APPENDIX M

BASE FACILITY STANDARD

Revisers: Please annotate your actions on the Revision Notes page right after the MILCON Introduction page.

***** Project Manager:

The first two title pages are for firms working for us in the 78 CEG.

The next two title pages after that are for firms doing MILCON designs.

The pages after that apply to all designs, including in-house projects.

BASE FACILITY STANDARD (BFS) -- ROBINS AFB, GA

FOR ARCHITECTURAL-ENGINEERING FIRMS
PERFORMING DESIGN SERVICES AT ROBINS AFB

MANAGED BY 78 CEG

Revised 22 Jul 2002

INTRODUCTION - FOR BASE MANAGED PROJECTS

This guide is to be treated as an official applicable code. It establishes mandatory requirements for all construction projects at Robins AFB, GA. The authority having jurisdiction is the office of the Base Civil Engineer, 78 CEG/CC. (Under the Base Civil Engineer are two separate Squadrons, 78 CES and 778 CES. Most facility design projects are handled within the 778 CES.) Each section in the guide will identify the person responsible for the standards of that section.

For projects involving depot maintenance facilities such as aircraft hangars and the Avionics Complex, the general oversight is by the Chief of 778 CES/CECM.

For all other projects, the general oversight is by the Chief of 778 CES/CECE.

BASE FACILITY STANDARD (BFS) -- ROBINS AFB, GA

FOR ARCHITECTURAL-ENGINEERING FIRMS
PERFORMING DESIGN SERVICES AT ROBINS AFB

ON MILITARY CONSTRUCTION (MILCON) PROJECTS

Revised 22 Jul 2002

INTRODUCTION - FOR MILCON PROJECTS

This Base Facility Standard is to be treated as an official applicable code. It is a mandatory technical guide that establishes requirements for construction projects at Robins AFB, GA. The "authority having jurisdiction" referenced in standards and codes, such as the National Electrical Code, is the office of the Base Civil Engineer, 78 CEG/CC. Each section in the guide will identify the person responsible for the standards of that section.

For projects involving depot maintenance facilities such as aircraft hangars and the Avionics Complex, the general oversight is by the Chief of 778 CES/CECM.

For all other projects, the general oversight is by the Chief of 778 CES/CECE.

The Design Agent offices of the Army Corps of Engineers (COE) have agreed to incorporate these standards into all designs accomplished for facilities at Robins AFB. Items not addressed in these sections shall be designed per the latest COE guidance and specifications.

General oversight for the Base is by the Base Project Manager identified in the Requirements and Management Plan (RAMP).

DESIGN-BUILD: When the MILCON project is design-build, these standards shall be incorporated into the contract documents as mandatory requirements. The only time they will not apply is when a particular requirement in these is excluded with words such as “In lieu of the requirements in the Robins AFB Base Facility Standard, do (fill in).” When no such words are so stated, then these requirements overrule.

Revision Notes (Starting Jan 2000):

30-Mar-00 Mech Section 11 - Clarified natural gas vs. electric heat, refined VAV specs, and added mech and elec room heat/cool requirements.

14-Apr-00 Added using water motor gongs in mech section.

21-Apr-00 Added more detailed CADD and word processing requirements in the General (G) section. This now requires the COE to provide us a copy of the CADD and spec files within 30 days after the project is awarded for construction.

13-Jun-00 Revised CADD requirements to ensure we receive full sets of as-builts, including unchanged sheets.

16 June 00 Revised structural design references.

17 Oct 00 Strengthened mechanical requirements on emission producing equipment permitting requirements.

15 Nov 00 Added Landscape plant list.

16 Feb 01 General revision for format. Combined smaller related sections and reordered them all. Reformatted some sections to use same paragraph numbering throughout the BFS.

22 Mar 01 We made a comprehensive revision at BCE direction. Details on revisions:
General: Updated several early paragraphs.
Environmental: Minor updates.
Civil: Expanded paragraph on irrigation.
Mech:
Para. 4 – Revised compressed air distribution requirements.
Para. 9b – Changed Mechanical Chief from Richard Eunice to Alan Whitmire.
Para. 11a – Added sub paragraph 3 for outside air requirements.
Para. 11b – Corrected spelling.
Para. 10a – Revised steam and condensate requirements.
Para. 10c – Revised gas piping requirements.
Para. 2b – Revised fire protection requirements.
Para. 7b – Changed Military Handbook 1008 to 1008c.
Para. 8a – Changed from the National Plumbing Code to the Uniform Plumbing Code.
Para. 8b – Revised copper piping requirements.
Para. 10b – Revised chilled water piping requirements.
Para. 10c – Changed requirement of # 14 AWG to # 10 AWG.
Para. 15m – Revised requirement for underground fuel piping.
(Continued)

22 Mar 01 (Cont.)
Elec: Updated lightning protection to add ESE, revised parking and street lighting

01 May 01 Environmental: Minor update to more strongly reference base spec 01560 for Environmental Requirements, even for COE projects, since it lists so many local and state requirements

08 May 01 Civil-Structural: Added note on antennas and other user equipment mounted on roofs and sidewalls.

21 May 01 Civil-Structural: Added note on showing contractor laydown area and trailer location. Added requirement to termite pre-treat new buildings and additions.
Mech: Added note to check structure when adding HVAC and ceiling to existing unconditioned space.

06 Jul 01 Deleted Conflicts paragraph in Electrical on Interior Lighting.

09 Aug 01 Minor update to Standards references in Civil section.

05 Sep 01 Elec Section on Elevators - updated the fire protection criteria based upon latest codes.

8 Nov 01 Revised force protection requirements to incorporate 30 Aug 01 Department of Defense Antiterrorism Construction Standards (Draft)

07 Jun 02 Several changes:
All - Changed office symbols to match reorganization.
General - Added requirement for MS Word copy of structural design analysis
Civil - Added silt screen requirement during construction, spelled out parking lot striping, revised ladder safety devices, revised lawn sprinkler narrative, and mentioned digging permit process
Arch - Listed exterior doors required, clarified grid ceiling layout, and added interior design standards for dormitories
Mech - elaborated on life-cycle-cost analysis considerations, and clarified lavatory and urinal features
Elec - Mentioned directional boring, high mast foundations, TVSS on service entrance, lightning protection update, some system grounds to be 10 ohms or less, lighting clarifications, added occupancy sensors for lighting, and mentioned using small generators for emergency lighting.

10 Jul 02 Minor Editing.

22 Jul 02 Civil - Edited erosion control, road cuts, parking spaces, and added 15" pipe

BASE FACILITY STANDARD FOR ROBINS AFB, GA

INDEX

<<<<< END OF INDEX >>>>>

GENERAL STANDARDS AND DOCUMENTATION

1. GENERAL: This document presents mandatory requirements for all construction projects at Robins AFB, GA. (See Introduction at the beginning of this document.) Several major areas have been pulled out into separate documents to prevent this becoming an encyclopedia that is handed out for even the smallest projects. The following documents are to be treated as part of this standard and used when applicable:

a. Base Architectural Compatibility Standard. This defines exterior treatments regarding colors and materials, as well as related aspects of landscaping and screening.

b. AFPAM 32-1097, Sign Standards. Refer to the CE Sign Shop as the office that interprets and applies the Standards.

c. Procedural Guide for AE Contractors (for base managed projects only). This provides additional administrative requirements that AE (Architect-Engineer) firms must follow.

2. EXCEPTIONS:

a. In general, we seriously discourage exceptions, although we recognize each project presents unique situations that may require approved deviations. Refer questions or exceptions requests to the Chief of Engineering Design, 778 CES/CECE, unless dealing with a particular Section that lists a different responsible person.

b. Any exceptions granted to these requirements shall be noted clearly in the project design analysis.

c. If they are not noted in the design analysis and approved, then the designer must comply with all mandatory requirements in this document. Failures to do so will be considered design errors. Thus, at its option, the Government through the Base Project Manager may require the A-E to correct any errors or omissions or discrepancies in its design at any time after discovery up until construction completion and acceptance. These changes shall be made at no additional cost to the Government and will be considered for AE liability.

3. DESIGN STANDARDS: Design shall conform to latest Air Force design criteria and the Base Comprehensive Plan. In general, the Air Force standards are found in Military Handbook 1190, AFI 32-1023, and Engineering Technical Letters. Certain types of facilities have additional requirements. Verify for each project.

4. DRAWINGS:

a. Design documents shall be provided in MicroStation CADD format, closely conforming to the Tri-Services Standards requirements as well as mandatory Base supplements. The specific format must be IGDS. Copies of the CADD Standards are available from the Waterways Experiment Station web site and the CADD Manager in 778 CES/CEC. More specific info is detailed in the paragraphs below.

b. For Base managed projects use the master drawing sets available, such as cover sheets, borders, title block text, and GIS (Geographic Information System) site plan data.

c. Full-size drawings shall be on size D sheets to accommodate the Robins Micrographics equipment. Size E drawings are too large and shall not be used unless facility size makes D size use impractical. Receive approval from the Base Project Manager prior to using "E" size sheets. All drawings shall have a graphic scale on them.

d. Normally provide separate demolition and installation site plans for all utilities. Include topography when applicable.

e. Electronic Files Delivered after Contract Award (MILCON projects only)

(1) Originals: Provide a complete set of CADD files to RAFB in electronic format upon completion of the design and a revised set within 30 days after the project is awarded for construction if changes were made during bidding. If the contract is design-build, then provide the files within 30 days after the design is considered 100% complete.

(a) General:

1. Provide on 3 ¼" DS/DD floppy disks or CD-ROM all CADD generated drawings in a format fully compatible with the CECE MicroStation CADD system. Comply with all applicable requirements of the latest Robins AFB Civil Engineering CADD Standards.

2. Transfer the electronic files with a transmittal note by certified mail or in person to the Base Project Manager.

(b) Develop project file names according to the Robins AFB Civil Engineering CADD Standards.

(c) Project files shall be delivered to the Government in the project directory structure established by the Robins AFB Civil Engineering CADD Standards. This is currently a main directory named as the project number (such as 980213) and subdirectories as follows:

1. Directory "dgn" includes all dgn files and an index in Microsoft Word format, as described in the Robins AFB Civil Engineering CADD Standards. All dgn files must be in this one common directory, so do not place any dgn files in subdirectories under the "dgn" directory.

2. Directory "spec" includes all Specifications (fully readable in MS Word) and their index.

3. Directory "gov" includes all other required documents, such as cost estimates, bid schedules, design analysis, etc, also fully readable in MS Word or MS Excel.

(3) Mandatory CADD Files Format:

(a) Direct design in .dgn (MicroStation) format is strongly encouraged. All CADD graphic files must be delivered to the Government in .dgn format that is fully compatible with Base MicroStation CADD. NOTE: If the AE chooses to design in *.dwg (AutoCAD) format and translate into *.dgn format, then the AE is advised that some aspects may not translate properly, and thus the translated .dgn files must be reworked after translation. Designing in .dwg format is at the AE's own risk and does not relieve the AE of the mandated requirement for full compatibility with the Base system.

(b) Ensure each drawing sheet prints out the CADD file name in the title block.

(c) If you have questions or problems occur in the submittal of diskettes, contact the project manager or CADD System Manager.

f. For Corps of Engineers MILCON projects, a complete set of design documents revised to show actual as-built conditions shall be given to 778 CES/CECE within 30 days of the time of Base acceptance of the completed construction. The complete set

shall include all changed as well as unchanged drawings. For O & M (Operations and Maintenance) projects this issue will be addressed in the contract documents.

5. SPECIFICATIONS AND CONTRACTING DOCUMENTS:

a. All Projects with Structural Design Analysis: Provide a complete copy of the structural portion of the design analysis in MS Word format to RAFB upon completion of the design, and a revised set within 30 days after the project is awarded for construction if changes were made during bidding. If the contract is design-build, then provide the files within 30 days after the design is considered 100% complete.

b. Base Managed Projects: Use the master specifications and contracting documents maintained in the 778 CES/CEC file server. These are provided in MS Word format, and all documents in the design packages must be submitted in Microsoft versions.

c. MILCON Projects: Certain Robins versions of COE Guide Specifications are maintained in the 778 CES/CEC file server and will be provided as applicable. We agreed with the COE to maintain these rather than write lengthy revision requirements in this document. All needed revisions and edits have already been made to these particular Sections. The Sections now maintained include these:

01560 – This environmental spec covers requirements at Robins.
14240 – Hydraulic Elevators
16335 – Padmounted Air Switches
16375 – Exterior Electric
16415 – Electrical Work, Interior
16500 – Communication Systems
16721 – Addressable Fire Alarm Systems

6. VICINITY MAP: Map will be provided showing location of Robins AFB in relation to the surrounding population centers, nearby airport, and the main gate to the Base.

7. BASE MAP: For O&M projects, a map will be provided showing the location of the following facilities:

a. Main Gate

b. Base Civil Engineer, Building No 1555

c. Engineering Design and Construction Management, Building No 280

c. Base Contracting Office, Building No 300

d. DMAG Office Building 321

7. BASE SERVICES AND UTILITIES AVAILABLE TO THE CONTRACTOR:

a. The contractor shall collect and remove from Base all trash and construction debris for the duration of the project. Topsoil and suitable fill dirt may at the discretion of 78 CES/CETH be disposed of on Base at a site designated by them; otherwise, dirt determined by 78 CES/CETH to be unsuitable must be removed from the Base. The Houston County Landfill is located a few miles south of Warner Robins on Hwy 247.

b. No sanitary sewer dump stations are available for use by the Contractor.

c. Normal usage of potable water shall be provided the contractor free of charge.

d. Electrical service shall be metered by the contractor and reimbursed to the Government at current Base rates for Military Construction Projects. Utilities are normally provided free of charge to the Contractor on O & M projects.

8. SPECIAL CONSTRUCTION CONSIDERATIONS: Mild weather throughout the year imposes negligible construction season limitations for Robins Air Force Base.

a. All necessary construction materials and labor are available within the Warner Robins/Macon/Atlanta area, which is within an approximate 120-mile radius of the project site.

b. A digging permit from the Base is required prior to beginning any excavation. A permit to weld is also required prior to welding on site. Standard specifications in MS Word for these items will be provided to the designer.

c. If the project involves work in a facility which will remain partially occupied during construction, the specifications shall require the contractor to maintain utilities (including heating and air conditioning) to the occupied portions of the facility at all times during which it is occupied.

<<<<< END OF SECTION >>>>>

SPECIAL INITIATIVES

1. GENERAL:

a. Refer questions or exceptions requests to the Chief of Engineering Design, 778 CES/CECE. Any exceptions granted to these requirements shall be noted clearly in the project design analysis. These are mandatory requirements for all construction projects at Robins AFB.

b. The Air Force and DOD often discover special situations that result in new requirements that must be incorporated into the latest facility design and construction documents. These are split out into this section to be sure these new areas are properly addressed. The current special initiatives include force protection/antiterrorism, sustainable design, and metric dimensioning.

c. Priorities: 1 Use soft metric in all design documents.

2 Force Protection/Antiterrorism overrules all other standards.

3 Sustainable Design comes next, but not in violation of the Base Architectural Compatibility Standards. Normally incorporate this concept in all cases where there is negligible cost difference from past practice. Discuss high cost cases with the Base Project Manager.

4 Follow the rest of the Base Facility Standard for all other items.

2. METRIC DIMENSIONING – Use soft metric dimensioning on all design documents.

3. FORCE PROTECTION STANDARDS/APPLICABILITY

a. The standards in this section are governed by *Department of Defense Antiterrorism Construction Standards (Draft)*, 30 Aug 2001. It supersedes the *Interim Department of Defense Antiterrorism/Force Protection Construction Standards*, 16 Dec 1999. These standards are required for **new** construction projects funded with all classes of funds including MILCON and O&M starting in FY 04. Until then, the interim standards of 1999 apply. However, since there is little difference between the two, designs should comply with the 2001 standards unless impractical or otherwise uneconomical. What is given below is a short summary of the more common requirements under the new standard. See the standard itself for greater detail.

b. These standards apply to **existing** buildings where (a) repairs or renovations costing greater than 50% of the replacement value, (b) the building is converted to a higher classification; e.g., changing from and inhabited to primary gathering building, (c) window or door replacement projects are planned, use glazing that meets the new standard, or (d) additions of 50% or more of the size of the existing building require the existing building to be upgraded as well.

c. Franchised food operations and stand-alone shoppettes are exempt from the standoff distances to parking and roadways. All other standards apply. Family housing units of fewer than 12 units per building and gas stations and car care centers are exempt from all provisions.

d. DEFINITIONS:

Billeting. Any building where five or more unaccompanied DoD personnel are routinely housed.

Inhabited building. Buildings routinely occupied by five or more DoD personnel which also have a population density of greater than one person per 40 gross SM (430 SF). Note that portions of buildings can be considered inhabited, such as the administrative portion of shop buildings. This implies that the inhabited (or primary gathering) portion of a building has to meet the criteria herein, but the uninhabited portion does not.

Primary gathering building. Inhabited buildings that routinely house 50 or more DoD personnel. Note that it is possible for a building to not be an inhabited building, but to be a primary gathering building. This could occur in a large hangar where the gross area per person is below the criteria, but which has 50 or more employees.

Roadways. Any surface intended for motor vehicle traffic.

Access roads. Any roadway within a controlled perimeter (the base fence constitutes a controlled perimeter) such as maintenance, delivery, service, emergency, or other special limited use road that is necessary for operation of the building. (This includes drop off driveways.)

Parking. Areas designated where vehicles may be left unattended.

e. PHILOSOPHY. The philosophy of the standards is to build greater resistance to terrorist attacks into all inhabited structures. The primary way, and least expensive way, is to maximize standoff distances. Other important goals include reducing flying debris hazards and constructing superstructures to avoid progressive collapse.

f. MINIMUM STANDOFF DISTANCES. Stand off distances are given under two categories. If sufficient space is available to provide satisfactory standoff distance as defined by the standards, then the building can be constructed using largely conventional methods. For tight sites, smaller distances are allowed if the building is hardened. However, the minimums with hardening can't be reduced further. See table AP 1.1. Some selected distances are given below.

	Category	**Not analyzed**	**Analyzed**
Parking and Roadways	Billeting & Pri Gathering	25 m (82 ft)	10 m (33 ft)
	Inhabited	10 m (33 ft)	10 m (33 ft)
Building Separation	Billeting & Pri Gathering	10 m (33 ft)	No minimum
	Inhabited	No minimum	No minimum
Trash Containers	Billeting & Pri Gathering	25 m (82 ft)	10 m (33 ft)
	Inhabited	10 m (33 ft)	10 m (33 ft)

Note 1. Access roads must be controlled so that unauthorized vehicles are prohibited from gaining closer access than allowed for roads and parking above. For parking areas, if the parking is required to be closer than the specified standoff distances, then parking may be allowed as close as 10 m (33 SF) if the parking area has an entry control point(s) established. The standard does seem to allow some drive-up/drop-off and access roads that are not controlled (see AP 1.1.4). This is for facilities that require this such as child care centers, medical facilities, exchanges and commissaries, and schools. Where this is required, ensure that those

areas or lanes are clearly defined and marked and that their intended use is clear to prevent parking of vehicles in those areas.

Note 2. Trash containers may be located closer to the building if the container is enclosed in a hardened enclosure. See the standard for more details.

Note 3. Unobstructed space must be provided for a minimum of 10 m (33 ft) away from the building. Nothing over 150 mm (6 in) high is allowed within that distance. This is to preclude concealment of a bomb or other terrorist device.

g. MECHANICAL AND ELECTRICAL EQUIPMENT.

(1). The preferred location of mechanical and electrical equipment such as transformers, air-cooled condensers, and packaged chillers is outside the unobstructed space or on the roof. This standard does not preclude the placement within the unobstructed space as long as the equipment does not provide an opportunity for concealment of explosive devices. If walls or other screening devices are placed around mechanical and electrical equipment within the unobstructed space, the equipment must be enclosed on all four sides and the top. Openings in the screening material will not be greater than 150 mm (6 inches).

(2). Air intakes for inhabited buildings must be at least 3 meters (10 feet) above the ground. Provide a kill switch easily accessible to the occupants that can shut down the mechanical system

(3). Route critical utilities so that they are not on the outside wall or next to the mailroom. Do not put redundant utilities in the same chase.

(4). Brace all overhead utilities to minimize the likelihood that they will fall. Design equipment mountings to resist live load forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction. Design to seismic standards also where required.

h. STRUCTURAL. There are a number of requirements for multistory buildings designed to prevent progressive collapse if one main member is damaged. Also, unreinforced masonry walls are prohibited for the exterior walls of new buildings. Provide a minimum of 0.05 % vertical reinforcement with a maximum spacing of 1200 mm (48 in). For existing buildings, implement mitigating measures to provide an equivalent level of protection.

i. GLAZING. Use a minimum of 6-mm (1/4 in) nominal laminated glass for all exterior windows and glazed doors. The glass consists of two nominal 3-mm (1/8-in) glass panes bonded together with a minimum of a 0.75-mm (0.030-inch) polyvinyl-butyric (PVB) interlayer. For insulated glass units, as a minimum the inner pane must be 6-mm laminated glass. Alternatives that meet the same performance are acceptable. Also, where minimum standoff distances are not available, provide enhanced glazing to provide the equivalent level of protection. See the standard for specific requirements for window frames (AP 1.3.1.2)

j. ENTRANCES/EXITS. Entrances and exits for new inhabited buildings must not face the installation perimeter if there will be a direct line of sight from outside the installation. For existing buildings, change the main entrance or screen the main entrance.

k. MAILROOMS. Locate mailrooms on the perimeter of the building and as far from the populated portions of the building and critical infrastructure as possible.

l. ROOF ACCESS. New buildings must have roof access from internal stairways or ladders. For existing buildings, eliminate exterior roof access where possible, or secure external ladders with safety climb devices or similar mechanisms per AFI

91-22. Ladder safety devices, cages, or wells are required on all fixed ladders 20 or more feet.

m. MASS NOTIFICATION. All new inhabited buildings must have a timely means to notify occupants of threats and instruct them in what to do in response to the threats. Any system that provides this is acceptable. For existing buildings the requirement is mandatory for billeting and primary gathering buildings, but recommended for all inhabited buildings.

n. RECOMMENDATIONS. There are a number of recommended measures that are not mandatory. See Appendix 2 for details. One of the items to consider is to locate drive up and drop-off points away from large glazed areas. There are a number of recommendations for laying out the building interior. Also, the standard recommends minimizing the size and number of windows.

4. SUSTAINABLE DESIGN (Under Development) - Designers shall incorporate sustainable design criteria into designs for Robins AFB.

<<<<< END OF SECTION >>>>>

ENVIRONMENTAL AND LANDSCAPING

1. GENERAL: Refer questions or exception requests to the Civil-Electrical Chief in 778 CES/CECE. Any exceptions granted to these requirements shall be noted clearly in the project design analysis. This section supplements the requirements and local criteria contained in the base's master specification 01560.

2. LOCAL CONDITIONS AND SPECIFICATIONS: Base master specification 01560 is kept updated on the latest environmental issues at Robins. Refer to it for disposal of fluorescent light tubes and ballasts, local disposal of solid, hazardous, and toxic waste, local landfill procedures, permits required, etc.

3. ENVIRONMENTAL IMPACT ANALYSIS (AFR 19-2, PARA 9): Each project is reviewed for environmental impact. The Government shall determine the environmental analysis required. The following items are used to show the status of an Environmental Analysis:

a. Categorical exclusion applies.

b. Environmental assessment under preparation.

c. Environmental assessment and FONSI completed.

d. Draft EIS under preparation.

e. Draft EIS filed.

f. FEIS under preparation.

g. FEIS filed.

4. THREATENED AND ENDANGERED SPECIES (AFI 32-7064): Do not affect any threatened or endangered species.

(Note: Not all of these status statements must be used, but only those that apply to the subject project.)

a. Project has no potential for affecting threatened or endangered species or critical habitats.

b. Threatened or endangered species will not be affected based upon advice from the regional office, U.S. Fish and Wildlife Services (USFWS).

c. Formal consultation with the regional office, USFWS, is in progress.

d. Formal consultation with the regional office, USFWS, completed.

5. WATER QUALITY (AFR 19-1, AFR 88-15, AFP 19-5): The project shall be reviewed to see if the water quality will be affected by the construction of this project. The following items are used to show the status of water quality:

(Note: Not all of these status statements must be used, but only those that apply to the subject project.)

a. Wastewater treatment management program for area (PL 92-500) is a function of the Environmental Management Directorate of Robins AFB.

b. Water quality criteria and standards (federal, state, and local). Water quality and standards are in accordance with 40 CFR 112, SPPCC Plan 40, CFR 120, applicable sections of PL-20-500, Georgia Water Quality Act, as amended and local regulations and NPDES Permit GA 0002852.

c. Treatment requirements coordinated with EPA and state requirements.

d. Facilities to be installed to meet regulatory agency criteria.

e. Wastewater characteristics (include average flow).

f. Where connections to an existing system are proposed:

(1) Wastes compatible with existing treatment process.

(2) Additional volume will not hydraulically overload existing collection and treatment system.

g. Permit requirements.

6. AIR QUALITY (AFR 19-1, AFM 19-5): The project shall be reviewed to see if the air quality will be affected by the construction of this project. The following items are used to show the status of water quality:

(Note: Not all of these status statements must be used, but only those that apply to the subject project.)

a. Applicable air quality criteria (federal, state, and local).

b. Type and amount of pollutants generated.

c. Action taken to comply with requirements.

d. Will abatement measures proposed result in other pollution problems (water pollution, solid waste problem, noise, etc.).

e. Existing control equipment/monitoring procedures.

f. Permit requirements (PSD, state, etc.).

g. Friable asbestos abatement work addressed?

h. Compliance with Volatile Organic Compound (VOC) regulations (federal, state, local).

7. SOLID WASTE (AFR 19-1, AFP 19-5): The project shall be reviewed to see if solid waste disposal will be affected by the construction of this project. The following items are used to show the status of solid waste:

(Note: Not all of these status statements must be used, but only those that apply to the subject project.)

a. Applicable solid waste disposal system criteria (federal, state, and local).

b. Waste volume generated: include type and characteristics of material to be disposed, while maximizing recycling /reuse of waste material.

c. Method of disposal, if by landfill: lechate contamination or pollution of groundwater.

d. Possibilities for recycling or use of contaminated fuel.

e. Type or waste involved (industrial, domestic, etc.).

f. Permit requirements.

8. NATURAL RESOURCES (AFI 32-7064 and RAFBI 32-7064): The project shall be reviewed to see if natural resources will be affected by the construction of this project. The following items are used to show the status of natural resources:

(Note: Not all of these status statements must be used, but only those that apply to the subject project.)

a. Protection of forest resources.

b. Impact on agricultural out leases.

c. Protection of fish and wildlife habitats.

d. Preservation of outdoor recreation resources.

e. Impact on prime or unique farmlands.

f. Impact on wetland areas.

9. LANDSCAPE DESIGN:

a. Approved plantings for the area include all those plants commonly used for landscaping in the area and in keeping with adjacent existing plantings. The Base Architectural Compatibility Standard and the Base Land Management Plan will provide additional information concerning desired and approved plants.

b. Facility setbacks shall be as shown in the Base Land Management Plan.

c. Types of turf shall be as shown in the Base Land Management Plan.

d. Seeding and sodding requirements over utility lines and at project site vary depending upon location.

e. Automatic sprinkler systems shall be installed for those areas that require regular maintenance and watering. See the Civil Section for detailed requirements.

f. Plants approved for Robins AFB are as follows (per Bob Sargent in WR-ALC/EM):

(1) Grasses

Centipede grass (*Eremochloa ophuriodes*)
Bermuda Grass (*Cynodon dactylon*)
St. Augustine Grass (*Stenotaphrum secundatum*)

(2) Ground Cover

Carpet Blue (Ajuga reptans)
Daylily (Hemerocallis sp)
Andora Juniper (Juniperus horizontalis) “Plumosa”
Blue Chip Juniper (Juniperus horizontalis) “Blue Chip”
Blue Rug Juniper (Juniperus horizontalis) “”Wiltonii”
Parsons Juniper (Juniper davurica) “Expansa”
Galax (Galax aphylla)
Ferns (variety of species)
Liriope (Liriope muscari)
Creeping Liriope (Liriope spicata)
Big Leaf Periwinkle (Vinca major)
Common Periwinkle (Vinca minor)
St. Johns Wort (Hypericum calycenum)

(3) Climbing Vines

Carolina Yellow Jessamine (Gelsemium sempervirens)
Trumpet Creeper (Campsis radicans)
Muscadine (Vitis rotundifolia)
Confederate Jasmine (Trachelospermum jasminoides), Madison cultivar

(4) Shrubs

Virginia Sweetspire (Itea virginica)
Common Sweetshrub (Calycanthus floridus)
Azalea (Rhododendron sp) – there are some excellent native species. Use native!
Glossy Abelia (Abelia grandiflora)
Possumhaw (Ilex decidua)
Common Winterberry (Ilex verticillata)
Dwarf Burford Holly (Ilex burfordii)
Dwarf Yaupon Holly (Ilex vomitoria)
Needlepoint Holly
Repandens Holly (Ilex crenata) "Repandens"
Helleri Holly
Wax Myrtle (Myrica cerifera)
Mapleleaf Viburnum (Viburnum acerifolium)
Chinese Snowball Viburnum (Viburnum macrocephalum)
American Beautyberry (Callicarpa americana)
Smooth Hydrangea (Hydrangea arborescens)
Oakleaf Hydrangea (Hydrangea quercifolia)
Red Buckeye (Aesculus pavia)
Loropetalum (Loropetalum chinense)

For crape myrtle, buy varieties that have strong resistance to powdery mildew infection. Good varieties include Acoma (white flowers), Natchez (white), Hopi (pink), Tonto (red), Biloxi (pale pink), Muskogee (lavender), and Tuscarora (dark pink)

Other useful shrub species include India hawthorn, Jack Frost ligustrum, little red oleander (keep in mind that this is poisonous--don't plant near houses or playgrounds), pampas grass, and firethorn (e.g., Pyracantha—has thorns!).

(5) Trees

White Oak (Quercus alba)
Southern Red Oak (Quercus falcata)
Laurel Oak (Quercus hemisphaerica)
Live Oak (Quercus virginiana)
Willow Oak (Quercus phellos)
Chestnut Oak (Quercus prinus)
Eastern Red Cedar (Juniperus virginiana)
Deodar Cedar (Cedrus deodara)
American Holly (Ilex opaca)
Loblolly Pine (Pinus taeda)
Shortleaf Pine (Pinus echinata)
Eastern Redbud (Cercis canadensis)
Southern Magnolia (Magnolia grandiflora)
Yellow Poplar (Liriodendron tulipifera)
Flowering Dogwood (Cornus Florida)
Winged Elm (Ulmus alata)
River Birch (Betula nigra)
Green Ash (Fraxinus pennsylvanica)
Black Cherry (Prunus serotina)

Carolina Laurel Cherry (Prunus caroliniana)
White Fringetree (Chionanthus virginicus)
Carolina Silverbell (Halesia carolina)
Crabapple (Malus sp.)
Red Maple (Acer rubrum)

Regarding Bradford Pear, Yoshino Cherry, and Leyland Cypress: there has been a strong tendency to overuse these species in the landscape. Yoshino Cherry (and Leyland Cypress to a lesser degree) is very susceptible to disease problems. Bradford Pear is a vigorous tree, but it is short-lived, and requires a great deal of maintenance. Recommend that all three species be used sparingly.

(6) Problem Plants. We are creating problems for ourselves by planting species that don't handle the middle Georgia climate well, are disease prone, or get out of control and overrun the landscape. We had a contractor conduct a study to identify nuisance exotic species on base last year. Here are the species that were identified:

(a) Severe problem. Don't plant these:

Autumn olive
Chinese Privet
Japanese honeysuckle
Kudzu
Multiflora rose
Chinese tallow tree (these have been planted in the Lakeside area; now they are spreading across the southeastern area of the base near PAVE PAWS)

2) Serious problem. Minimize their use in the landscape:

Mimosa
Alligatorweed (obviously this should have been ranked as a severe problem)
English ivy (this plant is out of control in parts of the housing areas, particularly the Lakeside area; it can kill trees)
Asian dayflower
Chinese wisteria (it's pretty, but it kills trees)

3) Low threat exotics:

Nandina (should only plant dwarf)
Photina (redtips)—don’t plant these—serious disease problems on Robins
Bahia grass (don’t plant this)

<<<<<<< End of Section >>>>>>>

CORROSION CONTROL

1. GENERAL:

a. Refer questions or exception requests to the Base Corrosion Control Engineer in Maintenance Engineering, 78 CES/CEA. Any exceptions granted to these requirements shall be noted clearly in the project design analysis.

2. GENERAL CRITERIA FOR EXTERIORS OF UTILITY SYSTEMS: In general, all above ground portions of utility lines and equipment shall be protected against corrosion by galvanizing or protective coatings. In general, underground lines and equipment made of metal shall be either uncoated or coated and cathodically protected. Details follow:

a. Metal Posts, Columns, and Bollards in contact with or embedded in concrete: Coal tar epoxy system for electrical insulation before placing on or in concrete. Final dry thickness of coats shall be 6 mils.

b. Metallic Parts in Concrete Pits: When no provisions are made to prevent water in the pits, add a zinc anode (min. 3 lb.) at the lowest metallic point.

c. Water Tanks:

(1) Exterior: Use an approved primer and two coat system.

(2) Internal: Provide impressed current cathodic protection with hi-silicon cast iron anodes.

d. Above Ground Tanks with Underground Lines: Provide protection of lines based upon type of substance stored.

e. Underground Tanks:

(1) Use double lined fiberglass tanks. Follow latest guidance from WR-ALC/EM on leak detection and other environmental standards.

(2) Provide protection of lines based upon type of substance stored.

f. POL Tanks shall have the bottoms coated and cathodically protected with isolation from other systems.

g. POL Lines shall be factory coated black steel with cathodic protection and isolating flanges. Provide surge arresters across the flanges to prevent sparks.

h. Natural Gas Lines shall be high-pressure polyethylene (PE) with PE valves and joints.

(1) Field locating (to enable path detection and to connect metal sections of the lines):

(a) Install marking tape with metal tracing wire 1 foot above pipe.

(b) Also install tracer wires placed on the lines using #14 AWG Cu with nicked TW insulation.

(2) Use metal riser assemblies at facilities (with isolating joints for metallic lines) and 1-pound hi-pot magnesium anodes connected.

i. Steam And Condensate Lines shall be metallic meeting ETL 88-6 with exterior coatings and cathodic protection.

(1) Use isolating flanges at facilities and major above ground transitions.

(2) Locate anodes at least 15 feet from lines to prevent drying out the ground around the anodes.

(3) Do not allow anode wires to cross either set of lines.

(4) Insulate the lines from the concrete in pits to prevent touching and accidentally protecting rebar.

(5) If using COE specification, modify it to require cathodic protection regardless of soil resistivity, to counter effects of anaerobic bacteria.

j. Domestic Water Lines shall be one of these:

(1) Plastic:

(a) Field locating (to enable path detection and to connect metal sections of the lines):

1. Install marking tape with metal tracing wire 1 foot above pipe.

2. Also install tracer wires placed on the lines using #14 AWG Cu with nicked TW insulation.

(b) Use metal riser assemblies at facilities with 1-pound hi-pot magnesium anodes connected.

(2) Cast iron lines.

(a) Do not coat the cast iron.

(b) Bond the joints with No. 4 Cu AWG insulated wire. Coat both ends of the Thermit wire connections.

(3) Ductile iron.

(a) Coat ductile iron:

1. Factory applied coating with field verification and correction is first choice.

2. Coal tar epoxy system is second choice.

(b) Bond the joints with No. 4 Cu AWG insulated wire. Coat both ends of the Thermit wire connections.

(c) Provide cathodic protection.

1. Use isolating flanges at facilities and major aboveground transitions.

2. Insulate the lines from the concrete in pits to prevent touching and accidentally protecting rebar.

k. Chilled and Hot Water Lines shall be metallic with exterior coatings and cathodic protection.

(1) Use isolating flanges at facilities and major aboveground transitions.

(2) Insulate the lines from the concrete in pits.

l. Industrial Waste Lines shall be one of these:

(1) PVC or other plastic is the first choice, provided the designer determines this is compatible with the waste products.

(a) Field locating (to enable path detection and to connect metal sections of the lines):

1. Install marking tape with metal tracing wire 1 foot above pipe.

2. Also install tracer wires placed on the lines using #14 AWG Cu with nicked TW insulation.

(b) Use metal riser assemblies at facilities with 1-pound hi-pot magnesium anodes connected.

(2) Cast iron.

(a) Do not coat the cast iron.

(b) Bond the joints with No. 4 Cu AWG insulated wire. Coat both ends of the Thermit wire connections.

(3) Ductile iron.

(a) Coat ductile iron:

1. Factory applied coating with field verification and correction is first choice.

2. Coal tar epoxy system is second choice.

(b) Bond the joints with No. 4 Cu AWG insulated wire. Coat both ends of the Thermit wire connections.

(c) Provide cathodic protection.

1. Use isolating flanges at facilities and major aboveground transitions.

2. Insulate the lines from the concrete in pits to prevent touching and accidentally protecting rebar.

m. Sanitary Waste Lines shall be one of these:

(1) Cast iron.

(a) Do not coat the cast iron.

(b) Bond the joints with No. 4 Cu AWG insulated wire. Coat both ends of the Thermit wire connections.

(2) PVC, Vitrified Clay, or Concrete. For field Locating (to enable path detection and to connect metal sections of the lines):

(a) Install marking tape with metal tracing wire 1 foot above pipe.

(b) Also install tracer wires placed on the lines using #14 AWG Cu with nicked TW insulation.

n. Electrical Lines when metal shall be coated but not cathodically protected. Do not use direct buried concentric neutral cables.

3. GENERAL CRITERIA FOR INTERIORS OF UTILITY SYSTEMS:

a. Potable water shall be in accordance with MIL-HDBK 1005/7A, DATED 1 SEP 99. Our well water is very corrosive and non-scaling.

b. Hot or Chilled Water systems for heating or cooling shall have equipment and chemicals installed for chemical water treatment in accordance with AFR 91-40. This applies to both closed and open-type recirculating systems.

c. Steam systems for heating shall have equipment and chemicals installed for chemical water treatment in accordance with AFR 91-40. This applies to both closed and open-type recirculating systems.

d. Storage Tanks for liquids shall be protectively coated on the interiors with interior cathodic protection when water is the liquid stored.

e. Other Utility systems do not require interior corrosion treatments.

4. DETAILED CRITERIA FOR EACH CORROSION PROTECTION METHOD. Insure drawings and specifications address these items:

a. Material Selection: Provide quality details to insure industry minimums are not used by installers when higher-level materials are required.

b. Protective Coatings:

(1) Prepare coating specifications for above and below ground high value metallic structures per AFM 85-3, "Paints and Protective Coatings" (revised 1982), except as modified below.

(2) Prepare metal surfaces using Rust Deoxidizing Primer (RDP) by Total Rust and Corrosion Control, Inc., in Atlanta, GA. Blasting systems are substitutes and must be individually approved for use at Robins AFB.

(3) On all metallic structures where we have approved surface preparation by blasting to white or near white finish, no blasted surface will be left unprimed beyond the normal workday. Any such unprimed surface must be reblasted.

(4) Do not use thin plastic film tapes, such as electrical tape, to coat underground structures or wiring. Reference NACE Standard RP-01-69.

(5) All protective coatings shall be mildew resistant.

(6) Verify coatings on underground utilities in field with holiday detector before burial.

(7) Coal Tar Systems:

(a) When using standard coal tar mastic on buried lines, use on RDP-prepared or near white blasted surfaces a primer and two coats of the coal tar to give a final dry thickness of 125 mils.

(b) When using coal tar epoxy on buried lines, use on RDP-prepared or near white blasted surfaces a primer and two coats of the coal tar epoxy to give a final dry thickness of 6 mils.

(8) Coat major cathodic structures like brass valves and copper lines underground to minimize corrosion of adjacent structures.

(9) Insulate thrust blocks on systems that have cathodic protection.

c. Cathodic Protection:

(1) Soil pH in the area generally ranges from 5.0 to 6.2.

(2) Soil resistivity on Base generally ranges from 10,000 ohm-cm to over 100,000 ohm-cm with anaerobic bacteria actively present.

(3) Base all cathodic protection design upon designer field tests made at the construction site. Tests include soil resistivity and water conductivity. We have soil resistivity grid maps of Robins for review.

(4) At Robins AFB, we now prefer deep well ground beds to conventional or distributed shallow bed designs. Obtain approval for other than deep well designs.

(5) Bury each pipeline in a separate trench with at least 2 feet separation from nearby utilities to preclude galvanic cells between different metals or new and old metals in case inadvertent metallic connections between the two ever occur.

(6) Install test stations and interference bonds for operational checks of cathodic protection systems and prevention of impressed current interferences between unprotected and protected pipeline systems.

(7) All cathodic protection designs not by Base specialists must be performed by a National Association of Corrosion Engineers (NACE) accredited "Corrosion Specialist." The Corrosion Specialist must have a minimum of five years experience in the design of cathodic protection systems.

(8) Criteria Of Protection:

(a) All installed cathodic protection systems must comply with the instant off rule.

(b) Due to the presence of anaerobic bacteria at Robins, our minimum criterion is -1.0V.

(c) No other criteria are allowed.

(9) Remember to connect the rectifier "+" terminal to the anodes in the field.

d. Industrial Water Treatment:

(1) General:

(a) Base the equipment installation upon specific information obtained at the construction site and upon existing Base water treatment methods. Information includes data such as current analysis of Base water.

(b) All water treatment design not by Base specialists must be performed by an NACE accredited "Corrosion Specialist" with at least five years experience in this design.

(c) Chemical pot feeders:

1. Use at least 5-gallon capacity.

2. Provide pressure gauge on intake side of protected system.

(d) Use interlocks to insure chemicals will not feed when main system is off; e.g., condenser pumps.

(e) Automatic chemical feed will use one of these methods:

1. Water meter - timer method, where chemicals are added in relation to water make-up.

2. Solids controller, to control boiler blow down and chemical feed based upon manual settings.

(f) Inject chemicals downstream of pumps.

(2) Chilled Water:

(a) Closed Systems:

1. 100 Tons or less: Use chemical pot feeders.

2. Over tons: Use automatic system.

(b) Open Systems (Cooling Towers): Use automatic system.

(3) Hot Water (Closed Systems):

(a) 1000 MBTU/H or less: Use chemical pot feeders.

(b) Over 1000 MBTU/H: Use automatic system.

(4) Steam:

(a) Use automatic system.

(b) Inject oxygen scavengers directly into the deaerator tank.

(c) Inject boiler water chemicals into the feed water line right before the boiler drum.

(d) Blowdown Dumping:

1. At main plants, dump to industrial waste.

2. Dump elsewhere to sanitary waste.

(e) Provide for manual blowdown of tank bottom.

<<<<< END OF SECTION >>>>>

CIVIL (SITE, STRUCTURAL, WATER, WASTE, AND IRRIGATION)

1. GENERAL: Refer questions or exception requests to the Civil-Electrical Chief in 778 CES/CECE. Any exceptions granted to these requirements shall be noted clearly in the project design analysis.

2. LOCATION PLAN: (Scale 1" = 400'):

a. Facility/project location: The project will be located at Robins AFB, GA.

b. Site access: All commercial construction traffic must enter at Gate 4. Construction projects on the Flightline may be permitted to use Gate 1 only when approved by the Base. The peak traffic flows at the site are from 0700 to 0830 and from 1530 to 1700.

c. Construction material storage areas: The proposed construction storage areas shall be shown on the site plan and shall be available for storage of construction materials throughout the construction contract. The Contractor will be responsible for security measures.

3. SITE PLAN: (Scale 1" = 50').

a. Existing grades and contours shall be shown on the site plan.

b. The facility orientation shall be shown on the site plan.

c. Show construction contractor laydown area adjacent to the site. Coordinate with CECC or CECM to determine whether the contractor will be allowed to have a trailer at the site, or whether it must be located elsewhere on the base, then show or describe the trailer location.

d. Erosion Control: The "Manual for Erosion and Sediment Control in Georgia" shall be used to design all erosion control measures. Details shall be included in the plans.

e. Pavements: Existing and proposed pavements shall be shown on the site plan. Describe pavements in detail.

(1) Streets, parking lots, and sidewalks:

(a) All sidewalks shall be constructed of rigid pavement (concrete). Rigid pavement shall be designed in accordance with AFM 88-6, Chapter 3, while flexible pavements (such as asphalt) shall be designed in accordance with AFM 88-7, Chapter 3.

(b) Striping parking spaces: Use larger than minimum space widths and aisle widths in commercial areas such as the Base Exchange and Commissary. Many patrons have SUV's, so the widths must allow for wider and deeper vehicles, as well as greater turning radii. In low turnover areas, the parking stalls shall be 9' wide by 18.5' long. On high turnover areas, the parking stall shall be 9.5' wide by 18.5' long. The parking stripe shall be one stripe only (not doubled) and 4" wide.

(c) Road cuts: Road cuts have to be approved by the Base Civil Engineer. If asphalt road is cut, replacement pavement required will be a minimum of 8" of concrete and 1 1/2" of asphalt. If concrete road is cut, replacement pavement required will be a minimum of 8" of concrete or the thickness of the existing pavement, whichever is greater. The replacement shall rest on no less than 12" of undisturbed soil on each side.

(2) Curbs, gutters, culverts, and pads: Provide sufficient curbs, gutters, culverts and other facilities to insure adequate drainage. No pipe smaller than 15" will be allowed. Do not paint curbs.

(3) Runways, taxiways, aprons, overruns, and shoulders: If the project involves construction of new, or alteration of existing, airfield pavement (including runways, taxiways, aprons, overruns and shoulders), the design must be reviewed for technical adequacy by the Base Pavements Engineer.

f. Bridges and fences: If the project involves construction of bridges, the design shall be in accordance with the latest edition of American Association of State Highway and Transportation Officials (AASHTO). If the project involves construction of fences, such fences shall be constructed in accordance with Military Handbook 1190, and AFM 86-2.

g. Structures and existing trees over three inches diameter shall be shown on the site plan. Remove only those trees necessary for the construction of the building. The designer shall incorporate as many of the remaining trees as possible into an effective landscaping plan in conjunction with a parking lot plan to accommodate the maximum number of vehicles. Specifically, show these on the site plan:

1) Existing railroads. No new railroads are required or anticipated.

2) Existing sanitary sewers.

3) Existing drainage ditches and headwalls.

4) Existing gas service lines.

5) Existing water lines.

6) Existing communication lines.

7) Existing EMCS lines.

8) Existing electrical lines.

9) Existing cathodic protection cables and equipment.

10) Existing heat service/steam lines.

11) Existing chilled water lines.

12) Existing POL facilities.

13) Existing fire hydrants.

14) Contractor construction limits for the project.

4. NARRATIVE DESCRIPTION:

a. Site restrictions: If the project site is in a restricted area, or the type of construction requires some site restrictions, then identify them in accordance with Air Force Standards.

b. Subsoil conditions: The soil in the area generally consists of poorly graded mixtures of sand clays and silty sands with the exception of the Flightline East Area where the soil generally consists of organic gray silty clay. The design Agent shall arrange for soil borings, plate-bearing tests, and CBR tests as required for a thorough subsoil investigation prior to final design. The water table varies basewide but is generally within 15-20 feet of the existing ground surface, with the exception of the Flightline East Area where the water table is generally within 0-5 feet of the existing ground surface.

c. Flood hazard evaluation: The existing elevation of the project site shall determine if is above or below the 100 year flood plain, which is at 258 feet above mean sea level. (In prior years the level had been 257 feet.)

d. AICUZ (Air Installation Compatible Use Zone) noise level criteria: The project site shall be evaluated for AICUZ noise level criteria to determine if any noise reduction will be required for this project.

e. Erosion/dust control requirements: Erosion control measures shall be designed in accordance with the latest edition of the "Manual for Erosion and Sediment Control in Georgia". Disturbed areas, including trenches, shall receive erosion control in the form of permanent turf established by seeding. Grasses and seeds shall be suitable for the area and season it is to be planted. Seeds shall be either Centipede or Bermuda if planted between April and August and Penntine or Falcon fescue if planted between September and March.

f. Base Comprehensive Plan (BCP) coordination: Describe conformance or nonconformance with BCP, such as future land use conflicts, etc.

g. Relationship of proposed siting to identified Installation Restoration Program sites. The project site location shall be identified by distance and direction (North, South etc.) from the IRP sites.

h. The use of cranes by construction personnel within the area around the airfield and runway requires formal crane permits. Contact 778 CES/CECP for assistance and information on the amount of advance notice required.

i. Digging Permits are required to do any excavation or earthwork. The weekly meetings are chaired by 78 CES and are usually held Monday mornings.

5. WETLANDS (AFI 32-7064): The project site shall be evaluated for the requirements of EO 11990.

6. FLOODPLAINS (AFI 32-7064): The project site shall be evaluated for the requirements of EO 11988.

7. ARCHAEOLOGICAL AND HISTORICAL SITES (LEE LTR, 4 JAN 82, PARA 1d): Consultation with State Historic Preservation Officer (SHPO) is required to determine if survey or evaluation indicates the project will or will not affect eligible property.

8. EO 12372, COORDINATION (AFI 32-7064): The project shall be coordinated with all intergovernmental departments as applicable.

9. FAA (AFI 32-7064): The project shall be reviewed for clearance requirements from the regional FAA.

10. NOISE SITING COMPLIANCE (AFI 32-7064): The project shall be reviewed for noise reduction requirements of AFM 19-10, If noise reductions apply, they shall be incorporated into the design and construction.

11. AIRFIELD CLEARANCE CRITERIA COMPLIANCE (AFR 86-14): The project shall be reviewed for compliance with airfield clearance criteria including clear zone and accident potential zones (AFR 86-14).

12. EXPLOSIVE QUANTITY/DISTANCE (Q/D) SITING AND SAFETY CRITERIA (AFR 127-100, CHAPTERS 5 AND 11): If a project involves munitions storage and explosives or other related facilities, it shall be reviewed for explosive quantity/distance siting and safety criteria (AFM 127-100, Chapters 5 and 11). If project does not involve explosives it shall be reviewed for Q/D clear zone criteria from any explosives facilities.

13. SOLAR APPLICATIONS: The designer shall review for energy conservation measures. (See Mechanical Considerations)

14. CIVIL DESIGN CONSIDERATIONS: The design shall incorporate civil design work necessary to adequately provide all site preparation included in the project. Civil design shall comply with the following Government design standards:

a. AFM 88-5, Chapter 4, Drainage for Areas other than Airfields

b. AFM 88-6, Chapter 8, Standard Practice for Concrete Pavements

c. AFM 88-6, Chapter 9, Bituminous Pavements Standard Practice

15. CIVIL CALCULATIONS: In addition, provide all civil design calculations at preliminary design submittal.

16. STRUCTURAL DESIGN CONSIDERATIONS: The A-E Design shall incorporate all structural design work necessary to construct a new facility or repair or modify and existing facility. Structural design shall comply with the following design standards in addition to those listed in Section G-1:

a. ASCE 7 (Latest Edition)-Minimum Design Loads for Buildings and Other Structures (excluding Chapter 9-Earthquake Loads).

b. TM 5-809-2/AFM 88-3, Chapter 2, Structural Design Criteria for Buildings

c. TM 5-809-3/AFM 88-3, Chapter 3, Masonry Structural Design for Buildings

d. TI 809-04, Seismic Design for Buildings (Dec 1998)

e. TI 809-05, Seismic Evaluation and Rehabilitation for Buildings (Nov 1999)

17. STRUCTURAL CALCULATIONS: In addition, the A-E shall provide all structural calculations at preliminary design submittal. The structural calculations shall include the following items:

a. Dead Load Break Down

b. Wind Load Calculation

c. Seismic Load Calculation

d. Comparison of Wind and Seismic Loads

e. Design of All Structural Elements: Roof Members, Walls and/or Columns and Foundations (Footings and Slabs)

f. Design of Building for Wind or Seismic Loads

18. SPECIAL STRUCTURAL REQUIREMENTS:

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

b. Clear span or height requirements: The project shall be designed for long span or height requirements as necessary.

c. Overhead support requirements: The project shall be designed for overhead support requirements including hoists, cranes, etc. as necessary.

d. Special bay sizes and access dimensions: The project shall be designed for special bay sizes with excessive dimension requirements as necessary.

e. Mezzanines: The project shall be designed for special floor loading requirements for all mezzanine areas as necessary.

f. Comply with force protection requirements as specified.

19. SUBSOIL INVESTIGATIONS: The soil investigation report shall include the following information about the soil:

a. Drilling tests

b. Soil layer classifications

c. Water content

d. Soil density based on standard penetration resistance

e. Recommended allowable soil bearing capacity or single pile capacity

f. A sketch of the area with the approximate location of soil boring holes

20. FOUNDATIONS: No foundation shall be constructed over existing or new water, sewer, steam, natural gas, chilled water, industrial waste and foundation drain lines. All foundations shall be stepped down to an elevation below the bottom of pipe invert elevation, or the pipe relocated.

21. ANTENNAS AND OTHER EXTERIOR USER EQUIPMENT:

a. No antennas or other user equipment are to be mounted on the roof or walls, unless the item was identified during the initial construction of the building with complete structural analysis and design included in the project design analysis and the construction drawings. No user equipment may be installed on the roof or walls of an existing building, since the original structural design did not provide for the weight and wind loads associated with any such equipment.

b. Exceptions may be granted only for small items approved on a case-by-case basis by the Structural Engineer in 778 CES/CECE or CECM. Request and approval must be in writing.

22. WATER SUPPLY:

a. The existing rated fire flow will be analyzed under a separate design section. See Fire Protection Standards.

b. All potable water on Robins AFB has been treated. The designer shall review to see if any additional treatment is required.

c. If the proposed project discharges any mixture of chemicals or solid waste into the industrial or water waste systems, the project shall be reviewed to determine if any additional chemical analysis of water is required to meet the EPA requirements for industrial or waste water treatment.

d. The existing Base water storage and distribution system will provide the water for the facility. The system consists of 5 or more wells producing up to 4200 gpm at 55 psig. This is currently insufficient to meet our needs in certain situations. The Base is attempting to obtain additional well capacity. The designer shall design the facilities to ensure adequate water for potable, industrial, and fire fighting requirements.

e. The designer shall review to see if there will be any unusual peak demand requirements.

f. 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). All underground steel systems shall be coated and/or wrapped to minimize cathodic protection current requirements. See Corrosion Control Standards.

g. All water lines serving a facility shall be equipped with a water meter and a backflow preventer.

h. Adequate controls shall be established to provide for wellhead protection from pollution. An area 25 ft in diameter minimum around the well called a control zone shall be fenced and the gate locked. No sources of pollution shall be allowed within this area including generator storage tanks and electrical transformers. However, electrical generators may be allowed within the area. Inner Management Zones of 100 ft. diameter shall also be established around each well. This area shall be maintained in such a way as to preclude pollution sources wherever possible.

23. WASTEWATER TREATMENT:

a. The designer shall project the industrial and/or functional wastewater discharge for the project. The quantity and quality of wastewater discharged shall be evaluated to see if it can be adequately handled by the existing Base wastewater treatment system. All efforts to incorporate recycling/reuse of wastewater shall be included.

b. All the existing sewer lines shall be shown on the site plan. Existing flow capacity shall be determined and the type of treatment required. The project shall evaluate the existing wastewater flow and available design capacity for treatment. The existing systems limitations such as wastewater compatibility and required wastewater segregation shall be determined for this project.

c. The project designer shall determine if the treatment system requires any improvements in the following areas: treatment plants, trunk mains, lift stations, fuel/oil-water separator or storage and bypass restrictions. The existing sewer lines shown on the site plan that will be under the proposed new facility shall be removed and relocated. No interruption of sewage flow shall occur.

d. Laboratory: The designer shall review to see if any new laboratory requirements will require modifications or additions to the existing laboratory facilities.

24. LAWN SPRINKLER SYSTEM:

a. General: Provide an underground sprinkler irrigation system as required to irrigate turf and planted areas associated with new facilities or projects that affect the building exterior landscaping. The design shall concentrate on ease of maintenance and durability of the working parts.

b. Modify standard specifications and drawings as needed to incorporate these requirements. CEAEC maintains a complete and detailed specification for irrigation system installation that may be obtained upon request.

c. The water supply for the sprinkler system shall be the Base potable water system. The design of the system shall provide adequate pressure to all sprinkler heads and not adversely affect the pressure required by the facility.

d. Submittals: All material submittals shall be coordinated with 78 CES/CEA for review.

(1) Electronic Drawings: The contractor shall provide three disk sets of electronic drawings in MicroStation *.dgn 2-D file format, compatible with the Robins AFB GeoBase system, and three (3) paper drawings that include a complete list of equipment and materials, and manufacturer's descriptive and technical literature, and installation instructions. Drawings shall show proposed system layout, type and number of heads and emitters, zone valves, drain pockets, backflow devices, controllers, and mounting details of controllers. Design(s) shall be in strict accordance with published manufacturer's design guidance.

(2) 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.

(3) Operating manuals shall detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout, simplified wiring and control diagrams of the system as installed, and system programming schedule.

e. Components: The components listed here have been proven to provide reliable and maintainable irrigation systems at Robins AFB.

(1) System shall operate with a minimum water pressure of 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.

(2) Sprinklers – The base standard (design basis) is Hunter I-20 Stainless Steel, Hunter I-25 Stainless Steel, Hunter Pop-Up Mist Heads 10A nozzle, 12A nozzle, 15A nozzle, 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.

(3) Emitter Heads: Emitter heads shall be self-cleaning with pressure compensating diaphragm with one or six self-piercing barbed outlets. Each shall be capable of emitting from ¼ to 2 gallons per hour flow. Emitter body shall be ultraviolet stabilized, algae, and heat resistant plastic construction.

(4) Remote Control Valves – The base standard (design basis) is Hunter HPV series, Hunter ICV with filter sentry in the applicable size, Rain Bird PGA and PEB series in the applicable size, and Weathermatic in applicable size.

(5) Automatic Controllers – The base standard (design basis) is Hunter ICC Commercial Controller 8 or equivalent.

(6) Control Wire – The base standard is 12-gauge single or multi-strand, whichever is applicable, UF type designed for direct burial. Wires shall be buried beside pipe in same trench and shall be attached to the piping in increments of every 15-20 feet. Rigid conduit shall be provided where wires run under paving. Each zone shall use different color wire, to facilitate zone identification. Zone wire color shall be continuous for the entire length of the circuit. One control circuit shall be provided for each zone and a circuit to control sprinkler system. 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. Splices and connections shall be watertight and leak-proof; and shall be indicated on the "as built" plan. Wire shall be within a

protective sleeve for bridge or water crossings, and where other conditions make it necessary.

(7) Pipe and Fittings – Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40 (solvent welded) or Schedule 80 (threaded), as applicable. All joints shall be primed with a purple colored primer (for inspection purposes) and cleaned before final assembly. All above ground pipe shall be coated galvanized steel. Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fitting shall conform to requirements of ASTM D2464, Schedule 80.

(8) Backflow Prevention Equipment: Use double check valve and pressure reducing assembly in the appropriate size, to be placed above ground on a concrete pad, 12 to 36 inches above grade. The assembly shall be covered by an insulated enclosure. Backflow preventer shall conform to the requirements of ASSE 1015 and shall be of brass construction, with two check valves, field test cocks, and two resilient seat full port ball valves. Install so that maintenance and service can be performed. Include freeze protection. The backflow preventer shall be tested in accordance with Backflow Device Test Report, the Double Check Valve Assembly portion (obtained from the base Civil Engineer Plumbing Shop). A Certified Backflow Prevent Assembly Tester shall accomplish these tests. The tests results shall be provided to the Civil Engineer Plumbing Shop backflow prevention monitor.

(9) Pressure Regulating Master Valve: Pressure regulating master valve shall be automatic mechanical self-cleaning; self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current with 0.70 amperes at 24 volts. Valve shall close slowly and be free of chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and one inlet tapping capable of being installed as straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 150 psi working pressure and pilot range from 10 to 125 psi.

f. Extra Stock: The following extra stock 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.

g. Installation: The irrigation system design shall meet the manufacturer’s requirements and incorporate the following:

(1) 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.

(2) 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. This elevation is critical and care shall be taken to set them exactly at, or slightly above the finished grade, never below.

h. Warranty – Additional Requirements: The contractor shall maintain the system for a period of one year after acceptance by the government. 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 78 CES/CEAC. The contractor shall continue to maintain the system, at no additional cost to the Government, until such time as all defects found at the one-year inspection are corrected and repaired.

25. TERMITE PRE-TREATMENT: For all new buildings or additions to existing buildings include termite pre-treatment of the ground along the new exterior walls.

<<<<< END OF SECTION >>>>>

ARCHITECTURAL

1. GENERAL CONSIDERATIONS:

a. Refer questions or exception requests to the Mechanical-Architectural Chief in 778 CES/CECE. Any exceptions granted to these requirements shall be noted clearly in the design analysis.

b. The buildings on Robins AFB are organized into four architectural compatibility zones. Facility operations and location determine the functional zones. This designation identifies desired exterior treatment as well as other design considerations as contained in the Robins Architectural Compatibility Standards. These zones are as follows:

(1) Industrial Flightline

(2) Operational Flightline

(3) Admin & Industrial

(4) Housing

c. Desired architectural styles: Buildings of various styles are dispersed throughout the Base and in a few instances their styles conflict with present use. It is desired that the styles of the new buildings relate to the older buildings. It is also desired that a sense of order be applied to the present random distribution of architectural styles throughout the Base. Further guidelines and/or questions concerning architectural styles, materials, colors, etc. are available from the Base Architectural Compatibility Officer in 778 CES/CECE.

d. All design shall be in accordance with AFM 88-3, Military Handbook 1190, Engineering Technical Letter (ETL) 92-2, and all other applicable codes and regulations as referenced herein. Also conform to NFPA 101 - Life Safety Code and the UBC (Uniform Building Code) or SBC (Standard Building Code). If there is a conflict, normally use the more stringent requirement. The specifications shall require all materials and equipment to be current production items.

e. All construction materials and skilled labor are available within the area of Warner Robins, Macon, and Atlanta - approximately within a 120-mile radius of the project site. No borrow or fill material is available on Robins Air Force Base. All necessary fill in excess of that obtained from excavation on the project must be obtained from sources from off the Base.

f. The facility shall be barrier-free and designed to meet the Uniform Federal Disability Act and Americans with Disabilities Act (ADA).

2. ARCHITECTURAL COMPATIBILITY STANDARDS:

a. The intent of our Architectural Compatibility Standards is to produce designs that reflect the Air Force goal of quality, creative designs with "understated excellence". Understated excellence is characterized by these considerations:

(1) Simplicity in design

(2) Durability of materials and finishes

(3) Reliability in utility and building systems

(4) Efficiency in function

(5) Completeness and appropriateness of detail

(6) Coordination in appearance and maintainability in configuration and layout

(7) Avoidance of grand scale and plushness

b. Facility floor plans and finish schedule for interior/exterior shall comply with the following publications:

(1) Robins Architectural Compatibility Standards

(2) AFP 88-41, Interior Design Guide

(3) AFH 32-1084, Facility Requirements

(4) Military Handbook 1190, Facility and Design Guide

(5) AFM 88-4, Chapter 9, Raised Floor Systems

(6) AF Pamphlet (AFPAM) 32-1097, Sign Standards

(7) AFR 85-10, Operation and Maintenance of Real Property

(8) AFI 32-1050, Roof Systems Management

(9) AFR 88-25, Military Family Housing Design and Construction Management and Robins AFB Housing Community Plan

(10) Air Force Carpet Policy ETL 00-6

(11) Air Force Materiel Command Commander's Guide to Interior Design

(12) Air Force Materiel Command Commander's Guide to Facility Excellence

c. Automatic data processing support: Provide raised floors similar to the aluminum type made by Floating Floors, Inc.

d. Interior/Exterior color and material presentation boards are required for approval on all projects. Provide 8 1/2 x 11 boards in binder format with heavy samples mechanically fastened. Color boards are required with the Preliminary (60%) and First Final (85%) submittals.

e. All exterior paint colors must conform to the Base exterior color scheme as defined in the Robins Architectural Compatibility standards. Certain exterior materials such as brick are standardized also. The Base's standard brick is Boral Brick Corporation's Red Matex. In some cases the brick must match adjacent facilities to achieve a uniform architectural appearance. Obtain approval from the Base Project Manager for the brick and mortar selection.

3. INTERIOR DESIGN STANDARDS

a. Interior finishes and furnishings are an important and integral part of facility construction, upgrade, and maintenance programs. While we often have design guidelines and budget limitations, we still expect quality professional design that does not have a "military" look. For instance, the use of dark wood paneling is no longer a required status symbol for executive offices. Dark blue or black doorframes are also outdated. If we are to achieve a clean, efficient "corporate look", we do not wish to perpetuate the mistakes of the past. We want to exceed the "minimum needs of the government" by addressing physical and psychological needs and providing a comfortable work or living environment. Function, maintainability, energy efficiency, and a pleasing general atmosphere are all-important elements of the design.

b. Interior structural materials and finishes are part of the design of all buildings. This includes anything attached to the building such as wall covering, wall bases, flooring, door and window trim, millwork and cabinetwork, hardware, interior signage, and all items with colors, patterns, or textures. Projects that contain only interior finishes are referred to as a Structural Interior Design (SID).

c. A project with furnishings is identified as a Comprehensive Interior Design (CID). Furnishings must include systems furniture or conventional office furniture, artwork, plants, window treatment, bedspreads, waste receptacles, and other decorative or functional accessories.

d. Systems furniture (Prewired workstations) shall be included as part of the construction requirements for all new administrative facilities and all administrative areas of any new facility when the administrative area contains at least 1,000 square feet of contiguous net office area. Refer to Engineering Technical Letters (ETL's) 90-2, 88-10, and 90-04 for systems furniture guidelines.

e. Furniture shall be durable, easily maintained, and selected from current GSA vendors. Upholstery shall be selected from manufacturers standard fabrics. Avoid using Customer's Own Material (C.O.M.) except in unique situations.

f. Equipment and furniture catalog cuts and price, presentation color/material boards, and interior perspectives shall be submitted for approval as part of the CID package.

g. All interior finishes shall be easily maintained, durable, and classic rather than trendy. The following guidelines apply to the majority of our projects:

(1) Permanent finishes such as ceramic tile, toilet partitions, and plastic laminate countertops shall be in neutral colors.

(2) Accent colors in brighter hues must be used in limited quantities such as a tile border or painted accent wall.

(3) Light colors shall be avoided for floor covering and high traffic areas.

(4) Type II vinyl wall covering must be used in neutral colors and subtle textures for upgraded areas.

(5) Corner guards, chair rails, or bumper guards shall be used depending upon the degree of wall protection required.

(6) Commercial vinyl tile shall be used in maintenance or industrial shop areas as well as break rooms.

(7) Walk off matting shall be used at all building entrances and in transition from shop areas to carpeted administrative areas.

(8) Wall colors shall be neutral, light-reflecting colors in a semi-gloss finish, if not directed otherwise.

(9) Ceilings shall be off-white in a flat or eggshell finish.

(9) Dark accent walls and murals are not recommended because of difficulty of repairing or maintaining.

(10) Semi-gloss or gloss paint is required for all trim, doors, and walls in areas that have moisture such as kitchens, restrooms, and bathrooms.

(11) For previously painted areas, site investigation is mandatory to determine proper surface preparation for new coatings or wall covering.

h. All carpet must comply with Air Force Carpet Policy (ETL 94-3). A patterned design or multicolored bold tweed has soil-hiding capabilities, where solid colors are recommended only for narrow borders and some billeting areas. Carpet tile is required only in areas with systems furniture or access floors. Avoid stripes and lines running parallel to walls and corridors.

i. Lighting solutions need to be explored to avoid boring uniformity and glare. Combinations of natural light, indirect lighting, general and task lighting can produce a more flexible and efficient plan. Fixtures shall be easily maintained and have easily obtainable replacement bulbs (or lamps). Consider the color rendition of lamp selection for its appropriateness to the area and function.

j. Interior signage shall be part of SID (Structural Interior Design) and shall include building directories. Workstation identification signs shall be included with systems furniture packages in the CID (Comprehensive Interior Design).

k. The current custodial contractor shall be able to easily maintain toilet accessories such as soap and towel dispensers. Avoid expensive multiple function units that are difficult to maintain.

l. Furnishings shall reflect the general style of the building but shall not be so trendy that they will be outdated in four or five years. Upholstery fabrics shall be durable and soil-hiding with brighter colors and patterns allowed. GSA vendors offer a wide variety of styles and upholstery options. Avoid using COM (customer's own material) because of expense and complication of ordering process.

m. Artwork and plants are finishing touches that shall be included if the budget allows. Landscapes or local themes are appropriate for public areas. Frames shall harmonize with other furnishings. Artificial plants soften formal arrangements and fill awkward corners.

n. The following Air Force publications are applicable to interior design and can be obtained from the applicable Design Section in 778 CES/CEC:

-------	AFMC Facility Quality Standards
-------	AF Carpet Selection Handbook
-------	AF Interior Design Presentation Format
ETL 94-3	Air Force Carpet Standard
AFP 88-40	Sign Standards
AFP 88-41	Interior Design Guidance
ETL 90-7	AF General Interior Design Policy
ETL 90-2	General Policy for Prewired Workstations and Systems Furniture
ETL 90-4	Systems Furniture Guide Specifications
ETL 89-10	Pre-Wired Workstations Guide Specifications

5. INTERIOR DESIGN - DORMITORIES

a. General: Well-coordinated, neutral color schemes hold up over longer periods of time. Good design extends beyond aesthetics to provide durability, acoustical, and energy-saving value, as well as morale enhancement for the inhabitants.

b. Finishes, Materials, and Colors: All permanent finishes shall be neutral colors. Medium range accent colors may be used only in small areas. Select neutral colors for surfaces that will have a long life, such as ceramic tile, mosaic, corian, laminates, window blinds, etc., to facilitate future finish material upgrades. Provide a pleasing color scheme in durable finish materials. Use color in non-permanent finishes to add interest and vitality, but do not allow color to dominate the environment. Coordinate materials, finishes, color, and texture selection to compliment the overall building design and image.

c. Carpet: Carpet with a small pattern, tweed design or random design is preferred for its appearance retention. Solid color carpet is not authorized. Level-loop or combination or loop and cut pile carpet is recommended for corridors. Select a pattern that will not accentuate the length of corridor. A cut pile is recommended for living unit. Provide a solid walk-off area if the living unit opens to the exterior. Heavy-duty commercial quality carpet cushion may be used in the living units, but cannot be used in the corridors. Carpet over cushion should be applied with the "double stick" method. Living /bedroom areas have a heavy wear classification for carpet, and public areas (corridors, television and game rooms, etc.) have a severe wear classification. The following minimum weights are recommended for dormitories:

(1) Cut pile - 11017 grams/m2 (30 ounces/SY)
(2) Bonded - 949 grams/m2 (28 ounces/SY)
(3) Loop pile - 814 grams/m2 (24 ounces/SY)

d. Walk Off: Provide hard surface e walk-off areas at exterior entrances to type B or C modules.

e. Hard Surface Flooring: Use commercial quality sheet vinyl composition tile (VCT) with a full depth pattern in the walk off area, vanity area, and the kitchen. Avoid white as a predominant color, "No wax" surfaces are not recommended, due to low durability.

f. Walls:

(1) Use vinyl wall covering as over smooth walls. Accent walls are optional, but must not be so bright or so dark as to shorten the room or negatively affect the interior lighting. Consider a texture wall covering as an accent instead of dramatic contrasting colors. Accent colors can also be used as textiles such as draperies and upholstery fabrics.

(2) Paint may be substituted for vinyl wall covering (VWC), but VWC is preferred. Where paint is used, multi-colored, speckled paint systems are preferred.

g. Ceiling: Paint ceilings off-white in a flat or eggshell finish or provide a light colored acoustical textured treatment.

h. Bathrooms: Use slip resistant ceramic floor tiles in bathrooms. Specify a mottled or shaded tile to hide discoloration from detergents, etc. Use ceramic wall tiles from floor to ceiling around bathtubs s and showers. Colored grout matching the ceramic tile is recommended for low maintenance and good appearance. Other areas may be at wainscot height. Install shower curtain rod instead of glass shower doors for ease in maintenance. Specify rod at proper height for conventional shower curtains 1800 mm x 11800 mm (72"x 72").

i. Window Treatment: Mini blinds, vertical blinds, draperies or combination are authorized. All window treatments must pass NFPA 701-1/702-2 Standard Method Fire Test for Flame Resistant Textiles and Films.

j. Furnishings. Furnishings shall reflect the general style of the building but shall not be so trendy that they will be outdated in four or five years. Upholstery fabrics shall be durable and soil-hiding with brighter colors and patterns allowed. GSA vendors offer a wide variety of styles and upholstery options. Avoid using COM (customer's own material) because of expense and complication of ordering process. Refer to Dorm Design Guide and QIP (Quarters Improvement Plan) for additional guidance on standards.

6. LOCKING DEVICES:

a. The door hardware shall be compatible with the Base Master Keying System. The keying system shall have seven pin interchangeable cores and interchangeable construction cores. The interchangeable cores as a design basis shall be Best Lock

or equivalent. The lockset shall be compatible with the Base Master System and shall be equal to Arrow, Falcon, Best Lock, or other locks that will accept the 7-pin Best-type core.

b. For those facilities that are not covered by the Base Master Keying System, provide keys and locks for any addition or renovation that are compatible with any existing master key and lock system that is to remain.

c. Furnish two master keys. These are to be sent direct to the Government's representative by registered mail.

d. Furnish two copies of keying control transcripts with 100% expansion per complex as listed in hardware set. These are to be sent direct to the Government's representative by registered mail or other certified means of delivery.

e. Maintenance Control: Furnish maintenance repair kits and manuals as listed in hardware set. These are to be sent direct to the Government's representative by registered mail or other certified means of delivery.

f. All padmounted transformers, exterior padmounted switchgear cabinets, etc. are to be equipped with a Best Lock Corporation padlock, lock number 21B720L-R with core number 8A59, 1 1/2" short shank. This is the same lock that is on all other high voltage equipment on Robins AFB, and it is imperative that exterior electrical personnel have one-key access to all high voltage equipment.

7. SCREENING MECHANICAL EQUIPMENT: Mechanical equipment, transformers, etc. shall be screened. Follow force protection requirements where more stringent than those below.

a. Low visitor or low aesthetic areas of the base: Use chain link fences

b. Administrative, community, recreation areas, and other areas as applicable for aesthetic purposes: Provide Rohn fences with an asphalt or concrete mowing strip at least 2’ wide (one feet on each side) to prevent grass growth next to the fence. Alternate methods include brick or pressure treated wood screens. Design to not block airflow for cooling the equipment.

c. Consider bushes and small trees if they do not block airflow for cooling the equipment, and if they provide the necessary visual screening.

8. WINDOWS: Follow force protection requirements to prevent flying glass shards. (Under Development)

a. Industrial Casement

b. Storefront

c. Residential

9. EXTERIOR DOORS: Keep these to a minimum. The following doors are required:

a. Main ingress and egress doors for personnel.

b. Utility room exterior doors.

(1) Main Mechanical and Electrical Rooms shall be located on the exterior walls of the facility, and their doors shall be on the exterior walls to improve accessibility for CEG shop personnel and to minimize disruptions to user personnel.

(2) Comm Rooms and non-main utility rooms may be located in the interior of the facility with interior doors.

(3) All shall be provided with locks such that only CE has the keys for these rooms.

10. ACOUSTICAL AND SUSPENDED CEILINGS: Center the tile grid on the center of the room. Space the tiles such that fractional pieces are of identical shape on the outside edges on opposite sides of the room.

<<<<< END OF SECTION >>>>>

MECHANICAL STANDARDS

1. GENERAL: Refer questions or exception requests to the Mechanical-Architectural Chief in 778 CES/CECE. Any exceptions granted to these requirements shall be noted clearly in the project design analysis.

2. DESIGN STANDARDS:

a. Mechanical systems shall be designed in accordance with Military Handbooks 1008 and 1190.

b. Fire Protection:

(1) A qualified Registered Fire Protection Engineer shall accomplish all fire protection system design work by designers from off the Base. The fire protection engineer shall be a professional engineer, registered by the fire protection written examination of the Council of Examiners for Engineers and Surveyors (NCEE).

(2) Comply with all Air Force Engineering Technical Letters for fire protection.

3. MAINTENANCE CONSIDERATIONS: Consideration shall be given to maintenance requirements of all mechanical equipment. The following shall be incorporated into mechanical designs:

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

b. Provide manufacturer's recommended service clearance and coil pull space for all equipment. Locate all valves, pumps, strainers, controls, sensors, and other items requiring regular service such that they can be maintained from floor level where possible. All units shall be mounted on a concrete slab. The degree of maintenance of an item is directly proportional to its accessibility. Permanent Maintenance platforms and access ladders shall be provided to all suspended mechanical units in hangers and high bay areas or above ceilings. Roof mounted units shall incorporate protection for roofing to allow regular maintenance.

c. Provide snap-on plastic pipe labeling only (no tape or stenciling). Comply with ANSI A13.1. Label all valves, instruments, etc. Provide a special tag on system isolation valves identifying area served (e.g. "chilled water shutoff to AHU's 1 - 4"). Require "valve" chart identifying all labeled items. Provide piping diagrams framed under glass in mechanical rooms.

d. Provide metal identification tag attached to each steam trap. Provide in the O&M manual a listing of each trap, trap capacity, type, and location.

4. COMPRESSED AIR DISTRIBUTION REQUIREMENTS: Outlets shall terminate approximately five feet above floor and shall have a valve drain cock. Each compressed air pipe shall have a pitch to it when it goes to a drain. Provide properly sized air dryers with a maximum pressure drop of 3 psi. A pre filter with an automatic condensate drain shall be used ahead of the air dryer with a maximum pressure drop of .5 psi. Use oil separators/filters with a max pressure drop of 1 psi ahead of equipment sensitive to oil contamination. Pressure tanks shall be sized to provide adequate compressed air storage for the system. Pressure tanks shall have an ASME National Board number. Tanks shall be equipped with a manual condensate drain, an automatic condensate drain, a liquid filled pressure gage and a pressure relief valve. Automatic condensate drains shall be design basis Drain-All brand. Each system shall be evaluated for the need of a demand controller. Provide a pressure-regulating valve at the point of use to maintain operating pressure.

5. ENERGY CONSERVATION MEASURES:

a. The designer shall consider energy conservation measures that are life cycle cost effective.

b. The facility energy consumption shall be in accordance with ETL 86-1.

c. As a general rule, 100% economizer HVAC systems are proven cost effective.

d. Solar Energy - Per HQ AFMC, solar assessment of active solar applications as mandated by ETL 84-1 is not cost effective. Passive Solar shall be analyzed and incorporated by A-E.

6. ENVIRONMENTAL CONSIDERATIONS:

a. The designer will not design a system utilizing exclusively CFC-11, CFC-12 or CFC-113 for any air conditioning and refrigerant equipment. R-22 refrigerant or any new non-CFC can be used in the design of these systems.

b. Natural gas burning equipment, paint spray booth systems or any other mechanical device that emits pollution may require permits from the Georgia EPD prior to installation. These permits could take as long as 90 days to receive after the application has been submitted to the state. Contact the Base Environmental Compliance office at (912) 926-9777 ext 162 or 126 to discuss emission issues. Provide all necessary permitting information in the design documents.

7. FIRE PROTECTION (See Electrical Section for Detection and Alarms)

a. Construction Submittal Requirements: Contractor shall submit fire protection system shop drawings, as-builts, and hydraulic calculations prepared and stamped by a Registered Fire Protection Engineer. A level III Technician certified by the National Institute for Certification in Engineering Technologies (NICET) in the Automatic Sprinkler System Layout sub-field of Fire Protection Engineering Technology in accordance with NICET 1014 is acceptable for design of new areas or new additions of less than 4000 SF where no fire riser is required.

b. Suppression:

(1) Water supply analysis/modification requirements: The designer is fully responsible for all water supply analyses required for each project, including making water flow tests, fire pump tests, etc. The Civil Engineering Plumbing Shop will assist the project A-E in making the tests and will provide previous flow test data when available.

(2) Calculations: Provide a hardcopy printout of the sprinkler hydraulic calculations in the HASS format (by HRS Systems, Atlanta, GA). Provide the final sprinkler design in the form of both the specified hardcopy printout plus the design data file compatible with the HASS sprinkler hydraulics program on 3.5-inch IBM-compatible floppy disk.

(3) Provide a preliminary sprinkler design by at least the Preliminary (65%) design stage. Hydraulic calculations shall be provided by at least the First Final (85-90%) design stage.

(a) Design shall be IAW NFPA 13, Military Handbook 1008c, Factory Mutual (FM), UL, UBC, and the System Safety Analysis for each project.

(b) In some cases, only sprinkler head locations need be shown, with calculations to be performed by the construction contractor. This must be approved during design fee negotiations for each project.

(4) Fire hydrants: Provide additional fire hydrants as needed.

(5) Fire extinguishers shall be in cabinets flush mounted to the wall.

(6) Warehouses shall have large drop sprinkler heads.

(7) Electronic equipment shall not have halon protection. Use preaction water suppression with early detection and shutdown of equipment.

(8) Fire Pumps are discouraged. If used, feed from another building or place a sign on the transformer feeding the building warning the Shops to not disconnect the transformer during a fire.

(9) Drawing Requirements: Drawings shall be prepared and stamped by a licensed Professional Engineer practicing in Fire Protection.

(10) Use water motor gongs at each riser.

c. Limiting: Provide dampers, vents, partitions, fire rated doors, and other materials as needed.

d. Pipe: Do not use either CPVC or polybutylene pipe in any fire protection piping systems.

8. PLUMBING:

a. General: Plumbing systems will be designed in accordance with the Uniform Plumbing Code. Plumbing systems will include water service pipes, building soil and waste drains and building storm drains, all pipes, fixtures, vents, branches, rain leaders and special piping systems necessary for fire protection. Individual shut-off valves shall be provided for each fixture. Floor drains shall be provided in all toilets, janitor closets, and mechanical rooms to prevent flooding.

b. Building Water Supply:

(1) Potable Water Source: The water supply will be from the nearest Base water distribution main line. Domestic water supply must have reduced pressure principle type backflow prevention. Any solder used in domestic water supply system must be 90/10 or 95/5.

(2) Hot Water Requirements: Domestic hot water shall be provided by the most cost-effective means. Consideration shall be given to heat recovery from superheated refrigerant gas to supplement domestic water heater.

c. Drinking Fountains: Provide refrigerated drinking fountains when fountains are needed. Drinking fountains are required in office and shop areas.

d. Sanitary Sewer System: See Civil Standards.

e. Piping Systems:

(1) Plumbing: Sanitary piping shall be schedule 40 PVC or cast iron. Domestic water piping may be Schedule 40 PVC/CPVC, type L copper (above ground), or type K copper (below ground). Galvanized steel piping may be used is some instances with Base approval.

(2) Hot/Chilled Water Systems: All hot and chilled water piping systems shall contain the following as a minimum.

(a) Make-up water system with reduced pressure principle backflow preventer.

(b) Freeze protection for exposed piping by means of glycol additives, drain down capabilities, or heat tape and insulation.

(c) Drains at low points of the piping system and vents at high points.

(d) Expansion tank for water expansion and air separator for air control.

(e) Balancing valves at the discharge of all pumps and at coils requiring metered flow.

(f) Water treatment sampling and injection ports for all closed loops.

(g) System design shall include water treatment capability.

f. Restroom Equipment: Provide floor-mounted and drained lavatories. Provide wall-mounted urinals in men's restrooms with motion-sensing flush valves.

9. STORM DRAINAGE SYSTEM: See Civil Section.

10. UTILITY DISTRIBUTION SYSTEM: Plans of the existing utility distribution lines will be provided by Base Civil Engineer. Utility meters shall be installed on all utilities.

a. Steam and Condensate: The designer shall evaluate the feasibility of using the central utility steam system and submit a recommendation to the Base. The Base shall make the decision to use the central system. When allowed by the Base, the steam and condensate system shall comply with ETL 88-6, Heat Distribution System Outside of Buildings.

b. Chilled Water/Hot Water/Dual Temperature Piping: Central chilled water shall be used when appropriate. The central chilled water plant currently has ample capacity to serve additional facilities. Contact the Mechanical Design Chief (Alan Whitmire) at (478) 926-3533, Ext 28400, to discuss availability of central chilled water prior to design. New underground chilled water distribution piping, 4 inches and larger, shall be insulated PVC Carrier pipe with an HDPE polyethylene jacket, 200 psi pressure class at 73.4 deg F, SDR 21, and conform to ASTM D2241. Chilled water piping smaller than 4 inches shall be insulated schedule 40 carbon steel pipe with an HDPE jacket. Provide tracer wire for locating buried PVC piping.

c. Natural gas - All underground natural gas lines installed on Robins AFB shall be polyethylene type PE 3408 as designated by ASTM D2513. Minimum wall thickness shall correspond to a standard dimensional ratio (SDR) of 11. 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. All underground metal piping shall be coated per the corrosion control section and shall have cathodic protection installed. Also install tracer wires placed on the lines using #10 AWG Cu with nicked TW insulation to facilitate detection of the wire with pipe locators.

11. HEATING, VENTILATION, AND AIR CONDITIONING:

a. General:

(1) When installing new HVAC and suspended ceilings in existing unconditioned spaces, such as when converting warehouse space to admin, performance a structural analysis to ensure the structural system can handle the additional weight of the ceiling and ductwork. Include in the design analysis documentation.

(2) Avoid the use of VAV boxes. These require frequent maintenance and have high failure rates. Instead, use modular VAV units such as Therma-fusers from Accutherm. They are available in VAV cooling only, in VAV cooling only with warm-up, and in VAV heating and VAV cooling.

(3) Where reheat is required, such as for humidity control, provide chilled water coils and hot water reheat coils.

(4) Outside air intakes shall be installed above ten feet or on the roofs of single story buildings in compliance with force protection requirements.

b. Heat:

(1) When performing a formal Life Cycle Cost analysis, the designer shall be sure to include all associated maintenance costs for each type of system. In general, our low electrical rates often appear to make electrical heat a less expensive option than natural gas heat. However, a closer look shows that annual maintenance costs were not properly included. Also note that Therma-fusers have ten-year warranties that drastically reduce maintenance costs for them compared to conventional VAV boxes.

(1) The designer shall select the type of heat system and energy source per the priorities below:

(a) New Systems

(1) Natural gas fired infrared (if applicable). This is our top choice.

(2) High efficiency natural gas fired systems. This is preferred for all situations where infrared is not practical. We are building a natural gas grid on Base, so we will often require gas lines be run from a moderate distance to the site. Fortunately, such lines are relatively inexpensive.

(3) Steam systems. Do not install a new system. This type is expensive for us to build and maintain, so using it requires approval as an exception.

(4) Electric heating and heat pumps. This is our last choice. We only allow these when the heat load is small and the building is a great distance from any natural gas lines. The controls tend to be on/off rather than variable, and trying to imitate variability with SCR's causes spikes in the electrical system. Therefore, using this system requires approval as an exception.

(b) Existing Systems

(1) Existing steam systems. It is preferable sometimes to leave the feed from a central plant, with the interior distribution converted to a hot water system for building heating. In addition, some facilities use part of the incoming steam for their processes. The designer shall consult with the Energy Manager in 78 CES/CEOE for him/her to make the choice on reusing the steam central feed or convert to natural gas feed. Document the Energy Manager's choice in the Design Analysis.

(2) Existing natural gas systems. Install natural gas fired infrared units where applicable. Then use high efficiency natural gas fired units for all situations where infrared is not practical.

(3) Existing electric heating and heat pumps. Convert to natural gas heating. We may allow retaining the electric heat system if the heat load is small and the building is a great distance from any natural gas lines. Using this system requires approval as an exception.

(2) Distribution Piping and/or Ducting: All distribution piping shall be copper, iron, ASTM A53 or ASTM A120 steel. Distribution piping shall be designed as a reverse return system. Water velocities in distribution piping shall not exceed 4 ft/sec. Piping shall be routed to provide the greatest accessibility possible for maintenance. Pipe chases shall have removable covers, which allow access to the

entire piping system. Converters, pumps, expansion tanks, and other items requiring maintenance shall be located such that they can be easily serviced from floor level. Provide drain valves to allow complete system drainage and air vents at high points and at coils.

c. Ventilation/Air Conditioning/Refrigeration Systems:

(1) All air conditioning system designs shall conform to the ban on CFC's in accordance with ETL 88-8, Chlorofluorocarbons (CFC) Limitation in Heating, Ventilating, and Air Conditioning (HVAC) Systems. The designer shall utilize central plant chilled water for air conditioning, if available. If not, an independent air conditioning system is to be installed. The designer shall consider Total Life Cycle Cost in selecting the type of air conditioning system. All air-handling units shall be specified with adequate space between heating and cooling coils to allow for cleaning and repair.

(2) Projected heat loads: the designer in accordance with ASHRAE procedures shall calculate the design heating load requirements.

(3) Authorized Type of System:

(a) Central plant chilled water may be available for use for air conditioning system. If not, an independent air conditioning system is to be installed. The A-E shall consider Total Life Cycle Cost in selecting the type of air conditioning system.

(4) Distribution Piping and Ducting: See paragraph 10.a. above.

(5) Typical space, ventilation, and temperature requirements: All administrative areas shall be designed for 75 deg F Dry Bulb (DB) and 50% Relative Humidity (RH) for summer and 70 deg F DB and 50% RH for winter. Install humidifiers in the AHU discharge to provide rehumidification.

(6) Mechanical Rooms: Install unit heaters to keep the temperature above 55 deg F DB. Provide forced ventilation for hot summer days.

(7) Electrical Rooms: In general, pieces of electrical equipment in these rooms are rated for 30 degrees C, or 86 degrees F. The ambient temperatures and humidity levels in our region are much higher than that, so these rooms shall have HVAC systems installed to keep the space to no more than 30 degrees C, or 86 degrees F. In some cases, bringing the HVAC return air through the electrical room can meet the need. Also install unit heaters as needed to keep the temperature above 55 deg F DB.

(8) Communications (Telephone, LAN, etc) Rooms: These are dedicated rooms with no other equipment or trades and shall contain conditioned air and a lockable door.

(9) Combined Mechanical and Electrical Rooms: Provide physically separate rooms in all new construction. For existing combined rooms, physically separate the two areas, then provide the necessary cooling to the electrical area.

d. Controls and metering: Controls shall be electronic/electric/Direct Digital control except that pneumatic actuators may be used. The designer is to utilize the Corp of Engineers standard control designs as a basis to begin design. Complex HVAC systems shall be designed as Direct Digital Control systems compatible and communicable with the existing Base DDC systems. Coordinate with the Base Project Manager for specific alterations pertaining to each project. Metering will be required for all utilities. Meters shall be non-resettable with a local numeric display. Employees of the control equipment manufacturer shall install control systems.

12. HVAC SYSTEM WATER TREATMENT:

a. General:

(1) Base the equipment installation upon specific information obtained at the construction site and upon existing Base water treatment methods. Information includes data such as current analysis of Base water.

(2) All water treatment design not by Base specialists must be performed by an NACE accredited "Corrosion Specialist" with at least five years experience in this design.

(3) Chemical pot feeders:

(a) Use at least 5-gallon capacity.

(b) Provide pressure gauge on intake side of protected system.

(c) Completely serviceable from floor level.

(4) Use interlocks to insure chemicals will not feed when main system is off; e.g., on condenser pumps.

(5) Automatic chemical feed will use one of these methods:

(a) Water meter - timer method, where chemicals are added in relation to water make-up.

(b) Solids controller to control boiler blow down and chemical feed based upon manual setting.

(6) Inject chemicals downstream of pumps.

b. Chilled Water:

(1) Closed System:

(a) 100 tons or less: use chemical pot feeders.

(b) Over 100 tons: use automatic system.

(2) Open system (cooling towers): Use automatic system.

c. Hot Water (Closed System):

(1) 1000 MBTU/H or less: use chemical pot feeders.

(2) Over 1000 MBTU/H: use automatic system.

d. Steam:

(1) Use automatic system.

(2) Inject oxygen scavengers directly into the deaerator tank.

(3) Inject boiler water chemicals into feed water line right before the boiler drum.

(4) Blowdown Dumping:

(a) At main plant, dump to industrial waste.

(b) Dump elsewhere to sanitary sewer.

(5) Provide for manual blowdown of bottom drum.

13. SYSTEM COMMISSIONING OF HVAC:

a. Special Requirements:

(1) On site training will be required to instruct Government personnel in each phase involved with the sequence of operation for the system. The training will be accomplished by the manufacturer's representative, and take between two and seven days as determined by the scope of the project. This training will include the set up, operation, and balance of the system for the respective Government shops. Specify that the training shall be conducted and completed prior to Prefinal inspection.

(2) An independent firm certified by the American Association of Balancing Contractors (AABC) or the National Association of Balancing Contractors (NABC) shall accomplish test and balance of the system. The Government reserves the right to spot check the contract. The contract will be spot checked by the balancing contractor in the presence of a Government representative. 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. If the system is dependent upon steam or chilled water, testing and balancing will be accomplished during the time of year when they are available.

(3) All required test results, equipment O&M manuals, and schematics shall be turned over to the Government two weeks prior to the Prefinal inspection.

(4) Other requirements will be provided in the project description if necessary.

(5) Specifications shall require construction contractor to demonstrate the proper operation of each function described in the sequence of operation.

14. AIR CONDITIONING/HEAT LOAD ESTIMATES: The designer is to provide complete load calculations with the preliminary design. If the designer uses a computer program to compute the loads, a description of the program and copies of all input data shall be included in the design analysis.

15. PETROLEUM, OILS, AND LUBRICANTS:

a. Design of all petroleum, oils, and lubricants (POL) systems shall be IAW Military Handbook 1022 (available on the Internet at http://www.afcesa.af.mil/AFCESA/TechSupport/POL/polwww.html), American Petroleum Institute (API), and other industry standards, including all applicable NFPA regulations.

b. Welders shall be certified and shall do all welding outside the fuels area.

c. All valves and piping accessories are required to be rated for fuels.

d. All electrical equipment shall be explosion proof per Division 1, Class 1.

e. Tank refill access shall be readily available to tank trucks.

f. Surge suppressors will be used to prevent pressure build-up in the lines.

g. All above ground tanks shall be diked in accordance with EPA requirements.

h. All below ground tanks shall meet the latest editions of the EPA regulations, be double walled, and have cathodic protection.

i. Safety rails and platforms (for gauging tanks) will be provided for above ground tanks.

j. All pumps will be rated specifically for the fuel they will be handling.

k. The system will be designed such that the metals being used in the system will not react with fuel.

l. All pipes shall be painted with the proper POL color coded markings.

m. Below ground piping will be double wall, properly coated, and cathodically protected per applicable EPA regulations. The designer will evaluate the use of underground fuel pipe and submit recommendations to the Base. The Base will make the decision on the use of underground piping.

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

o. Pumps to below ground tanks shall have leak detectors for piping pressure loss.

p. WARNING signs will be properly displayed.

q. Underground tanks will be anchored properly so that flotation will not occur.

r. Pea gravel backfill will be used to fill around tanks.

s. All tanks will have manways with access ladders.

<<<<< END OF SECTION >>>>>

ELECTRICAL STANDARDS

INTRODUCTION

MILCON Designs and Design/Build: Use Army Corps of Engineers (COE) Specifications for Robins AFB. These Electrical Standards take precedence over the National Electrical Code minimum requirements, COE standard design criteria (listed in the Savannah District Design Manual for Military Construction), and any other design guidance or standard.

Refer questions or exception requests to the Base Project Electrical Engineer in 778 CES/CECE or CECM. Note clearly in the design analysis any exceptions granted to these requirements.

The major sections and subsections are as follows:

SECTION 1 - GENERAL

1.01 STANDARDS: Follow these requirements and applicable publications. This lists requirements we expect to be covered in the design for new or altered facilities. These standards take precedent over all codes such at the National Electrical Code, ANSI C2, and NFPA.

1.02 DRAWINGS

a. General:

(1) These subparagraphs are placed in the normal order of the "E" plates for a new facility.

(2) Use different site and floor plans to separate demolition from new work.

b. First Sheet:

(1) Show electrical legend.

(2) List general comments for all electrical sheets.

c. Site Plan:

(1) General: Show all other exterior utilities that will affect the installation of the new underground power. This points out potential interference between different utilities.

(2) Site work:

(a) Protecting the Environment: Route underground lines to avoid cutting tree roots as much as possible.

(b) Call for seeding and sodding over disturbed earth areas that are affected by construction.

(c) Provide details for patching concrete and asphalt.

(d) All lines shall be bored and jacked under road and driveway pavements. Primary voltage ductbank/line across parking lots shall be cut and patch. Secondary lines (600 volts or less) across parking lots shall be directional bore. (NOTE: Wherever possible and economically advantageous, use directional boring instead of boring and jacking. Typical depth of directional boring is 4', or greater when obstructions are encountered. Directional boring is especially helpful where there is heavy underground congestion with existing utilities.)

d. Power Plan:

(1) Provide separate mechanical and electrical rooms in new or altered facilities.

(a) Provide electrical rooms with exterior doublewide doors of adequate height for future removal of large electrical equipment.

(b) Ensure adequate clear space around electrical equipment in accordance with the National Electrical Code.

(2) Provide an electrical single line diagram on the drawings.

(a) Show the available symmetrical short circuit current at each bus.

(b) Show grounding of dry-type transformers.

e. Interior Lighting:

(1) Show a light fixture schedule with mounting height in the table.

(2) Show a perspective view of each fixture on the drawings.

(3) Lighting plans: Show a junction box and 6 feet of flexible metal conduit to all light fixture connections above suspended ceilings, acoustical or gypsum.

f. Lightning Protection:

(1) Show roof and counterpoise (or tripod ground rod sets) design.

(2) Provide details of air terminals, conductor attachments, roof penetrations, etc.

(3) Show all details based upon the type of roof on the project. For example, if the project contains a standing seam roof, then all details shall be shown based on attachments to a standing seam roof.

g. Fire Alarm - Riser Diagram:

(1) Show signal line circuits, notification circuits, and transceiver. Coordinate conduits with manufacturer and Contractor in design/build contracts.

(2) Show as a 2-conduit loop system.

(3) Show antenna location.

h. Telephone/Communications/CATV: Show both plan views and riser diagrams.

1.03 MEDIUM VOLTAGE DISTRIBUTION: The Base system is owned by Robins AFB and consists of overhead and underground conductors at 12.47/7.2 KV, multi-grounded wye, 3-phase, 60 Hertz.

1.04 LOAD LEVELS: Calculate load levels for at least the following items. Derate for 50 degree C ambient in uncooled spaces.

a. Branch and feeder circuits.

b. Panelboards and switchboards.

c. Generators and automatic transfer switches.

d. Transformers.

1.05 DEMAND FACTORS: Size service entrance, pad mount transformers, downstream panelboards, dry type transformers, feeders, etc., as listed below.

a. General Purpose Convenience Receptacles:

(1) First 10 KVA, use 100 percent demand. PF = .95 lagging.

(2) 50 percent demand factor for remaining over 10 KVA. PF = .95 lagging

(3) Note: This does not include system furniture receptacles in office areas, individual office rooms, and large open office areas without system furniture.

b. Mechanical Equipment: Assume 100 percent demand load, PF = .80 lagging.

c. Lighting: Assume 100 percent demand load at PF = .95 lagging. Lighting shall be considered a continuous load with circuits serving such loads not loaded more than 80 percent of their rating.

d. System Furniture: Assume each cubicle contains one (6 amp) 720 VA CPU computer and a (2 amp) 240 VA computer monitor. Design on each four cubicles sharing a (8 amp) 960 VA printer. Include in load calculations an additional 180 VA per cubicle for typical furniture task lighting and miscellaneous loads (such as calculators, electric pencil sharpeners, etc.) Assume 80 percent demand load at PF = 0.95.

e. Individual Office Rooms: Assume each room contains one (6 amp) 720 VA CPU computer, one (2 amp) 240 VA computer monitor, and one (8 amp) 960 VA printer. Include in load calculations an additional 180 VA per room for typical desktop task lighting and miscellaneous loads (such as calculators, electric pencil sharpeners, etc.) Assume 100 percent demand load at PF = 0.95.

f. Large Open Offices (250 SF and above) w/o system furniture: Design using 15 VA per SF at 80 percent diversity at PF = 0.95.

g. Busways (and Bus Ducts): Calculate busway ampacity by using 1.25 times largest motor load plus all other loads plus 25% spare capacity, at 80% Power Factor (PF). Protective device and feeder to each busway shall have an ampacity not less than the busway ampacity. For purposes of sizing service entrance and upstream distribution panels, assume each busway contains a demand load of not less than 50 percent of the rated busway ampacity at 80% PF. No additional demand factor or diversity shall be applied. Each busway shall be fed with a separate protective device and homerun feeder.

h. Pad Mount Transformers and Service Lateral Conductors - No additional diversity or demand factor shall be applied to the pad mount transformers and service lateral conductors. Pad mount transformers and service lateral conductors shall have an ampacity equal to or greater than the service entrance rated equipment.

i. Service Entrance Rated Equipment - Service entrance rated equipment shall be sized based on a summation of the individual demand loads. No additional diversity or demand factor shall be applied to the service entrance rated equipment.

j. Feeders - These shall be sized to carry the anticipated current. Demand factors may be specific depending on a certain application. Demand factors not listed, or proposed that are different from this standard, must be approved by 778 CES/CECE at Robins AFB.

1.06 POWER SYSTEM PROTECTION STUDY

a. Design: Perform a short-circuit study during design to determine proper AIC ratings of all electrical equipment. Include calculations in the design analysis.

b. Construction: Perform a short-circuit study and time-current coordination study during construction but prior to procurement of any equipment/material. Both the short-circuit study and the time-coordination study shall be performed by the same company. For MILCON projects, see the Section 16415 paragraph on Coordinated Power System Protection for the format of these studies.

c. MVA: At a minimum, use 400 MVA with X/R = 15 available at the primary side of the main transformer.

d. Scope: Include the protective system from the nearest upstream devices beyond the padmount primary fuses down to and including all adjustable or selectable low-voltage protective devices.

e. Limiters: Do not use low voltage cable limiters to achieve short-circuit limitation for equipment.

f. Transient Voltage Surge Suppression (TVSS) is required at the main service entrance as a minimum. Double-ended switchboards will require a TVSS on each side.

1.07 MOTORS

a. Size: Motors of more than 1/2 HP shall be 3-phase.

b. Reduced Voltage Starting: Use reduced voltage motor starting on 75 HP and up. For smaller motors, evaluate motor-starting voltage drop and provide reduced voltage starting if over 10% drop.

c. Efficiency of polyphase squirrel-cage induction motors shall be premium, design E per NEMA MG-1 - 1993, rev. 1.

SECTION 2 - EXTERIOR

2.01 EXTERIOR POWER

a. Underground: Feed all new facilities underground.

(1) All primary underground feeders and secondary feeders from the transformer to the service entrance shall be installed in concrete-encased duct as described below.

(2) Design/build Contractor shall investigate the primary utilities. A new air switch shall be installed. Exceptions by the Base Project Manager may be granted upon request, depending on the current exterior utilities and the load within the facility. Note: If load requires a total capacity of 1500 KVA or above, then two air switch compartments will be needed to serve the two pad mount transformers. Refer to "Service Entrance Transformers" listed below for requirements of double-ended design.

(3) Designer shall use double-ended main switchboard on a transformer capacity of 1500 KVA and larger. In other words, if the load requires 1500 KVA or larger transformer capacity, the designer shall use two transformers (e.g.: two 750 KVA) with a double-ended switchboard construction. Double-ended design shall have a main breaker on each side and a tie breaker.

(4) Air switches shall be provided and installed in order to comply with the Electrical Standards. Each pad mount transformer shall be connected to a separate air switch compartment. Transformers shall not be looped to feed downstream pad mount transformers.

b. Equipment Pads:

(1) Size pads to extend beyond transformer/switch 6” on all sides.

(2) Precast pads are not allowed. Equipment pads shall be poured on site with 3000 psi and reinforcing steel.

(3) Pads shall have no openings to the dirt below. This is to keep fire ants out. Seal all openings and windows in pads with concrete.

(4) Use a counterpoise around the pad with #4/0 bare copper conductors. Add one ¾” X 10’ copper clad ground rod at all four corners. Extend a separate #4/0 bare copper conductor, in a PVC sleeve, to each equipment section (in the primary and secondary sections of padmount transformers and all four sections of padmounted switches). All connections below grade shall be exothermic type. Show detail on drawings.

c. Duct Bank:

(1) For main lines (from manhole or switch to manhole), run 4-way 5 inch PVC (Sch. 40 or Type DB) concrete-encased, as a minimum. No EB (thin wall) will be accepted.

(2) Minimum size conduit from manhole to transformer shall be 2-4” PVC (Sch. 40 or Type DB) concrete-encased. No EB (thin wall) will be accepted.

(3) For last turn up into a pad, use Sch. 80 PVC if concrete is not encasing the last piece.

(4) Provide pull wires (nylon, Greenlee #430, 210 tensile strength) in each empty conduit.

(5) Use sweeping bends if only one turn of less than 90 degrees.

(6) Turns of 90 degree or more for 500 MCM, 15 KV shall have a manhole at the turn. Handholes are allowed for two runs (single phase or three phase) of #2, 15 KV only.

(7) Run neutral with phase conductors in each conduit.

(8) Use metallic backed warning tapes above all duct banks. Show detail section for duct on drawings.

(9) Where underground secondary conductors are used in lieu of busway, install in concrete encased duct sized per the NEC.

d. Cable: Main line is defined as cable running from switch to switch or riser pole to switch.

(1) Primary cable shall be 1/C, 15 KV, copper, XLPE (MV-90), shielded with 100% insulation.

(2) Neutral conductor shall be 600 volt with THWN insulation.

(3) Main line - 500 MCM, with #4/0 neutral.

(4) Transformer feeders shall be #2 with #2 neutral.

e. Manholes and Handholes:

(1) Primary manholes:

(a) Use minimum size 8′ x 8′ x 7′.

(b) Place no more than 450′ apart.

(c) Provide four 5″ cast-in-place inserts on each inside wall.

(d) A manhole shall be provided at each switch location. Connect to manhole with one 5″ duct entering each switch section.

(2) Primary (for #2, 15 KV cable only) and secondary handholes shall be 4′ X 4′ X 4′. All sides and bottom shall be concrete.

(a) 500 MCM, 15 KV cable shall be installed in manholes only.

(b) Turns of 90 degrees or more shall use secondary handholes or runs greater than 300′.

(3) Provide sumps.

(4) Provide circular metal covers and not removable tops, since these often require power equipment to remove.

(a) Provide minimum clear opening of 32″.

(b) Provide H20 wheel loading.

(5) Core drill all existing manholes/handholes.

f. Connections:

(1) Use no primary cable T-splices! This includes inside manholes and handholes.

(2) Use only padmounted air switches for primary connections.

(3) Pad mount transformers shall not be looped to connect downstream pad mount transformers. Each pad mount transformer shall be connected to a dedicated air switch compartment. Three #2 primary conductors with #2 neutral shall be connected to each pad mount transformer from a dedicated air switch compartment.

g. Padmount Air Switch Features - Design basis is S&C PMH-10

(1) 4-way, Air type.

(2) Live front, rated 600 amps with viewing window.

(3) Gang switched.

(4) No mechanical interlocks.

(5) Switches shall be factory painted Brown, Robins AFB #48.

(6) Furnish with the following options:

(a) Dual-purpose front barrier

(b) Grounding stud

(c) 18-inch carbon steel base spacer, noncompartmented to match enclosure.

(7) Furnish 6 locks and one key for each switch installed. Use locks manufactured by Best Lock Corporation, lock number 21B720L-R with core number 8A59, short shank. Keys provided shall be blank and uncut, also manufactured by Best Lock Corporation.

h. Riser Pole Connections When Specified.

(1) Use 5" rigid steel for 500 MCM and 4" rigid steel for #2.

(2) Make transition from overhead riser to underground with rigid steel elbow.

(3) Use fiberglass arms only on pole.

i. Service Entrance Transformers:

(1) Live-front transformers are not allowed.

(2) Primary transformers shall not be installed indoors.

(3) A separate transformer shall feed each facility or building.

(4) Use low profile utility type for single-phase units.

(5) Designer shall use double-ended main switchboard on a transformer capacity of 1500 KVA and larger.

(a) Each transformer shall be sized to carry approximately 60 percent to 80 percent of the total demand load served.

(b) Use normally open tie breaker with Kirk key interlock.

(6) Provide secondary feed to main switchboard via feeder busway instead of parallel conductors when the ampacity of the service entrance conductors from an individual transformer is greater than 1600 amps.

(a) Busway shall be copper with internal copper ground.

(b) Provide bus fittings for the transformer and facility wall connections by the busway manufacturer.

(c) Exterior busway shall be NEMA 3R with aluminum housing.

(7) Secondary Cables

(a) Run underground.

(b) Use single conductor copper with THWN insulation.

(c) Use no conductors larger than 500 MCM.

(8) All new facilities shall be fed with 480/277 volts, unless special permission is granted by Civil Engineering at Robins AFB. On facilities with 480/277 volts and 208/120 volts, service into the facility shall be 480/277 volts

with interior dry type step down transformers to supply the 208/120-volt system. Using separate exterior pad mount transformers to supply the 480/277-volt system and 208/120-volt system is not acceptable.

j. Transformers shall be padmount construction with the following features:

(1) Outdoor metal-enclosed padmount

(2) Primary - 12,470V Delta, Secondary - 480/277 volts

(3) Consisting of high-voltage (incoming) compartment, transformer section, and low-voltage compartment

(4) Full height isolating barriers

(5) Single phase shall be low profile utility type

(6) Incoming compartment:

(a) Dead-front construction

(b) Loop-feed with universal bushing wells

(c) Load-break connectors

(d) Load-break primary switch

(e) Fuses (Side-wall mounted "Bay-O-Net" oil-immersed expulsion fuses in series with coordinated oil-immersed current limiting fuses). For transformers exceeding 1500 KVA use full range current limiting tandem mounted fuse assembly.

(f) External tap changer

(g) Lightning/surge arresters.

1. Dead-front

2. 9 KV

3. MOV-type

(h) Inserts

(i) Parking stands

(j) OA 55/65^{O}C

(k) Four 2-1/2% high voltage taps, two above and two below rated voltage

(l) Sufficient clearance for access to drain plugs

(7) Transformers shall be factory painted Brown, Robins AFB #48.

(8) Furnish 1 lock and one key for each transformer installed. Use locks manufactured by Best Lock Corporation, lock number 21B720L-R with core number 8A59, short shank. Keys provided shall be blank and uncut, also manufactured by Best Lock Corporation.

k. Unit Substations:

(1) Use outdoor unit substations when renovating an existing facility with insufficient space inside electrical rooms to install new equipment. New facilities shall be designed with adequate interior floor space inside the facility electrical rooms for the new electrical equipment.

(2) Use walk-in outdoor house/power building for the secondary side.

(a) Thermally insulate the walk-in housing.

(b) Provide ventilation fans, lights receptacles, and heating and air conditioning. Provide power from a small panelboard inside the enclosure.

(3) The same manufacturer shall manufacture the housing, transformer, and switchgear.

l. Transformer Metering

(1) Provide metering at all pad mount transformers. This metering shall be in addition to the metering requirements at all service entrance equipment.

(2) The Electrical Contractor shall sub-contract to Georgia Power Company for the material and installation of the metering at the pad mount transformer. Include a bid cost of $2,700 (as of late 2001) for Georgia Power Company's' Services. Contact GA Power at 800-205-1664.

(3) The Electrical Contractor shall provide a 1-inch conduit from the bottom of the pad mount to the metering cabinet provided by Georgia Power.

(4) The Electrical Contractor shall provide a 1-inch conduit from the metering cabinet to the telephone backboard.

(5) Provide note on drawings to indicate that contractor shall subcontract with GA Power for procurement and installation of meter.

2.02 EXTERIOR LIGHTING - GENERAL

a. Parking Lot Lighting

(1) General requirements:

(a) Use aluminum poles.

(b) Calculate lighting levels based upon IES (Illumination Engineering Society) for maintained levels for parking lots - design for 2.0 FC average with no point less than 1.0 FC.

(c) Fixtures shall be controlled by individual photocells on each fixture. Photocells shall activate at 3 foot-candles of ambient light.

(d) Feed at 277 V. If feasible, feed by panelboards mounted adjacent to padmounted transformers. Otherwise, feed from adjacent buildings served by the parking lots.

(2) Primary standard is high mast lighting.

(a) Use 100’ poles equipped for up to 12 fixture heads, even if fewer heads are used. Holophane is base preference.

(b) The manufacturers do not have recommended foundation designs; so require the contractor to provide a submittal showing their proposal to withstand a 90 mph wind with 12 luminaires on the top of the pole. (NOTE: We have had some installations with a 17’ deep hole 4’ in diameter, with bolts 72 inches long, and a 14’ cage 3.5’ in diameter for concrete reinforcement. The bolts were 2” in diameter, and the rebar was sized at no. 5. The installation included a vertical I-beam 14’ long.)

(c) Fixtures are specially made for this purpose and have 1000 W HPS lamps.

(d) Have the manufacturer provide a printout showing the FC point-to-point calculations for the lot layout.

(e) Include stainless steel hoisting cables with a mechanism that is operated by an electric drill for lowering the fixture set to ground level for maintenance.

(f) Also provide double aircraft warning lights on poles located north of Fifth Street.

(3) Secondary standard is for shorter poles with cobra heads.

(a) Provide 25’ poles with screw-in bases and 6’ or 8’ arms as applicable.

(b) Foundations shall be constructed as follows: 16 inch diameter helix made from hot rolled steel per ASTM A635; base plate size 15 inch diameter bolt circle and constructed of hot rolled steel; shaft size approximately 7 ft 6 inches constructed of steel pipe per ASTM A53. Entire finish shall be hot dipped galvanized per ASTM A123. Design Basis --- Chance Cat # XT112-0284

(c) Fixtures shall be cobra head type with 250W HPS lamps. Use “wide area” lenses and fixtures. Shoebox type fixture heads are unacceptable due to difficulty in maintenance and high first cost.

(4) Last preference, discouraged due to difficulty of maintenance and higher initial cost, is for shorter poles with rectangular box shaped fixtures on short horizontal arms.

(a) Only use these along paths and sidewalks near administrative facilities where a high degree of aesthetics is desirable. These must meet the balanced goals of architectural compatibility, energy budgets, and sustainability.

(b) Provide on poles no taller than 10’ due to maintenance difficulty.

(c) Poles may be colored with anodized aluminum if this better meets the architectural compatibility requirements.

(d) Foundations shall be constructed per manufacturer recommendations. If possible, use screw-in bases and foundations such as for parking lot 25’ poles, but sized smaller as required.

b. Street Lighting

(1) General requirements:

(a) Only provide where adjacent parking lot lighting is insufficient for street level.

(b) Calculate lighting levels based upon IES (Illumination Engineering Society) for maintained levels - design for 1.0 FC with no point less than 0.5 FC.

(c) Fixtures shall be controlled by individual photocells on each fixture. Photocells shall activate at 3 foot-candles of ambient light.

(d) Feed at 277 V. If feasible, feed by panelboards mounted adjacent to padmounted transformers.

(2) Primary standard is high mast lighting as described above.

(3) Secondary standard is for shorter poles with cobra heads as described above.

c. Sidewalk Lighting: Any sidewalk that is not adequately lighted by the parking lot lighting and branches into the entryway of the facility shall be lighted with sidewalk lighting. Design Basis -- Lithonia KBR6 series with 70-watt metal halide lamps.

d. Exterior Doors: Exterior Doors: Provide wall pack metal halide fixtures above or next to all exterior doors.

e. Facility Site Lighting: If security is a concern or parking lot is adjacent to a wall, provide wall pack metal halide fixtures spaced to provide 2.0 FC average to the area.

f. Exterior Storage Area Lighting: Provide lights around the perimeter of the entire storage area.

(1) Lights shall be 30 feet tall, round, tapered aluminum pole with two-floodlight type lighting fixtures mounted on 2 tenons 180 degrees apart.

(2) Fixtures shall be 400 watt HPS with a NEMA type 6 X 5 light distribution.

(3) Install pole on a screw-in base.

(4) Poles shall withstand steady wind velocity of 80 MPH and have a 1.3 gust factor based on the effective projected area of the fixtures and brackets provided.

(5) Poles shall be one piece, spun construction, with cast aluminum base, ground lug, handhole, and sanded satin aluminum.

(6) Poles shall be spaced to provide 10 foot-candles.

2.03 EXTERIOR LIGHTING SPORTS: All lighting shall be metal halide. Calculate lighting levels based upon IES (Illumination Engineering Society) for maintained levels.

a. Baseball and Softball Fields: Lighting levels shall be based on Class of Play Type II per IES. Layout poles shall be as recommended by the IES standard.

b. Tennis Courts - Lighting levels shall be based on Class of Play Type II per IES. Layout of poles shall be as recommended by the IES standard.

c. Type: All lighting shall be metal halide.

d. Poles - All pole construction shall be concrete set in a concrete base.

2.04 LIGHTNING PROTECTION

A. Mandated Need: Provide on all facilities with explosives or hazardous materials. Ground in accordance with Chapter 7, Lightning Protection, DoD 6055.9_STD and AFI 32-1065, Grounding Systems.

B. Determined Need: Use NFPA 780 (Lightning Protection Code) Appendix H, Risk Assessment Guide, with F = 1 along with 0.5 adjustment for Southeast area. If R = 9.0 or higher, install lightning protection. (Note: Calculated values of R that are 7.0 and higher are rated Severe.)

C. Documentation: Present all calculations in the design analysis.

D. Design for buildings under 4,000 square feet:

(1) Design per UL and NFPA 780.

(2) Conductors:

(a) Use only copper, except on galvalume or other aluminum roof materials.

(b) All conductors on roofs shall be treated as main conductors.

(3) Install Transient Voltage Surge Suppression (TVSS) on the service entrance of each protected facility. Assume one service entrance per facility unless field checking or RAFB record drawings indicate otherwise. Our specification master is labeled 16672, Transient Voltage Surge Suppression.

(4) Installation:

(a) Methods shall conform to UL 96A.

(b) Components shall conform to UL 96.

(c) Contractor shall obtain a UL letter of findings for the facility. The UL letter of findings shall be provided to the Government directly by UL after inspection by UL personnel. The Contractor shall make all corrections listed in the UL letter of findings.

(d) Use no adhesive connections without approval as a formal exception. A rubber washer and tek screw shall securely attach conductors installed on metal roofs. Facilities with standing seam roofs shall have the conductors and air terminals attached to the roof at the top of the standing seams to minimize roof penetrations. Apply sealant under bases and between screw and washer. (In some cases Silaprene adhesive may be granted as an exception when requested).

(e) Thru roof penetrations are not allowed except at downlead locations at the perimeter of the facility.

(f) All down conductors shall be concealed in the wall with CPVC sleeve.

(g) Entire roof perimeter and at all ridges shall have air terminals spaced at 20 ft intervals maximum.

(h) All other locations in the center of the roof between the ridges and the perimeter shall have air terminals spaced in a square grid at 50 ft maximum intervals.

(i) If the facility contains a structural steel support system, then the structural steel can be used for the downlead connections. The connection at the top of the roof to the steel shall not exceed 100 ft average intervals. Also, connections from the base of the steel to the counterpoise around the facility shall not exceed 60 ft average intervals. All connections to the steel shall be exothermic type, top and bottom. Thru-roof conductors shall only be installed at the perimeter of the facility at downlead locations.

(j) If structural steel is not used as a down conductor, then UL Listed Class conductors shall be installed in PVC concealed in the wall. Connections shall not exceed 100 ft to the roof conductors and 100 ft to the counterpoise around the facility. Thru roof penetrations shall be used to connect the down conductors. Thru-roof conductors shall only be installed at the perimeter of the facility at downlead locations.

(k) A counterpoise shall be installed around the entire facility. Counterpoise shall be minimum #1/0 bare copper and installed 2 feet below grade per NFPA 780. All below grade connections shall be exothermic type. (In some cases tripod grounds with rods 20’ apart at downlead locations may be granted as exceptions when requested).

(l) Standing seam metal clamps shall not be used. All connections to standing seam metal roofs shall be screwed with a tek screw at the top of the seam. Coordinate details with lightning protection installer.

(m) Air Terminals (rods) are typically 10” in height.

E. Design for buildings of 4,000 square feet and larger (per RAFB approval by HQ AFCESA):

(1) Use the Electronically Activated Streamer Emission (EASE) system: design basis is Prevectron IV by National Lightning Protection Corporation.

(2) Design per manufacturer’s requirements.

(a) Our specification master is labeled 16671- Lightning Protection - EASE.

(b) Install Transient Voltage Surge Suppression (TVSS) on the service entrance of each facility within the protected radius if not previously installed. Assume one service entrance per facility unless field checking or RAFB record drawings indicate otherwise. Our specification master is labeled 16672, Transient Voltage Surge Suppression.

(3) Existing Facilities: Mount each EASE device on a pole or mast 15’ – 20’ horizontally to the side of the nearest building roof edge. Consider roof mounting for very tall facilities.

(4) New Facilities: Consider roof mounting first, then on a pole or mast to the side. Ensure the structural requirements for roof mounting are covered in the design package.

(5) Design Criteria: State on drawings:

(a) Soil resistivity is 25,000 Ohm-cm, unless actual values at the site are known.

(b) The highest elevation of any object on each building.

(6) Shielding Ground Bed: Provide vegetation as first choice and fencing as second choice over the top of the ground bed to protect personnel from voltage gradients in the soil during a lightning strike.

SECTION 3 - SERVICE ENTRANCE

3.01 SYSTEM GROUNDING

a. Soil Resistivity: The median value runs in the 25,000 ohm-cm range for soil near buildings at Robins AFB. This would normally result in a single ground rod having a resistance of nearly 100 ohms. To meet the NEC requirement of 25 ohms or less a tripod set of ground rods 20 feet apart with Thermit-welded bare copper 4/0 wire between them is usually sufficient, provided the closest ground rod is at least 10 feet from the facility.

B. Buildings under 4,000 SF roof size and larger buildings without any admin space or office: When a bldg or structure meets this description after the work of this project, the system ground may meet the NEC requirement of 25 ohms or less.

C. Buildings of 4,000 SF and larger roof size with any admin space or office: Provide maximum of 10 ohms of resistance to hard earth ground in the system ground connected to the electrical service entrance.

3.02 SWITCHBOARDS, PANELBOARDS, AND MOTOR CONTROL CENTERS

a. Choice of type:

(1) Use switchboard construction when 1000 Amps or larger.

(2) Use power distribution panelboard construction when equal to 800 Amps. Boxes shall be minimum 9 ½ inches deep.

(3) Use panelboards when 600 Amps or less.

b. General:

(1) Use NEMA 3R outdoors. NEMA 4X may be specified in cases where the corrosion potential is high. Fiberglass is preferred over stainless steel for NEMA 4X.

(2) Use copper bus only.

(3) In motor controllers, use only adjustable motor circuit protectors with separate thermal overload elements, not thermal-magnetic circuit breakers.

(4) Size to allow for a 25% increase in power demand.

(5) Spare pole/space capacity shall be minimum 30% of total pole/space capacity.

(6) Panelboards, switchboards, or motor control centers shall not be tapped to feed new loads. If there is no space for protective devices in the existing piece of equipment to feed the new load, then a new panelboard, new switchboard (add section if feasible), or new motor control center (add section if feasible) shall be provided.

(7) Existing Equipment: When installing breakers in existing panels, insure the manufacturer can still supply them and at reasonable price and delivery schedule.

(8) When doing any work involving the main service entrance, install or re-install a laminated riser diagram of the electrical system on the wall near the panel.

(9) Provide typed directories in each cabinet.

(a) Clearly label each circuit as to type load and specific location. Ex.: Receptacles N. Wall

(b) Note on the directory from where the cabinet is fed. Ex.: Fed From Panel PA in Mech Room, Ckt. 4.

(10) All service entrance equipment shall contain a main breaker. If the facility requires double ended design, as stated elsewhere in this standard, then two main breakers with a normally open tie breaker shall be provided.

(11) Feeders to service entrance and any panelboard within the facility shall not contain any derated neutrals. As a minimum, neutrals shall have an ampacity of the phase conductors. Feeders to panels with 200 percent rated neutral busses shall have the neutral conductors rated 200 percent of the feeder phase conductors.

(12) New construction shall be designed with one service entrance.

(13) Labeling of Panel Schedules and Drawings for Branch Circuits: Each homerun symbol on the drawings shall be labeled in accordance with the pole numbers instead of a circuit number.

(a) Three-phase loads shall be designated by the three-pole numbers, such as HB - 1,3,5 or HB - 8,10,12. The single pole number, such as LA-12, shall designate single-phase loads.

(b) Panel schedules shall be numbered with odd numbers on the left side, top to bottom, and even numbers on the right side top to bottom.

c. Distribution Panelboards and Switchboards:

(1) Protect by breakers. Fuses are not permitted.

(2) All switchboards and panelboards shall be 3-phase, 4-wire, with ground bus. Install a neutral conductor to all switchboards and panelboards regardless of load.

(3) If the main breaker has ground fault protection, provide it as well on the feeder breakers.

(4) Show future frame space in all service entrance rated or distribution panelboards or switchboards, with full mounting hardware provided for plugging the breakers into them.

(a) Switchboards. 1000 - 1200 amps, provide:

1. 1-400 amp frame space.

2. 2-225 amp frame spaces.

3. 1-100 amp frame space.

(b) Switchboards. Greater than 1200 amps, provide:

1. Two 400-amp frame space.

2. 2-225 amp frame spaces.

3. 1-100 amp frame space.

(c) Double-ended switchboards. Provide for each side (a) or (b) above for future frame space sizes.

(d) 800 amp panelboards. Provide:

1. 2-225 amp frame spaces.

2. 2-100 amp frame spaces.

(e) 600 amp panelboards and below. Provide:

1. 1-225 amp frame space.

2. 3-100 amp frame spaces.

(f) All frame space sizes shall be based on three pole breakers.

(5) Use an electronic multi-meter in the main panelboard or switchboard instead of ammeters,

(6) On double-ended switchboards, control switches and meters shall be connected to the side of the energized source. As soon as power is de-energized from one of the incoming sides of the double-ended switchboard, all control power shall automatically transfer to the other side of the available energized source.

(7) Switchboards

(a) Main through bus shall be fully rated and non-tapered copper bus.

(b) Distribution sections shall have the same depth as the main service section.

d. Panelboards - Other:

(1) All panelboards shall be "main breaker interior" type unless the upstream circuit protective device is within sight of the downstream bus being fed.

(2) Gutter taps, sub-feed lugs, feed-thru panels, and taps of conductors inside junction boxes are unacceptable circuit feeds to panelboards.

(3) All panelboards shall be fed from a separate circuit breaker in an upstream bus. The only exception to this shall be when no more than two panelboards shall share the same feeder circuit from a dry type transformer. The second panelboard shall be connected from a feeder breaker in the first panelboard. The second panelboard shall be installed adjacent to the first panelboard or inside the same room.

(4) If multiple (three or more) 208Y/120 volt panelboards are fed from the same dry type transformer, then a 208Y/120 volt distribution panelboard shall be installed downstream from the dry type transformer. Each panelboard shall be connected to a dedicated circuit breaker in the distribution panelboard.

(5) Use minimum 225 Amp with 42 poles unless specifically stated elsewhere.

(6) Mount main breakers at the top or bottom in a vertical position specifically designed for that purpose. Exceptions only apply for approved applications of 100 Amps of less and 30 poles or less.

(7) Do not use load center type panelboards except for military family housing construction and temporary lodging facility construction.

(8) Panelboards with 200 percent rated neutrals shall be used when supplying power to the following areas:

(a) Office administrative areas

(b) Cubicles or System Furniture

(c) Individual office Rooms

(d) Large open office areas

(e) Computers

(f) Electronic Equipment

(g) Electronic Test Labs

(9) When supplying panelboard feeders to panels with 200 percent rated neutrals, the neutral conductors to the panel shall have an ampacity of twice the phase conductors in the feeder.

(10) When supplying panelboard feeders to panels with 100 percent rated neutrals, the neutral conductors to the panel shall not be derated less than the phase conductors in the feeder.

(11) Column width panelboards are unacceptable.

(12) Panelboards shall not contain integral TVSS units. Any TVSS units installed at panelboards shall be separate units and installed adjacent to the panelboards.

e. Circuit Breakers:

(1) Use only bolt-on type or I-Line type.

(2) Do not use ground fault breakers. Use only individual ground fault receptacles.

(3) Magnetic only switches shall not be installed in any switchboard or panelboard. All breakers shall have thermal-magnetic characteristics.

f. Main Breakers and Feeder Breakers shall be as follows:

(1) Main and Tie Breakers in Main Switchboards – (Including Double-Ended)-Service Entrance Rated.

(a) Insulated-case.

(b) 100% rated.

(c) Individually mounted drawout.

(d) Solid state trips with digital ammeter display and trip functions per Specifications.

(e) Electrical operation with backup manual operation.

(2) Feeder Circuit Breakers in Main Switchboards – (Including Double-Ended) Service Entrance Rated.

(a) Molded-case.

(b) 80% rated.

(c) Group mounted - stationary.

(d) Solid state trips with digital ammeter display and trip functions per Specifications.

(e) If feeder breaker is greater than 1200 Amps, use insulated case 100% rated, stationary type, with trip functions the same as specified for the molded case breakers.

(3) Main Circuit Breakers in Main Distribution Panels (MDP) - Service Entrance Rated (600 - 800 Amp Bus).

(a) Molded-case.

(b) 80% rated

(c) Stationary mounted.

(d) Solid state trips with digital ammeter display and trip functions per Specifications.

(4) Feeder Circuit Breakers in Main Distribution Panels (MDP) - Service Entrance Rated (600 - 800 Amp Bus).

(a) Molded-case.

(b) 80 % rated.

(c) RMS digital solid-state trip with adjustable short time and instantaneous pickup.

(5) Breakers Used in Service Entrance Rated Panelboards Less than 400 Amps shall be molded-case thermal magnetic.

(6) Circuit Breakers within a Sub-distribution Panelboard and 600 Amps or Greater.

(a) Molded-case.

(b) 80 % rated.

(c) RMS digital solid-state trip with adjustable short time and instantaneous pickup.

(7) Circuit Breakers within a sub-distribution panelboard and 400 Amps or less shall be molded-case thermal magnetic.

(8) If required by the project scope, breakers shall have additional metering functions for the solid-state trips.

(a) Functions shall include the following:

1. Energy (KWH, MWH)

2. Real Power (KW, MW)

3. Total Power (KVA, MVA)

4. Frequency (HZ)

(b) Provide device monitor to serve as a central location for reading and displaying all data at each solid-state trip unit and the facility meters. Connect monitor to all devices with a RS-485 network. Device monitor shall be a separate device from the facility meter.

g. Startup: Provide special startup along with training on setting and maintaining the breakers to CE shops. Use an independent testing firm registered with NETA or manufacturer's service engineer to set the adjustable devices. Include:

(a) Startup in the field.

(b) CE Shop training.

(c) O&M manuals.

(d) Schematics of electronic devices.

(e) Solid state trips tested in field with a portable test kit.

(f) Specified equipment used in the startup provided to CE shops for future maintenance.

3.03 GENERATORS, TRANSFER SWITCHES, AND FUEL TANKS

a. Generators: Base actual size on load analysis for 60-80% loading, based upon field readings when possible.

b. Fuel Tanks:

(1) Provide tank large enough for generator to run 72 hours at 100% rated load.

(2) Fuel tank shall be above ground, similar to Convault construction. The fuel tank shall be encased with secondary 3000-psi concrete container.

(3) A day tank is not required. The fuel shall be fed directly to the diesel fuel pump intake line. A 3.0-PSI anti-siphon check valve shall control fuel feeding into the diesel fuel pump.

(4) Include a high level alarm in the fuel tank to prevent overflow.

(5) Include an interstitial leak monitoring system to monitor and prevent tank leakage from the tank into the tank enclosure.

(6) Copper tubing is not allowed. Use only threaded black steel.

(7) Install a ¾" X 10' ground rod in a ground well. Extend a #1/0 copper conductor from the ground rod to the tank.

(8) Include on all four sides of the fuel tank the following markings:

(a) Flammable

(b) No Smoking within 50 Feet

(c) Diesel Fuel

(d) Capacity of Tank

(9) If the top of the tank is greater than 42" above finished grade, include steps.

c. Transfer switches:

(1) Switches shall be four-pole with switched neutral.

(2) Use bypass feature for critical facilities per design guidance.

(3) Automatic transfer switches and controls shall be installed in electrical rooms and not in areas where steam piping or other high humidity "generators" are present. Transfer switches shall not be installed outdoors.

(4) All transfer switches shall be of the automatic type.

(5) Transfer switches shall have the following features:

(a) A see-through polycarbonate cover for all live parts (such as in Cummins-Onan).

(b) Programmed transition for switching inductive loads. This shall delay the transfer switch mechanism to allow load inductive voltages to decay prior to connection to the oncoming source. This device shall have an adjustable time delay from 0 to 60 seconds, and an LED lamp to indicate the module is in the timing function.

(c) Permanently attached manual operating handle for backup to automatic switch mechanism. This shall provide load-break manual operation under load with quick make/quick break design.

SECTION 4 - INTERIOR

4.01 INTERIOR POWER

a. General.

(1) In existing facilities fed at 208V, convert to 480V. In new facilities the service voltage shall be 480Y/277 unless the Civil-Electrical Chief in 778 CES/CECE gives approval for 208Y/120 volts.

(2) Provide small distributed dry-type transformers (delta-wye) as needed for 208Y/120V to step the voltage down from 480Y/277. In administrative areas, locate the dry type transformers in electrical closets with the panelboards. Distribute the dry type transformers throughout the facility next to the loads.

(3) Use reduced voltage motor starting on 75 HP and up. For smaller motors, evaluate motor-starting voltage drop and provide reduced voltage starting if over 10% drop.

(4) Power Factor Correction: Install capacitors to correct power factor to 95% at full load for motors 5 HP and larger. Show every capacitor next to the motor. Install as close to the motor terminals as possible.

(5) The Contractor shall have an electrician with a Master's License on site during all installations.

(6) Use generic "off the shelf" equipment. Field fabrication of panels, switches, etc., is not allowed.

(7) Equipment that is obsolete or scheduled to be obsolete is not allowed.

(8) Provide a submittal at the final inspection that lists the vendors for all equipment, so CE shops can contact them later as needed.

(9) The following types of wiring are not allowed:

(a) Multiconductor type cables

(b) Armor-Clad and Metal Clad Cable

(c) Cable bus

(d) Non-Metallic Sheathed building cable, except in residential housing.

(e) Electrical Nonmetallic Tubing

(f) Underfloor raceway systems.

(10) All wiring shall be rated 600 volts, single copper conductor, with Type THHN/THWN insulation.

(11) All wiring shall be installed in metallic conduit raceways above grade or PVC (schedule 40) below grade.

(12) Wireway (rectangular shells with top covers into which cables are laid) are highly discouraged and allowed by exception only.

(13) Cable tray may be used as a raceway for power wiring only for major feeds in hallways above ceiling grids. Any other application shall be approved as an exception.

(14) Raceways shall be concealed wherever practical in finished spaces.

(15) Motor Control Centers shall have disconnect devices, branch circuit overload protection, and controllers mounted in a single assembly. Whenever the starter is located in the MCC, use instantaneous trip circuit breakers with separate adjustable overloads. If the unit contains no starter, and the starter is located at the machine, then a thermal-magnetic circuit breaker shall be used to supply the motor feeder.

(16) Electric - Operated Projector Screens in Conference Rooms, Classrooms and Training Rooms: Coordinate locations with user. Provide power and wall switches for control.

(17) Provide exhaust fans inside all main electrical rooms. Interior electrical closets next to administrative spaces shall be air-conditioned.

(18) Main electrical rooms shall be a separate room with no other trades sharing the electrical room. Main electrical room shall be located on an exterior wall with exterior double doors, and without a center support, in the opening for removal of equipment. Doors shall contain an exterior lock.

(19) Electrical closets within the facility shall be separate rooms with no other trades sharing the closets. Electrical closet doors shall contain a lock.

(20) In all new projects, provide a metal cabinet in the main electrical room next to the service entrance.

(a) Metal cabinet shall contain hinged doors and a location for a padlock.

(b) Cabinet shall be minimum four feet tall, three feet wide, and two feet deep. Cabinet shall have three metal shelves.

(c) Allow square footage in the floor plan for the metal cabinet.

(d) Inside the cabinet, the Contractor shall place one full set of as-built drawings, one set of all electrical shop drawings and one set of all electrical Operation and Maintenance manuals.

(21) New facilities shall size the main electrical room based on current project equipment sizes and future floor space. Designers shall layout the equipment in the room and show the future floor space on the drawings. Future floor space shall be provided as indicated below:

(a) For service entrance rated 800 amps and below, provide future floor space typically along the walls in the main electrical room for the following:

1. Provide future floor space for one dry type transformer. Minimum size typically for each dry type shall be based on 36 inches width x 24 inches depth X 46 inches height.

2. Provide future floor space for two wall-mounted panelboards. Minimum size for each panel shall be based on 20-inch width X 5 3/4-inch depth X 50 inch tall.)

(b) For service entrance rated above 1000 amps, provide future floor space in the main electrical room along the walls for the following:

1. Provide future floor space for two dry type transformer. Minimum size for each dry type shall be based on 36 inches width x 24 inches depth X 46 inches height).

2. Provide future floor space for three wall-mounted panelboards. Minimum size for each panel shall be based on 20-inch width X 5 3/4-inch depth X 50 inch tall.)

(22) New facilities shall size the electrical closets based on current project equipment sizes and future floor space. Electrical closets are defined as rooms that contain electrical equipment (such as dry type transformers, sub-distribution panels, etc) for distributing electrical power within a facility downstream from the main electrical room.

(a) Designer shall lay out the equipment in the room and show the future floor space on the drawings.

(b) Provide future floor space in the electrical closets for the following:

1. One dry type transformer. Minimum size for each dry type shall be based on 36 inches width x 24 inches depth X 46 inches height.

2. Two wall mounted panelboards. Minimum size for each panel shall be based on 20-inch width X 5 3/4-inch depth X 50 inch tall.)

(23) Unless special permission is granted by Civil Engineering, all dry type transformers shall be installed within the main electrical room and the electrical closets within the facility.

(24) Unless Civil Engineering or the project scope grants special permission, all service entrance equipment shall be installed within the main electrical room of the facility.

b. Branch Circuits.

(1) On all new circuits, allow for future expansion by loading less than the NEC maximum.

(2) 20 Amp receptacle circuits, place no more than 6 duplex outlets on a circuit. All circuits supplying convenience receptacles shall be protected with a 20-amp circuit breaker.

(3) Do not use multi-wired circuits (shared neutrals) for single-phase loads. Run a separate neutral.

(4) Do not use underfloor duct systems.

(5) Provide a separate green grounding equipment conductor in all conduits. Raceway shall not be used as a sole equipment ground. Ground shall be sized in accordance with Table 250-95 of the NEC.

(6) Do not use ground fault breakers for 120 volts, 20-ampere circuits.

(a) Use only individual ground fault receptacles.

(b) Provide GFCI receptacles in all bathrooms, locker rooms, within all wet areas of a facility, and at all outside locations.

(7) Branch circuits shall be rated a minimum of 20 amperes, except where lesser ratings are required for specific applications. Branch circuit conductors will in no case be less than No. 12 AWG.

(8) Maximum of three phases or poles shall be installed in any conduit system, which includes single-phase circuits, regardless of derating tables in the NEC.

(9) The combined voltage drop on feeders and branch circuits will not exceed 5 percent. Individual voltage drop on feeder and branch circuits shall not exceed the recommendations of the NEC.

c. Dry-type Transformers:

(1) Use dry-type general purpose (delta-wye) in the facilities except in cases listed below which require K = 13 non-linear dry type transformers.

(2) Electrical closets shall have 80 degree rise types. An electrical closet is not considered the main electrical room, but a room that is remote from the main electrical room in the facility. Electrical closets shall be used for distribution of electrical panels, dry type transformers, IPS system, etc, for serving administrative areas. Transformers with a 150-degree rise are acceptable in large open industrial areas, warehouses, and the main electrical room.

(3) Use K-rated (K=13) non-linear dry types when providing power to the following areas:

(a) Office administrative areas

(b) Cubicles or System Furniture

(c) Individual office Rooms

(d) Large open office areas

(e) Computers

(f) Electronic Equipment

(g) Electronic Test Labs

(4) Electrical closets that contain dry type transformers and located within the administrative areas shall have air conditioning.

(5) Dry type transformers shall be not be ceiling-mounted or wall-mounted. Mount the transformer on a concrete pad on the floor with rubber pad isolators.

(6) Maximum size dry type shall not exceed 300 KVA.

d. Low voltage cable and conduit:

(1) Use only copper conductors.

(2) Use THHN indoor and THWN outdoors.

(3) Base conductor size on the above.

(4) Do not use setscrew or die cast conduit connectors on EMT conduit. Use steel compression fittings only.

(5) Screw-in flex connectors are not allowed. Connectors for flexible metal conduit shall be malleable iron/zinc plated and of the 2-screw clamp type with insulated throats conforming to UL 514B & NEMA FB-1.

(6) For areas without conditioned air, design using a 45 degree Celsius ambient temperature. For conductors in these areas, apply the ambient derating factors in NEC, Table 310-16.

e. Computer areas:

(1) Locate separate emergency shutdown switches (inside hinged covers to prevent accidental activation) for all computerized operations, including their air handling and computer room units. Locate switches at each exit door of the computer room.

(2) Activation of the fire alarm system shall also shut down the computer equipment, computer room units, and air-handling units.

f. Air Handling Equipment and Devices:

(1) Device Plates: All device plates shall be type 302, 0.035 inch thick, brushed finish, and UL Listed stainless steel.

(2) Disconnect Switches:

(a) Heavy duty type.

(b) NEMA 3R outdoors, NEMA 4X in corrosive areas.

(c) When fused, use rejection type R fuses.

g. Grounding:

(1) Ground rods - ¾" X 10'. Use exothermic weld to connect to grounding system.

(2) Grounding shall be per Specifications.

h. Wall switches:

(1) 20 Amp minimum.

(2) Industrial Specification Grade, not general or standard grade.

i. Convenience Receptacles:

(1) An outlet is defined as 20 Amp minimum, NEMA 5-20R, duplex. Locations shall be as described for convenience receptacles in this standard.

(2) Industrial Specification Grade, not general or standard grade.

(3) When weatherproof, use spring-hinged flap covers.

(4) Convenience receptacles shall be located 18 inches AFF, to the center of the outlet. Exception: 24 inches AFF to bottom of outlet plate is allowed in explosion proof areas.

(5) Explosion proof convenience receptacles shall be provided at all explosion proof areas within a facility. Locations shall be as described for convenience receptacles in this standard. Explosion proof convenience receptacles shall be rated in accordance with Article 500 of the National Electrical Code.

(6) Explosion proof convenience receptacles shall be duplex type, rated 20 amperes.

(7) Provide a plug for each explosion proof convenience receptacle.

j. Convenience Receptacles shall be provided in all the following areas listed below:

(1) At Communication Outlets - adjacent to each communication outlet

(2) Small Individual Office Rooms (less than 250 SF) - one outlet on each wall.

(3) Conference Rooms:

(a) One outlet ceiling mounted approximately 18 feet from the center wall where a projection screen would be installed.

(b) An outlet on each wall but mounted at 16 ft maximum separations around the perimeter of the room. I

(c) Install one outlet in the corner of the room opposite where a projection screen would be used.

(d) Install a floor mounted receptacle in the front of the room for a podium.

(4) Communication Rooms: Provide two outlets in the center of each wall.

(5) Receptacles for Pre-wired System Furniture:

(a) Prewired system furniture is defined as furniture that contains pre-wired powered panels with plug-in receptacles and communication outlets mounted in the furniture base.

(b) Prewired system furniture would have the communication wiring extended into the furniture channel through a power pole or flexible whip.

(c) If furniture is included in the scope, then all raceway, wiring, and power capacity shall be provided. Wiring shall be extended to the furniture and terminated on the outlets.

(d) If the project does not provide the prewired systems furniture, then provide all electrical prewiring for the furniture. Power prewiring shall include breaker provisions, panelboards, wiring with associated raceway, flexible conduit whips with wiring to power poles, and load capacity in calculations. All connections as needed to the systems furniture shall be provided. The furniture manufacturer will furnish power poles by others. This shall occur if any of the cases below apply:

1. The design/build RFP provides a quantity of systems furniture cubicles in administrative areas for bid purposes of the electrical prewiring.

2. The project is designed by a consulting firm and then bid under an independent separate contract for construction only. In this case, the consulting firm shall provide a preliminary layout of the furniture in the bid drawings. The successful bidder on the construction contract shall then prewire the system furniture.

(e) Design for Prewired system furniture shall be as follows:

1. Eight-wire systems furniture shall be the design.

2. In each cubicle, design with two general purpose outlets on different circuits and one dedicated outlet in each cubicle. Each outlet shall be on a different partition in the cubicle. Each general-purpose outlet in a cubicle shall be on a separate phase in the systems furniture.

3. Maximum four cubicles shall share the same circuits.

4. The dedicated outlet in the four cubicles shall share the same circuit in the eight-wire system furniture.

5. General purpose outlets in the four cubicles shall be balanced between the three phases.

(6) Administrative areas larger than 250 square feet with or without prewired systems furniture (now or later):

(a) In these spaces, install one outlet at 8 feet intervals around all walls and one outlet on each furred out interior column.

(b) These outlets shall be installed flush in the walls and interior columns. This is in addition to the outlets specified for prewired system furniture cubicles.

(7) Non-Prewired Systems Furniture - If furniture is installed in areas of the facility, which is not prewired system furniture, but uses the outlets in the walls, then provide the following:

(a) Two outlets shall be installed in the center of each cubicle flush mounted in the wall. Maximum separation shall not exceed 8 feet on the walls. Maximum two cubicles shall share a circuit.

(b) In design/build projects, the location of furniture or quantity of workstations in each area shall be included in the RFP.

(8) Mechanical, Electrical rooms and Mechanical Mezzanines: One outlet at 20 ft intervals around all walls. Provide additional outlets as needed to coordinate with equipment locations.

(9) Mechanical and Electrical Equipment: One outlet shall be installed within 16 feet to 20 feet of each piece of equipment. This shall be provided wherever equipment is located, whether inside or outside, roof, mezzanines, etc.

(10) Corridors: Provide one outlet at every 20-ft interval along the length of the corridor (on one side of wall or alternate wall).

(11) Lobby: Two outlets total, on opposite walls.

(12) Warehouses, Shop Areas, Storage Areas, and Hangars: One outlet at 40 feet intervals around the perimeter of all walls and on outlet at all interior columns. Locate outlets in the web of interior columns.

(13) Each DDC Control Panel - Provide one receptacle outlet at each DDC control panel. This is used for maintenance personnel to use portable tools, laptops, etc.

(a) This is in addition to a hardwired connection for the panels' power.

(b) At each DDC panel, provide a dedicated hardwired circuit for the DDC panel power requirements.

(14) All other areas within a facility not specifically addressed above shall have outlets installed as follows:

(a) Install one outlet at 16 ft maximum intervals around the perimeter of all walls and one outlet on each interior column. Locate outlets in the web of interior columns.

(b) Walls less than 16 feet shall have minimum one outlet installed on each wall; this outlet shall be centrally located on the wall but may be the same outlet as outlets spaced 16 ft on center around the room.

(15) Receptacles outside the facility shall be as follows:

(a) Install outlets at 200 ft maximum intervals around the facility.

(b) One outlet shall be installed at each personnel door on the outside.

(c) One outlet shall be installed at each roll-up door on the inside.

(d) One outlet shall be installed at all mechanical equipment outside within 16 feet to 20 feet of the equipment.

(16) Coordination Notes: The above is based on the minimum requirements. A/E shall be responsible to coordinate with the user on the exact location for the outlets during the design stage. This shall be based on final equipment locations, users' needs, and workstation or desk locations. This statement applies to design projects and design/build contracts.

k. Special Receptacles for Hangars: Obtain special requirements from user or project scope of work.

4.02 INTERIOR LIGHTING

a. Calculate lighting levels based upon IES (Illumination Engineering Society) for maintained levels. Maintained level is defined as a calculated foot-candle level taking into consideration all depreciation light loss factors (LLF).

b. General Lighting

(1) For fluorescent, tube shall be rapid start, 4', 32W, T8, 3500K color, CRI of greater than 75, and a minimum output of 2900 lumens.

(2) When service voltage is 480Y/277 Volts, feed lights at 277 volts.

(3) Modular wiring systems are not allowed.

(4) Install a junction box and 6 feet of flexible metal conduit to all light fixture connections above suspended ceilings, acoustical or gypsum.

(5) In open office areas with systems furniture, include a light loss partition factor in calculations. Design illumination at task level shall be not less than 30 foot-candles, after applying all light loss factors and a partition factor. Include all tables from industry standards that show the source of partition factors used in the calculations. Assume the offices contain partitions with a 50 percent reflectance factor having dimensions 6 ft long by 6 ft wide by 6 ft tall. Any additional required lighting levels will be obtained using task lighting within the partitions.

c. General Patterns: In general, lighting within a facility shall be as follows:

(1) Entry way In Front Of Facility at the Exterior of the Facility: Provide uplight or downlight on both sides to light the entrance into the facility and any planters at the entryway. The designer will choose the fixture types. Fixture shall be architecturally pleasing with the location and enhance the appearance of the entryway into the facility.

(2) Entry Way or Vestibule:

(a) Small Areas: Compact fluorescent downlights. Downlight fixtures shall contain a matte black-ridged baffle with a specular clear Alzak reflector.

(b) Width or depth 6 ft or greater: Fluorescent fixtures built into an architecturally pleasing light cove. Long sections of lights shall have 4-foot fluorescent strips staggered. Show detail of light cove on architectural drawings with fixture details on electrical sheets.

(c) For large areas, consider a combination of cove lighting with compact fluorescent downlights or 2 X 2 fixtures to match the hallways/corridors.

(d) Recessed linear lighting with a refractive acrylic lens along walls or built into architectural ceiling contours.

(e) Pictures on walls -- Directional floods

(3) Facilities with a Built-in Service Desk

(a) Provide down task lighting with compact fluorescents directly over the entire service desk counter, spaced 4 ft on center. Downlight fixture shall contain a matte black-ridged baffle with a specular clear Alzak reflector. Provide switch next to entrance into the service desk area.

(b) Work area behind the counter within the service desk area shall be the same type as used for the Foyer/Halls/Corridors, or the same type fixtures used directly over the service desk counter. Provide switch next to the entrance into the service desk area for each type of fixture.

(4) Foyer/Halls/Corridors: Fixtures shall be 2 ft X 2 ft with refractive acrylic lens troffer. Fixture shall contain 17 watt, T8, 2-foot fluorescent lamps. Maximum of three lamps shall be used in a fixture.

(5) Administrative Office Spaces:

(a) In small individual offices, minimum two 2 ft X 4 ft light fixtures (three tubes) shall be installed.

(b) The following fixture types are allowed where noted:

1. Nominal 5 1/2 inch deep, para-contoured housing, die formed code gauge, prime cold rolled steel. Fixture shall be 18-cell semi-specular louvered, 2 ft X 4 ft parabolic with three 32-watt T8 four-foot fluorescent lamps.

2. 2 ft X 4 ft recessed direct/indirect lighting with three 32-watt T8 four-foot fluorescent lamps. (Use this application in small individual offices only.) Design Basis -- Lithonia AV.

3. Large office areas (500 square feet and larger) with system furniture and high ceilings (10 feet and above), consider pendant mount 8 feet long direct/indirect lighting. Support fixtures from 3/32-inch diameter cable. 8 feet length fixtures shall contain four F32T8 lamps. Fixtures shall be installed in continuous rows. All four lamps may be on the same ballast to conserve energy. Color of fixture to be determined during design with the user. Fixture shall contain a parabolic louver that meets RP24 direct glare requirements as defined in IES publication, RP24 VDT Lighting. Parabolic louver shall be constructed of semi-specular aluminum. Fixture shall be UL Listed. Design Basis: Ecolite 310.

4. Large open office areas (500 square feet and larger) with system furniture and ceiling heights less than 10 feet, use 2 X 4 fixtures with refractive acrylic lens. Design Basis: Holophane 8224

(6) For Computer Rooms, Classrooms, Training rooms, Conference Rooms:

(a) The following types are permitted for general room lighting:

1. Nominal 5 1/2 inch deep, para-contoured housing, die formed code gauge, prime cold rolled steel. Fixture shall be 18-cell semi-specular louvered, 2 ft X 4 ft parabolic with three 32-watt T8 four-foot fluorescent lamps.

2. 2 ft X 4 ft recessed fixtures with three F32T8 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, 45 degree shielding.

(b) For conference rooms: Provide supplemental dimmable incandescent fixtures in addition to the general room lighting listed above. Incandescent dimmable fixtures shall be located as follows:

1. Around the perimeter of the room at approximately four feet on center.

2. In the center of the room approximately four feet on center to provide uniform luminance over a location for a conference table. For large conference tables, provide incandescent fixtures (one foot inside the table and all the way around the table four feet on center).

3. Incandescents at the perimeter of the room shall be switched separately from the incandescents over the conference table.

(c) Switching of General Room Lighting in Classrooms, Training Rooms, Conference Rooms, and Computer Rooms: Provide switches for multiple lighting levels of the fluorescent fixtures. In these areas, switching shall contain all of the features listed below:

1. Room shall be switched in three distinct areas: front one third, middle one third, and back one third. This applies in all cases except the computer room.

2. All fixtures shall be switched with inboard/outboard lamps separately. In other words, in three tube fixtures, the outer two lamps shall be switched separately from the inner lamp.

(7) Restroom Areas

(a) Acoustical ceilings: 2 ft X 2 ft with refractive acrylic lens troffer. Fixture shall contain minimum three F17T8, rapid start fluorescent tubes.

(b) Gypsum Ceilings: Same type fixture except use ceiling brackets provided by the manufacturer for gypsum ceilings.

(c) Over Mirrors: Provide supplemental lighting directly over all mirrors with both up and down lighting.

(8) Industrial Highbay Fixtures:

(a) Highbay fixtures shall be used in applications where the bottom of the fixture is 25 feet and higher above the floor.

(b) Type lighting shall be enclosed industrial highbay heavy-duty fixture. Housing shall be die-cast aluminum. Optics shall be spun aluminum reflector. Fixture support shall be malleable iron hangar rated for 120 LBS and permit 20-degree swing. At the fixture ballast, provide quick disconnect and receptacle/plug assembly. Pendant drops shall be rigid conduit. All fixtures shall be installed at a constant elevation above the finished floor. Breakers shall not be used to switch HID lighting.

(c) All lighting shall be metal halide.

(9) Industrial Lowbay Fixtures:

(a) Lowbay fixtures shall be used in applications where the bottom of the fixture is less than 25 feet above the floor.

(b) Housing shall be die-cast aluminum. Optics shall be spun aluminum reflector. Fixture support shall be malleable iron hangar rated for 120 LBS and permit 20-degree swing. At the fixture ballast, provide quick disconnect and

receptacle/plug assembly. Pendant drops shall be rigid conduit. All fixtures shall be installed at a constant elevation above the finished floor. Breakers shall not be used to switch HID lighting.

(c) All lighting shall be metal halide.

(10) Aisle Lighting in Warehouses:

(a) Use fixture with elongated narrow asymmetric or wide asymmetric lighting pattern. Use low bay or high bay depending upon height. Install light fixtures between all isles or racks and on each side.

(b) Conduit shall be installed perpendicular to the isles or racks. Fixture support shall be malleable iron hangar rated for 120 LBS and permit 20-degree swing. At the fixture ballast, provide quick disconnect and receptacle/plug assembly. Pendant drops shall be rigid conduit. Breakers shall not be used to switch HID lighting.

(c) Design for a maintained level of 75 foot-candles.

(d) All lighting shall be metal halide.

(11) Mechanical and Electrical Rooms:

(a) Provide open industrial fluorescent lighting F32T8 lamps. Provide clear guards or a screen over all 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.

(12) Loading Docks:

(a) Provide wrap-around fixtures (four feet) with two F32T8 fluorescent lamps.

(b) Design using 50 foot-candles at the floor level.

(13) Janitor Rooms: Provide fixture with a wrap-around lens. Switch fixture inside room.

(14) Canopies and Loading Docks:

(a) Canopies not used as a Loading Dock

1. Consider wrap around fixtures (four feet) with two F32T8 fluorescent lamps.

2. Design using 20 foot-candles at floor level.

(b) Loading docks

1. Consider wrap around fixtures (four feet) with two F32T8 fluorescent lamps.

2. Design using 50 foot-candles at floor level.

(15) Switching - General

(a) Circuit Breakers shall not be used to switch any lighting circuits.

(b) Switches at doorways shall control all lighting spaces within the room or area.

(c) Classrooms, training rooms, conference rooms, and computer rooms: See above.

(d) When required by project scope, provide a low voltage relay controller next to panelboards to control lighting. Panelboards with lighting relays are unacceptable.

(e) Occupancy Sensors - Provide these in private or small offices and restrooms (types specially suited for restrooms), as a minimum. Provide in other suitable areas for energy conservation. Locate the switches to avoid nuisance activation by personnel walking by the doorway and to avoid being covered by an open door or furniture.

(16) Interior Sports Lighting:

(a) All interior sports lighting shall be based on Class of Play Type II per IES.

(b) Lamps shall be metal halide.

(17) Spare Parts: The Contractor shall turn in the following after final inspection:

(a) One of each type of fixture for spare stock.

(b) 10% of each type of lamp for spare stock.

4.03 EMERGENCY AND EXIT LIGHTING

a. General:

(1) Facilities over 25,000 square feet shall contain an interruptible power system (IPS) or a simplified UPS such as manufactured by Dual-Lite. Emergency egress lighting and exit signs within the facility shall be connected to the IPS central battery system. (NOTE: In many cases, we have found a small permanent generator is a better choice than an IPS. Use this option as first choice over the IPS unless a Life Cycle Cost Analysis indicates the IPS is better in a specific application. When a generator is used, treat all statements below for the IPS as applying instead to the generator system.)

(a) In areas with metal halide lamps, selected overhead metal halide fixtures shall be connected to the IPS system to provide the emergency lighting. Entire overhead metal halide fixture shall be connected to the IPS system. Quartz lamp shall be used in the fixture to provide initial foot-candles until the metal halide lamp strikes and starts to illuminate.

(b) In areas with fluorescent lighting, connect selected fixtures to the IPS system for emergency lighting. Entire fluorescent fixture shall be connected to the IPS system. Exit signs within the facility shall be connected to the IPS system.

(c) Emergency lighting fixtures shall not be switched except by branch circuit breakers in the IPS system.

(2) Wall packs with integral battery units are not acceptable within the facility. For facilities less than 25,000 SF, emergency lighting shall be provided with integral battery packs in the fixtures.

(3) Clearly mark the emergency fixtures, so Shop personnel can find them easily.

(4) Install an emergency light in each electrical and mechanical room.

(5) Place a laminated drawing of the system near the IPS unit, or near the main electrical panel for a system of individual fixtures, but always on the building interior.

(6) Interruptible Power System (IPS)

(a) IPS shall contain a solid-state true no-break inverter module with zero transfer time from standby to operational mode.

(b) Central inverter shall contain a fax/modem capability for emergency lighting.

(c) Unit shall be UL Listed 924 for emergency lighting and power equipment and UL listed 1778 for uninterruptible power system.

(d) Provide field startup services from the manufacturers' service representative.

(e) IPS system shall be Y2K compliant.

(f) IPS system shall utilize sealed lead-calcium (not nickel-cadmium) batteries with 10 year expected life.

(7) Use only one IPS in the main electrical room for the whole building.

(8) Facilities with more than one floor shall have separate panelboards on each floor.

b. Exit Signs

(1) For facilities greater than 25,000 SF, exit signs shall be connected to a central IPS unit.

(2) For facilities less than 25,000 SF, exit signs shall contain an integral battery for 90 minutes of illumination.

(3) All exit signs shall be LED type. Exit signs in lobby or vestibule shall be clear with red lettering.

(4) Self-illuminating or reflective types are not allowed.

SECTION 5 - SPECIAL INTERIOR SYSTEMS

5.01 FIRE DETECTION AND ALARM SYSTEMS

a. General

(1) Fire Alarm system shall be addressable Style 6 signal line circuits and Style Z indicating appliance circuits. Exceptions are approved for those cases

where an economic analysis shows a non-addressable system is less expensive to install.

(2) The FACP shall distinguish between as supervisory trouble and system trouble.

(3) The FACP shall be installed in an air-conditioned space.

(4) Use only two-conduit looped system. Fire alarm riser shall be drawn as a two-loop conduit system.

(5) Use manufacturer's representative to terminate wiring in the FACP and program the FACP. Manufacturer's representative shall be present at testing of the fire alarm system.

(6) Shop drawings shall be done on CADD.

(7) Use alarm by-pass switches in the Fire Alarm Control Panel (FACP) for HVAC shutdown.

(8) Provide red tape or fire alarm conduits every 10 feet.

(9) Contractor shall provide:

(a) Submittals in accordance with Specification Section 16721.

(b) As-builts and schematics.

(c) O&M manuals.

(d) Spare parts and parts list.

(e) Testing before acceptance.

(f) CE Shop training.

(10) In out buildings or other locations where detectors are connected by underground conduits to the main building, provide MOV-type surge arresters on both ends.

(11) Spare Parts, Minimum: Detectors - 10%, and no less than two of each type.

(12) Place spare parts in a Contractor-furnished metal cabinet near the FACP.

(13) Place a laminated drawing of the system near the FACP.

(14) Keep detectors away from HVAC vents.

(15) FACP shall disable all air conditioning computer room units in the event of any alarm within the facility.

(16) FACP shall disable all air handling systems and exhaust fans over 5000 CFM in the event of an alarm within the facility.

(17) All equipment shall be Y2K compliant.

(18) Facilities with AFFF suppression systems shall use a separate and dedicated FACP for notification and detection.

b. Detection: Provide the following in addition to requirements in the NFPA Codes. In the case of a conflict between this standard and the NFPA codes, the requirements in this standard shall govern. Items listed shall be considered as minimum contractual requirements.

(1) Smoke Detectors

(a) Project scope may add to the smoke detector locations listed in this standard. For Design/Build projects, additional detector locations may be defined in the project scope of work or the RFP.

(b) In facilities with raised flooring systems, provide smoke detectors below the raised floors.

(c) Install duct mounted smoke detectors in HVAC ducts, fed from the 24 volt DC fire alarm panel, not from the HVAC controls.

1. Supply: Provide duct detectors in all supply ducts greater than 2000 CFM.

2. Return: Provide duct detectors in any return duct in return systems over 15,000 CFM.

(d) In administrative areas, computer facilities, or testing labs with preaction sprinkler systems, provide ceiling mounted smoke detectors to electrically activate the preaction system through the FACP. If the facility contains a raised flooring system, provide additional smoke detectors below the raised floor.

(e) All smoke detectors shall be photoelectric type only unless stated otherwise. Ionization may be used if requested by a designer for an application and approved by the Civil-Electrical Design Chief.

(f) Spacing of smoke detectors shall provide the spacing and location in accordance with manufacturer's recommendations and the requirements of NFPA 72E. However, spacing shall not exceed 30 ft by 30 ft per detector and 30 linear feet per detector along corridors. Do not locate detectors within 3 feet of air supply diffusers and registers, or within 12 inches of lighting fixtures.

(g) In dormitory rooms, provide local alarm smoke detectors and centrally alarmed heat detectors.

(2) Heat detectors:

(a) All areas that are not protected by an automatic wet pipe sprinkler system shall contain heat detectors. Heat detectors shall be spaced in accordance with NFPA 72.

(b) Provide one in each mechanical and electrical room.

(c) In industrial areas with a preaction sprinkler system, provide ceiling mounted heat detectors to electrically activate the preaction system through the FACP.

(3) Manual Pull Stations

(a) Provide at all exits from the facility and along long walls at every 200’ per NFPA 101.

(b) Provide at each exit from an electrical room and a mechanical room when these rooms exit the facility.

(c) In areas with preaction sprinkler systems, install a manual pull station at each exit from the preaction sprinkler zone of protection.

(4) Sprinkler Risers:

(a) Wet Pipe Sprinkler System:

1. Provide pressure type switch with retard chamber. Pressure switch shall have 0-90 second field-adjustable delay.

2. Install tamper switch on all OS&Y valves, including OS&Y valves at all backflow preventers.

(b) Preaction systems:

1. Provide pressure type switch with retard chamber. Pressure switch shall be instantaneous delay.

2. Provide low air switch that will activate the FACP whenever the pressure drops 10 pounds below normal. Supervision shall be provided by an independent and dedicated air supply system for fire protection piping only. No shop air or facility air shall be used for air supervision.

3. Install tamper switch on all OS&Y valves, including OS&Y valves at all backflow preventers.

4. Preaction Systems Riser shall have an electrically actuated solenoid that is tripped by the FACP only. The FACP shall be programmed to trip the solenoid under the following conditions:

aa. Any manual pull station within the exit path of the preaction sprinkler zone of protection.

bb. Any combination of two detectors that occur at the same time, such as two detectors ceiling mounted, two detectors under a raised floor, or one ceiling mounted detector and one detector below the raised floor.

(c) Dry Pipe System Risers:

1. Provide pressure type switch that shall alarm the FACP when the dry pipe system is activated. Pressure switch shall be set to alarm at a pressure below the supervisory air switch.

2. Provide low air switch that will activate the FACP whenever the pressure drops 10 pounds below normal. Supervision shall be provided by an independent and dedicated air supply system for fire protection piping only. No shop air or facility air shall be used for air supervision.

3. Install tamper switch on all OS&Y valves, including OS&Y valves at all backflow preventers.

(5) Install tamper switch on each PIV valve.

(6) Provide system alarm signals for waterflow and supervisory trouble for valve tamper switches.

(7) Elevators: The following shall be provided:

(a) Heat detector in the top of the elevator hoistway where the top of the hoistway is protected by automatic sprinklers.

(b) Heat detector in the elevator equipment room.

(c) Heat detectors shall be combination rate of rise and fixed temperature type. Heat detectors shall be located within 2 ft (610 mm) of sprinkler heads in the top of the elevator hoistway (where provided) and in the elevator equipment room, and shall be designed to activate before the sprinkler head discharges water.

(d) Smoke detector in the top of the elevator hoistway where the top of the hoistway is protected by automatic sprinklers.

(e) Smoke detector in the elevator equipment room.

(f) Smoke detector at each elevator lobby.

(g) Where sprinklers are provided in the top or bottom of elevator hoistway, supervisory tamper switches shall be installed on the sprinkler lines that enter the top or bottom of the hoistway. This device will be located at an accessible location where the sprinkler branch line enters the hoistway or pit. The tamper switches shall be located outside the hoistway.

(h) Supervisory tamper switch for the sprinkler line that enters the elevator equipment room. This device shall be located in the sprinkler branch line to the elevator equipment room. The tamper switch shall be located outside the elevator equipment room.

(i) Shunt trip on the breaker that feeds power to the elevator in the upstream panel board. Breaker shall shunt trip without delay whenever a heat detector is activated in the top of the hoistway (where provided) or in the elevator equipment room.

(j) Where the elevator control system is provided with a battery-lowering device, provide a signal from the FACP to the elevator controller at the same time the FACP shunt trips the elevator circuit breaker. The signal to the elevator controller shall disable the battery-lowering device without delay when the shunt trip is activated.

(k) The FACP shall send a signal to the elevator controller to represent which smoke detector is in alarm. The elevator controller shall use these signals to send the elevator to the appropriate floor. The designated level is the main floor or other level that best serves the needs of emergency personnel for fire fighting or rescue purposes. The alternate level is the floor with the second best access for emergency personnel.

(l) The activation of a smoke detector at the elevator lobby on the designated level shall cause the elevator to go to the alternate level. The activation of a smoke detector at the top of the hoistway (where provided), or at any elevator lobby other than the designated level shall cause the elevator to return to the designated level.

(m) The activation of a smoke detector in the elevator equipment room shall cause the elevator to return to the designated level, unless the

equipment room is located on the designated level. In that case the elevator shall go to the alternate level.

(n) Where the elevator control system is provided with a battery lowering device, provide 1 NC/NO (normally closed /normally open) set of auxiliary contacts on the manual disconnect for the power in the elevator equipment room. Whenever the manual disconnect is turned off, the battery lowering device shall be disabled.

(o) If either the shunt trip breaker feeding the elevator is activated or the manual disconnect turned off, then the battery-lowering device shall be disabled.

(p) Show all devices on the fire alarm one line diagram.

c. Notification:

(1) Provide audible/visual devices in the following areas:

(a) All corridors.

(b) Open administrative rooms larger than 500 square feet.

(c) All warehouses and interior large storage areas.

(d) Other areas as required by code or the project requirements.

(2) Provide visual only type devices in the following spaces:

(a) All restroom facilities.

(b) Classrooms and training rooms.

(c) Other areas as required by code or the project requirements.

(3) Provide a remote annunciator with LCD display in the main lobby or entrance of all facilities.

(4) Provide a water motor gong or alarm.

d. Fire Alarm Control Panel (FACP):

(1) The FACP shall distinguish between supervisory trouble and system trouble.

(2) Batteries: Provide sealed gel-type for best life and reduced maintenance.

e. Fire Alarm Reporting System, Radio Type Transmitter

(1) The Contractor shall provide the transmitter, antenna, side-mount bracket, and surge arrester. The transmitters shall be radio type transceivers compatible with Base Monaco system. Frequency is FM at 138.975 MHZ, +- 5 KHZ. Transmitter shall have 16 zones for new facilities.

(2) Install radio transmitter next to FACP.

(3) Connect alarm, system trouble, and supervisory trouble to the transmitter for each FACP.

5.02 VOICE/DATA COMMUNICATIONS, EXCEPT DORMITORIES

a. General:

(1) Base cable plant is owned by the Base and consists of overhead and underground copper cable and fiber optics. The Base will provide all incoming cables.

(2) Completely prewire the internal communications systems including all cabling, raceway, outlets, terminations, telephone connectors, etc.

(3) Facilities less than 20,000 SF, provide 2-4" ducts. Facilities greater than 20,000 SF, provide 4- 4" ducts. Extend from Communications Room to nearest communications manhole unless specified otherwise.

(4) Outlet conduit size shall be ¾" minimum.

(5) Communication wiring shall be installed in the following raceways:

(a) Voice and data wiring shall be installed in a complete and continuous raceway system.

(b) Cable trays shall be used as a raceway for communications wiring in all areas that contain administrative (office space) or acoustical tile ceilings. Cable trays shall not be installed above fixed ceilings.

(c) Designer shall show layout of cable tray on the drawings. Show in all main corridors, around interiors of large rooms, and connections to all communication backboard locations. Size of tray shall be 6-inch depth and 12 -inch wide as minimum. Each outlet shall connect to the cable tray through a separate ¾ inch EMT conduit.

(d) If the area does not contain administrative (office space) or acoustical tile ceilings, then each outlet shall be extended in 3/4 inch conduit to the nearest cable tray above the ceiling or extended in 3/4 inch conduit the entire length from the outlet to nearest communication room.

(6) Facilities with more than one floor shall have separate dedicated communication rooms on each floor. The main communication room shall be located on the first floor with sub-communication rooms on other floors.

(7) Maximum length of conductor shall not exceed 300 feet (CAT 5). When considering length, add all vertical and horizontal runs as installed. Horizontal runs shall be considered as parallel and perpendicular to the building. Communication rooms shall be provided on each floor in multi-story facilities.

(8) Provide telecommunications closets (TC) as needed throughout the facility to ensure that the length of wiring from the TC to the most remote workstation does not exceed 300 feet. In addition, telecommunication closets shall be provided for every 10,000 SF of administrative space. The distance of 300 cable feet is from the hub rack in a communication room to the point-of-use jack.

(10) All telecommunications closets and main communications rooms shall be dedicated rooms with no other equipment or trades. These rooms shall contain conditioned air and a lockable door.

(11) Provide at each backboard a copper ground bus:

(a) Sizes shall be as follows:

1. Main communications room: 2 feet length, 4 inch high, 1/4 inch thick.

2. Telecommunications closets: 1 feet length, 4 inch high, 1/4 inch thick.

(b) Install ground bus in each communication room with two standoff brackets and two insulators. In areas with gypsum board, install wood backing behind gypsum board.

(c) Grounding Conductors between Copper Ground Busses:

1. At the main communications room, connect one insulated #500 MCM copper conductor to the copper ground bus from the service entrance ground bus.

2. At each telecommunications closet, connect one insulated #4/0 AWG copper conductor to each ground bus from the ground bus in the main communication room. There shall be a separate #4/0 copper conductor from the main communications room to each telecommunications closet. No sharing or looping between closets to the main communications room is allowed.

3. All connections to the copper ground busses shall be compression type lugs.

(12) Main Communication Room:

(a) Main communication room shall be located on an exterior wall of the facility.

(b) Main communication room shall be provided with double doors without a center support to ensure that large equipment can be easily installed and removed.

(c) Size: Minimum allowable size shall be 108 sq ft (9 ft X 12 ft).

b. Outlets:

(1) All outlet locations shall have three jacks (one voice jack and two data jacks) installed in the same junction box.

(2) Voice jacks shall be CAT 5, 8-pin RJ-45 modular connector, and ivory color.

(3) Data jacks shall be CAT 5, 8-pin RJ-45 modular connector, and orange color.

(4) Wiring shall be EIA/TIA T568B wiring pattern for voice and data.

(5) Each jack shall have separate 4-pair conductors back to the nearest Telecommunications Closet or Main Communications Room and shall meet the following standards:

(a) UL listed

(b) EIA/TIA 568

(c) EIA/TIA/TSB-40

(d) EIA/TIA/TSB-36

c. Wiring:

(1) Voice: CAT 5, 4-pair (UTP) unshielded twisted pair, 24 AWG copper, plenum rated (when using open cable trays). Use white color insulation.

(2) Data: CAT 5, 4-pair (UTP) unshielded twisted pair, 24 AWG copper, plenum rated (when using open cable trays)). Use blue color insulation.

(3) Fiber: Multimode 62.5/125 um fiber optic cable in 27 mm inner duct plus one 27 mm inner duct with pull cord.

(4) Each jack shall have separate 4-pair conductors rated CAT 5 back to the nearest Telecommunications Closet or Main Communications Room.

(5) Voice Riser:

(a) Provide from each telecommunications room to the Main Communications Room. Cables shall be routed directly and unspliced from each telecommunication closet to the main communications room.

(b) Each shall contain a minimum of three 100 pair cables to each telecommunications room from the Main Communication Room. Cable shall be rated CAT 3 and consist of 24 AWG copper conductors. Cable shall be UL Listed Type CMR.

(c) Install in a complete raceway system from each telecommunication room to the Main Communication Room. Riser cable shall not be installed in the overhead cable tray system used for voice/data wiring.

(d) Cross-connect cables shall be provided if required by the project.

(e) Provide one 4-inch conduit as spare duct from each telecommunication room to the Main Communication Room.

(6) Data riser:

(a) Provide fiber cable to each telecommunication room from the main communication room. Cables shall be routed directly and unspliced from each telecommunication closet to the Main Communications Room.

(b) Cable shall contain a minimum 6 individual 62.5/125 micron multi-mode fibers. Cable shall be rated OFNR per NFPA 70.

(c) Install fiber in orange flexible interduct.

(d) Provide two spare orange flexible interducts from each telecommunications room to the Main Communication Room.

d. Backboard Terminations

(1) Voice Station Jacks:

(a) Terminations shall be 6600-type punch down blocks rated for CAT 5 mounted on stand off block.

(b) Two separate sets of 6600 blocks shall be provided in the Main Communication Room and each telecommunication closet: one set for the voice station jacks and another set for the voice riser tie cable. Separation between the two sets of blocks shall be a minimum of 12 inches.

(c) Provide number required plus 25 percent spare.

(2) Data Station Jacks:

(a) Terminations shall be modular jack panel. Jacks shall be T568B wiring pattern. The modular jack panel shall have on the front an 8 pin RJ-45 connector. The rear of the modular panel shall contain type 110 connecting blocks mounted on a printed wiring board. The 110 connecting blocks shall be made continuous to the 8 pin modular jack on the front of the panel through printed wiring board interconnections. The panel shall be 19 inches wide.

(b) Provide number required plus 25 percent spare.

(3) Voice Riser Cable:

(a) Terminate the riser cable on 6600 punch-down blocks at both ends.

(b) Use separate blocks for the riser cable terminations from the station cable terminations. Separation between the two sets of blocks shall be a minimum of 12 inches.

(4) Fiber Data riser: Terminate all fibers at each end with Type ST connectors on a multimode fiber optic patch panel. Enclosure shall provide splicing capabilities for the fiber cables.

e. Device Plates:

(1) All device plates shall be Type 302, 0.035 inch thick, brushed finish, UL Listed stainless steel.

f. Backboards:

(1) ¾" plywood installed on wall in Main Communications Room.

(2) Provide two 120-volt duplex outlets at the main telephone backboard in the Main Communications Room.

g. Hub rack:

(1) Provide hub rack in each Main Communications Room.

(2) If modular RJ-45 patch panels are wall mounted, then install hub rack on the hinged side of the modular blocks.

(3) Unless stated elsewhere, hub and network equipment will be provided and installed in the hub rack by the Government.

(4) Install cable tray from the wall mounted data patch panel to the hub rack.

h. Conflicts: In design/build projects, the RFP scope of work may specify communication outlets in addition to the locations indicated in this standard. Both

shall be used for the location of outlets within a facility and shall be considered as minimum contractual requirements. However, in the case of a conflict, the RFP scope of work shall take precedence.

i. Locations: As a minimum, communication outlets shall be located as follows:

(1) Individual Office Rooms: Two outlets total, one outlet on opposite walls. Each outlet location shall contain one voice jack and two data jacks installed in the same junction box.

(2) Conference Rooms: Provide an outlet on each wall but 16 feet maximum separation. In one corner (opposite of the wall where a projection screen would be used), install one outlet in the corner of the room. Each outlet location shall contain one voice jack and two data jacks installed in the same junction box.

(3) Computer Rooms: Provide an outlet on each wall but 16 feet maximum separation. Each outlet location shall contain one voice jack and two data jacks installed in the same junction box.

(4) Communication for Prewired System Furniture:

(a) Each cubicle shall contain one outlet. Each outlet at each systems furniture cubicle shall contain three jacks, consisting of one voice jack and two data jacks.

(b) Prewired system furniture is defined as furniture that contains pre-wired powered panels with plug-in receptacles and communication outlets mounted in the furniture base. Also, prewired system furniture would have the communication wiring extended into the furniture channel through a power pole or flexible whip.

1. If pre-wired systems furniture is included in the scope, then provide one outlet with wiring extended into the base of the channel and terminated on the outlets into each cubicle. This shall include all punch-down blocks and terminations at the communications room, wiring with associated raceway, and terminations on the outlets in the furniture.

2. If the project does not provide the prewired systems furniture, then all communication prewiring for the furniture shall still be provided. Communication Prewiring for system furniture shall consist of all punch-down blocks and terminations at the communications room, wiring with associated raceway, and terminations on the outlets in the furniture. Contractor shall leave approximately 40 ft slack above the furniture location in a junction box. After others install the furniture, then the Contractor shall extend the wiring into the base of the channel. Outlets shall then be provided and terminated on the cables in the systems furniture. This shall occur if any of the cases below apply:

aa. The design/build RFP provides a quantity of systems furniture cubicles in administrative areas for bid purposes of the communication prewiring. This is either displayed on the RFP drawings or defined in the project scope RFP.

bb. The project is designed by a consulting firm and then bid under an independent separate contract for construction only. In this case, the consulting firm shall provide a preliminary layout of the furniture in the bid drawings. The successful bidder on the construction contract shall then pre-wire the system furniture.

(5) Administrative areas larger than 500 square feet with or without prewired systems furniture (now or later):

(a) In these spaces, install one outlet at 16 feet intervals around all walls and one outlet on each furred out interior column.

(b) Each outlet location shall contain one voice jack and two data jacks installed in the same junction box.

(c) This is in addition to the outlets specified for prewired system furniture cubicles.

(6) Non-Prewired Systems Furniture - If furniture is installed in areas of the facility, which is not prewired system furniture, but uses the outlets in the walls, then provide flush in the walls the following:

(a) An outlet shall be installed in the center of each cubicle flush in the wall, but maximum separation shall not exceed 8 feet intervals.

(b) Each outlet shall consist of one voice jack and two data jacks.

(c) This does not apply to "Prewired system furniture", in which the outlets are installed in the furniture channel or base.

(7) Main DDC Control Panel - Provide one outlet with one voice and two data jacks at the main DDC control panel in the facility.

(8) Lobby - Provide one voice jack, 48" AFF for a pay phone in the entrance to the facility.

(9) Warehouses/ Storage Areas - Provide one outlet every 40 feet around all perimeter walls. Each outlet location shall contain one voice jack and two data jacks installed in the same junction box.

(10) Shop Areas - Provide 1 voice outlet at every 16 feet on around all perimeter walls.

(11) Mechanical Room - Provide a single voice jack next to the door. This is a separate voice jack from the jack at the main DDC control panel.

(12) Electrical Room - Provide a single voice jack next to the door.

(13) Explosion proof areas: Provide conduit with wiring installed to the phone location. Leave 3 ft of wiring in explosion proof junction box with plugged opening for future connection.

(14) Hangars - No outlets in the hangar bay unless requested by user or specified elsewhere.

(15) Residential Construction - Provide voice outlets as follows:

(a) One voice jack in the kitchen.

(b) One voice jack in the family room.

(c) Two voice jacks in the each bedroom, each jack on opposite walls.

(16) Note: --- The above is based on the minimum requirements. A/E shall be responsible to coordinate with the user on the exact location for the outlets during the design stage. This shall be based on final equipment locations, users' needs, and workstation or desk locations. This statement applies to design projects and design/build contracts.

5.03 VOICE/DATA COMMUNICATIONS IN DORMITORIES

a. Lines within the facility shall be a part of the project.

b. Lines to the facility will be accomplished by the Air Force. Two local Cable Television Companies, under separate contract, will provide exterior service.

c. Outlets:

(1) Provide two outlets in each living/sleeping room.

(a) Outlet #1: One voice jack/one data jack in the same junction box (CAT 5 for both).

(b) Outlet #1 shall be installed on an opposite wall, not adjacent from Outlet #2.

(c) Outlet #2: Single CATV jack and single voice jack (CAT 5).

(d) Voice jack in Outlet #2 location and the voice jack in Outlet #1 location shall be jumpered together at the backboard and served from the same line.

(e) Data jack in Outlet #1 shall be a separate 4-pair conductor (CAT 3) extended back to the nearest Communication Room.

(2) Voice shall be CAT 5, 8-pin RJ-45 modular connector, and ivory color.

(3) Data shall be CAT 5, 8-pin RJ-45 modular connector, and orange color.

(4) Termination wiring and other materials shall be as specified in Specifications.

(5) Shall meet the following standards:

(a) UL listed

(b) EIA/TIA 568

(c) EIA/TIA/TSB-40

(d) EIA/TIA/TSB-36

d. Wiring:

(1) Voice: CAT 5, 4-pair (UTP) unshielded twisted pair, 24 AWG copper, (plenum rated in open cable tray).

(2) Data: CAT 5, 4-pair (UTP) unshielded twisted pair, 24 AWG copper, (plenum rated in open cable tray).

(3) Provide riser tie cable for the voice and data wiring from each Telecommunications Closet to the Main Communications Room.

(4) All wiring from living/sleeping rooms shall terminate in a dedicated communications room on that floor.

(5) All wiring shall be installed in conduit.

e. Backboards: (1) ¾" plywood installed on wall in Communications Room.

f. CATV Requirements for Dorms:

(1) Extend RG-6 from each living/sleeping room to the nearest Telecommunications Closet/Communications Room. No wiring between rooms shall be shared.

(2) Each CATV outlet shall be installed in conduit from the outlet to the nearest Telecommunications Closet/Communications Room.

(3) CATV wiring shall be installed in separate raceway from the voice/data wiring.

(4) CATV wiring shall be terminated on separate backboards from the voice/data wiring in the Telecommunications Closet/Communications Room.

(5) For each living/sleeping room, provide and install two separate splitters (one for each future CATV company) at the backboard in the nearest communication room. Splitters for each living/sleeping room shall be installed at a communication room on the same floor as the living/sleeping room. On the backboard, install one company's splitters on top of the other company's splitters. All splitters shall be provided and installed under the project by the Contractor.

(6) Each companies splitters shall be connected together with a RG-6, 60 percent shielded minimum rated coax cable. All splitters in each communication room shall be installed in a single hinged enclosure, NEMA 1 gasketed enclosure. No splitters shall be installed outside the nearest communication room.

(7) All splitters and wiring shall be provided and installed under the project by the Contractor.

(8) Each floor communication room shall have two separate RG-11 cables running from that backboard to the first floor communication room backboard. Leave cables coiled up (24 inches) at the first floor communication room backboard. Connect each RG-11 cable at each floor communication room to the splitters for each future CATV company.

(9) Install two separate 1-inch conduits from each communication room on each floor to the main communication room on the first floor. Install RG-11 cables in one conduit with the other as spare.

5.04 CATV, EXCEPT DORMITORIES

a. Lines within the facility shall be a part of the project. See separate Air Force guidelines for dormitories.

b. Lines to the facility will be accomplished by the Air Force. Two local Cable Television Companies under separate contract will provide exterior service.

c. Ducts: Provide 2-4" ducts. Extend from Communications Room to nearest communications manhole unless specified otherwise.

d. Wiring: Extend RG-6 from each outlet to the Communications Room. No wiring between outlets shall be shared unless approved by the applicable Design Section Chief in 778 CES/CEC.

e. Outlets: Each CATV outlet shall be installed in conduit from the outlet to the Communications Room.

f. Terminations: CATV wiring shall be terminated on separate backboards from the voice/data wiring in the Communications Room.

g. Backboard: Provide all cabling, terminations at the outlets and terminations at the backboard. Amplifier shall be provided at the backboard.

h. Design/Build Projects: Location of CATV outlets shall be described in the RFP scope of work.

i. Device Plates shall be Type 302, .035 inch thick, brushed finish, and UL Listed stainless steel.

5.05 PAGING AND SOUND SYSTEMS: When the scope requires a paging or sound system, the following shall be designed into the system:

a. Zone facility by functional areas, with each area on a separate zone. Offices shall be on a separate zone from shops, warehouse space, etc.

b. Speakers shall be located throughout the halls, lobbies, shops/warehouse space, hangar space, industrial areas, and any other administrative areas as specified elsewhere.

c. Industrial Areas: Provide projector horns in the industrial areas.

d. Admin Areas: Each zone in the office administrative areas shall contain volume control at the master and in the room with the speakers.

e. Shielding: All wiring shall be shielded wire.

f. Scope: Provide complete system with amplifiers, speakers, wire with raceway, mixer, microphone, and other equipment as needed or specified elsewhere for a complete and operable system.

<<<<< END OF SECTION >>>>>

<<<<< **END OF BASE FACILITY STANDARD** >>>>>