC Changes – HVAC Systems UFC, HVAC-HVAC Controls TCX and Thermal Insulation Specification

CATEGORY: For Information

1. **References**:

a. 10 USC 2867 – Energy Monitoring and Utility Control System Specification for Military Construction and Military Family Housing Activities

b. Unified Facilities Criteria (UFC) 3-410-02, Lonworks ® Direct Digital Control for HVAC and other Loca

c. UFC 3-410-01

d. UFC 1-200-02

e. UFGS 23 09 0

f. UFGS 23 09 2 Control Systems

g. UFGS 23 09 2 Control Systems

2. **Purpose.** This EC criteria direction and f

3. **Applicability.** Th the Corps and others C

4. **Background.** Bas changes to the HVAC various Corps District at great length due to t of the two TCXs enab HVAC Controls guida that now meets or exc

5. **Changes to UFC** were posted on 1 Nov

5. Changes to UFC 3-410-01…

ECB No. 2018-10
Subject HVAC Changes – HVAC Systems UFC, HVAC-HVAC Controls TCX and Thermal Insulation Specification

a. Paragraph 3-5.16 on Variable Refrigerant Flow (VRF) Systems: The new wording reflects a Tri-Service view on VRF systems. VRF systems need to comply with the current HVAC controls criteria which were developed to meet 10 USC 2867. This code mandates an open Energy Monitoring and Utility Control System specification and open associated HVAC controls criteria. From paragraph 3-5.16.1.1: "All HVAC control systems, including VRF systems, must meet the requirements of UFGS 23 09 00 and either UFGS 23 09 23.01 or UFGS 23 09 23.02. The reason behind the change to the VRF paragraphs was to present a Tri-Service unified position on VRF systems. As of August 2018, none of the VRF system manufacturers met this requirement. Wording from ECB #2017-7 dated 22 Mar 2017 VRF has been recalled and is being revised and reissued to more accurately reflect the following issues:

(1) Concern of Refrigerant Concentration - The refrigerant lines are run inside buildings usually over office spaces. A typically sized VRF system contains enough refrigerant to asphyxiate occupants in the event of a refrigerant leak.

(2) Long refrigerant runs are common with VRF systems and many times the lines are branched out. A refrigerant leak would be difficult to locate and once found very difficult to repair as there is other piping and ductwork installed in dropped ceilings.

(3) VRF Systems have proprietary control systems. These closed systems are not permitted per UFC 3-410-02 Lonworks ® Direct Digital Control for HVAC and other Local Building Systems, with Change 1. This UFC states, "An Open DDC system is characterized by the ability for any qualified entity to readily modify, operate, upgrade, and perform retrofits on the DDC system."

b. Paragraph 3-3 on Dedicated Outdoor Air Systems (DOAS): Wording was revised for the Army and the Navy/Air Force. The Army paragraph continues to state the requirement for a DOAS with zone sensible cooling systems and may be life cycle cost effective with a central system. Guidance is provided on performing a life cycle cost analysis in this paragraph. The designer will need to follow UFC 1-200-02 High Performance and Sustainable Building Requirements as well on life cycle cost analysis.

6. **Technical Center of Expertise (TCX).** The Heating, Ventilating and Air Conditioning Control Systems TCX has now been combined with the Heating, Ventilating, and Air Conditioning TCX. The new name will be Heating, Ventilating, and Air Conditioning - HVAC Controls TCX. HNC is the assigned lead of this TCX. The following link includes the HVAC-HVAC Controls TCX:

http://www.hnc.usace.army.mil/Missions/Centers-of-Expertise/

7. **Changes to Unified Facility Guide Specifications.** UFGS 23 07 00 Thermal Insulation for Mechanical Systems now permits polyisocyanurate insulation for both above ground cold pipeline (-34 to 16 deg C; -30 to 60 deg F) and above ground hot pipeline (above 16 deg. – 60 deg F) IF the insulation meets the flame spread index of 25 and the smoke developed index of 50 when tested in accordance with ASTM E84. In all cases the insulation must be provided with a

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05B-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 and hot water pipes and supply air ducts 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 in order 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. <u>The single manufacturer of all HVAC chiller systems at Robins AFB shall be Carrier.</u> Use of non-standard components is authorized only until existing stocks are exhausted.

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 and maintained in accordance with the manufacturer's recommendations

5B-1.8.1.3 All HVAC Air Handling units which are greater than five (5) tons in cooling capacity shall be provided with ultraviolet (UV) lighting that is adequate to the capacity of the air handling unit.

5B-1.8.1.4 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-1.8.1.5 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-1.8.1.6 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.

5B-1.8.1.7 Airside economizers shall not be used at Robins AFB IAW UFC 3-410-01, Section 3.6.3.

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 shall comply with ASHRAE 90.1.

TABLE 5B.3

DUCTWORK INSULATION MINIMUM ALLOWABLE THICKNESS							
Climate Zone	Duct Location						
	Exterior	Ventilated Attic	Unvented Attic above Insulated Ceiling	Invented Attic w/Roof Insulation	Unconditioned Space	Indirectly Conditioned Space	Buried
Heating – Only Ducts							
3	R-3.5	None	None	None	None	None	None
Cooling – Only Ducts							
3	R-6	R-6	R-6	R-3.5	R-1.9	None	None
Combined Heating and Cooling Ducts							
3	R-6	R-6	R-6	R-3.5	R-3.5	None	R-3.5
Return Ducts							
1-8	R-3.5	R-3.5	R-3.5	None	None	None	None

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.4

TEMPERATURE REQUIREMENTS BY LOCATION[1]					
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 Therma-Fuser™ -type Systems ≥1 CFM/SF at full open capacity[2]				
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	55°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	55°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.				

[1] Per *ANSI/TIA-559-C*

[2] *See 5B-1.8.1.4*

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
- More than 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-2.3 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 insure 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-4 SYSTEM COMMISSIONING OF HVAC

5B-4.1 Training

5B-4.1.1 On-site training shall be provided to instruct Government personnel in each phase involved with the sequence of operation for the system.

5B-4.1.2 Training shall be accomplished by a “certified” manufacturer's representative and shall be conducted and completed prior to Pre-Final inspection.

5B-4.1.3 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-4.2 Testing

5B-4.2.1 Test and balance of the system shall be carried out by an independent firm certified by the American Association of Balancing Contractors (AABC) or the National Association of Balancing Contractors (NABC).

5B-4.2.2 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-4.2.3 If 25% of the systems checked are not within the required allowance (allowance being: 10% of what is stated on the plans) the balancing Contractor will return to the site and completely redo the testing and balancing.

5B-4.2.4 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-4.2.5 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-5 SYSTEM MAINTAINABILITY

5B-5.1 System Configuration

5B-5.1.1 Adequate clearances and accessibility shall be provided around all pieces of equipment for periodic maintenance, inspection and cleaning.

5B-5.1.2 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.

5B-5.1.3 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-5.1.4 Equipment shall be installed so that service of one piece of equipment shall not require disturbance of adjacent equipment.

5B-5.1.5 Coils shall be fully removable without requiring demolition of any building components.

5B-5.1.6 Piping configuration at all coils shall include unions to facilitate easy removal.

5B-5.1.7 Isolation valves shall be provided for each terminal unit, zone, branch, long runs, etc. as necessary for proper isolation and access during maintenance.

5B-5.2 Component Locations

5B-5.2.1 Mechanical equipment is not permitted on the roof.

5B-5.2.2 Only secondary items that do not require maintenance or access such as vents are permitted with approval from the Roofing Program Manager.

5B-5.2.3 Anything penetrating the roof shall be painted the same color as the roof.

5B-5.2.4 Water treatment systems for boilers/chillers shall be designed and installed to allow chemical handling at the floor level.

5B-5.2.5 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, paragraph 3.3-5.

SECTION 5C

MECHANICAL ENGINEERING ELEMENTS

WATER DISTRIBUTION SYSTEMS

5C-1 SYSTEM WATER SUPPLY

5C-1.1 General Information

5C-1.1.1 Any construction project which includes a modification to the Robins AFB potable water system (including additions, extensions and repairs) shall include preparation and submittal of an water/engineering Design Package 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 at a scale that provides for ease of viewing and understanding and includes 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 The rated fire flow shall be analyzed for each project.

5C-1.2.2 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-1.2.3 If the proposed project discharges any mixture of chemicals or solid waste into the industrial or sanitary waste water 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-1.2.4 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 if a high water demand is expected in an area that marginally meets pipe size and pressure requirements.

5C-1.3 Water Supply Protection

5C-1.3.1 <u>Installation Requirements</u>

5C-1.3.1.1 Any underground potable water system installed in a declared environmental hot zones, 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-1.3.2 Cathodic Protection

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 Bioenvironmental Engineering and the 78th Civil Engineer Industrial Utilities Shop 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 principle 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 principle backflow preventer shall be provided on all new or renovated projects connected to potable water. Backflow preventer shall be located in accessible locations with adequate clearance space for maintenance and repairs.

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 above ground applications

5C-2.3.1.2 Type K copper for below ground applications

5C-2.3.1.3 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-2.3.1.4 Poly Pipe (HDPE - PE3408) is acceptable for use for the main plumbing water pipe

5C-2.3.2 Hot and Chilled Water System Components

5C-2.3.2.1 Make-up water system with reduced pressure principle 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.

5C-2.3.3.2 Water closets shall be floor mounted when possible and incorporate flush valve operation.

- Any wall mounted fixtures shall incorporate closet carriers or fixture carriers.
- Wall mounted lavatories shall incorporate floor mounted carriers with concealed arms.
- Tank type water closets shall not be provided.

5C-2.3.3.3 Urinals in men's restrooms shall be wall-mounted and incorporate closet carriers or fixture carriers as applicable.

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 AFI 32-1067.

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 that are readily accessible for inspection and maintenance.

5C-3.1.5 All BPDs shall be inspected and tested by the Robins AFB Backflow Manager before being put 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 AMDS/SGPB, Bioenvironmental Engineering and the Civil Engineering Plumbing Shop.

5C-3.3 Installation Guidance

5C-3.3.1 Minimum depth for all new underground utilities shall be three (3) feet from the top of the piping to the grade elevation.

5C-3.3.2 Tracer wires and warning tape shall be placed on underground lines using #10 AWG Cu with nicked TW insulation to facilitate detection of the wire with pipe locators for all plastic and CPVC, PVC and PE piping. Warning tape shall be located six (6) to 12 inches below grade.

5C-3.3.3 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.

SECTION 5D

MECHANICAL ENGINEERING ELEMENTS

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:

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

5D-1.3 Equipment Schedules

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

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

5D-1.4 Contingency Planning

Central Plant compressed air systems are considered on par with electrical generation systems. As such, every effort should be made to provide both a maintenance spare and an emergency spare compressor (but do not duplicate other contingency factors) and to ensure capability to operate at full capacity with any possible single point of failure. Provide an Operational Risk Management (ORM) analysis of likely

concurrent points of failure, so the Base can make an informed decision to mitigate a specific risk or determine operational responses as needed.

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 effectively 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 after-cooler 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 in order 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. Accurately determine operating temperature and pressure, since even minor changes in either can result in substantial operating cost increases.

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) based on 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.

Provide an Economic Evaluation to determine which type of system 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, well-lighted, and ventilated areas of sufficient size to permit easy access for cleaning, inspection, maintenance, repair and 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 Compressors shall not be allowed to sit in storage for extended periods prior to installation unless it is by the recommendations of the manufacturer.

5D-3.3.2 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-3.3.3 Connection to a compressor shall be made with a flexible connection to avoid damage to components internal to the compressor due to vibration.

5D-3.3.4 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 and size of air compressor, and can be determined from air compressor manufacturers.

5D-3.3.5 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-3.3.6 All duct shall be rated to withstand the heat generated.

5D-3.3.7 Compressors shall be filled with all manufacturer required fluids and shall have all manufacturer required filters prior to start up. Initial startup shall be by the manufacturer or a manufacturer approved vendor.

5D-3.3.8 A sound test shall be performed on all compressors and accessories after installation. Any variation from approved standards will be corrected prior to final approval.

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 Thermal mass air dryers are the most effective means of controlling 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-4.2.4 An after-filter shall be provided to protect downstream piping and equipment from any debris or particles that may be added to the air as a result of passing through the dryer.

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 adequate compressed air storage for the compressed air system.

5D-5.1.3 Equip tanks with a manual condensate drain, an automatic condensate drain, a liquid filled pressure gauge and a pressure relief valve.

5D-5.2 Installation

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

5D-5.2.2 Provide adequate 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 will be Type K or Type L.

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

When copper pipe or tubing is used, brazed joints will be used for connections.

- Brazing filler metals with melting temperatures between 1,000 degrees Fahrenheit and 1,600 degrees Fahrenheit will be used.
- Press fit style fittings may also be used if installed per manufacturer's recommendations.

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

5D-6.1.6 PE 3408 Polyethylene, SDR 7.4 pipe, butt fusion welded is acceptable for underground applications.

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

MECHANICAL ENGINEERING ELEMENTS

FIRE SUPPRESSION

5E-1 GENERAL GUIDANCE

5E-1.1 Oversight

5E-1.1.1 Plan Preparation

5E-1.1.1.1 System design drawings can be provided by either the A/E or Contractor. 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.

5E-1.1.1.2 A Registered Fire Protection Engineer or registered P.E. in the State of Georgia in a related engineering discipline with a minimum of five (5) years of experience, dedicated to fire protection engineering that can be verified with documentations shall prepare and stamp all fire suppression system design drawings, shop drawings, as-builts and hydraulic calculations.

5E-1.1.1.3 A Level III technician certified by the National Institute for Certification in Engineering Technologies (NICET) with a specialty in Electrical and Mechanical Systems Engineering Technology/Fire Protection/Water-Based System Layout may prepare design for new areas or additions comprising areas smaller than 4,000 square feet where no fire riser or fire pump is required.

5E-1.1.2 Installation

5E-1.1.2.1 The installing firm shall provide a factory trained authorized representative of the manufacturer with a NICET Level III (or higher) technical training for the project. This individual shall supervise the installation of the system and certify the system specifications, shop drawings and NFPA 72. This individual must be present at all inspections and testing of the system. Note: “Supervise” means to provide sufficient field visits during a project for adequate quality control.

5E-1.1.2.2 A factory trained authorized Technician from the manufacturer or a NICET Level II (or higher) Technician shall install all wiring and make terminations of the field devices and terminations at all cabinets and panels. This technician shall then program the system. The Electrical Contractor shall not install wiring.

5E-1.1.2.3 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).

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.

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 Provide additional fire hydrants if existing hydrants are not accessible within 300 feet.

5E-2.1.2 On all new supply air systems with design capacity greater than 2,000 CFM, smoke detectors shall be included on the design for both the supply and return side of the system (IMC and NFPA 90A).

5E-2.1.3 Provide dampers, vents, partitions, fire rated doors and other materials as needed.

5E-2.1.4 Fire extinguishers shall be placed in cabinets flush mounted to the wall.

5E-2.1.5 Provide steel Schedule 40 or heavier pipe for all fire suppression systems. Do not use any Schedule 10 pipe. 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-2.1.6 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-2.1.7 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-2.1.8 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-2.1.9 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-2.1.10 Electronic equipment shall not have halon protection. Use wet pipe water suppression with early detection and shutdown of equipment.

5E-2.1.11 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-2.1.12 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/FT²)/FT²							
		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-3 MASS NOTIFICATION SYSTEM (MNS)

5E-3.1 General

5E-3.1.1 Follow all requirements in scope of project, Army Corps of Engineering Manual (EM), EM-385-1-1, Safety and Health Requirements Manual and NFPA 241, Safeguarding Construction, Alteration, and Demolition Operations for protection of facility during construction.

5E-3.1.2 Provide autonomous control unit (ACU) with fire alarm control unit.

5E-3.1.3 Provide a local operation console for the MNS.

5E-3.1.4 Provide battery backup for MNS.

5E-3.1.5 All mass notification NAC circuits shall be Class A.

5E-3.1.6 Provide an interface radio transceiver and antenna that will communicate with the base-wide "Big-Voice" system meeting the Base (78 ABW/SC) requirements. Robins AFB currently uses the UVIC UltraVoice® Indoor Controller with an UltraVoice® Audio and Relay Module (UVARM) manufactured by Federal Signal Safety and Security Systems to interface with the Mass Notification System (MNS).

5E-3.1.6.1 Use Transceiver from Federal Signal.

5E-3.1.6.2 Pre-recorded messages to use for programming "Big-Voice" interface can be obtained from Federal Signal.

5E-3.1.6.3 Mass notification system shall be capable of receiving messages from the Federal Signal basewide system.

5E-3.2 Installation Guidelines and Occupancy Standards

5E-3.2.1 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 <u>only</u> Fire Alarm or <u>only</u> Mass Notification Systems (MNS) or <u>both</u>. 78 CEG/CEN is the AHJ for this decision.

5E-3.2.2 Exterior area-wide fire alarm boxes/systems are not required. There can be some fire devices installed outside a building.

5E-3.2.3 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.

5E-3.3 Wiring Methods

5E-3.3.1 <u>Wiring</u>

5E-3.3.1.1 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.

5E-3.3.1.2 New wireless fire alarm systems shall not be used on Robins AFB at this time.

5E-3.3.1.3 Actual size of conductors shall be determined by voltage drop calculations and/or as recommended by the manufacturer, but shall not be less than size indicated in this standard.

- Signaling Line Circuits (SLC) - No. 16 AWG size at a minimum, Type FPLR
- Speaker Circuits - No. 16 AWG size at a minimum, Type FPLR
- Notification Appliance Circuits (NAC) for strobes - No. 14 AWG size at a minimum, Type THHN/THWN
- Initiating Device Circuits (IDC) - No. 14 AWG size at a minimum, Type THHN/THWN

5E-3.3.1.4 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.

5E-3.3.1.5 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.

5E-3.3.2 Raceways

5E-3.3.2.1 Raceway shall be installed in accordance with NFPA 70 and NFPA 72.

5E-3.3.2.2 Raceway fill shall be in accordance with NFPA 70. Forty (40) percent fill shall not be exceeded.

5E-3.3.2.3 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.

5E-3.3.2.4 Detection: Separate raceways shall be provided for the Signaling Line Circuit (SLC) loop from other wiring.

5E-3.3.2.5 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.

5E-3.3.2.6 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.)

5E-3.3.3 Conduit

- Conduit installed underground outside building perimeter shall be PVC SCH 40.
- PVC shall not be used above ground; It shall not be used to penetrate fire rated walls
- The minimum size of conduit shall be ¾ inch, except that conduit carrying 120 volts power from a circuit breaker panel to the Fire Alarm or MNS may be ½ inch.

5E-3.3.4 Junction Boxes

Paint all junction boxes and covers red in unfinished areas. Flexible conduit does not have to be painted.

If exposed in finished areas, junction boxes and covers may be painted to match color of wall.

For junction boxes in finished areas, Contractor shall provide the words, “Fire Alarm” on the inside cover of the junction box.

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.

5E-3.3.5 Component Wiring Requirements

5E-3.3.5.1 Do not loop wiring thru the backbox of a device unless the wiring terminates in that device.

5E-3.3.5.2 Termination at a device shall be a complete break in the wire, do not loop the wire around the screw.

5E-3.3.5.3 Do not connect notification devices to the style 6 wiring loop using addressable modules.

5E-3.3.5.4 Indicating appliance circuits shall be connected directly to the Fire Alarm Control Panel (FACP) terminals or to expansion power supply panels.

5E-3.3.5.5 Devices that have pigtails and no terminal strips are not acceptable.

5E-3.3.5.6 If mini- addressable modules are used, they shall have built on terminal strips.

5E-3.3.5.7 Surge Protection Device (SPD): Install metal-oxide varistor (MOV)-type surge arresters on both ends of wiring that enters and returns from the building.

5E-3.3.5.8 Special Robins AFB Requirements (Fire Alarm only or combined Fire Alarm and Mass Notification):

All circuits shall be Class A except as follows: Buildings that are less than 2500 square feet in size may be considered for the installation of Class B circuits on a case-by- case basis. Approval by the Robins AFB Fire Prevention Office and 78 CEG is required.

5E-4 FIRE ALARM CONTROL SYSTEM

5E-4.1 Fire Alarm Control Panel (FACP)

5E-4.1.1 Specifications

5E-4.1.1.1 Only Fire Alarm Control Panels (FACPs) that are compatible with the existing system at Robins AFB can be obtained from the following manufacturers: Notifier®, Edwards Signaling™ and Simplex. For FACPs in facilities less than 1000 square feet, Fire-Lite® Alarms are also an option.

5E-4.1.1.2 Panels shall be red in color.

5E-4.1.1.3 FACPs 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.

5E-4.1.2 Location

5E-4.1.2.1 Main control panels shall be located in an environmentally conditioned space. 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.

5E-4.1.2.2 All critical components for the system shall be located in 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.

5E-4.1.2.3 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.

5E-4.1.2.4 All control, extender and auxiliary fire alarm panels shall be located at five (5) feet above finished floor measured to the centerline of the panel. Measurement can be plus/minus two (2) inches.

5E-4.1.3 Back-Up

5E-4.1.3.1 Provide secondary emergency power capable of sustaining the system for 48 hours.

5E-4.1.3.2 Provide sealed-type batteries as specified by the manufacturer to insure that the entire control panel and its parts are UL listed and will remain under warranty.

5E-4.1.4 Circuits

5E-4.1.4.1 All fire alarm SLC and NAC circuits shall be Class A.

5E-4.1.4.2 All circuits shall be supervised.

5E-4.1.4.3 Each extender panel, other subpanels, etc., shall be individually addressed and monitored for trouble conditions.

5E-4.1.4.4 Provide a factory installed Digital Alarm Communicator Transmitter (DACT) capable of Contact ID Format, compatible with the radio transceiver.

5E-4.1.4.5 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.

5E-4.1.4.6 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.

5E-4.2 Radio-Type Transmitter (Fire Alarm)

5E-4.2.1 Each fire alarm system must communicate with the base fire alarm system.

5E-4.2.2 The AES Radio Transmitter (7788F) shall be mounted within three feet of Fire Alarm Control Panel (FACP) it serves.

5E-4.2.3 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.

5E-4.2.4 The Fire Alarm Control Panel (FACP) shall transmit Contact ID thru the AES Radio System.

5E-4.2.5 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

5E-4.2.5 Mount a tamper switch in the radio transmitter cabinet, connected to the AES input Zone 8.

5E-4.2.6 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.

5E-4.2.7 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.

5E-4.2.8 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.

5E-4.3 Detection Devices

5E-4.3.1 Smoke Detectors

5E-4.3.1.1 Use only addressable smoke detectors.

5E-4.3.1.2 Locate required smoke detectors above the Fire Alarm Control Panel (FACP) within 12 inches of ceiling, if possible.

5E-4.3.1.3 Spacing of smoke detectors shall allow for a 10% overlap in coverage.

5E-4.3.2 Duct Smoke Detectors

5E-4.3.2.1 Provide in the air supply systems with a capacity greater than 2000 CFM.

5E-4.3.2.2 Locate downstream of the air filters and upstream of any branch ducts.

5E-4.3.2.3 Shall be same manufacturer as the alarm control panel, and fed from the 24 volt DC fire alarm panel, not from the HVAC controls.

5E-4.3.2.4 Shall send a supervisory signal to the main FACP. Provide remote test switches and remote light emitting diodes (LEDs) for each smoke detector.

5E-4.3.2.5 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.

5E-4.3.3 Heat Detectors

5E-4.3.3.1 All areas shall contain heat detectors unless a specific exception has been granted.

5E-4.3.3.2 Rating of heat detector shall be 135°F to 174°F.

5E-4.3.3.3 Spacing of heat detectors shall allow for a 10% overlap in coverage.

5E-4.3.4 Manual Pull Stations

5E-4.3.4.1 Locate manual pull stations within five (5) feet of each exterior exit door and each door into an exit stairway.

5E-4.3.4.2 Provide double action type manual pull stations with mechanical reset features without the use of a key.

5E-4.3.5 Flow Indicators

5E-4.3.5.1 Provide Vein Type Flow Switch.

5E-4.3.5.2 Flow switch shall have a 0-90 second field adjustable delay.

5E-4.3.6 Addressable Monitoring Modules

5E-4.3.6.1 Single type monitor modules shall be used at each point that is not inherently addressable.

5E-4.3.6.2 Provide a light on the front cover of device to indicate the active status of this point.

5E-4.3.6.3 Do not use addressable dual monitoring modules.

5E-4.3.7 Dry Pipe Sprinkler System

5E-4.3.7.1 Use of dry-pipe systems shall be limited in use.

5E-4.3.7.2 Provide monitoring of high and low pressure on dry pipe sprinkler systems on a per riser basis.

5E-4.3.8 Tamper Switches

5E-4.3.8.1 Provide a supervisory tamper on all valves that could affect correct operation.

5E-4.3.8.2 Post Indicator Valves (PIV) located outside the facility shall not be monitored. 78 CEG shall provide a lock on these units.

5E-4.3.9 Fire Water Instrumentation

5E-4.3.9.1 Provide Vein Type Flow Switches with 0-90 second field adjustable delay.

5E-4.3.9.2 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.

5E-4.3.9.3 Provide monitoring of high and low air pressure on dry pipe sprinkler systems on a per riser basis.

5E-4.3.9.4 Provide a supervisory tamper on all valves that could affect correct operation

5E-4.3.9.5 Post Indicator Valves (PIV) located outside the facility shall not be monitored (78 CEG shall provide a lock on these units.)

5E-4.4 Notification Systems

5E-4.4.1 Do not provide a water motor gong or alarm.

5E-4.4.2 Provide clear strobes at all locations inside the building to meet the accessibility requirements for persons with hearing disabilities.

5E-4.4.3 Provide visual notification in common areas, employee work spaces and public use areas. This standard defines “employee work spaces” as administrative space, including individual office spaces.

5E-4.4.4 Provide one visual notification in each mechanical, electrical and telecommunication room located centrally in the room.

5E-4.4.5 Provide horns for audible notification. Sound level of horns must be 15 dB above the ambient level. Horns are not required in individual offices or restrooms.

5E-4.5 Releasing Systems

5E-4.5.1 Panels

5E-4.5.1.1 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.

5E-4.5.1.2 Panel is to be located adjacent to the system it controls, but not in the hazardous area served.

5E-4.5.2 Wiring Methods

5E-4.5.2.1 Provide a surge protection device on incoming power to the control unit.

5E-4.5.2.2 Provide separate raceways for the releasing system.

5E-4.5.2.3 Mark the raceways for the releasing system with a three (3) inch yellow band every ten feet.

5E-4.5.2.4 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.

5E-4.5.2.5 Electronic solenoids used for release of the suppression system must be FM Approved for intended use.

5E-4.5.3 Detection Devices

5E-4.5.3.1 Shall be chosen to optimize the deluge system and shall be connected to the deluge panel, not the central fire alarm control panel.

5E-4.5.3.2 Actual activation of deluge system shall be manually operated by pulling one of the releasing system pull stations.

5E-4.5.4 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.”

5E-4.6 Fire Pump Monitoring

Upon activation of the fire pump controller, the FACP shall send a general alarm through-out the building, if it is not already in alarm.

5E-4.7 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.

5E-5 COMBINED FIRE ALARM AND MASS NOTIFICATION SYSTEM

5E-5.1 General

5E-5.1.1 A single manufacturer shall provide the combination 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. Control Panels must be compatible with the existing system at Robins AFB can be obtained from the following manufacturers: Notifier®, Edwards Signaling™ and Simplex.

5E-5.1.2 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.

5E-5.2 Radio-Type Transceiver

5E-5.2.1 Provide an interface radio transceiver and antenna that will communicate with the base-wide "Big-Voice" system meeting the Base (78 ABW/SC) requirements. Robins AFB currently uses the UVIC UltraVoice® Indoor Controller with an UltraVoice® Audio and Relay Module (UVARM) manufactured by Federal Signal Safety and Security Systems to interface with the Mass Notification System (MNS).

5E-5.2.2 Contractor shall purchase the Transceiver from Federal Signal (Current Local Area Representative, Joseph Brady, 919-607-3131) and state that the system is for Robins AFB.

5E-5.2.3 Contractor shall procure the radio that fits within the transceiver separately from Macon Communications Inc. (Current POC, John McCall, 478-788-6222.) 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.)

5E-5.2.4 Pre-recorded messages to use for programming "Big-Voice" interface can be obtained from Federal Signal Corporation.

5E-5.2.5 Provide a short length of PVC conduit for the cables to exit the wall. Seal opening on the outside of the facility.

5E-5.2.6 Transceiver shall not be placed in finished spaces or any space that takes away from the user's functional space.

5E-5.2.7 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.

5E-5.3 Notification

5E-5.3.1 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 work spaces and public use areas. This standard defines “employee work spaces” as administrative space, including individual office spaces.

5E-5.3.2 Audible

5E-5.3.2.1 The combined system shall use the same speakers for both fire alarm and mass notification.

5E-5.3.2.2 Use only digital amplifiers, not analog type.

5E-5.3.2.3 All spaces where mass notification is required, including individual offices, shall have speakers as needed to provide acceptable intelligibility.

5E-5.3.2.4 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.)

5E-5.3.2.5 Industrial spaces with high ceilings and high ambient noise, such as hangars, use 15 watt loudspeakers. Lower ceiling industrial areas may use 8 watt speakers depending on design and layout. Most of these areas will not require speakers since MNS is only required in inhabited spaces unless Statement of Work (SOW) or RFP states otherwise.

5E-5.3.2.6 Speakers should not be used at a tap setting more than half of the maximum allowed wattage. Use speakers with adjustable taps.

5E-5.3.2.7 In open spaces with drop ceilings, use ceiling mounted speakers evenly spaced throughout for a uniform sound distribution.

5E-5.3.2.8 For speaker circuits, use of 70 volt systems is encouraged to reduce voltage drop for large facilities.

5E-5.3.2.9 Provide speakers outside buildings when there are areas that occupants frequent, especially next to entrance/exit doors.

5E-5.4 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.

5E-5.4.1 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.

5E-5.4.2 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.

5E-5.4.3 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.

5E-5.4.4 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.).

5E-5.4.5 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.

5E-5.5 Received Messages

Mass notification system shall be capable of receiving messages from the Federal Signal basewide system.

5E-5.6 Local Operating Console

5E-5.6.1 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. It shall be located within a 200 foot travel distance for all building occupants. 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.

5E-5.6.2 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

5E-5.6.3 The LOC shall be same manufacturer as the combined system.

5E-5.6.4 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.

FIGURE 5E.3

US Army Corps of Engineers

ENGINEERING AND CONSTRUCTION BULLETIN

No. 2018-17 **Issuing Office:** CECW-EC **Issued:** 25 Oct 18 **Expires:** 25 Oct 20

SUBJECT: New Requirements for Visual Notification for Mass Notification Systems

CATEGORY: Directive and Policy

1. **References**:

a. Unified Facilities Criteria (UFC) 4-021-01 Change 1, DESIGN AND O&M: MASS NOTIFICATION SYSTEMS, January 2010

2. **Purpose.** This directive provides new requirements for mass notification systems.

3. **Applicability.** This applies to new mass notification systems for new construction and rehabilitation projects for U.S. Army facilities. This also applies to new mass notification systems for new construction and rehabilitation projects for U.S. Air Force facilities when the U.S. Army Corps of Engineers is the design and construction agent. This ECB has been approved for U.S. Air Force facilities by the USAF AHJ office (AFCEC/CO), and applies unless otherwise directed by AFCEC/CO.

4. **Background.** UFC 4-021-01, Design and O&M: Mass Notification Systems, requires Army and Air Force facilities to use amber strobes at all locations inside the facility as the visible signal to alert occupants with hearing disabilities about non-fire related emergency situations. These amber strobes are activated in conjunction with the delivery of pre-recorded or live voice messages over the mass notification system. The amber strobes are provided at the same locations as would be required for fire alarm clear strobes.

5. **Directive.**

a. Amber strobes must no longer be used in new mass notification systems. In lieu of amber strobes, clear or white strobes marked with the word "ALERT" must be used for new mass notification systems. Clear or white strobes must be provided for shared use by the facility's combination mass notification and fire alarm system. The clear or white strobes are activated in conjunction with voice messages over the mass notification or fire alarm system.

b. Light-emitting diode (LED)-type text signs must be installed for the new mass notification system, and the fire alarm system (if present). These text signs are activated in conjunction with voice messages over the mass notification or fire alarm system.

c. Comply with the following changes to UFC 4-021-01:

(1) Add the text "Army and Air Force" to the beginning of the first sentence in Section 4-3.4.2.1.

SECTION 5F

MECHANICAL ENGINEERING ELEMENTS

WHOLE FACILITY METERING

5F-1 GENERAL REQUIREMENTS

5F-1.1 Metering shall be installed in all facilities listed in Tables 5F.5, 5F.6 and 5F.7, at locations identified for projects in the Statement of Work (SOW) and in new facilities belonging to a reimbursable customer.

5F-1.2 Metering is not required in new facilities that are less than 5,000 SF and/or have the potential to consume less than 3,000,000,000 BTUs of combined electric and natural gas, provided electric, natural gas and water meters are not required to have individual meters.

5F-1.3 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-1.4 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. In no case shall the metering required as a part of this standard be provided through the HVAC control system.

5F-1.5 Robins AFB manages its own utilities. Contractor shall provide meter bases and meters. Do not indicate that meters are to be provided by 'Others."

5F-2 INTERFACE WITH VIRTUAL CE LAN

5F-2.1 Connectivity

Each electrical meter installed shall have the capability to tie physically to the Virtual CE LAN, also known as the CE-COINE (Community of Interest Network Enclave) on base. Other pulse meters shall be connected to the pulse inputs of the electrical meters.

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. The price for the meters below do not include installation of the meter nor material for installation of the cabling to connect to the CE-LAN.

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.

5F-2.4.2 Outside of the facility the CAT 6 cable shall be routed underground or overhead at a height of at least six (6) 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-2.5 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. 78 ABW/SC Contractor can provide comparison costs and recommendations on best method.

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. Contact the Energy Office 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

Most single phase connections utilize a 100 Amp or 200 Amp inline meter and do not have 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 CT's to the meter test block.

5F-3.6 Meter and Meter Electronics

5F-3.6.1 Three Phase

Provide a Schneider ION 8650 C with onboard I/O Board Option B (3 Form A Digital inputs).

5F-3.6.2 Single Phase

Provide an ION advance revenue meter with same interface to the CE Virtual LAN.

5F-3.6.3 Transformers

5F-3.6.3.1 When Current Transformers (CTs) are required, use standard sized CTs that closely match the amperage rating for the circuit to be metered.

5F-3.6.3.2 Potential transformers (PT's) are not normally required.

5F-3.6.3.3 For 4160 volt and 12,470 volt circuits that are required to be metered, provide CT's and PT's of correct ratings.

5F-3.6.4 Labeling

5F-3.6.4.1 Provide labels in the cabinet where the meter is installed.

5F-3.6.4.2 The first label shall indicate the voltage of the system being metered.

5F-3.6.4.3 The second label shall indicate the multiplier of the meter including CT, PT and meter constants.

5F-3.6.4.4 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 by the Mechanical Subcontractor at the point where the gas line enters the facility.

5F-4.1.2 Existing natural gas pressure can vary between 80 and 50 psi at 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 the pressure to be utilized in the facility. Mount the regulator in the correct orientation and set it 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 drop the pressure down 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 ONICON F 5500 Thermal Mass Flow Meter with dry output closure only. The output shall be run in conduit to the closest electrical meter and attached to its input.

5F-4.3.2 For base purposes, pressure and temperature compensating meters are not required.

Provide for manual readings in addition to the electronic readings.

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-4.3.4 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 When and if required, provide 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 60 and 40 psi on the base depending upon the location.

5F-5.2 Meter and Meter Head

5F-5.2.1 Provide a water meter to operate at the regulated pressure. The meter shall be Sensus Omni T2 with pulse output. For instances where this meter does not work well, an ONICON F3500 Magnetic Flow Meter may be used.

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 SEWAGE CONNECTION

At this time there is no requirement to meter sewage.

5F-7 INDUSTRIAL WASTE CONNECTION

At this time there is no requirement to meter industrial waste.

5F-8 STEAM CONNECTION

5F-8.1 Location, Temperature and Pressure

5F-8.1.1 Steam is metered at the main steam production plants only. If additional metering is required, this requirement will be identified by 78 CEG.

5F-8.1.2 Temperature and pressure of steam is 358 degrees Fahrenheit (°F) at 125 psi.

5F-8.2 Smart Unit

5F-8.2.1 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-8.2.2 Provide for manual readings in addition to the electronic readings.

5F-8.2.3 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-8.3 Transmitted Data

TABLE 5F.4

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

5F-9 CHILLED WATER CONNECTION

5F-9.1 Location and Pressure

5F-9.1.1 Chilled water will only be metered at the main production plants that serve more than one facility.

5F-9.1.2 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-9.1.3 Temperature is less than 50 degrees Fahrenheit (°F) for the supply and return.

5F-9.1.4 At each building to be metered, two meters must be installed, one for the incoming line and one for the outgoing line. The consumption within the building will be the difference in these two readings.

5F-9.2 Smart Unit

5F-9.2.1 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-9.2.2 Provide for manual readings in addition to the electronic readings.

5F-9.2.3 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-9.3 Transmitted Data

TABLE 5F.5

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

5F-10 RENOVATION AND DEMOLITION

5F-10.1 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

5F-10.2 Demolition

5F-10.2.1 All meters included in building demolition projects shall be turned into the Energy Office.

5F-10.2.2 Cabinets and test blocks must be turned in with electrical meters.

TABLE 5F.6

FACILITY METERING				
COVERED FACILITY LIST				
38	127	229	385	2036
44	137	231	638	2039
45	140	255	640	2048
48	142	300	641	2051
49	150	301	644	2053
50	158	321	645	2057
54	162	323	670	2071
59	165	340	700	2072
80	166	350	768	2078
81	169	351	826	2079
82	177	364	905	2094
83	180	365	923	2312
89	189	368	956	2316
91	210	371	982	2328
110	215	376	988	2390
125	228	380	1555	20036
				20128

TABLE 5F.7

FACILITY METERING				
CSAG REIMBURSBLE FACILITY LIST				
13	110	169	620	2390
23	114	171	621	4387
28	119	180	624	4388
30	120	181	628	4389
33	125	189	630	4390
38	128	191	631	4391
41	129	198	633	4392
42	131	203	634	4393
44	132	204	635	4444
45	137	215	636	20028
47	139	229	638	20031
48	140	230M	639	20036
49	142	256	640	20042
50	144	257	642	20045
54	145	269	645	20093
59	146	288	648	20119
81	148	291	651	20120
82	149	309	653	20121
83	150	321	670	20128
84	151	323	672	20130
86	154	324	673	20131
89	155	364	675	20137
91	158	425	676	20139
93	161	430	680	20149
103	162	432	903	20180
104	163	449	2100	20262
109	165	607	2251	

** Some facilities may be on more than one list.*

TABLE 5F.8

FACILITY METERING				
OTHER REIMBURSBLE FACILITY LIST				
116 ANG	AAFES	DLA	DAPS	MWR
35		333	301 (Part)	184
266	920	340	DRMO	186
2043	922	351 (large Part)	1600	499
2045	978	365	1601	540
2053	982	368	1602	593
2059	990	376 large part)	1603	595
2063	Corps of Engineers	380	FMS	596
2072	702	385	231	987
2076	CARE Office	393	Royal Australian	1170
2078	368 (part)	602		1303
2079	DECA	606	DSPC	1307
2081	660 (Part)	641	376 (Part)	
2094	923	660 (>60%)	Hospital	
2302	Housing	1612	207	
2304	Crestview	DLA Richmond	700	
2305	Forest Park	120	700A	
2307	Turner Park	163	701	
2312	US Post Office	301 (Part)	4700	
2316	910 (Part)	992	Base Restaurant	
2320	Robins Federal Credit Union	SunTrust	166	
2328	646	160	300, 376, 608 (part)	
2336	20166	Lockheed Martin	640, 645 (Part)	
2350		640 (Part)		

*Discuss with Energy Office. Some of these smaller reimbursable customers may require a less expensive meter or none at all due to percentage sharing.

ROBINS AIR FORCE BASE

CHAPTER 6
ELECTRICAL ENGINEERING ELEMENTS

Electrical Substation

SECTION 6A

ELECTRICAL ENGINEERING ELEMENTS

BROAD 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 of 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 Selection of Equipment and Components

New electrical 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.

6A-1.2.1 Generic "Off the Shelf" Equipment

Field fabrication of panels, switches, etc., is not allowed.

6A-1.2.2 Obsolete Equipment

Equipment that is obsolete or scheduled to be obsolete is not allowed.

6A-1.2.3 Product List

Provide a submittal at the final inspection that lists the vendors for all equipment, so that 78 CEG shops can contact them later as needed.

6A-1.3 Installation

6A-1.3.1 Existing equipment that is not being renovated or removed should be left undisturbed.

6A-1.3.2 All equipment shall be installed level and plumb and shall be located to be easily accessible for maintenance. Conduit shall be installed parallel to dominant structure surfaces and supported at five (5)-foot intervals in conformance with National Electric Code (NEC) requirements.

6A-1.3.3 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-2 ENERGY CONSERVATION

The goal at Robins AFB is to balance energy conservation with protection of human life, security of facilities and equipment, and our ability to quickly and efficiently maintain and repair electrical equipment. Alternate and new technologies may be used if they meet the following criteria:

- The product has been commercially available for two years or more and replacement parts or readily available.
- Its use is economically advantageous or acquisition price and maintenance costs are equivalent to conventional designs.
- The product or its use has not been prohibited by AFCEC.

6A-3 EQUIPMENT PADS

6A-3.1 Pad Requirement

6A-3.1.1 Most equipment such as air switches, transformers, walk-in enclosures, switchboards, etc. requires an equipment pad for placement.

6A-3.1.2 Any pad mounted equipment placed within the 33-foot “unobstructed zone” around a building that must comply with the provision of UFC 4-010-01, shall be enclosed in accordance with Para. 3-3.5 using a seven (7) foot tall, 9 gauge chain link fence that is secured so that unauthorized personnel may not gain access.

6A-3.2 Pad Size and Layout

Size pads to extend beyond each and/or all of the equipment to be placed upon the pad. If more than one piece of equipment will be placed on the pad, provide the following minimum spacing:

6A-3.2.1 Transformer and/or air switches with doors facing each other: 10 feet

6A-3.2.2 Air switch non-door side and any other piece of equipment: 3 feet

6A-3.2.3 Transformer non-door side + any other equipment except an air switch: 2 feet

6A-3.2.4 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-3.2.5 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-3.3 Pad Construction

Transformers and other electrical equipment shall be set and bolted onto poured-in-place concrete pads. Pads shall be constructed IAW typical standard shown at Figure 6A.2.

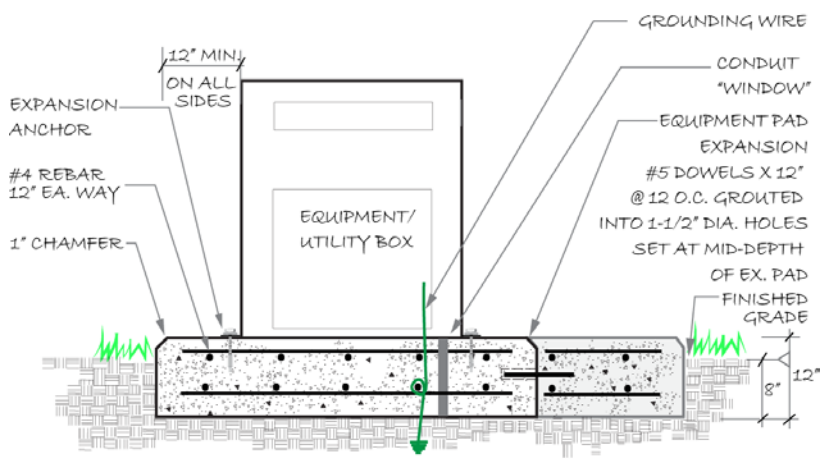
FIGURE 6A.2

6A-3.4 Pad Expansion

6A-3.4.1 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-3.4.2 Any side of pad that needs to be extended shall be extended a minimum of one (1) foot.

6A-3.4.3 Extensions or additions to the pad shall be connected using dowels and be finished at a height level with the existing pad.



1. PROVIDE 12" POURED-IN-PLACE CONCRETE, f'C=4,000 PSI; REINFORCED STEEL Fy=60,000psi
2. SET #4 REBAR TOP & BOTTOM 12" O.C. EACH WAY; CLEAR COVER BOTTOM 3"; TOP 2"
3. PLACE 1/2 GROUT BETWEEN BOTTOM OF EQUIPMENT & TOP OF CONCRETE
4. CONSTRUCT PAD W/ "WINDOW" FOR ENTRANCE OF CONDUIT TO EQUIPMENT.
5. SEAL "WINDOW" WHEN INSTALLATIOIN COMPLETE.
6. USE MIN 5/8" DIA. EXPANSION ANCHOR IMBEDDED 5" FOR EQUIPMENT ANCHOR
7. ADD GROUNDING TO THE ASSEMBLY
8. NO PRECAST PADS ALLOWED.

CONCRETE EQUIPMENT PAD

6A-3.5 Distance to Manholes or Handholes from Equipment

TABLE 6A.3

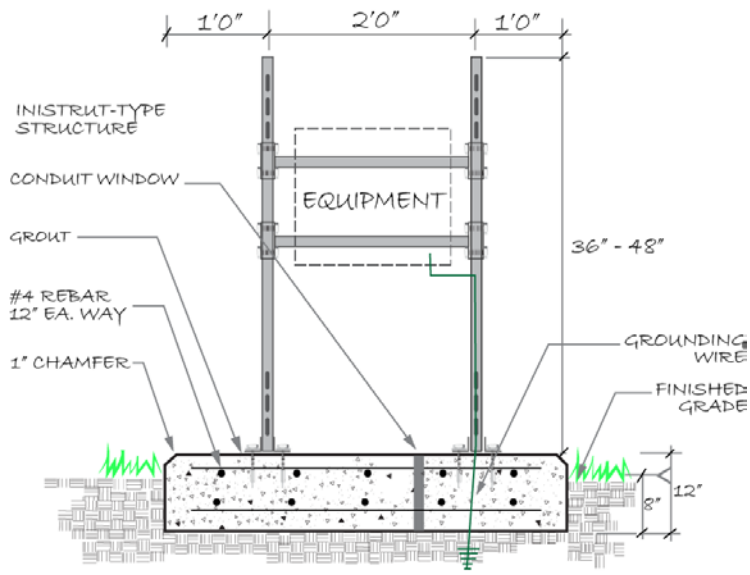
Distances to Manholes or Handholes	
Nearby Elements	**Minimum Distance (ft)**
Edge of Aprons, Taxiways, Runways	15
Any Hydrant, Lateral, or Control Pit	50
Fueling Points	200
Edge of Roadways	8-10

6A-3.6 Housekeeping Pads

6A-3.6.1 Any floor mounted distribution equipment shall be supplied with a housekeeping pad. Pad shall be at least four (4) inches above finished floor.

6A-3.6.2 Size pads to extend beyond each and/or all of the 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 or length.

FIGURE 6A.4



1. PROVIDE 12" POURED-IN-PLACE CONCRETE, f'C=4,000 PSI; REINFORCED STEEL Fy=60,000psi
2. SET #4 REBAR TOP & BOTTOM 12" O.C. EACH WAY; CLEAR COVER BOTTOM 3"; TOP 2"
3. CONSTRUCT PAD W/ "WINDOW" FOR ENTRANCE OF CONDUIT TO EQUIPMENT
4. BUILD EQUIPMENT STRUCTURE WITH UNISTRUT-TYPE COMPONENTS;
5. EQUIPMENT ELEMENTS SHALL BE PRE-FINISHED COLOR - ROBINS 48
6. PROVIDE UNISTRUT-TYPE MANUFACTURED HARDWARE FOR CONNECTIONS
7. USE MIN 5/8" DIA. EXPANSION ANCHOR IMBEDDED 5" FOR UNISTRUT ANCHOR
8. PROVIDE 1/2 GROUT BETWEEN BOTTOM OF UNISTRUT AND TOP OF CONCRETE
8. SEAL "WINDOW" WHEN INSTALLATIOIN COMPLETE
10. ADD GROUNDING TO THE ASSEMBLY
11. NO PRECAST PADS ALLOWED.

UNISTRUT-TYPE EQUIPMENT PAD
TYPICAL MINIMUM

6A-3.7 Utility Equipment Stand

Utility switches or controls that are being relocated from wooden poles or 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 115 MPH. The metal shall be PVC coated or primed and painted to color match Robins 48. Conduit access shall be provided through the concrete pad. The equipment stand assembly shall be grounded.

6A-3.8 Utility Poles

Metal or concrete utility poles may be utilized. No new wooden utility poles may be installed.

6A-4 UTILITY BOLLARDS

6A-4.1 Placement

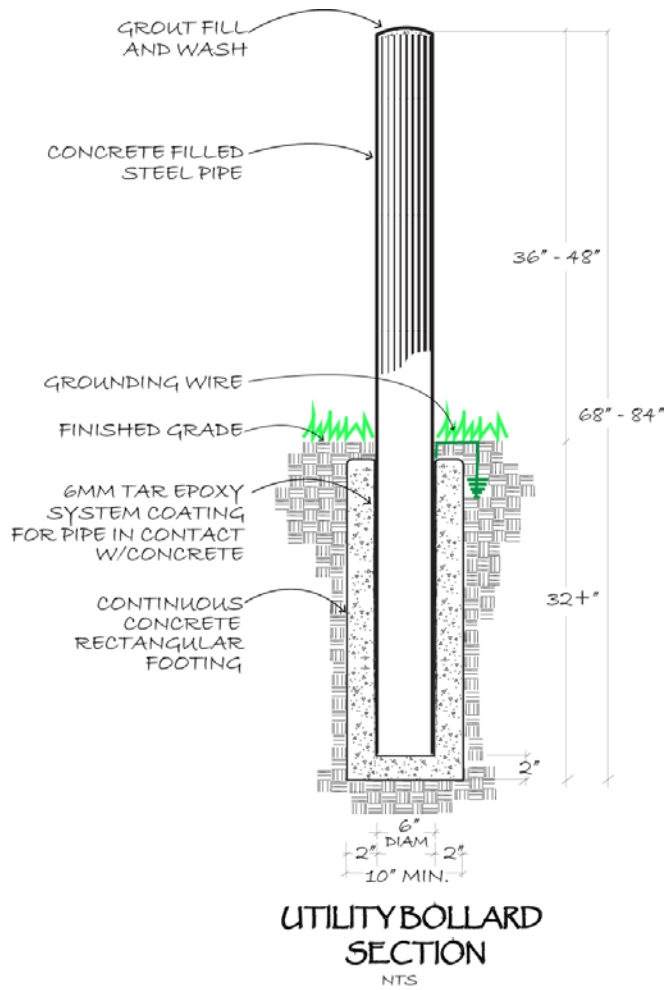
6A-4.1.1 Bollards shall be placed at each corner of the equipment/pads forming a rectangle. Each bollard shall be located at least 12 inches from any point on the pad or equipment. If the danger to the equipment is only from one side, then only two bollards may be used.

6A-4.1.2 As an exception, only two bollards are required for low-profile single-phase transformers on a pad by themselves. Place diagonally.

6A-4.1.3 Manholes are exempt from this protection as long as the round lid (that is traffic rated) is level with the ground.

6A-4.1.4 If distance between utility bollards is greater than 15 feet, then equally space bollards at a distance of 5 to 10 feet.

FIGURE 6A.5



6A-4.2 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 two (2) inch thick encasement of concrete for the full depth. Height shall be 36 to 48 inches tall, depending on the height of the equipment. Metal posts, columns and bollards that come in contact with or are embedded in concrete shall be coated with a coal tar epoxy system. The final dry thickness of coats shall be six (6) mm.

6A-5 UNDERGROUND UTILITY PLACEMENT

6A-5.1 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. Where a pipeline is installed in a casing under a roadway, provide electrical insulation. Seal all encased lines against water intrusion.

6A-5.2 Line Separation

Electrical cables and services shall be placed no less than three feet apart horizontally from other buried utilities.

6A-6 ELECTRICAL CLOSETS

6A-6.1 Industrial and Shop Areas

6A-6.1.1 Electrical distribution equipment may be wall/floor mounted in industrial/shop areas.

6A-6.1.2 Step-down transformers may be mounted on columns as a space saver. Provide a non-fused disconnect on the supply side of the transformer mounted at appropriate height. Panelboards may be mounted under these step-down transformers.

6A-6.1.3 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-6.2 Administrative Areas

6A-6.2.1 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-6.2.2 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-6.2.3 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-6.3 Walk-in Enclosures (Outside of Facility)

6A-6.3.1 Use this option only during renovations where there is insufficient space inside the building or where critical operations require the transfer of one circuit at a time.

6A-6.3.2 Walk-in enclosures shall be large enough for the distribution equipment to be installed with required spacing and a minimum of four foot working clearance.

6A-6.3.3 They shall be insulated and ventilated sufficiently to remove the heat generated by equipment present. If solid state breakers are provided, provide supplemental air conditioning. Provide heat during the winter time.

6A-6.4 Dedicated Equipment Space

6A-6.4.1 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-6.4.2 Conduits and control equipment are not considered foreign objects.

6A-6.4.3 A transformer cannot be located below a panelboard.

6A-6.4.4 The minimum area requirement for placement of electrical equipment will be 30 inches or the width of equipment whichever is greater.

6A-6.4.5 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.

TABLE 6A.6

DEDICATED ELECTRICAL EQUIPMENT SPACING		
Equipment	**Spacing**	**Distance**
Typical	Min. Placement Area	30” or width of equipment and at least 72” above equipment
Typical	Min. Working Area Width Clear of Obstruction	36” wide x 78” height
	Min. Separation	6” side to side
480 volts	Min. Working Area Width Clear of Obstruction	42” from facing wall
		48” face to face

6A-6.5 Electrical Room Doors

6A-6.5.1 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-6.5.2 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.

6A-6.5.3 Panic hardware shall be placed on all new electrical room doors regardless of size of gear contained therein.

6A-6.6 Existing Electrical Equipment

When replacing or working on existing electrical equipment that is located in hangars, warehouse, work space or admin areas, it may be left in place.

FIGURE 6A.7

6A-6.7 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-6.8 Removal of Electrical Room(s)

If an electrical room or closet is being relocated or replaced, remove all electrical equipment, conduit, etc. from the walls, floor and ceiling. Prepare the room for another use.

6A-7 RECEPTACLE PLACEMENT

Power outlets consists of convenience outlets, workstation outlets, general purpose receptacles, special purpose receptacles and system furniture outlets/connections.

FIGURE 6A.8

MINIMUM RECEPTACLE PLACEMENT AND SPACING					
Location	**Placement/Spacing**	**STD**	**GFCI**	**COM**	**Height**
Bldg Exterior	1 per 20 feet of wall around facility (Weatherproof)		x		18" above finished floor (AFF) to center of outlet
Warehouse, Shop/Storage Areas, Hangars	1 per 40 foot interval on walls 1 per interior column As needed for special requirements	x			
Personnel Door	1 @ ≤ 2 feet (Outside) Weatherproof		x		
Roll-Up Door	1 @ ≤ 2 feet (Inside)		x		
Mechanical Equipment	Within 16 – 20 feet (Outside) (Weatherproof)		x		
	Within 16 – 20 feet (Inside)	x			
Mechanical Room	1 per 20 feet around room	x			
Communications Room		x			
DDC Control Panel	1 @ each panel	x			
Bathroom, Locker Room,	1 min ≤ 6 ft from sink		x		12" above sink or 4 ft above floor near sink
Janitor's Closet	1 min ≤ 6 ft from sink		x		4 feet above floor
Snack Bar, Break Area	1 per 4 feet of countertop; 1 min. When ≤ 6 ft from sink	x	x		8" above counter
	1 per 10 foot interval along walls When ≤ 6 ft from sink	x	x		18" AFF
	1 per microwave When ≤ 6 ft from sink	x	x		
Vending Machine, Water Cooler	1 per piece of equipment ≤ 2 feet away		x		18" AFF
Kitchen Equipment such as Refrigerator, Stove, Coffee Pot, Microwave	1 per piece of equipment, dedicated w/ correct amperage OR 1 per 8-10 workstations				8" above counter or 18" AFF
Lobbies, Entryways, Vestibules	2 Minimum on opposite walls 1 per 10 foot interval around space, if larger	x			18" AFF
Corridors	1 @ 50 foot intervals (either side) Min. 2 per corridor	x			
Other Non-Admin Areas	≤ 25 foot intervals around perimeter Min 1 per wall in center 1 per interior column	x			
Conference Rooms, Class Rooms	1 @ ceiling for projection device 1 @ opposite corner	x			
	1 per 12 feet around room	x			18" AFF
	1 in floor for podium	x		x	
Administrative Areas	*Add time control for 50% of convenience outlets*	x		x	
Printers	1 per piece of equipment, dedicated w/ correct amperage	x		x	
Workstations	1 quadraplex per WS or computer/Match systems furniture *Add time control for 50% of outlets*	x		x	

FIGURE 6A.8

MINIMUM RECEPTACLE PLACEMENT AND SPACING					
Location	**Placement/Spacing**	**STD**	**GFCI**	**COM**	**Height**
Explosion Proof Receptacles	As needed				24" AFF to bottom of outlet

6A-8 STANDARD PLAN AND OPERATIONS REQUIREMENTS

6A-8.1 One Lines

6A-8.1.1 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-8.1.2 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-8.1.3 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-8.1.4 If the facility only has battery pack fixtures, provide the map only.

6A-8.1.5 Contractor shall provide copies of each one-line and associated instruction for approval before they are placed.

TABLE 6A.9

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-8.2 Shop Drawings

6A-8.2.1 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-8.2.2 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-8.2.3 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-8.2.4 Include corrosion recommendations for changes of methods, equipment sizes, and installation criteria, at no additional cost to the Government. Changes of materials are not permitted. Approval is at the sole discretion of the Contracting Officer.

6A-8.3 As-Built Drawings - Electrical

6A-8.3.1 In addition to the normal “as-builts” for the overall project, 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-8.3.2 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-8.3.3 Complete records in AutoCAD, VISIO Adobe .pdf and deliver as part of the construction contract. They will form part of the base Communications and Information Systems Installation Records (CSIR) and must be delivered to the BCSO CSIR manager upon contract completion.

6A-8.4 Operating and Maintenance Instructions

6A-8.4.1 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-8.4.2 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-8.5 Operating and Maintenance Orientation

Conduct an orientation course for up to four personnel before pre-final inspection. The training period shall consist of a total of two (2) hours during normal working hours and will be scheduled at Government convenience.

6A-8.6 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

ELECTRICAL ENGINEERING ELEMENTS

MEDIUM TO LOW VOLTAGE

6B-1 GENERAL GUIDANCE

6B-1.1 No Overhead or Direct Buried Cable

Except in some very limited situations no overhead distribution exists on Robins AFB or will be approved in the future. 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 (most of the time ties into another line.) Run 4-way five (5) inch PVC (Sch. 40 or Type DB) concrete-encased, as a minimum.

6B-2.1.3 Switch Laterals

Air switches are placed near manholes to facilitate ties. Switch laterals run from manhole to air switch. Run 4-way five (5) inch PVC (Sch. 40 or Type DB) concrete-encased, as a minimum.

6B-2.1.4 Transformer Laterals

Run 2-4” PVC (Sch. 40 or Type DB) concrete-encased for lines from manhole through handholes to transformer. If lateral crosses a road, run 4-4” PVC (Sch. 40 or Type DB) concrete-encased to the first handhole/manhole location across the street; continue with 2-4” PVC (Sch. 40 or Type DB) concrete-encased to the transformer.

6B-2.2 Arrangements

6B-2.2.1 Minimum depth to top of concrete-encased ductbank is 30 inches to top of ductbank.

6B-2.2.2 Use sweeping bends if only one turn of 90 degrees or less.

6B-2.2.3 Use Schedule 40 PVC conduit for turn-ups into pads.

6B-2.2.4 Encased burial (EB) (Schedule 10) will NOT be accepted.

6B-2.2.5 Minimum spacing between conduits shall be three (3) inches at closest point. Use ductbank spacers on a five (5)-foot interval to maintain spacing. Stake braces to keep conduit from floating.

6B-2.2.6 Minimum thickness of concrete on top, bottom and sides of ductbanks shall be three (3) inches.

6B-2.2.7 Use 3000 psi conduit for ductbanks.

6B-2.2.8 No 15 kV ductbank shall be routed under or through a building to another location. Some existing situations are present with a 15 kV circuit inside and under buildings. If the transformer is not being moved outside but cable is being replaced, obtain permission from 78 CEG.

6B-2.2.9 No 15 kV conduit shall be routed exposed to air or inside buildings above ground level. Identify any existing situations so they can be corrected by a future project. Obtain permission from 78 CEG before reusing or leaving these conduits in place.

6B-2.2.10 Place a magnetic tape 12 inches above each ductbank for the entire length of the ductbank 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 four-5 inch cast-in-place inserts on each inside wall. Unused inserts shall be capped with end bells to prevent water seepage into the manhole.

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-3.1.4 Provide sump inside manhole. All conduits shall remain open to allow any moisture/water to flow into the manhole.

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 (total of 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-3.3.4 Provide H20 wheel loading for top.

6B-3.3.5 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 Handholes are different from manholes in the respect that handholes usually have tops that are completely removable so that access to cables can be obtained due to the shallow depth of the hole.

6B-4.1.2 Handhole may or may not have predrilled holes. If predrilled inserts are used, factory installed end caps shall be provided for each openings.

6B-4.1.3 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-4.1.4 Do not place a handhole in a roadway, alleyway or parking lot. Use a manhole instead.

6B-4.1.5 If more than four (4) runs are needed, do not use a handhole, use a manhole instead.

6B-4.1.6 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-4.1.7 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-4.1.8 Tier rating of handholes shall be Tier 15 for normal applications. For 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-4.2.3 One handhole shall always be placed within 100 foot of transformer or closer to assist in pulling cables.

6B-4.3 Clearances

- 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 <u>"T" Splices</u>

No "T" splices are allowed.

6B-5.2.2 <u>In-Line Splices</u>

- Splices that extend the length of the cable shall be made only in manholes and handholes.
- 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.

6B-5.2.3 <u>Design Basis</u>

6B-5.2.3.1 500 MCM: Prysmian Elaspeed® Splice Kit 15SHJCe-500 (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: Prysmian Elaspeed® Splice Kit 15SEJCe-4/0 (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: Prysmian Elaspeed® Splice Kit 15SEJCe-2 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 padmount transformers.

6B-5.3.2 Standardized rules for all work shall prevail unless an exception is warranted to accommodate special conditions at Robins AFB or requirements for long term maintenance.

6B-5.4 Termination per Cable Type

- 500 MCM cable: PCT15J4 or 3M 5636
- 4/0 cable: PCT15J4 or 3M 5635
- #2 cable: PCT15J1 or 3M 5633

Air Switch
Set on Carbon Steel Base
Set on Pad

6B-6 AIR SWITCHES

6B-6.1 Design Basis

6B-6.1.1 Use Federal Pacific 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-6.2.4 Provide for and meet stand-off distances required by the project to certain facilities.

6B-6.3 Lock and Key

Furnish six (6) locks and one key for each switch installed. 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

6B-6.4.1.1 Provide a fault indicator system for each section that 500 MCM cabling is installed in the air switch. For work on existing air switches, reuse existing units as much as possible. Provide a new unit (if not present) in each section of air switch that 500 MCM 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-6.4.1.2 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-6.4.2 Lateral Runs to Transformers:

Provide a fault indicator system for each section that feeds transformers when cabling is installed in the air switch. For work on existing air switches, reuse existing units as much as possible. 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-6.4.2.2 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 Padmount Standard

Padmount transformers are the standard and should be used where ever possible. The use of close-coupled transformers and substation type transformers should be minimized. If anything other than a padmount transformer is required then seek guidance and permission from 78 CEG/CENMP Project Manager and Electrical Engineer.

6B-7.1 General Guidelines

6B-7.1.1 Each transformer shall be connected to an air switch.

6B-7.1.2 No transformer looping is allowed.

6B-7.1.3 Oil filled transformers shall use less flammable oil.

6B-7.1.4 Windings shall be copper.

6B-7.1.5 Transformers shall have a winding temperature rise of 65 degrees, OA class.

Single Phase Padmount Transformer with Switchgear on Rack and Generator

6B-7.1.5 Transformers shall be factory painted Brown, Robins AFB #48 or to match the main color of the adjacent facility.

6B-7.2 Size Guidelines

6B-7.2.1 Transformers with secondary voltage of 240V or 208V shall not exceed 500 kVA.

6B-7.2.2 Transformers with secondary voltage of 480V shall not exceed 2500 kVA.

6B-7.3 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-7.4 Lock and Key

Furnish one lock and one key for each transformer installed. 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-7.5 Fusing

6B-7.5.1 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-7.5.2 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-7.5.3 For large transformers (2000 and 2500 kVA) provide a bayonet arrangement with high-ampere overload fuse.

6B-7.5.4 Provide one set of current sensing fuses in packaging placed inside the high voltage compartment attached to the door.

6B-7.5.5 Provide one two inch (2") spare conduit from secondary compartment to outside of pad and cap.

6B-7.6 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 per cent 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

Interrupter Switch

Side A: Incoming Power
Side B: Lightening Arrestors

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.

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

ELECTRICAL ENGINEERING ELEMENTS

LOW VOLTAGE

6C-1 EQUIPMENT SIZES

Distribution equipment of the type and size as indicated below shall be utilized on Robins AFB

6C-1.1 2000 Amps and Above

Use switchboard construction with draw-out main breakers with solid state trip

6C-1.2 800 to 1800 Amps

Use switchboard construction with solid state main breakers or motor control centers

6C-1.3 600 and 800 Amps

Use power distribution panelboard construction

6C-1.4 100 to 400 Amps

Use panelboards

6C-2 SERVICE VOLTAGE

6C-2.1 Three Phase (480Y/277)

Use for most industrial buildings

6C-2.2 Three Phase (208Y/120)

Use for most office buildings

6C-2.3 Single Phase (240/120)

Use for most small shops, sheds and temporary facilities

6C-3 METERING

6C-3.1 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-3.2 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-4 SURGE PROTECTION DEVICES (SPDs)

6C-4.1 Required Locations

6C-4.1.1 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-4.1.2 At each generator serving the facility. SPDs shall be located at the first distribution equipment fed by the generator.

6C-4.1.3 At the upstream panel of any mainframe or server-type computers.

6C-4.1.4 At the power feed for each of the following:

- Fire alarm systems
- Communication systems
- Security systems
- Television systems
- Intercom systems

6C-4.1.5 At entrance/exit points to/from buildings where communication systems are located

6C-4.1.6 At entrance/exit to/from buildings where fire alarm circuits are located

6C-4.1.7 On each side of double-ended switchboards

6C-4.2 Placement Guidelines

6C-4.2.1 SPD units may be located integrally with switchboards, but shall be external to panelboards.

6C-4.2.2 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-4.2.3 Up to 200 Amp service or panelboard shall be rated at 60 kA mode with 180 kA/phase peak surge current.

6C-4.2.4 400-600 Amp service or distribution panelboard shall be rated at 180 kA mode with 240 kA/phase peak surge current.

6C-4.2.5 Over 600 Amp service or switchboard shall be rated at 200 kA mode with 600 kA/phase surge current.

6C-4.2.6 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-5 STEP-DOWN (DRY-TYPE) TRANSFORMERS

6C-5.1 Use dry-type general purpose (delta-wye) transformers for step-down of voltage within the facility. Windings for step-down transformers shall be copper. Maximum size shall not exceed 300 kVA. Minimum size shall be 30 kVA.

6C-5.2 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-5.3 Efficiency of step-down transformers shall be at least 97% for transformers above 25 kVA.

6C-5.4 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-6 SWITCHBOARDS

6C-6.1 Switchboard construction with front access breakers are the preferred 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-6.2 Distribution sections shall have the same depth as the main service section.

6C-6.3 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 LT, ST, Instantaneous and GF.
- Be electrically operated with backup manual operation.

6C-6.4 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, Instantaneous and GF.

6C-6.5 Feeder circuit breakers shall meet the following criteria:

- Provide 80% rated, insulated-case or molded-case

Switchboard with Solid State Breakers

- Provide solid state trips with digital integral ammeter display with LT, ST and instantaneous trip functions. Trip setting shall be capable of independent adjustments
- Shall have the same short-circuit rating as the main breaker

6C-6.5.1 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-6.5.2 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.

C-6.5.3 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-6.5.4 All phase, neutral and grounding bus bars shall be copper. This is applicable whether they are mounted horizontally or vertically.

6C-7 MOTOR CONTROL CENTERS (MCC)

6C-7.1 MCC Construction

6C-7.1.1 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-7.1.2 MCCs shall be equipped with a main breaker located in its own section.

6C-7.2 Feeder "Buckets"

6C-7.2.1 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:

- MCP: When the motor starter is located in the "bucket", use a motor circuit protector (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-7.2.2 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, such as 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-7.5 General Requirements

6C-7.5.1 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-7.5.2 All phase, neutral and grounding bus bars shall be copper. This is applicable whether mounted horizontally or vertically.

6C-7.5.3 Three-phase horizontal bus bars shall be 600, 800, 1200, 1600, 2000 or 2500 Amps as required.

6C-7.5.4 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-7.5.5 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-7.5.6 The neutral bus, if applicable, shall be fully rated continuous throughout the MCC.

6C-7.5.7 Any 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-7.3 Spare Parts

6C-7.3.1 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-7.3.2 Compartments for spare requirements shall be complete with buses, hinged doors and draw-out units but without load terminal connections.

6C-7.3.3 Compartments for future combination motor-control units shall be complete with hardware, buses and hinged doors ready to receive future draw-out units.

6C-7.3.4 Other spare spaces provided by manufacturer shall be complete with buses and screwed-on front cover plates.

6C-7.4 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-8 DISTRIBUTION PANELBOARDS 600 AND 800 Amps

6C-8.1 Construction Requirements

6C-8.1.1 Distribution type power panelboard construction shall be used.

6C-8.1.2 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-8.1.3 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-8.1.4 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-8.1.5 All phase, neutral and grounding bus bars shall be copper. This is applicable whether mounted horizontally or vertically.

6C-8.1.6 Phase buses shall be full size their entire height. Buses shall be provided for the normal height of breaker space in panel.

6C-8.2 Spare Parts

6C-8.2.1 Provide one (1) ea. spare of the two (2) most used size of feeder breakers.

6C-8.2.2 Provide two (2) empty spaces.

6C-9 PANELBOARDS 100 TO 400 Amps

6C-9.1 Construction

6C-9.1.1 Use panelboard Construction with a minimum 225 Amp bus rating and main circuit breaker.

6C-9.1.2 Main circuit breaker shall be Molded-Case breaker with minimum size of 225 Amps.

6C-9.1.3 Branch circuit breakers shall be 80% rated, Molded-Case bolted type.

6C-9.1.4 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-9.1.5 Minimum size breaker shall be 20 Amps.

6C-9.1.6 All phase, neutral and grounding bus bars shall be copper. This is applicable whether mounted horizontally and vertically.

6C-9.1.7 Phase buses shall be full size their entire height. Buses shall be provided for the normal height of breaker space in panel.

6C-9.2 Spare Parts

Provide spare circuit breakers to fill approximately 25 percent of the pole spaces in new panelboards. The remaining unused positions will be spare.

SECTION 6D

ELECTRICAL ENGINEERING ELEMENTS

GROUNDING

6D-1 GENERAL GUIDANCE

6D-1.1 Construction

6D-1.1.1 Ground rods shall be ¾ 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 The test well shall be placed on a level concrete pad that is 3½ inches thick, and extends at least one (1) foot on all sides around the test well.

6D-1.3.3 Ground rods for test points shall be driven one (1) foot below grade.

6D-1.3.4 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-1.3.5 For facilities with lightning protection, provide a ground 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:

6D-1.4.3.1 At changes in direction

6D-1.4.3.2 At test wells placed at the end of each down conductor for lightning protection systems (LPS)

6D-1.4.3.3 At least every 100 feet of length for LPS

6D-1.4.4 Use stranded 4/0 AWG base copper wire for ground rings

6D-1.4.5 Use stranded 1/0 AWG bare copper wire for interconnections

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.

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

ELECTRICAL ENGINEERING ELEMENTS

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 encouraged at Robins AFB.

6E-1.3.2 Catenary Systems may be if economically justified. Complete a Cost Analysis and present it to 78 CEG for approval.

6E-1.3.3 Mast and other systems identified in NFPA 780 may be used if approved by 78 CEG.

6E-1.3.4 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 Prevectron 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 a 50 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 a 35 foot 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 connection can be bolted and compression fitted. Bollards and other heavy metal object shall be bonded by welding or exothermic weld.

6E-1.5.2 Below Ground: All connection 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 50 feet apart around the exterior of the facility and 35 feet apart integrally on the roof.

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 are considered sufficiently protected against lighting strikes if the steel columns are grounded.

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 50 foot interior spacing to 35 feet.

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

TABLE 6E.2

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**

SCORE = (Item 5 X Item 6) + (Item 7 X Item 8 X Item 9 X 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

(Area of Facility ÷ 10,000) + (6 x Height of Facility)

Item 7 Construction

1	Metal Structure and Metal Roof
15	Non0Mettallic 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

ELECTRICAL ENGINEERING ELEMENTS

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.

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 and 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 OSP and ISP installed by the Construction Contractor or their Sub-Contractors must be permanent link tested. Passing 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 Base Communications and Information Systems Officer (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. The minimum COMM Room size at Robins AFB is 10 feet by eight (8) feet, or a size that is approximately 1.1 percent of the area being served. In multi-story buildings, a minimum of one COMM space should be located on each floor. 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 larger than 10,000 square feet or in facilities that house substantial IT equipment. The CER shall be sized IAW UFC-3-580-01 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, grounding, etc.

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 or mechanical rooms. 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-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 on each 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 at a later time. 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. All receptacles 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 bar in each CER and TR in accordance with this document.

6F-3.4 Entrance Conduit

Install at least 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. Include the appropriate number of hand-holes based on distance requirements. If a building being renovated does not have the minimum entry conduits, install additional four (4)-inch conduit as described above. The distance between handholes/manholes shall not exceed 500 feet.

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 interducts 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 dual-channeled power poles <u>or</u> separate COMM poles for access to system furniture. 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 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.

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

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:

6F-3.11.3 NIPRNet (unclassified network) Green Cable with SC connectors

6F-3.11.4 SIPRNet (classified network) Red Cable with SC connectors

6F-3.11.5 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.

6F-4 COMMUNICATIONS FOR MINOR PROJECTS

In most cases premise wiring for minor construction and renovations is provided by the 78 ABW/SC Base Telecommunications Contractor (BTS). 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

ELECTRICAL ENGINEERING ELEMENTS

INTRUSION DETECTION SYSTEMS

6G-1 DESIGN AND ACQUISTION

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. 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 At this time, 78 CEG personnel are trained and in place to maintain these systems. 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 REQUIRMENTS

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 as a result 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-2.1.10 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-2.3.3.2 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-2.3.3.3 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 shall have the same geographic resolution as 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

ELECTRICAL ENGINEERING ELEMENTS

AUXILIARY POWER

6H-1 GENERATOR PLACEMENT AND SIZE

6H-1.1 Usage

6H-1.1.1 Generators may be required to support mission functions where controlled shutdown or delayed power restoration is unacceptable. They may also be required for missions that require immediate power restoration, uninterrupted power or support emergency systems.

6H-1.1.2 A generator installed to support a mission function that is essential shall be installed and connected to provide power only to the mission essential functions within a single facility. Using one generator to support multiple facilities is not authorized due to simultaneous risk to multiple missions. The generator installed will meet all the needs in the facility (i.e. Government requirement and emergency requirement and multiple locations within the facility.) Separate Automatic Transfer Switches (ATS) may be required.

6H-1.1.3 All generators must be approved by AFCEC. The approval process takes approximately four months.

6H-1.2 Location Guidelines

6H-1.2.1 Generators are usually located outside the facility with NEMA 3R enclosures.

6H-1.2.2 Clear access of four (4) feet shall be provided and maintained around all four sides of the generator.

6H-1.2.3 Provide a generator disconnect and prime mover shutdown per NEC 445.18.

6H-1.3 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-1.4 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 Emission Requirements

The model year of each generator shall be certified by the manufacturer to meet Tier 4 emission standards and the emissions standards contained within 40 CFR 60. 4201 or 40 CFR 60.4202, respectively (40 CFR 60 Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engine [CI ICE]). Provide EPA Certificates of Conformity to EPA requirements for the model year of the engine procured.

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 autostart. 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 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 weather proof 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 not required that the generator and Automatic Transfer Switch (ATS) be manufactured by the same company. ASCO ATSs are preferred.

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-4.2.2 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 Use only threaded black steel. Welded joints may be used. When welded joints are used, provide a threaded union at strategic locations so that piping can be disconnected in sections for work on the piping system.

6H-4.2.4.2 Provide a ball cut-off valve on each of the supply and return fuel line next to the point that the pipe exits/enters the tank. This valve shall be steel. Brass or other metal valves are not acceptable.

6H-4.2.4.3 Fuel line solenoid valves are required.

6H-4.2.5 Safety

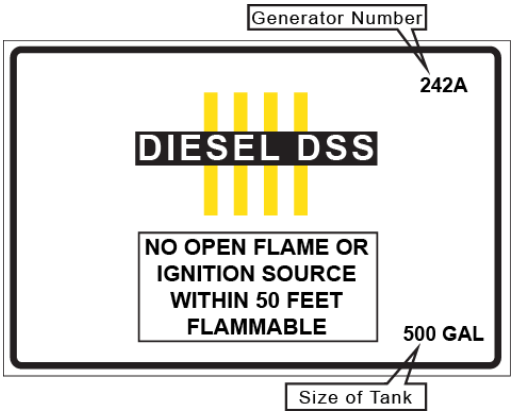
6H-4.2.5.1 If the top of the tank is greater than 42 inches above finished grade (including mounting means), include sloped steps with handrails IAW OSHA 1910.25(c) as well as an OSHA compliant platform to use when working or inspecting the top of the tank.

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

FIGURE 6H.1



6H-4.2.6 Signage

Place the sign shown in Figure 6H.1 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

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

ELECTRICAL ENGINEERING ELEMENTS

CORROSION CONTROL

6I-1 SERVICES OF CORROSION ENGINEER

A NACE certified corrosion engineer 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 waste water lines and lift stations
- Sewer lines and lift stations
- Chilled and hot water lines

SECTION 6J

ELECTRICAL ENGINEERING ELEMENTS

LIGHTING

6J-1 GENERAL

6J-1.1 Light Source

Robins AFB has standardized on LED light sources 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 facilities is 3000K for light sources.

6J-1.2 Photometric Data

Provide a photometric analyses 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

Because of Arc Flash concerns, all lights shall have some type of local switching capability. Panelboard breakers cannot be used for this purpose. Even when automatic controls such as time clocks, occupancy sensors, networked controllers, etc. are utilized, provide local on/off switching of the lights. All sensors shall be hardwired. Robins does not allow wireless sensors at this time.

6J-1.3.1 Occupancy and Vacancy Sensors

An occupancy sensor is used for interior applications to automatically turn the lights on when an occupant enters the space and automatically turn the lights off after a period of undetected occupancy. Below are different types of occupancy sensors.

6J-1.3.1.1 Passive Infrared Sensors (PIR): These detect the difference in heat between a human and the surroundings. Because of this, the sensor must be able to "see" the entire space and any obstruction such as partitions, shelves, or cabinets will block detection.

6J-1.3.1.2 Ultrasonic Technology: This relies on high frequency sound waves to detect movement in the space. This movement could be a person moving, or air movement created by a person's activity and is appropriate for spaces that have partitions such as open office areas. Such sensors need to be located so that they do not sense the "false-occupancy" of an air vent or a passer-by in an adjacent space. Ultrasonic technology sensors are recommended for most applications.

6J-1.3.1.3 Dual Technology Sensors: These sensors combine both the capabilities of PIR and ultrasonic to detect occupancy. Both an ultrasonic and PIR detection of occupancy is required for the lights to turn on but only one sensor technology is required for the lights to remain on. This type of sensor is best used in large spaces with low occupant activity levels.

6J-1.3.1.4 Vacancy Sensors: These require the occupant to manually turn the lights on when entering a space and the sensor automatically turns the lights off after a period of undetected occupancy. Provide vacancy sensors in lieu of manual switches in private or small offices and restrooms (types especially suited for restrooms), as a minimum. Also provide in other areas for energy conservation, including hallways that contain more than four fixtures and large administration-type spaces. In these situations, locate the sensors to avoid nuisance activation by personnel walking by the doorway and to avoid being covered by an open door or furniture.

- Set the time delay on the unit to 30 minutes initially.
- Set the sensitivity according to the activity in the space or at its medium range initially.

6J-1.3.2 Daylight Sensor Technologies

When required by project scope, provide proper controls including occupancy sensors and/or daylight-responsive dimming to reduce or shut off the lights when they are not needed. Establish zoned lighting in large areas so that groups of lights may be operated independently of other groups. Interior lighting in buildings larger than 5,000 square feet with large window spaces must be controlled with an automatic control system of devices: Areas within 20 feet of windows must be controlled by daylighting and other areas by occupancy/vacancy sensors to shut off building lighting.

6J-1.3.2.1 Open Loop Photosensors: These determine the light level by measuring the outside light availability. Based upon the light level measured, a signal is sent to adjust the electric lighting by either increasing or decreasing the light level depending on the exterior daylight availability.

6J-1.3.2.2 Closed Loop Photosensors: These determine the light level in a space by measuring the inside light availability. Based upon the light level measured, a signal is sent to adjust the electric lighting by either increasing or decreasing the light level depending on the interior daylight availability.

6J-1.3.2.3 Self-Adapting: These technologies “learn” how the space is used by occupants and adjust the lights as necessary. The technology responds in real-time and automatically adjusts both the sensitivity of the sensor and the delay time. Self-adapting sensors are best used in spaces where neither the occupants nor the activities vary from day to day. Self-adapting technology is not recommended for classrooms and conference rooms.

6J-1.3.2.4 Automatic Lighting Controls: Automatic dimming is a more sophisticated form of dimming that allows the lights to dim automatically given the conditions of the space. Automatic dimming is used in conjunction with daylight sensors, timers, etc.

6J-1.3.3 Time Controls

Time control technology will require the use of lighting relay panels.

6J-1.3.3.1 Time Switch: Automatic switching takes place in conjunction with occupancy controls when the space becomes unoccupied. The lights turn off after a designated period of inactivity.

6J-1.3.3.2 Time Clock: This device automatically adjusts the lights at a specific time or based on astronomical events such as sunrise or sunset. The clock shall be controllable for 365 days per year and 24 hours per day. One clock shall be used for as many lighting circuits as possible. This type of control may be applicable in spaces where there is constant occupancy, limited daylight and minimal activity in

non-peak hours of the day. Start of day shall not be later than 6:30 AM. End of day shall not be earlier than 6:00 PM. In some cases this time may need to be adjusted for different shifts.

6J-1.3.3.3 Override: For each room provide an override switch that will allow up to two (2) hour override. This can be in the form of a low voltage switch with the delay adjustment (adjustment must be up to two hours, set at two hours at the beginning) back at the time clock controller. This arrangement will allow the whole lighting circuit to be powered, not just the individual room. Where a series of override switches may override the same circuit, the timer override shall (as each is pressed) set the timer to a two hour delay (maximum).

6J-1.3.3.4 Schedule: A preset schedule can be programmed to automatically turn the lights on or off based upon trends in occupancy. Different schedules are created for weekdays, weekends, evenings and holidays.

6J-1.3.4 Network Control System

A network control system can be connected in a number of different ways. Implementing addressable ballasts or drivers provides digital addresses for all ballasts or drivers and connects them as a system through network cabling. The zoning of such a system is configured through software and provides flexibility as the needs of the space evolve over time. If network controls extend beyond the building, additional certification may be required.

6J-1.3.4.1 The digital addresses allow control over each ballast or driver individually and allow for flexibility of the system as the needs of the space evolve over time.

6J-1.3.4.2 A wireless system communicates with all devices (sensors, dimming ballasts, dimming drivers and area controllers) over radio frequency.

6J-2 DESIGN REQUIREMENTS

6J-2.1 Priorities

6J-2.1.1 Interior lighting systems design shall have the following priorities:

- Reduce energy consumption
- Reduce maintenance costs
- Improve lighting quality
- Have the lowest possible life cycle cost

6J-2.1.1.2 Use design light levels as indicated in UFC 3-530-01. If a range of levels is provided select a level in the middle of the range and make sure that all factors accounting for degradation of light from maintenance, lens, ballasts, etc. are taken into account. Critical design issues are indicated below and shall be addressed in the design analysis:

- Use a three (3) foot working plane height in most areas.
- Determine the voltage to be used (usually 277 volts).
- Have a lighting vendor lay out the lights and provide point-by-point layouts to meet the applicable requirements. Layouts must address visibility, glare and surface brightness.

- If there will be obstructions in the rooms or some of the rooms, make sure that the vendor takes these into account.
- Assume 100 percent demand load at PF = .95 lagging. Lighting shall be considered a continuous load. Lighting circuits should not be loaded to exceed 80 percent of the circuit breaker rating.

6J-2.2 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-2.3 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-2.4 Interior Sports Guidance

All interior sports lighting shall be based on Class of Play Type III per the Illumination Engineering Society (IES).

6J-2.5 Sensor Layout Guidance

For areas where daylight, motion sensors, etc. will be used, provide the optimum layout of the sensors. Provide drawing to include each sensor/each control strategy & the specific lights that it controls.

6J-2.5.1 Daylighting

Determine the best location to take advantage of the morning and/or afternoon sun.

6J-2.5.2 Motion (IR or UV) Sensors

6J-2.5.2.1 Each motion sensor type has a specific curve of detection.

6J-2.5.2.2 When multiple sensors are used to affect lights in a large room, provide an overlap in the sensor curves by 10% so sensitivity of personnel will be increased.

6J-2.5.2.3 For all sensors show the effective curves of detection in the design analysis.

6J-2.5.2.4 On drawings indicate which sensor controls which light(s).

6J-2.6 Life Cycle Costing (LCC)

A/E shall provide a LCC to show the most cost effective lighting system option. All systems must be capitalized twice in the analysis period but not to exceed 40 years. Use a straight-line depreciation for light fixtures from initial cost to a zero cost at end of life. Use the Building Life Cycle Cost (BLCC) program from the Whole Building Design Guide. This allows standardization of fuel costs and terminology. See UFC 3-530-01 for details of the analysis.

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.

6J-3.1 Pendant Mounted/Hung Luminaires

Pendant mounted/hung luminaires are suspended from the ceiling/roof structure and may light below, uplight the ceiling, or provide a glow in all directions. Mount pendant/hung fixtures at an appropriate height that will not result in a direct view of the source and provide adequate lighting levels.

6J-3.1.1 Single Light Source Fixtures (round)

6J-3.1.1.1 Pendant drops: These that must be hung with a rigid conduit and are used primarily in hangars and warehouses.

- Fixture hangers (junction box specifically designed for purpose) shall allow a plumb and level installation with a threaded malleable box rated for 120 lbs support and permit a maximum 20 degree swing. Connect fixture hanger to a threaded raceway (rigid metal conduit) with conduit supports within eighteen inches of either side of the fixture support.
- Fixtures with a rigid conduit hanger length longer than 2 feet shall have lateral bracing.
- All fixtures shall be installed at a constant elevation above the finished floor.

6J-3.1.1.2 Rectangular Fixtures(less than one (1) foot wide): These should be considered for ceilings greater than eight (8) foot in height in office areas. They are typically used in shop and mechanical/electrical rooms.

- Provide a support rod/wire/chain at each end
- Set on four (4) foot centers for fixtures longer than four (4) foot in length with flex from the junction box above to the connection provided in the fixture.

6J-3.1.1.3 Rectangular Fixtures (more than one (1) foot wide): These should be considered for ceilings greater than eight (8) feet in height in office areas. They are typically used in warehouse and hangar areas and can be used in shop and mechanical/electrical rooms.

- Provide a support rod/wire/chain at each corner and on each side
- Set on four (4) foot centers for fixtures longer than four (4) feet with flex from the junction box above to the connection provided in the fixture.

6J-3.3 Wall Mounted Luminaries

Sconces or uplights may light the wall, ceiling, or provide a decorative glow. Steplights, often recessed into a wall, are located low on a wall can illuminate pathways and stairs.

6J-3.4 Ceiling or Surface Mounted Luminaires

Ceiling or surface mounted luminaires provide a downlight and may also glow, depending on the type of housing and lens. Fluorescent and LED luminaires are available in linear or compact versions. This type

of luminaire is mounted directly to the ceiling. Lenses should adequately diffuse the light to avoid becoming a glare source and to prevent an image of the light source from showing on the lens.

6J-3.4.1 Recessed Troffers

These are generally used for installation in office spaces.

6J-3.4.2 Surface Mounted or Recessed Fixtures

These can be mounted in gypsum board and other type ceiling in bathrooms.

6J-3.4.3 Recessed Luminaires (Cans)

These recessed luminaires typically light the horizontal surface below, or possibly an adjacent wall and are also used for general ambient lighting. However, they are most appropriate as task lighting or accent lighting/wall washing. Semi-recessed luminaires use a lens or shade, dropped below the ceiling plane, to provide a decorative element as well as put some brightness on the ceiling.

- All recessed luminaires have a housing above the ceiling that contains the light source and provides power. The housing must be suitable for the luminaire location. For example, in an insulated ceiling, the housing must be rated for contact with insulation or "IC" rated.
- For 2' x 2' or 2' x 4' ceiling grids, use four (4) support wires, one at each corner to hang the fixture from the roof structure independently.

6J-3.5 Safety Requirements

6J-3.5.1 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-3.5.2 Wire Cages

The lamp or lens of a pendant fixture shall be enclosed by a wire guard when it is mounted or hung in a warehouse, hangar, sports area, shop area or maintenance facility. If the bottom of the fixture is located above the steel of the facility's roof structure, the wire guard may be omitted. Due to the inherent design of LEDs, wire guards are not necessary.

6J-3.5.3 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 LEDs. Contractor may use one of the methods below:

6J-3.5.3.1 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-3.5.3.2 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 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-3.5.3.3 Provide a means of access to the fixtures such as catwalks, platforms, etc.

6J-3.5.3.4 Provide a fixture lowering device.

6J-4 TYPICAL LIGHTING AREAS

6J-4.1 Administrative-Type Areas

In general, lighting within a facility shall be one of the systems below:

6J-4.1.1 LED (First Preference)

LED fixture either 2 x 2 feet or 2 x 4 feet.

6J-4.1.2 Fluorescent Fixture #1 (Second Preference)

Nominal 5½ inch deep housing. Fixture shall be 18-cell semi-specular louvered, 2 x 4 foot parabolic with three 28-watt T8 four-foot fluorescent lamps.

6J-4.1.3 Fluorescent Fixture #2 (Third Preference)

2 x 4 foot recessed direct/indirect lighting with three 28-watt T8 four-foot fluorescent lamps.
Design Basis -- Lithonia AV.

6J-4.1.4 Fluorescent Fixture #3

With ceiling height greater than 10 feet, consider pendant mounted eight (8) foot long direct/indirect lighting. Fixture shall contain a parabolic louver that is constructed of semi-specular aluminum and reduces glare.

6J-4.1.5 Fluorescent Fixture #4

For ceiling heights less than 10 feet and system furniture, 2’ x 4’ fixtures with refractive acrylic lens with 28 watt T8 fluorescent lamps.

6J-4.1.6 Lighting Scenario #5

In small individual offices, a minimum of two light fixtures shall be installed.

6J-4.2 Built-In Service Areas

6J-4.2.1 Provide down task lighting directly over the entire service desk counter.

6J-4.2.2 Provide switch next to entrance into the service desk area.

6J-4.3 Computer Rooms

6J-4.3.1 Use LED 2 x 2 foot or 2 x 4 foot recessed fixtures and clearly identify the type of lens to be used OR use nominal 5½ inch deep, 18-cell semi-specular louvered, 2 x 4 foot parabolic with three 28-watt T8 four-foot fluorescent lamps.

6J-4.3.2 Use LED 2 x 2 foot or 2 x 4 foot recessed fixtures and clearly identify the type of lens to be used OR use 2' x 4' foot recessed fixtures with three 28-watt T8 lamps and injection molded absolute cut-off lens with specular silver 1/2 inch x 1/2 inch x 1/2 inch square in-line cube cell.

6J-4.4 Classrooms, Training and Conference-Type Rooms

6J-4.4.1 Follow the Administrative-Type Area protocol.

6J-4.4.2 Consider other fixtures and/or lens to reduce glare on a projection screen.

6J-4.4.3 Provide supplemental fixtures in addition to the general room lighting for conference room. Fixtures shall be located as follows:

6J-4.4.3.1 Dimmable (LEDs or CFLs): Provide dimmable (LED or CFL) lights throughout the room in conference rooms larger than 400 square feet.

6J-4.4.3.2 Switched CFL: Provide standard CFL recessed can lights throughout the room, switched separately from the general room lighting for rooms less than 400 square feet. CFL lighting shall provide a maximum of 20 foot candles.

6J-4.5 Entryways or Vestibules

6J-4.5.1 Small Areas

Use LED or compact fluorescent downlights.

6J-4.5.2 Large Areas

Consider a combination of cove lighting with compact fluorescent downlights and/or fixtures to match the hallways/corridors and/or recessed fluorescent and/or LED in high ceilings.

6J-4.5.3 Pictures on walls

Use directional floods.

6J-4.6 Foyers, Halls or Corridors

Fixtures shall be 2 x 2 foot or 2 x 4 foot fluorescent with refractive acrylic lens troffer. Use a maximum of three lamps in a fixture.

6J-4.7 Hangars, Warehouses and other High-Height Industrial Areas

6J-4.7.1 General Use

6J-4.7.1.1 < 25 feet: Use LED, LED low bay or T8 fluorescent low bay fixtures.

6J-4.7.1.2 25 to 50 feet: Use LED high bay or T5HO fluorescent high bay fixtures.

6J-4.7.1.3 > 50 feet: Use LED high bay fixtures.

6J-4.7.2 Aisle Lighting in Warehouses

6J-4.7.2.1 Use fixtures as indicated for General Use.

6J-4.7.2.2 Add aisle lighting with high racks. Use fixture with elongated narrow asymmetric or wide asymmetric lighting pattern. Install light fixtures between racks and in each aisle. Run conduit parallel with aisles

6J-4.7.2.3 When low racks are present, follow General Use layout.

6J-4.8 Interior Sports Areas

Fixtures shall be LED or fluorescent.

6J-4.9 Janitor Rooms

Provide fluorescent fixture with a wrap-around lens. Switch fixture inside room.

6J-4.10 Mechanical and Electrical Rooms

6J-4.10.1 Provide open industrial fluorescent lighting with 28-watt T8 lamps. Fixture shall be of a type that requires a forced movement along the longitudinal axis of the lamp for insertion and removal of the lamp.

6J-4.10.2 These lights shall be switched. Do not turn off lighting that provides illumination for working spaces about electrical service equipment such as switchboards, panelboards, or motor control centers with occupancy sensors, vacancy sensors or timers.

6J-4.10.3 Provide wire cage for fixtures with lens or bare tubes to cover the bottom of the fixture irrespective of height. Provide safety chain for pendant mounted fixtures.

6J-4.11 Restrooms

6J-4.11.1 On Acoustical Ceilings

2’ x 4’ fluorescent is preferred, with refractive acrylic lens troffer or LED 2’ x 2’ or 2’ x 4’ with appropriate mounting hardware may be used.

6J-4.11.2 On Gypsum Ceilings

2’ x 4’ fluorescent is preferred, with refractive acrylic lens troffer, except use ceiling brackets provided by the manufacturer for gypsum ceilings or LED 2’ x 2’ or 2’ x 4’ with appropriate mounting hardware may be used.

6J-4.11.3 Over Mirrors

Provide supplemental lighting directly over all mirrors. No incandescent lamps are to be used.

6J-5 RENOVATION AND DEMOLITION

6J-5.1 Renovation

6J-5.1.1 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-5.1.2 If the ceiling is being replaced during renovation, replace the light fixtures and associated wiring.

6J-5.1.3 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-5.1.4 Solar lights are not allowed except in limited circumstances as approved by 78 CEG.

6J-5.2 Demolition

6J-5.2.1 If use of an area is being changed, remove fixtures (and associated wiring and /or conduit) back to the panel and recycle.

6J-5.2.2 Follow all recycling guidance provided by Environmental (Chapter 2)

SECTION 6K

ELECTRICAL ENGINEERING ELEMENTS

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 in order 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 foot 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

ELECTRICAL ENGINEERING ELEMENTS

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.

Traffic Signal Pole with Two Mast Arms And Pedestrian Signal

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 on 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.

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 cross road, 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 cross road, then cycle. For roads intersecting Robins Parkway provide a blinking red light from 1800 to 0500 hrs.

Appendix A
CRITERIA REFERENCE DOCUMENTS

This publication posts that most recent edition of each listed document at the time of publication. A more recent version may have been published. Unless otherwise specified, the most recent edition of the referenced publication applies.

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
AIR FORCE FEDERAL ACQUISITION REGULATIONS SUPPLEMENT (AFFARS)								
AFFARS Part 5352.223-9000	Elimination of Use of Class I Ozone Depleting Substances (ODS)			x			x	
AIR FORCE GUIDANCE								
AFCEC A-GRAM 17-01	Change to AF New Construction and Major Renovation Certification Requirements	Feb-17	x	x	x	x	x	x
SDD Memo	Air Force Sustainable Design Development (SDD) Implementing Guidance Memorandum	6/2/2011		x			x	
SBP Memo	Department of Defense Sustainable Buildings Policy (SBP) Memorandum	11/10/2013		x			x	
AIR FORCE INSTRUCTIONS (AFI)								
AFI 23-204	Organizational Fuel Tanks	2012		x				
AFI 31-101	Integrated Defense	2017				x		x
AFI 32-1021/ AFGM2018-01	Planning and Programming Military Construction (MILCON) Projects	2016/2018		x		x	x	x
AFI 32-1023	Design and Constructing Military Construction Projects	2015				x		
AFI 32-1024	Standard Facility Requirements (w/ change 2) (certified current 2016)	2011/2016				x		
AFI 32-1032/ AFGM2018-01	Planning and Programming Appropriated Fund Maintenance, Repair, and Construction Projects	2015/2018						x
AFI 32-1042	Standards for Marking Airfields	2016			x			
AFI 32-1051	Roof Systems Management	2014				x		
AFI 32-1052	Facility Asbestos Management	2014		x		x		
AFI 32-1053	Integrated Pest Management Program	2014		x		x		
AFI 32-1054	Corrosion Control	2014				x	x	x
AFI 32-1061/ AFGM2018-01	Providing Utilities to U.S. Air Force Installations	2016/2018			x			x
AFI 32-1062	Electrical Systems, Power Plants and Generators	2015						x
AFI 32-1065	Grounding Systems	2017			x			x
AFI 32-1067	Water and Fuel Systems	2015		x	x	x	x	
AFI 32-1068	Heating Systems and Unfired Pressure Vessels	2017					x	
AFI 32-7040	Air Quality Compliance and Resource Management (w/change 1) *(certified current 2016)*	2014/2016		x	x	x		
AFI 32-7042	Waste Management (w/change 1) (certified current 2017)	2014/2017		x	x	x		
AFI 32-7044	Storage Tank Environmental Compliance (w/change 1)	2015/2016		x		x		
AFI 32-7064	Integrated Natural Resource Management (w/change 2)	2014/2016		x		x		
AFI 32-7065	Cultural Resources Management (w/change 1)	2014/2016		x		x		
AFI 32-7086	Hazardous Materials Management	2015		x		x		
AFI 32-10112	Installation Geospatial Information and Services (Installation GI&S)	2018	x					
AFI 48-144	Drinking Water Surveillance Program	2014			x		x	
AFI 91-202 AFGM2018-01	The Air Force Mishap Prevention Program (w/change 1)	2015/2017 /2018	x	x	x	x	x	x
AIR FORCE MANUALS (AFMAN) / AIR FORCE PAMPHLETS (AFPAM)								
AFMAN 32-1072_IP	Water-Well Drilling Operations *(certified current)*	2008/2018			x		x	

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
AFPAM 90-803	*Risk Management (RM) Guidelines and Tools (certified current)*	2013/2017	x					
AFMAN 91-201	Explosives Safety Standards *(certified current)*	2011/2017			x			
AFMAN 91-203	Air Force Occupational Safety, Fire, and Health Standards	2018	x	x	x	x	x	x
AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)								
AASHTO LTS-6	Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition	2013/2015			x			x
AMERICAN CONCRETE INSTITUTE INTERNATIONAL (ACI)								
ACI 318-19	Building Code Requirements for Structural Concrete	2019			x			
ACI 530/530.1-13	Building Code Requirements for Masonry Structures	2013			x			
ARCHITECTURAL BARRIERS ACT / ACCESS BOARD								
2010 ADAAG	ADA (Americans with Disabilities Act) Standards for Accessible Design	2010				x		
AMERICAN IRON AND STEEL ASSOCIATION (AISI)								
AISI D100-13	Cold-Formed Steel Design Manual	2013/2014			x			
AISI S100-12	North American Specification for the Design of Cold-Formed Steel Structural Members	2012			x			
AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)								
ANSI/ASME A13.1	Scheme for the Identification of Piping Systems	2007/2015	x				x	
ANSI/ASSE A10.1	Pre-Project & Pre-Task Safety and Health Planning	2011	x					
ANSI/ASSE Z359.1	Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components	2007	x					
ANSI/ASSE Z490.1	Criteria for Accepted Practices in Safety, Health and Environmental Training	2016	x					
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) STRUCTURAL ENGINEERING INSTITUTE (SEI)								
ASCE/SEI 7-10	Minimum Design Loads for Buildings and Other Structures	2010/2017			x			
SEI/ASCE 37-2014	Design Loads on Structures During Construction	2014			x			
AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)								
ASHRAE Std. 62.1	Ventilation for Acceptable Indoor Air Quality	2016				x	x	
ASHRAE Std. 90.1	Energy Standard for Buildings Except Low-Rise Residential Buildings	2016				x	x	x
AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)								
ASME 19.1-2013	Test Uncertainty – Performance Test Codes	2005/2013					x	
ASME BPVC15	Boiler and Pressure Code Section VIII Pressure Vessels	2015					x	
ASME PTC 19.3 TW-2016	Thermowells – Performance Test Codes	2010/2016					x	
ASME PTC-10-1997	Performance Test Code on Compressors and Exhausters	1997/2014					x	
ASTM INTERNATIONAL								
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials	2016	x					
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials	2016	x					

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
ASTM C840-16	Standard Specification for Application and Finishing of Gypsum Board					x		
AMERICAN WOOD COUNCIL (AWC)								
ANSI/AWC NDS-2015	National Design Specification (NDS) for Wood Construction	2015			x			
AMERICAN WELDING SOCIETY (AWS)								
AWS D1.1	Structural Welding Code - Steel	2015			x			
AWS D1.3	Structural Welding Code - Sheet Steel	2018			x			
AWS D1.4	Structural Welding Code - Steel Reinforcing Bars	2018			x			
COMPRESSED AIR AND GAS INSTITUTE (CAGI)								
Sixth Edition	Compressed Air and Gas Handbook						x	
DEPARTMENT OF DEFENSE (DOD)								
DODI 4170.11	Installation Energy Management	2009/2016					x	x
DODI 8500.01	Cybersecurity	2014					x	x
DODI 8510.01	Risk Management Framework (RMF) for DoD Information Technology	2014/2016					x	x
DoD Supplement MUTCD	DoD Supplement to the National Manual on Uniform Traffic Control Devices (MUTCD) for Street and Highway	2015					x	x
MDMP	SAF/IE, Air Force Meter Data Management Plan	2014					x	x
NDAA 2010	National Defense Authorization Act	2010						
Utilities Meter Policy	Undersecretary of Defense Utilities Meter Policy	2013					x	x
DRYWALL FINISHING COUNCIL INCORPORATED (DWFC)								
	Method for Inspecting Interior Joint Treated Gypsum Panel Surfaces	2009				x		
	Recommended Levels of Paint Finish over Gypsum Board	2009				x		
	Recommended Surface Treatment for Finishing Gypsum Board to Attain a Level 5 Finish	2010				x		
[US ARMY CORPS OF ENGINEERS] **ENGINEER MANUALS (EM)**								
EM-385-1-1	Safety and Health Requirements Manual	2014	x				x	x
[US ARMY CORPS OF ENGINEERS] **ENGINEERING AND CONSTRUCTION BULLETIN**								
ECB 2017-22	Electronic Red-lines, As-builts, and Record Drawings	2017	x					
ECB 2018-10	HVAC Changes – HVAC Systems UFC, HVAC-HVAC Controls TCX and Thermal Insulation Specification	2018	x				x	x
ECB 2018-11	Control System Cybersecurity Coordination Requirement	2018					x	x
[UNITED STATES (US)] **ENVIRONMENTAL PROTECTION AGENCY (EPA)**								
40 CFR 61	National Emission Standards for Hazardous Air Pollutants			x				
40 CFR 82 Subpart E	The Labeling of Products Using Ozone-Depleting Substances	1995/2016		x				
40 CFR 141.43 Section 1417	Safe Drinking Water Act (SDWA) Reduction in Lead Drinking Water Act (RLDWA) Community Fire Safety Act of 2013	1986/1996, 2011, 2013		x	x		x	
40 CFR 261	Identification and Listing of Hazardous Waste			x				

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
40 CFR 262	Standards Applicable to Generators of Hazardous Waste			x				x
40 CRF 280.60-67				X				
42 USC 6962	Resource Conservation and Recovery Act (RCRA, Section 6002)	1994		x				
42 USC 7401	Clean Air Act (CAA)	1970/1977		x				
49 CFR 173	Hazardous Materials Regulations: Shippers—General Regulations for Shipments and Packaging			x				
EISA	Energy Independence and Security Act (EISA) of 2007 (Public Law 110-140-Dec. 19, 2007)	2007		x				x
EPA 841-B-09-001	Technical Guidance on Implementing the Stormwater Runoff Requirements under Federal Projects and Section 438 of the Energy Independence and Security Act (EISA)	2009		x	x			x
(AIR FORCE) **ENGINEERING TECHNICAL LETTERS (ETL)**								
ETL 01-18	Fire Protection Engineering Criteria - Electronic Equipment	2001 Active					x	x
ETL 04-4	Trenchless Technology (TT) for Crossing Air Force Pavements(w/change 1)	2004 Active			x		x	
ETL 04-05	Design Recommendations for Potable Water System Security (FOUO)	2004 Active			x		x	
ETL 14-1	Construction and Operation and Maintenance Guidance for Storm Water Systems	2014 Active		x	x			
ETL 94-6	Fire Protection Engineering Criteria and Technical Guidance - Removal of Halogenated Agent Fire Suppression Systems (w/change 1)	1994 Active		x			x	
ETL 95-1	Halon 1301 Management Planning Guidance (w/change 1)	1995 Active		x	x		x	
FEDERAL AVIATION ADMINISTRATION (FAA) ADVISORY CIRCULAR (AC)								
FAA AC 150/5320-5D	Airport Surface Drainage Design	8/15/2013		x				
FEDERAL ACQUISITION REGULATIONS (FAR)								
FAR Part 23.404	Use of Recovered Materials and Bio-based Products, Agency Affirmative Procurement Programs			x				
FAR Part 52.223-11	Ozone-Depleting Substances and High Global Warming Potential Hydrofluorocarbons.			x				
FEDERAL POLICY								
EPACT 2005	Energy Policy Act	2005				x	x	x
Executive Order 13514	Federal Leadership in Environmental, Energy and Economic Performance	2009		x		x	x	x
Executive Order 13834	Efficient Federal Operations	2018		x		x	x	x
FEDERAL HIGHWAY ADMINISTRATION (FHA)								
MUTCD	Manual on Uniform Traffic Control Devices (MUTCD) - Rev 2	2009/2012			x	x		x
GYPSUM ASSOCIATION (GA)								
GA-214-2015	Recommended Levels of Finish - Gypsum Board					x		
GA-214-2017	Quick Reference Guide					x		
GA-216-2013	Application and Finishing of Gypsum Panel Products					x		
GEORGIA DEPARTMENT OF NATURAL RESOURCES (GA DNR) ENVIRONMENTAL PROTECTION DIVISION (EPD)								

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
Georgia Rule 391-3-1	Georgia Air Quality Rules: Air Quality Control	/2016		x				
Georgia Rule 391-3-4	Solid Waste Management	/2016		x				
Georgia Rule 391-3-11	Hazardous Waste Management	/2016		x				
Georgia Rule 391-3-14	Asbestos Removal and Encapsulation	/2016		x				
Georgia Rule 391-3-15				x				
Notice of Intent (NOI)	National Pollutant Discharge Elimination System (NPDES) General Permit No. GAR 100001, 100002 & 100003	2015		x	x			
OCGA 12-8-20	Georgia Comprehensive Solid Waste Management Act of 1990	1990/2004		x				
GSMM (Blue Book)	Georgia Stormwater Management Manual Vol. 1, 2 & 3	2016 Edition		x	x			
Rev: 517200.OES.2.0 2ND Edition	Minimum Standards for Public Water Systems	2000			x			
SB 370	Georgia's Water Stewardship Act	2010/2012			x		x	
Georgia State Minimum Standard Plumbing Code	Georgia State Amendments to the International Plumbing Code (IPC) published by the International Code Council (ICC)	2012/2015					x	
GEORGIA DEPARTMENT OF TRANSPORTATION (GDOT)								
GDOT	Traffic Signal Design Guidelines	2016						x
GEORGIA SOIL AND WATER CONSERVATION COMMISSION (GSWCC)								
Green Book	Manual for Erosion and Sedimentation Control in Georgia	2016 Edition		x	x			
HOUSTON COUNTY, GEORGIA								
	Water Resources Protection Ordinance for Houston County, GA	2005		x				
Local Design Manual (LDM)	Stormwater Local Design Manual for Houston County, GA	2005		x				
INTERNATIONAL ASSOC. OF PLUMBING AND MECHANICAL OFFICIALS (IAMPO)								
2015 UPC	Uniform Plumbing Code® (UPC)	2015					x	
INTERNATIONAL ACCREDITATION SERVICE® (IAS)								
AC472	IAS Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems (AC472).		x					
INTERNATIONAL CODE COUNCIL (ICC)								
2015 IBC®	International Building Code (IBC)	2018			x	x		x
ICC	ICC Performance Code™ for Building and Facilities	2018				x		
IFC	International Fire Code	2018				x		
IPC	International Plumbing Code	2018					x	
ILLUMINATING ENGINEERING SOCIETY(IES)								
ANSI/IES RP-8-18	Design and Maintenance of Roadway and Parking Facility Lighting	2018						x
HB-10-11	The Lighting Handbook, 10th Edition	2011						x
METAL BUILDING MANUFACTURERS ASSOCIATION (MBMA)								
MBMA	Metal Building Systems Manual	2012	x		x			
NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE®) INTERNATIONAL								
	NACE® International Standard Practice	Latest Editions						x
NATIONAL ELECTRICAL SAFETY CODE (NESC)								
IEEE-C2-2017	National Electrical Safety Code® (NESC®)	2012/2017						x
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)								

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
NFPA 1	Uniform Fire Code	2018				x	x	x
NFPA 13	Standard for the Installation of Sprinkler Systems	2019					x	x
NFPA 30A	Code for Motor Fuel Dispensing Facilities and Repair Garages	2018					x	x
NFPA 37	Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines	2018						x
NFPA 70®	National Electrical Code® (NEC)	2017					x	x
NFPA 70E®	Standard for Electrical Safety in the Workplace®	2018					x	x
NFPA 72®	National Fire Alarm and Signaling Code®	2019					x	x
NFPA 75	Standard for the Fire Protection of Information Technology Equipment	2017					x	x
NFPA 77	Recommended Practice on Static Electricty	2019						x
NFPA 101®	Life Safety Code®	2018				x	x	x
NFPA 241	Standard for Safeguarding Construction, Alteration, and Demolition	2019					x	x
NFPA 780	Standard for the Installation of Lighting Protection Systems	2020						x
NFPA 850	Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations	2015						x
NFPA 5000®	Building Construction and Safety Code®	2018			x		x	x
NATIONAL INSTITUTE FOR CERTIFICATION IN ENGINEERING TECHNOLOGIES (NICET)								
NICET®	National Institute for Certification in Engineering Technologies							x
NATIONAL INSTITUTE OF BUILDING SCIENCES								
NCS V6	United States (US) National CAD Standard (NCS)®- V6	2014	x					
OCCUPATIONAL SAFETY AND HEALTH STANDARDS (OSHA)								
29 CFR 1910	Occupational Safety and Health Standards		x	x				
OSHA Std No. 1910.95	Occupational Noise Exposure						x	
1910.303	General							x
29 CFR 1926	Safety and Health Regulations for Construction		x	x				
OSHA 3146-05R	Fall Protection in Construction		x					
PAINTING CONTRACTORS ASSOCIATION								
Industry Standards	PDCA Industry Standards	2019				x		
ROBINS AFB STANDARDS								
Best Practices	Best Practices for Landscaping at Robins Air Force Base (AFB)	2011		x	x	x		
ROBINS AFB GPP	Green Procurement Program (GPP) Plan	2007		x				
ROBINS AFB IDP 31-101 (FOUO)	Robins AFB Integrated Defense Plan	2018						x
STEEL DECK INSTITUTE (SDI)								
ANSI/SDI No. FDDM	Floor Deck Design Manual First Edition	2014/2015			x			
ANSI SDI No. DDM04	Diaphragm Design Manual Fourth Edition	2015/2015			x			
TELECOMMUNICATIONS INDUSTRY ASSOCIATION / ELECTRONIC INDUSTRIES ALLIANCE (TIA/EIA)								

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
TIA-568 Rev. D	Balanced Twisted-Pair Telecommunications Cabeling and Components Stds.	2018						x
TIA-569 Rev. E	Telecommunications Pathways and Spaces	2019						
TIA-570 Rev. D	Residential Telecommunication Infrastructure Standard	2018						x
TIA 606C	Adminstrative Standard for Telecommunicaitons Infrastructure	2017						x
TIA-607 Rev. C	Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises	2015						x
UNITED FACILITIES CRITERIA (UFC)								
UFC 1-200-01	DoD Building Code (General Building Requirements) (w/change 2)	2016/2018	x	x	x	x	x	x
UFC 1-200-02	High Performance and Sustainable Building Requirements (w/change 3)	2016/ 2018	x	x	x	x	x	x
UFC 1-300-01	Criteria Format Standard	2006/2018				x		
UFC 1-300-02	Unified Facilities Guide Specifications (UFGS) Format Standard (w/change 2)	2014/2019				x		
UFC 1-300-07A	Design Build Technical Requirements	2005				x		
UFC 1-300-08	Criteria for Transfer and Acceptance of DoD Real Property (w/change 2)	2009/2011				x		
UFC 3-101-01	Architecture (w/change 4)	2011/2019				x		
UFC 3-110-03	Roofing (w/change 3)	2012/2019				x		
UFC 3-110-04	Roofing Maintenance and Repair	2007				x		
UFC 3-120-01	Air Force Sign Standard (w/change 3)	2014/2017				x		
UFC-3-120-10	Interior Design	2018				x		
UFC 3-190-06	Protective Coatings and Paints	2004				x		x
UFC 3-201-01	Civil Engineering (w/change 1)	2018/2019			x	x		
UFC 3-201-02	Landscape Architecture (w/change 1)	2009/2009			x	x		
UFC 3-210-10	Low Impact Development, (LID) (w/change 1)	2015/2016		x	x	x		
UFC 3-220-01	Geotechnical Engineering	2012			x	x		
UFC 3-220-04FA	Backfill for Subsurface Structures	2004			x			
UFC 3-220-05	Dewatering and Groundwater Control	2004			x			
UFC 3-220-10N	Soil Mechanics	2005			x			
UFC 3-230-01	Water Storage, Distribution, and Transmission (w/change 1)	2018/2018			x	x		
UFC 3-230-02	Operation and Maintenance: Water Supply Systems	2001			x			x
UFC 3-230-03	Water Treatment (w/change 1)	2012/2018			x			
UFC 3-240-01	Wastewater Collection (w/change 2)	2012/2019			x	x		
UFC 3-240-02	Domestic Wastewater Treatment (w/change 1)	2012/2019			x			
UFC 3-240-13FN	Industrial Water Treatment Operation and Maintenance	2005			x			
UFC 3-250-01	Pavement Design for Roads, Streets, Walks and Open Storage Areas	2016			x			
UFC 3-250-03	Standard Practice Manual for Flexible Pavements	2018			x			

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
UFC 3-250-04	Standard Practice for Concrete Pavements (w/ch 2)	2004/2009			x			
UFC 3-250-11	Soil Stabilization for Pavements	2004			x			
UFC 3-260-01	Airfield and Helicopter Planning and Design	2019			x			x
UFC 3-260-04	Airfield and Helicopter Marking	2018			x			
UFC 3-301-01	Structural Engineering (w/change 4)	2013/2018	x	x	x	x		
UFC 3-110-03	Roofing (w/change 3)	2012/2019			x	x		
UFC 3-310-04	Seismic Design for Buildings (w/change 1)	2013/2016		x	x	x		
UFC 3-310-08	Non-Expeditionary Bridge Inspection, Maintenance and Repair	2018		x	x	x		
UFC 3-320-06A	Concrete Floor Slabs on Grade Subjected to Heavy Loads	2005		x	x	x		
UFC 3-340-01	Design and Analysis of Hardened Structures to Conventional Weapons Effects (FOUO)	2002		x	x	x		
UFC 3-340-02	Structures to Resist the Effects of Accidental Explosions (w/change 2)	2008/2014		x	x	x		
UFC 3-400-02	Design: Engineering Weather Data	2018					x	
UFC 3-401-01	Mechanical Engineering (w/change 1)	2013/2015,				x	x	x
UFC 3-410-01	Heating, Ventilating, and Air Conditioning Systems (w/change 4)	2013/2017				x	x	x
UFC 3-410-02	Direct Digital Controls for HVAC and Other Building Control Systems	2018					x	x
UFC 3-410-04	Industrial Ventilation	2017					x	
UFC 3-420-01	Plumbing Systems (w/ ch 10)	2004/2015				x	x	x
UFC 3-420-02FA	Compressed Air (w/ch 1)	2003/2007					x	
UFC 3-430-01FA	Heating and Cooling Distribution Systems	2003					x	
UFC 3-430-11	Boiler Control Systems	2001					x	
UFC 3-450-01	Noise and Vibration Control	2003				x		
UFC 3-460-01	Design: Petroleum Fuel Facilities (w/ change 3)	2010/2018					x	x
UFC 3-470-01	Utility Monitoring and Control System (UMSC) Front End and Integration	2018				x	x	x
UFC 3-501-01	Electrical Engineering	2015	x			x	x	x
UFC 3-520-01	Interior Electrical Systems (w/change 1)	2015/2019				x	x	x
UFC 3-530-01	Interior and Exterior Lighting Systems and Controls (w/ch 3)	2015/2016				x		x
UFC 3-535-01	Visual Air Navigation Facilities (w/change 1)	2017/2018						x
UFC 3-540-01	Engine-Driven Generator Systems for Backup Power Applications (w/change 1)	2014/2017						x
UFC 3-550-01	Exterior Electrical Power Distribution (w/change 2)	2016/2019				x		x
UFC 3-560-01	Operations and Maintenance: Electrical Safety (w/change 1)	2017/2018				x		x
UFC 3-570-01	Cathodic Protection (w/change 1)	2016/2019						x
UFC 3-570-06	Operation and Maintenance: Cathodic Protection Systems	2019						x

Regulation	Description	Yr Published/ Last Updated	1	2	3	4	5	6
UFC 3-575-01	Lightning and Static Electricity Protection Systems	2012						x
UFC 3-580-01	Telecommunications Interior Infrastruccture Planning and Design (w/change 1)	2016/2016				x	x	x
UFC 3-600-01	Fire Protection for Facilities (w/change 3)	2016/2019				x	x	x
UFC 3-740-05	Handbook: Construction Cost Estimating (w/change 1)	2010/2011				x		
UFC 4-010-01	DoD Minimum Antiterrorism Standards for Buildings	2018		x	x	x	x	x
UFC 4-010-02	DoD Minimum Antiterrorism Standoff Distances for Buildings (FOUO)	2012				x		
UFC 4-010-05	Sensitive Compartmented Information Facilities, Planning, Design & Construction (w/change 1)	2013/2013			x	x	x	
UFC 4-010-06	Cybersecurity and Facility Related Control Systems (w/change 1)	2016/2017			x	x	x	x
UFC 4-020-01	DoD Security Engineering Facility Planning Manual	2008				x	x	x
UFC 4-020-02FA	Security Engineering Concept Design (FOUO)	2005						x
UFC 4-021-01	Design and O&M: Mass Notification Systems (w/change 1)	2008/2010				x		x
UFC 4-021-02	Electronic Security Systems	2013						x
UFC 4-22-02	Selection and Application of Vehicle Barriers (w/change 1)	2009/2010				x		
UFC 4-22-03	Security Fences and Gates	2013				x		
UFC 4-023-03	Design of Buildings to Resist Progressive Collapse (w/change 3)	2009/2016		x	x	x		
UFC 4-023-07	Design to Resist Direct Fire Weapons Effects (w/change 1)	2008/2017				x		
UFC 4-211-01	Aircraft Maintenance Hangars (w/change 1)	2017/2017				x		
UFC 4-211-02	Aircraft Corrosion Control and Paint Facilities	2012					x	x
UFC 4-440-01	Warehouses and Storage Facilities	2014/2019				x		
UFC 4-610-01	Adminstrative Facilities (w/change 2)	2008/2014				x		
UFC 4-832-01N	Design: Industrial and Oily Wastewater Control	2004			x			
Unified Facilities Guide Specification (UFGS)								
			x	x	x	x	x	x
UNITED STATES CODE (USC)								
42 USC 7671j(b)(c)(d)	Labeling / Class I and Class II Substances	1990/2015		x				
USC Section 136 et seq.	Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)	1996			x			
UNITED STATES GYPSUM COMPANY (USG)								
	The Gypsum Construction Handbook, 7th Edition	2014				x		

Appendix B
FORMS

ROBINS AFB BASE FACILITY STANDARD ***WAIVER REQUEST***	**BFS Form 1-1**

TO: *(78 CEG/CEN Workflow)*	**FROM:** *(Contractor / Requester)*	DATE *(YYYYMMDD)*
CONTRACT NUMBER	SUBMISSION NUMBER	SUBMITTAL ☐ NEW ☐ RESUBMITTAL
PREVIOUS SUBMISSION NUMBER	PROJECT NUMBER	

TO BE COMPLETED BY CONTRACTOR/REQUESTER			**FOR GOVERNMENT USE ONLY**			
ITEM NO.	SPECIFICATION SECTION/ PARA NO./DRAWING NO.	DESCRIPTION OF MATERIAL *(Include Type, Model Number, Catalog Number, Mfg., etc.)*	AP-PROVED	DISAP-PROVED	SEE REVERSE	INITIAL

BY COMPLETING THIS FORM, THE UNDERSIGNED CONTRACTOR CERTIFIES THAT THE MATERIAL COMPLIES WITH ALL SPECIFICATIONS OF SUBJECT CONTRACT.

DATE *(YYYYMMDD)*	TYPE OR PRINT NAME AND TITLE	SIGNATURE

FOR GOVERNMENT USE ONLY

TO: *(Base Civil Engineering Officer)*

For Evaluation and Action

DATE *(YYYYMMDD)*	TYPE OR PRINT NAME AND GRADE	SIGNATURE

TO: *(78 CEG/CEN)*

RECOMMEND ☐ APPROVAL ☐ DISAPPROVAL AS INDICATED ABOVE AND SUBJECT TO ANY APPLICABLE COMMENTS ON THE REVERSE

DATE *(YYYYMMDD)*	TYPE OR PRINT NAME AND GRADE	SIGNATURE

TO: *(Contractor / Requester)*

☐ APPROVED ☐ DISAPROVED AS INDICATED ABOVE AND SUBJECT TO ANY APPLICABLE COMMENTS ON THE REVERSE SIDE. REQUEST RESUBMITTAL ON DISAPPROVED ITEMS WITHIN DAYS OF DATE SHOWN BELOW.

DATE *(YYYYMMDD)*	TYPE OR PRINT NAME AND GRADE	SIGNATURE

Houston County MSW Landfill
2018 Kings Chapel Road
Perry, Georgia 31069
Telephone: (478) 987-0089 Fax: (478) 987-0102

Profile No:_____
(Assigned by Houston County)

SPECIAL WASTE ACCEPTANCE APPLICATION (SWAA)

Generator Name: _____Contact:_____
Address:_____
Telephone:_____Fax:_____
Description of Waste:_____
Source / Location of Waste: _____
Waste Quantity:_____Cubic Yards ☐ Tons ☐
Frequency of Disposal: Daily ☐ Weekly ☐ Monthly ☐ One Time ☐ Other _____

LABORATORY DATA (Please attach a hard copy of laboratory test data)

Physical Properties: Physical State:_____Solid ☐ Semisolid ☐ Liquid ☐ Color:_____
Halogenated Organics: mg/kg Flash Point: _____☐F Odor: Yes ☐ No ☐
Water Content: _ % by Weight Paint Filter Test Passed ☐ Failed ☐
Reactive: No ☐ Yes ☐ With H2S ___ mg/kg HCN _____ mg/kg Others _____ mg/kg
pH Value: _____(S.U.) Infectious: Yes ☐ No: ☐
Chemical Properties (TCLP): (Concentrations in mg/l)

Arsenic	___	m-Cresol	___	Hexachlorobenzene	___	Pyridine	___
Barium	___	p-Cresol	___	Hexacholorobutadiene	___	Selenium	___
Benzene	___	Total Cresol	___	Hexachloroethane	___	Silver	___
Cadmium	___	2,4-D	___	Lead	___	Tetrachloroethene	___
Carbon Tetrachloride	___	1,4 Dichlorobenzene	___	Lindane	___	Toxaphene	___
Chlordane	___	1,2 Dichloroethane	___	Mercury	___	Trichloroethene	___
Chlorobenzene	___	1,1 Dichloroethylene	___	Methoxychlor	___	2,4,5 Trichlorophenol	___
Chloroform	___	2,4 Dinitrotoluene	___	Methyl Ethyl Ketone	___	2,4,6 Trichlorophenol	___
Chromium	___	Endrin	___	Nitrobenzene	___	2,4,5TP (Silvex)	___
o-Cresol	___	Heptachlor (a hydroxide)	___	Pentachlorophenol	___	Vinyl Chloride	___

None of the above constituents exceed TCLP disposal limits_____
Others (List) _____
Other Information: Delivery method: Bulk ☐ Other_____
Regulatory Agency Approval Received: Yes ☐ No ☐ Permit Number_____
Material Safety Data Sheet Provided: Yes ☐ No ☐

Generator's Certification Statement

"I certify under penalty of law that this document and all attachments were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. To the best of my knowledge, the material described above is not classified as hazardous waste under current regulations, and I agree to notify Houston County MSW Landfill if such classification changes. The attached information provided is true and accurate to the best of my knowledge."

Signature of Authorizing Agent_____Date_____

Name of Agent (Typed or Printed) _____Title_____

WASTE MANAGEMENT REPORT (MONTHLY)

Contract Number _____
Contractor _____
Contractor POC: _____
Phone No: _____

Government Inspector: _____
Project # Title: _____
Date: _____

I. MSW Landfill Disposal

Quantity (tons): _____
Landfill Site: _____
Tip fee/ton ($/ton): _____
*Total cost of disposal ($): _____
*Total cost/ton ($/ton): _____

II. C&D Landfill Disposal

Quantity (tons): _____
Landfill Site: _____
Tip fee/ton ($/ton): _____
*Total cost of disposal ($): _____
*Total cost/ton ($/ton): _____

III. Inert Landfill Disposal

Quantity (tons): _____
Landfill Site: _____
Tip fee/ton ($/ton): _____
*Total cost of disposal ($): _____
*Total cost/ton ($/ton): _____

IV. Alternatives to Landfilling (Recycling Strongly Encouraged)

Type of Material	Quantity (pounds or tons)	Destination	* Handling & Transportation Cost ($)	*Expected Revenue & Tip Fee Earnings ($)	* Net Cost ($)	*Cost if Landfilled ($)	* Comparison Cost (+)/Savings (-)
Cardboard							
Dimensional wood							
Beverage containers							
Land debris							
Concrete							
CMU							
Asphalt							
Metals - all types							
Gypsum board							
Paint							
Carpet							
Insulation							
Glass							
Cast stone							
Wood materials							
Electric cable							
PVC piping							
Rubber flooring							
Raised flooring							

IV. Total net cost (+) or savings (-) from all alternatives to landfilling all project waste _____

V. Means of keeping recyclables free of contamination
All similar materials will be grouped together based on the requirements of the recycling center.
All dissimilar materials will be kept in separate containers/bins in order to avoid contamination.

VI. Meetings to be held to address waste management
At regularly scheduled job site coordination/progress meetings and at job safety meetings, waste
discussed to clarify any confusion with craftspeople.

* Optional

BFS Form 2-3

Houston County MSW Landfill
2018 Kings Chapel Road
Perry, Georgia 31069
Telephone: (478) 987-0089

Profile No:_____
(Assigned to SWAA)

WASTE SHIPMENT TRACKING DOCUMENT

Generator Name:_____ Contact: _____
Address: _____
Telephone: _____ Fax: _____
Description of Waste: _____
Location of Waste: _____

Date Shipped: _____ Quantity Shipped: _____

Certification: I certify the waste described above is the waste represented by the Special Waste Acceptance Application (SWAA) of the same Profile Number and no regulated hazardous waste has been introduced into the waste.

Generator's Signature: _____ Date: _____

Transporter: _____ Contact: _____
Address: _____
Telephone: _____

Certification: I certify no regulated hazardous waste was introduced into the waste while in my custody:

Hauler's Signature: _____ Date: _____

Waste Disposal Site: Houston County MSW Landfill

Quantity Received: _____

Certification: I certify receipt and proper disposal of the Special Waste Profiled materials covered by this manifest.

Operator's Printed Name: _____

Operator's Signature: _____ Date: _____

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1 2 3 4 5 6 7 23 24 25 26 27 28 29 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

DOCUMENT IDENTIFIER | RI FROM & M S | UNIT OF ISSUE | QUANTITY | SER | SUPPLEMENTARY ADDRESS | SIGN | FUND | DISTRIBUTION | PROJECT | PRIORITY | REQUIRED DELIVERY DATE | RI | OCM/OGPND

1. TOTALPRICE — DOLLARS | CTS

2.SHIPFROM

3.SHIPTO

4. MARK FOR

UNIT PRICE — DOLLARS | CTS

5. DOC DATE

6. NMFC

7. FRT RATE

8. TYPE CARGO

9. PS

10. QTY. REC'D

11.UP

12. UNIT WEIGHT

13. UNIT CUBE

14. UFC

15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

18. TY CONT

19. NO CONT

20. TOTAL WEIGHT

21. TOTAL CUBE

22. RECEIVED BY

23. DATE RECEIVED

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) [illegible]

27. ADDITIONAL DATA

Reset

Adobe Designer 7.0

BFS Form 6-1

APPENDIX
DATA FORM

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/cm^2, 2 = 8 cal/cm^2, 3 = 25 cal/cm^2, 4 = 40 cal/cm^2.
   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 6-2

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	4. Meets requirements?
		☐ Integral ☐ Mast ☐ Catenary	☐Yes ☐No

5. Ground ring electrode installed?	5.a. Material	5.b. Size	5.c. Depth	5.d. Distance
☐Yes ☐No				

6. Ground rods installed?	6.a. Diameter	6.b. Length	6.c. Depth	6.d. Material	6.e. Quantity
☐Yes ☐No					

7. Zone of protection met?	7a. Drawings included?	8. Surge suppression installed?	8a. Type of Surge Suppression
☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	

9. Resistance check accomplished?	9a. Within acceptable limits?	10. Protrusions < 3/16"protected?	10a. Protrusions ≥3/16" bonded?
☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	

Section II - Down Conductor (DC) Specifications

11. Size	12. Material	13. Quantity	14. Bend Radius ≥8"?
			☐Yes ☐No

15. Spacing	16. Protected?	16a. Material	16b. Bonded?
	☐Yes ☐No		☐Yes ☐No

Section III - Air Terminal (AT) Specifications

17. Height	18. Supported	19. Diameter	20. Type
	☐Yes ☐No		☐ 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