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1 SEPTEMBER 1987
SUPERSEDING ALL
PREVIOUS ISSUES OF
DOD 4270.1-M

MILITARY HANDBOOK

FACILITY PLANNING AND DESIGN GUIDE

AMSC N/A

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PREFACE

This handbook is divided into two parts. Part I is a reprint of DoD 4270.1-M, "Policy Guidelines for Installation Planning, Design, Construction and Upkeep," which outlines the installation commander's role and responsibility for the development and care of the installation.

Part II, Technical Guidance, is a compilation of standards, references, and detailed technical guidance that is provided as a tool to assist installation commanders, their staffs, their design and construction agents, and their chain-of-command in this development and care. While these criteria were not developed primarily for use in review of military construction program and budget submissions, it is recognized they may be used for that purpose. Projects should not, however, be approved or disapproved solely on the basis of these criteria. All requirements, and particularly those which exceed this guidance, must therefore be fully explained and justified in accordance with other applicable DoD and Service programming/budget directives to ensure understanding by the reviewing officials.

Recommendations for improvement to this handbook are encouraged and frequent deviations from the included criteria should be reported on the DD From 1426 provided inside the back cover to Naval Facilities Engineering Command, Code 04, 200 Stovall Street, Alexandria, VA 22332. (Lead activity for maintenance of this handbook).

This handbook may be used as a reference document for procurement activities such as contracting for professional design services. However, this handbook shall not be used as a reference document in military or federal specifications, for procurement of materiel, or in other similar procurement activities.

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CHAPTER 13. FAMILY HOUSING FACILITIES CRITERIA

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ABBREVIATIONS AND ACRONYMS

AAFES	Army and Air Force Exchange Service
ACI	American Concrete Institute
ADP	Automated Data Processing
A-E	Architect-Engineer
AFM	Air Force Manual
AFR	Air Force Regulation
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
A&L	Acquisition and Logistics
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Regrigeration and Air Conditioning Engineers
ASTM	American Society of Testing and Materials
A&TBCB	Architectural and Transportation Barriers Compliance Board
AWG	American Wire Gauge
BIA	Brick Institute of America
BLAST	Building Loads Analysis and System ThermoDynamics
Btu	British Thermal Unit
Btuh	British Thermal Unit per Hour
C	Centigrade
(C)	Confidential
CAC	Community Activity Centers (see chapter 5, paragraph G.8.b.)
CAC	Career Advisory and Counseling (see chapter 5, paragraph E.5.b.)
CDD	Cooling Degree Days
CEGS	Corps of Engineers Guide Specification
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFA	Commission of Fine Arts
cfm	Cubic Feet per Minute
CFR	Code of Federal Regulations
cm	Centimeter or Centimeters
cm^2	Square Centimeters
CO	Commanding Officer
COE	Chief of Engineers
CONUS	Continental United States
CPO	Chief Petty Officers
DAEN-ECE-A	Architectural and Building Systems Branch, Engineering Division, Office of the Chief of Engineers
DASD(I)	Deputy Assistant Secretary of Defense (Installations)
DEQPPM	Defense Environmental Quality Program Policy Memoranda

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ABBREVIATIONS AND ACRONYMS (continued)

DD	Department of Defense
DDESB	Department of Defense Explosives Safety Board
DM	Design Manual
DoD	Department of Defense
DOE	Department of Energy
EAF	Environmental Adjustment Factors
EDP	Electronic Data Processing
Edu. Ctr.	Education Center
EIS	Environmental Impact Statement
EMT	Electrical Metallic Tubing
E.O.	Executive Order
EP	Enlisted Personnel
EPA	Environmental Protection Agency
F	Fahrenheit
FAMCAMPS	Family Camps
FAR	Federal Acquisitions Regulation
FCGS	Federal Construction Guide Specification
FEMA	Federal Emergency Management Agency
FEMP	Federal Energy Management Program
FR	Federal Register
F.R.	Fire-Resistance
ft	Foot or Feet
ft^2	Square Feet
FY	Fiscal Year
GED	General Education Development
gpm	Gallons per Minute
GSA	General Services Administration
HDD	Heating Degree Days
HND	Housing and Urban Development
Hq.	Headquarters
HQDA	Headquarters, Department of the Army
HVAC	Heating, Ventilation and Air-Conditioning
Hz	Hertz
IES	Illuminating Engineering Society
I&L	Installation and Logistics
IMC	Intermediate Metal Conduit
Inc.	Incorporated
JCS	Joint Chiefs of Staff
Kg	Kilogram or Kilograms
Km	Kilometer or Kilometers
kPa	Kilopascal
L	Liter or Liters
LPG	Liquidified Petroleum Gas
L/S	Liters per Second
m	Meter or Meters
m^2	Square Meters
m^3/h	Cubic Meters per Hour
$m^3/h-m^2$	Cubic Meters per Hour per Square Meter

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ABBREVIATIONS AND ACRONYMS (continued)

ml/s	Milliliter per Second
Max.	Maximum
MCWB	Mean Coincident Wet Bulb
MEGA	Millions
MILCON	Military Construction
Min.	Minimum
MRA&I	Manpower, Reserve Affairs and Installations
MTMC	Military Traffic Management Command
MWR	Morale, Welfare and Recreational
NATO	North Atlantic Treaty Organization
NAVAIDS	Air and Sea Navigational Aids
NAVFAC	Naval Facilities Engineering Command
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NCO	Noncommissioned Officers
NCPC	National Capital Planning Commission
NCR	National Capital Region
NEPA	National Environmental Policy Act
NFGS	Naval Facilities Guide Specification
NFPA	National Fire Protection Association
No.	Number
NPDES	National Pollutant Discharge Elimination System
NSI	National Standards Institute
OASD	Office of the Assistant Secretary of Defense
ODASD(I)	Office of the Deputy Assistant Secretary of Defense (Installations)
OJT	On-The-Job-Training
O&M	Operations and Maintenance
OMB	Office of Management and Budget
OSHA	Occupational Safety and Health Act
PCB	Polychlorinated Biphenols
P.L.	Public Law
P.O.	Post Office
POL	Petroleum, Oils, and Lubricants
psi	Pounds per Square Inch
RCRA	Resource Conservation and Recovery Act
RDF	Refuse Derived Fuel
RFTP	Requests for Technical Proposals
ROTC	Reserve Officers Training Corps
SE	Selective Energy
SF	Square Feet
SIR	Savings to Investment Ratio
SJI	Steel Joist Institute
S&L	Shipbuilding and Logistics
SQ FT	Square Feet
STAT	Statute
STD	Standard

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ABBREVIATIONS AND ACRONYMS (continued)

TDA	Table of Distribution and Allowances
TDY	Temporary Duty
TE	Total Energy
TLF	Temporary Lodging Facilities
TM	Technical Manual
TOE	Table of Organization and Equipment
TV	Television
(U)	Unclassified
"U"	Thermal Transmittance
"U_R"	Thermal Transmittance - Roof
UBC	Uniform Building Code
UEPH	Unaccompanied Enlisted Personnel Housing
UFAS	Uniform Federal Accessibility Standards
UL	Underwriters' Laboratories, Inc.
UOPH	Unaccompanied Officers Personnel Housing
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
U.S.C.	United States Code
USMC	United States Marine Corps
USPS	United States Postal Service
W	Watts
WECS	Wind Energy Conversion Systems
YR	Year

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PART I

POLICY GUIDELINES FOR INSTALLATION PLANNING, DESIGN, CONSTRUCTION AND UPKEEP

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DoD 4270.1-M
SEPTEMBER 1987

DEPARTMENT OF DEFENSE

POLICY GUIDELINES FOR INSTALLATION PLANNING, DESIGN, CONSTRUCTION AND UPKEEP

OFFICE OF THE DEPUTY
ASSISTANT SECRETARY OF DEFENSE
(INSTALLATIONS)

EXCELLENT INSTALLATIONS — THE FOUNDATION OF DEFENSE

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THE OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301-8000

PRODUCTION AND
LOGISTICS

September 1, 1987

FOREWORD

This Manual is issued under the authority of DoD Directive 4270.1, "Construction Criteria," July 11, 1983. It supersedes all previous editions of DoD 4270.1-M, "Construction Criteria." It complies with the policy of DoD Directive 4001.1, "Installation Management," dated September 4, 1986, which gives installation commanders broad authority to decide how best to accomplish their mission, and instructs headquarters to cancel regulations that limit installation commanders' freedom.

This Manual applies to the Office of the Secretary of Defense (OSD), the Military Departments, the Organization of the Joint Chiefs of staff (OJCS), the Unified and Specified Commands, the Defense Agencies, and activities administratively supported by OSD (hereafter referred to collectively as "DoD Components"). It does not apply to health care facilities.

Some detailed technical criteria are required that affect more than one Service; such criteria will be developed through a Tri-Service effort as indicated in subsection D.2. of DoD Directive 4270.1. Tri-Service and any other individual Service directives will conform to the basic policy guidance of this Manual.

DoD Components may obtain copies of this Manual through their own publication channels. Other Federal Agencies and the public may obtain copies from the Office of the Deputy Assistant Secretary of Defense for Installations, Washington, D.C. 20301-8000.

Bob Stone

Robert A. Stone
Deputy Assistant Secretary of Defense
(Installations)

Excellent Installations - The Foundation of Defense

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A. INTRODUCTION

This Manual is written for installation commanders. It is their guide to provide excellent facilities through new construction and through maintenance, repair, and renovation of existing permanent and temporary facilities so that the installation can accomplish its mission now and in the future.

The Manual is based on the principle that an investment in excellent facilities is an investment in people—our most valuable resource.

B. OBJECTIVE

The objective of all installation planning, design, construction, and upkeep for the Defense Department is to provide excellent places to work and live for the soldiers, sailors, airmen, and marines who defend America. Investment in excellent facilities quickly pays off in improved capability and performance of our combat forces. Excellent facilities engender *pride*—the fuel of human accomplishment.

C. GENERAL GUIDANCE

Military bases are hometowns. They should have all the facilities a good town has—not just housing, but land and buildings designed for recreation, cultural and religious activities, education, health care, shopping, and work. Military bases ought to be the kind of towns you would want your sons and daughters to work and live in.

You cannot plan, design, or build an excellent facility unless you thoroughly understand what the customers want. Spend a lot of time finding out. Ask the unit commanders, the NCOs, the young officers and enlisted people, and their families, how to make things better. Pay a lot of attention to features, finishes, and furnishings because they mean quality to your customers. The facility is excellent <u>only</u> if the customers say it is.

Encourage and enable your people to improve their own working and living places. They get better facilities far sooner and a greater feeling of pride and ownership. To see it done well, visit the U-Do-It Store at Ft. Lee, Virginia, or the One Stop Shop at F.E. Warren Air Force Base, Wyoming.

If your installation has an architectural theme, stick to it. If you are starting with a hodgepodge, pick a theme and work toward it. You might find it useful to hire a base architect to oversee the design and improvements to all buildings year after year. Remember, these facilities will be around for a long time. We have an opportunity to make them an enduring source of pride. Design to cut energy use, while providing pleasant, comfortable living and working environments. When you rehabilitate a facility, you can get energy (and cost) savings in the bargain. In maintaining *facilities*, keep energy consuming systems in good repair; apply our new shared energy savings legislation; reward innovation. And remember the first rule of energy conservation—don't hassle the troops. Give them plenty of light and let them adjust the temperature. If you have people working in the dark or if they're too cold or too hot, you are wasting a resource far more costly and valuable than energy.

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Pay close attention to protecting the natural environment and historical and archaeological sites. Compliance with environmental laws and regulations is not only a statutory requirement; it makes good sense for protecting the well-being of your people and the environment. If you are not familiar with national and local laws and rules, get expert advice. Following the rules will help you to produce excellent facilities.

Physically handicapped people are entitled to use many facilities on military installations. As a general rule, make buildings accessible to physically handicapped people unless the building is to be used only by able-bodied military personnel. Make at least five percent of your family housing units (no less than one house) accessible.

D. SECURITY AND SURVIVABILITY

Build survivability in, so that military operations can continue after attacks. Don't forget to build protection into dormitories, dining halls, and offices, as well as into buildings where equipment is stored and maintained. Some techniques are quite inexpensive, like designing buildings so that people will not be exposed to flying window glass. CINCs and major commands will determine the appropriate level of protection.

E. COST BENEFIT ANALYSIS

The goal is <u>not</u> to minimize the life-cycle cost of the facilities, but to maximize the performance of the people who use the facilities. Excellent facilities are worth more than they cost.

When you do cost-benefit analyses of new facilities versus old, don't forget about the people who use the facilities. Numerical analysis can never predict the extra performance of people whose pride and efficiency are boosted by excellent facilities. But, numerical analysis <u>can</u> demonstrate that only a very small increase in the output of people who work in a building is needed to pay for the extra cost of an excellent building. Use this simple formula:

$$\text{The extra output (in percent) needed to pay for excellence} = \frac{(A-B)}{C \times D} \times 100$$

where: A is the lifetime cost of creating and maintaining an excellent facility

B is the lifetime cost of maintaining the old facility

C is the years of life

D is the annual cost of the people who use the facility

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F. SIZES

The best guide to sizing is an existing facility that is satisfying the desires of the people who use it. Whatever the facility, find the best example you can and ask the people who use it how to make the next one better. If possible, use examples from America's best run, profit-making companies.

Remember to ask the customers—the commanders, the NCOs, the troops—what they want. Don't make buildings too small. An undersized building is more wasteful than an oversized one because people are more expensive than buildings.

Dormitory living space is, by law, set by OSD. Dormitories must be built with the particular unit in mind. Consider the type of unit, its mission, its equipment, and its location. While there must be some commonality in the net living space, the whole dormitory complex must add to, not detract from, the unit's mission. Here are the current standards in net living space:

Standard Net Living Space for Unaccompanied Officers and Enlisted

Rank	Net Square Feet
O3 and above	460
O1 and O2	330
E7 to E9	360
E5 and E6	180
E1 to E4	90 (2 to a 180 square foot room)
E1 recruits	72 (open bay)

Finally, the goal is to provide our soldiers, sailors, airmen, and marines with a home. Include places to clean and store gear (these don't count as living space), ample parking, telephone and cable hook-ups, and indoor and outdoor lounge areas, places to prepare food, and lots of privacy.

G. UPKEEP

The objective of facility upkeep is to enhance and maintain the pride of military units. When paint peels, the bare wood begins to deteriorate and so does unit pride. When pavement cracks, it begins to erode and so does unit pride.

You know that good upkeep preserves facilities from decay that in the long-term would be more costly to repair. More important, good facility upkeep preserves unit pride; pride, like the facilities, is far less costly to maintain than to rebuild. Since pride is so essential to military readiness, it makes sense to invest heavily in it.

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H. WORLD WAR II WOOD BUILDINGS, TEMPORARIES, AND RELOCATABLES

"Temporary" wood buildings from the 1940s make up a large proportion of our current facilities. We will need them for a long time to come. But that does not mean we must compromise our goal of excellent installations. Here are some pointers:

1. Make them safe; don't put people in fire traps.

2. Keep them painted, even if they are programmed to come down some day. People are using them, or at least looking at them; their pride is at stake.

3. Give them a complete face lift. Modern renovation materials can work wonders. Go see what's been done at Moody AFB, Georgia; Nellis AFB, Nevada; or Naval Air Station, Brunswick, Maine. You won't be able to tell the 1940s buildings from the brand new ones.

I. DETAILED TECHNICAL GUIDANCE

The Military Departments may issue detailed guidance to assist installation commanders in planning, designing, and building excellent facilities. However, as much of this guidance as possible should be in the form of advice and assistance rather than control and direction. The commanding officer is responsible for accomplishing the mission of the installation and is accountable for all resources applied to the mission, and must have the authority to make investment decisions.

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PART II

TECHNICAL GUIDANCE

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CHAPTER 1

GENERAL

A. PURPOSE

1. General. This part prescribes technical criteria to serve as a guide in the design and construction of high quality facilities that are durable, functional, economical, safe, esthetically pleasing, and have reasonable operating and maintenance costs. While these criteria are intended to serve as a guide and yet offer considerable flexibility, those sections identified as based on law, Executive Order, DoD Directives, Federal Regulations, and other governing standards must be treated accordingly.

2. Applicability. The criteria contained in this handbook may be used in considering all facilities at military installations in the United States and, to the extent practicable, in other locations worldwide. The criteria may also be used as a baseline in the planning and design of:

a. New facilities in the military construction program.

b. Minor construction and nonappropriated fund projects.

c. Major alterations to existing structures for the purpose of rehabilitation or conversion into permanent facilities.

d. Certain nonpermanent construction, as indicated.

3. Improvement of Existing Facilities. Improvement of existing facilities for the sole purpose of meeting these criteria should not be undertaken.

B. DESIGN CONSIDERATIONS

1. Economic, Engineering, and Environmental Studies. The design of military facilities should be supported by appropriate economic, engineering, and environmental studies.

a. Design Features. These studies should include, but not be limited to, those design features of the facility that contribute the most to the construction quality, life cycle cost, energy efficiency, environmental impact, and performance of people and the mission.

b. Life Cycle Costs. Design decisions for all types of construction projects should consider life cycle cost and the impact on productivity and operating efficiency of the functions within the facility. Studies should be made that consider the life cycle cost of the facility so as to arrive at an economical cost that takes into

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consideration not only the initial construction cost, but also the operating and maintenance costs of the building and associated impact on the mission performed within it over the anticipated life of the facility.

2. Design Requirements. The design of military facilities should:

a. Be based on the actual requirements of the project.

b. Contribute to the pride of the people who work there.

c. Meet the operating requirements of the using activity and provide reasonable flexibility to accommodate foreseeable changes in requirements by the using activity.

d. Provide highly functional facilities at the lowest practicable construction and acquisition costs consistent with total life cycle economy.

e. Be appropriate for the type or importance of the facility and the local surroundings, and meet the necessary environmental requirements, including applicable federal, state, and local pollution control criteria and standards.

3. Construction Qualities. The quality of construction should be as high as necessary to provide construction suitable for the actual needs of the intended occupancy. For industrial and service facilities, such as shops and storage facilities, an austere quality of construction with reduced finishes may be provided. For buildings of more sophisticated occupancy, such as laboratories and major headquarters buildings, a higher quality of construction with better finishes should be considered.

4. Use of Local Construction Methods, Materials, and Skills. Designs should consider economies that can be effected by the use of suitable local construction methods, materials, and skills that are consistent with the intent of these criteria.

5. Use of Standard or Stock Products. Commercially available standard or stock equipment, fixtures, and materials should be used when practicable.

C. CONSTRUCTION LEVELS AND BUILDING TYPES

1. Building Definitions. The definitions provided below are used in this handbook and used by the Military Departments and DoD Components to describe the levels and types of construction of most DoD buildings and related facilities.

a. Permanent Construction. Buildings and facilities designed and constructed to serve a life expectancy of more than 25 years, should be energy efficient, and should have finishes, materials, and systems selected for low maintenance and low life cycle cost.

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b. Semipermanent Construction. Buildings and facilities designed and constructed to serve a life expectancy of more than five years but less than 25 years, should be energy efficient, and should have finishes, materials, and systems selected for a moderate degree of maintenance using the life cycle approach.

c. Temporary Construction. Buildings and facilities designed and constructed to serve a life expectancy of five years or less using low cost construction, and with finishes, materials, and systems selected with maintenance factors being a secondary consideration.

d. Mobilization and Emergency Construction. Buildings and facilities designed and constructed to serve a specific mobilization or emergency requirement. Buildings should be austere to minimize construction time and maximize conservation of critical materials. Maintenance factors and longevity should be secondary considerations.

e. Building System and Subsystems. A building system is an assembly of dimensionally and functionally precoordinated subsystems which, when combined, produces an essentially complete and functional building. A subsystem is one of many building components designed and manufactured to be combined and integrated with other types of subsystems to produce an entire building system.

f. Industrialized Buildings. Buildings in which major components and some subsystems are constructed at a factory, transported to the jobsite and erected. An example is factory construction of individual walls with the plumbing and electrical wiring already installed.

g. Manufactured Buildings. Buildings constructed from whole building modules that are constructed at a factory, transported to the jobsite and connected to other modules to form an entire structure. An example is multistory unaccompanied personnel housing in which each living unit is factory constructed with walls, floors, ceilings, plumbing, and electrical wiring.

h. Pre-Engineered Buildings. Buildings constructed entirely from a manufacturer's system of standard stock items. Pre-engineered buildings often rely on a modular dimension system and can be constructed in a wide range of configurations and sizes.

i. Relocatable Buildings. Buildings designed to be dismantled to facilitate relocation and normally purchased as equipment to fill a temporary requirement.

j. Portable Buildings. Buildings designed to be easily moved intact.

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2. Criteria for Building Systems Construction.

a. Standards and Quality. The standards and level of quality authorized in this handbook apply to industrialized, manufactured, pre-engineered, and other types of building systems construction.

b. Component Parts. The component parts should be readily available and be able to be procured competitively. In other words, it is not intended that designs, or availability of specified or offered component parts, be subject to further research or development, or both, but rather that the component parts be standard, off-the-shelf stock items.

c. Manufactured and Pre-Engineered Buildings. These types of construction may be used for military buildings when such use is indicated by life cycle cost to be economical; when they will meet the functional and performance requirements of the project; and when they can be architecturally compatible with the environment in which they will be erected. Because of the great variance in the cost and quality of such structures on the market, extreme care must be used in selection to ensure that the quality of the facility to be provided is commensurate with the project requirements and expected longevity of the mission to be served.

d. Relocatability. Relocatability should be specified only when the project justification certifies that the facility involved is of uncertain tenure and the provisions of this feature will not result in a degradation of proven standards of design, architecture and engineering, or result in increased operating and maintenance costs. When relocatability is the primary design consideration, DoD Instruction 4165.56 (reference (1a)) shall apply.

D. OCCUPATIONAL SAFETY AND HEALTH ACT CONSIDERATIONS

The Occupational Safety and Health Act of 1970 (reference (1b)) requires that safety standards issued by the Secretary of Labor be followed in the work place. Section 19 of this Act requires federal agencies to establish and maintain effective and comprehensive programs, consistent with the standards issued by the Secretary of Labor. Those standards issued by the Secretary of Labor that affect the design of buildings are principally found in the General Industry Standards, 20 CFR 1910 (reference (1c)). The design of all military facilities that serve as places of employment shall conform to, or be consistent with, all applicable standards published under the Occupational Safety and Health Act (OSHA) of 1970 (reference 1b)).

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REFERENCES

(1a) DoD Instruction 4165.56, "Relocatable Buildings," April 3, 1981
(1b) "Occupational Safety and Health Act of 1970"
(1c) General Industry Standards, 20 CFR 1910, Occupational Safety and Health Administration, Department of Labor, 200 Constitution Avenue, N.W., Washington, D. C. 20210

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CHAPTER 2

ENVIRONMENTAL QUALITY

A. GENERAL

In keeping with this nationwide concern for the environment, the Congress and the Administration have enunciated several policies for its preservation and enhancement. In general, environmental legislation requires that federal agencies comply with procedural as well as substantive requirements of the designated regulatory agencies, including the payment of appropriate fees. The documents issuing these policies are discussed below, and key personnel at all levels should be made aware of their contents so as to assist in the decision making process.

1. 42 U.S.C. 4321-4361, The National Environmental Policy Act (NEPA) (reference (2a)). This Act declares a national policy to (1) encourage productive and enjoyable harmony between people and their environment, (2) provide for the prevention or elimination of damage to the environment and biosphere, and stimulate the health and welfare of people, and (3) enrich the understanding of the ecological systems and natural resources important to the nation. This Act requires, among other items, that every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the natural environment, include a detailed five-point statement on the environmental impact of the intended action. The Council on Environmental Quality has issued implementing regulations for NEPA (reference (2b)) that provide specific information concerning the preparation and coordination of environmental documentation.

2. Executive Order 11514 (reference (2c)). This Executive Order directs federal agencies to implement the National Environmental Policy Act (NEPA) (reference (2a)). Further, it requires that federal agencies provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. Among other items, the Executive Order requires that federal agencies monitor, evaluate, and control, on a continuing basis, activities so as to protect and enhance the quality of the environment.

3. Executive Order 11593 (reference (2d)). This Executive Order requires that (1) the federal agencies provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the nation, (2) federal agencies initiate measures necessary to direct policies, plans, and programs in such a way that federally-owned sites, structures, and objects of historical, architectural, or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people.

4. Clean Water Act of 1977, Public Law (P.L.) 95-217, as amended (reference (2e)). Among other items, this Act establishes the National Pollutant Discharge Elimination System (NPDES) and requires federal

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agencies to apply for a permit for each point source of wastewater discharge and comply with the conditions of each permit. Wastewater sent to a publicly-owned treatment plant must meet pretreatment standards prescribed by this Act and of the agency that owns the treatment plant. The Act also requires that construction of facilities for treatment of wastewater at federal facilities after September 30, 1979, not be initiated unless alternative methods for wastewater treatment using innovative treatment processes and techniques are used. This requirement is not applicable when the life cycle cost of the alternative treatment works exceeds the life cycle cost of the most cost-effective alternative by more than 15 percent. This Act also requires that for certain pollutants, point source discharges shall be treated using the best available technology economically achievable.

5. Clean Air Act, Public Law (P.L.) 95-90, as amended (reference (2f)). Among other items, this Act requires federal agencies to apply for permits to operate and to construct facilities to control stationary air pollutant sources and to comply with the conditions of each permit.

6. Solid Waste Disposal Act, Public Law (P.L.) 94-580, as amended by the Resource Conservation and Recovery Act and Amendments (reference (2g)). Among other items, this Act requires federal agencies to properly manage hazardous waste from its time of generation to its disposal. Agencies must obtain permits for their hazardous waste treatment, storage, and disposal facilities. Proper shipping papers (manifests), packaging, and labeling must be used when transporting hazardous waste. The 1984 amendments apply the requirements to persons who generate as little as 100 kilograms of hazardous waste in any month, and require registration and controls on underground tanks used for storing oil and hazardous waste.

7. Toxic Substances Control Act, Public Law (P.L.) 94-469, as amended (reference (2 h)). Among other items, this Act requires Federal Agencies to properly manage the use and disposal of all toxic substances and specifically requires such management of Polychlorinated Biphenols (PCB) and items that contain PCB.

8. Safe Drinking Water Act, Public Law (P.L.) 95-190, as amended (reference (2i)). Among other items, this Act requires federal agencies who own or operate drinking water distribution systems to ensure that the water meets primary drinking water standards, and where required, that such systems are registered, licensed, or permitted. This Act also requires that special attention be paid to the protection of designated sole source aquifers during construction and operation of Department of Defense facilities.

9. Executive Order 12088 (reference (2j)). This Executive Order outlines the policies that are to govern compliance with federal, state, and local environmental standards by federal facilities. The head of each executive agency is responsible to ensure that federal facilities

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are at all times designed, constructed, operated, and maintained in compliance with all federal, state, and local environmental requirements. The Executive Order further requires that a plan be sent annually to the Office of Management and Budget (OMB) to provide for improvements necessary to meet applicable standards. Exemptions from applicable control standards may only be granted by the President. Furthermore, the construction or operation of federal facilities outside the United States shall comply with the environmental pollution control standards of general applicability in the host country or jurisdiction.

10. Executive Order 12114 (reference (2k)). This Executive Order requires that responsible officials of federal agencies take into consideration pertinent environmental considerations when making decisions on major federal actions outside the geographic borders of the United States and its territories and possessions.

11. Executive Order 12316 (reference (2l)). This Executive Order delegates to the Secretary of Defense the responsibility for investigation and removal of hazardous substance releases from DoD facilities and vessels.

12. Protection of Historic and Cultural Properties. Policies are issued by the following documents:

a. Executive Order 11593 (reference (2d)).

b. National Historic Preservation Act, Public Law (P.L.) 89-665 (reference (2m)).

c. Archaeological Resources Protection Act, Public Law (P.L.) 96-95 (reference (2n)).

13. Comprehensive Environmental Response, Compensation and Liability Act of 1980 with Ammendments PL 99-499 (reference (2o)). This Act subjects federal agencies to courses of action to clean-up sites where the agencies may have been wholly or partially responsible for contaminating the soil or groundwater. Also, the Act requires reporting of hazardous substance releases and previous disposal actions.

B. GUIDELINES

In consonance with the congressional and administration guidance provided in Section A., above, the following general guidelines on environmental quality apply to construction:

1. Necessary measures shall be taken to minimize all forms of environmental pollution and meet federal, state, and local environmental quality standards. Environmental pollution is that condition that results from the presence of chemical, physical, or biological agents in the air, water, or soil that so alter the natural environment that an

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adverse effect is created on human health or comfort, fish and wildlife, other aquatic resources, plant life, and structures and equipment to the extent of producing economic loss, impairing recreational opportunity, or marring natural beauty.

2. Environmental factors shall be carefully examined when developing projects and studying alternative means of meeting the requirements.

3. The maintenance and enhancement of environmental quality shall be given full consideration in decision making along with economic, social, and technical factors.

4. Recommendations on projects shall be based on a balanced evaluation of military requirements and the economic and environmental factors involved.

5. Historical and archaeological places meeting the criteria of the national register and other areas of special interest relating to natural wildlife and plant life will be preserved to the extent possible and in accordance with appropriate public laws.

6. When practicable, the environment of the community or locality in which the public works are situated should be enhanced so as to increase its value to the public. Necessary coordination shall be maintained with the state and local community in accordance with the requirements of E.O. 12371 (reference (2p)) as implemented by DoD Directive 4165.61 (reference (2q)).

C. PLANNING AND DESIGN FOR ENVIRONMENTAL QUALITY

1. Environmental Factors. In keeping with the above guidelines, special attention must be given to environmental factors in the development, design, and construction of military facilities. The following factors, which are covered in other chapters of this handbook, shall be given increased attention in project development:

a. Compatibility with the existing and planned adjacent communities (chapter 3).

b. Development of military installation master plans should take into account environmental quality considerations (chapter 3).

c. Flood hazard considerations (chapter 3).

d. General architectural design provisions (chapter 5).

e. Grading, drainage, erosion, and dust control (chapter 3).

f. Landscaping and open space distribution, arrangements, and use (chapter 3).

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g. Noise (chapter 3).

h. Provisions for the physically handicapped (chapter 5).

i. Siting of hazardous materials facilities (chapter 3).

j. Siting, orientation, and arrangement of buildings within an overall planning and design framework (chapter 3).

k. Siting of utilities (chapter 3).

l. Topography, natural beauty considerations, and hazards and nuisance effects (chapter 3).

m. Effects on historic places and archaeological sites (chapter 2).

2. Environmental Effects of Alternative Approaches. Environmental effects of alternative approaches to providing required facilities shall be analyzed and evaluated with a view toward enhancing the environment and minimizing any detrimental environmental effects.

D. PREPARATION OF ENVIRONMENTAL DOCUMENTS

In accordance with the requirements of NEPA, implementing regulations from the Council on Environmental Quality and DoD Directive 6050.1 (reference (2r)) and DoD Directive 6050.7 (reference (2s)), environmental effects must be considered when planning projects and proposals. The appropriate documentation shall be developed as soon as sufficient project information is available. The military services should strive to complete the environmental documents for military construction projects before submitting the annual military construction program to Congress.

E. POLLUTION ABATEMENT

1. General Policy on Pollution Abatement. Overall policy guidance for abatement of pollution at military installations is covered in DoD Directive 5100.50 (reference (2t)). According to the requirements of E.O. 12088, (reference (2j)), the design of military construction projects must include provisions for meeting the applicable standards for controlling pollution. Accordingly, the annual submission of the military construction program shall include a statement indicating that the necessary provisions for the control of pollution have been included in the project designs.

2. Control of Water Pollution. Control of water pollution at military installations must be provided according to E.O. 12088 (reference (2J)), as implemented by DoD Directive 5100.50 (reference (2t)). Preliminary engineering studies and designs required for the construction, alteration, and additions of water pollution control facilities should be started in sufficient time to ensure sound cost estimates for budgetary

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purposes, compliance with applicable water quality standards, and with installation spill prevention control and countermeasures plans, Title 40, U.S.C., CFR, Part 112 (reference (2u)).

3. Control of Air Pollution. Control of air pollution at military installations shall be in accordance with E.O. 12088 (reference (2j)), as implemented by DoD Directive 5100.50 (reference (2t)).

a. Planning of Air Pollution Control Projects. It is essential that planning for all air pollution abatement facilities be started far enough in advance to obtain proper engineering review of all applicable standards and all alternative solutions to the problems. Adequate lead time is also necessary to develop suitable designs that will provide the realistic cost estimates necessary to ensure a reliable budget program.

b. Engineering Considerations of Air Pollution Control Projects. While air pollution control facilities must be provided to meet current emission standards within the time limit established in E.O. 12088 (reference (2j)), it is essential that full engineering consideration be given to possible future requirements. To the extent possible for current projects, engineering decisions shall be made to accommodate future additions or modifications at minimum cost. It is essential that the design engineer be fully knowledgeable of pollution control requirements being considered for future adoption, especially at the state and local levels.

F. ENVIRONMENTAL PROTECTION DURING CONSTRUCTION OPERATIONS

When designing a project in accordance with P.L. 91-190 (reference (2v)), and E.O. 12088 (reference (2j)) and E.O. 11514 (reference (2c)), and P.L. 89-665 (reference (2w)), necessary measures shall be taken to eliminate or minimize degradation of the environment during construction operations.

1. Review of Construction Projects. Construction projects shall be reviewed to identify any potential sources of pollution or other damage to the environment that may occur during the construction of the military facilities. The scope of environmental considerations during construction activities concerns potential pollution of the air, land and water, and involves hazardous waste, noise, radiant energy, solid waste, and other pollutants. It also includes the effects on archaeological sites, historic places, and the preservation and enhancement of general aesthetic values during and after construction.

2. Technical Specifications for Environmental Quality. Upon a determination that there is a potential source of degradation to the environment during construction operations, suitable provisions shall be included in the technical specifications of the project to eliminate or minimize the damage. When developing these specifications, particular attention shall be given to:

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a. Compliance. Ensuring that federal, state, and local laws pertaining to environmental pollution and historic and archaeological preservation are complied with during construction operations.

b. Construction Operations. Providing coverage in the specifications to minimize pollution and adverse effects from construction operations, including:

(1) Air pollution caused by open burning; use of volatile materials, such as asphalts and paints; and dust caused by clearing, excavation, and grubbing.

(2) Destruction of land forms, vegetation, archaeological resources and historic buildings or structures.

(3) Noise pollution.

(4) Sediment control.

(5) Water pollution caused by spillage of bitumen, fuels, grease, and oils; erosion; cement and concrete spillage; aggregate washing; and sanitary and other waste disposal.

REFERENCES

(2a) 42 U.S.C. 4321-4361, "The National Environmental Policy Act of 1969"
(2b) Title 40, Code of Federal Regulations (CFR) 1501-1506, "Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures"
(2c) Executive Order 11514, "Protection and Enhancement of Environmental Quality," March 5, 1970 (as amended by Executive Order 11991, May 24, 1977)
(2d) Executive Order 11593, "Protection and Enhancement of the Cultural Environment," May 13, 1971
(2e) Public Law 95-217, "Clean Water Act of 1977," as amended
(2f) Public Law 95-90, "Clean Air Act," as amended
(2g) Public Law 94-580, "Solid Waste Disposal Act," as amended
(2h) Public Law 94-469, "Toxic Substances Control Act," as amended
(2i) Public Law 95-190, "Safe Drinking Water Act," as amended
(2j) Executive Order 12088, "Federal Compliance with Pollution Control Standards," October 13, 1978
(2k) Executive Order 12114, "Environmental Effects Abroad of Major Federal Actions," January 4, 1979
(2l) Executive Order 12316, "Responses to Environmental Damage," August 14, 1981
(2m) Public Law 89-665, "National Historic Preservation Act of 1966," October 15, 1966, as amended by Public Law 95-515, December 12, 1980
(2n) Public Law 96-95, 93 STAT-721, "Archaeological Resources Protection Act of 1979"

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REFERENCES (continued)

(2o) 42 U.S.C. 9601, "Comprehensive Environmental Response, Compensation and Liability Act of 1980" as ammended by PL 99-499, "Superfund Ammendment and Reauthorization Act of 1986"
(2p) Executive Order 12371, "Intergovernmental Review of Federal Programs," July 16, 1982
(2q) DoD Directive 4165.61, "Intergovernmental Coordination of DoD Federal Development Programs and Activities," August 9, 1983
(2r) DoD Directive 6050.1, "Environmental Effects in the United States of DoD Actions," July 30, 1979
(2s) DoD Directive 6050.7, "Environmental Effects Abroad of Major Department of Defense Actions," March 31, 1979
(2t) DoD Directive 5100.50, "Protection and Enhancement of Enviromental Quality," May 24, 1973
(2u) Title 40, U.S.C., Code of Federal Regulations, CFR, part 112, "Oil Pollution Prevention"
(2v) Public Law 91-190, "National Evnironmental Policy Act of 1969"
(2w) Public Law 89-665, "Historic Properties Preservation Program"

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CHAPTER 3

MASTER PLANNING AND SITING CRITERIA

A. GENERAL

1. Master Plans. Comprehensive master plans are developed to provide guidance for management of the resources of Department of Defense installations and to provide a systematic process to control orderly growth of the installations. Master plans shall document existing assets and conditions, and identify future development plans and capabilities for response to changing conditions.

2. Security Threats. Threats to the security of military installations and facilities may greatly affect operations by requiring an increase in protective measures. The threats include espionage, sabotage, terrorism, and theft. Planning and design of military installations and facilities should consider the vulnerability to these threats, using the assessments of intelligence community agencies, and should provide installation land use, facility sites, site development, and facilities design appropriate to the assessed threat.

3. Coordination. Development of master plans should provide for consideration of the planning goals and objectives of the communities surrounding the military installation, coordinated in compliance with E.O. 12372 (reference (3a)) as implemented by DoD Directive 4165.61 (reference (3b)).

B. INSTALLATION SECURITY

1. Installation Planning. Threats to military installations are of two major types: natural and human.

a. Natural Threats. The natural threats are the consequence of natural phenomena and normally are not preventable by physical security measures. Examples include earthquakes, fires, fogs, floods, storms and winds, and ice and snow. While these threats cannot be prevented, effective planning and design can be used to reduce the impact of natural disasters on the operations and security of the military installation.

b. Human Threats. Effective planning and design can mitigate or prevent espionage, sabotage, terrorism, and theft. Planning for land use, circulation, and site development should incorporate measures that enhance military installations and facility security. In general, the number of points of access to the military installation and facilities should be limited and physical security emphasized for facilities that house large numbers of personnel. These are critical to operations (bulk fuel storage, communication facilities, hangars, magazines, piers, power plants, water plants), or have great symbolic value (headquarters offices). These facilities are at greater risk for sabotage or terrorist action.

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2. Fencing. The use of fencing to enclose military installations or to enclose and separate areas within a military installation should be limited to those conditions requiring physical security or protection of life, except as stipulated for family housing. Where fencing is required, attention should be given during design to ensure that the fencing selected is functionally adequate and architecturally compatible with the surroundings.

C. SITING OF BUILDINGS

1. Location.

a. Functional Relationships. Buildings should be sited in proper functional relationship to each other for convenience, operational efficiency, physical security, and in consonance with long term development plans.

b. Locational Relationships. Buildings should be located in consonance with the topography for construction economy and preservation of the character of the site. Facilities should be grouped by function to assist in maintaining physical security. Parking should be placed where surveillance exists in the normal course of activity.

2. Orientation. Buildings should be oriented to take advantage of passive solar heating and cooling. Air-conditioned buildings should be sited so that the long axis of the building is in an east-west plane as possible.

3. Physical Character of the Site.

a. Natural Resource Considerations. An active concern for natural resource values should be considered in the siting of facilities in accordance with DoD Directive 4700.1 (reference (3d)). The proposed use will be matched to the natural resource capability and ecological compatibility of the site. Installation natural resource management plans should be consulted when making these determinations.

b. Soil and Foundation Conditions. Soil and foundation conditions should be investigated to ensure suitability for economical excavation, site preparation, building foundations, utility lines, grading, and planting. Bearing capacity tests should be made to ensure economical and stable foundations for buildings and other structures.

c. Hazards and Nuisance Effects. Hazards and nuisance effects, such as excessive dust, noise, odors, and smoke; explosives storage or electromagnetic radiation or interference, or both; created by the land uses adjacent to the project site, should be given careful consideration in site selection and development.

4. Vehicular and Pedestrian Circulation.

a. Street Network. Planning and design of the street network within each project area should be coordinated with the overall traffic master plan for the military installation. Placement of new facilities

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should not interfere with the planned street system. Convenient and safe vehicular access and circulation, consistent with security objectives, should be major considerations during the site location and design phases of the project. Additional guidance dealing with the planning and geometric design for roadways serving abutting land uses is available in Military Traffic Management Command, MTMC Pamphlet 55-10 (reference (3e)). Plans should also include essential vehicular services such as cargo deliveries, fire protection, maintenance needs, and trash collection. Routes should be laid out which are short, direct, and continuously under some form of surveillance. Appropriate design techniques should discourage through traffic use of the installation street system.

b. Parking Facilities.

(1) Off and On Street Parking. Off street parking should be provided for both organizational and nonorganizational vehicles. Except for residential areas, parking on the street is highly discouraged due to the greater accident potential.

(2) Joint Use Facilities. In the interest of economy and efficiency of land use, joint use parking facilities should be designed where feasible. The best opportunity for such application occurs where a predominately daytime activity adjoins a predominately evening hour activity. In this case, the use of the parking facilities by patrons of both activities should permit a substantial reduction in parking area with little or no loss of space availability and convenience.

(3) Space Factors. Factors and criteria for nonorganizational vehicle parking spaces in table 3-1 may be used to make initial estimates of parking requirements.

c. Sidewalks. Sidewalks should be designed to provide convenient and safe pedestrian access and necessary circulation. Their width should be based on the pedestrian traffic volume. When steps are required, provide at least three risers. If sidewalks serve facilities that are accessible to the physically handicapped or may be used by the physically handicapped, no steps should be provided. See chapter 5.

D. LAND USE RESTRICTIONS FOR RUNWAY CLEARANCES AND NOISE ABATEMENT

1. Runway Clearances. Facilities should be sited in accordance with the Joint Service Manual, AFR 86-14, TM 5-803-7, NAVFAC P-971 (reference (3f)).

2. Acceptable Noise Levels from Aircraft and Other Loud Noise Sources. Whenever possible, facilities should be sited in accordance with the recommendations of the Joint Service Manual, TM 5-803-2, NAVFAC P-970, AFM 19-10 (reference (3g)). Otherwise, they should be provided with sound attenuation features to achieve at least the sound level reductions

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specified in chapter 4 of that manual. The objective is to obtain the maximum practicable acoustic separation between objectionable noise sources and all facilities not directly associated with the noise producing activity. The purpose and type of construction of a proposed facility and probable reaction to noise of persons using it are factors that must be given equal importance and consideration with economics, land availability, and function when determining siting. As an example, the high internal noise of some shops, combined with the type of activity being carried on, tend to make these facilities relatively insensitive to external sounds. Whereas, administrative facilities are generally quite sensitive to intrusive noise. These subjects are addressed in detail in the Joint Service Manual, TM 5-803-2, NAVFAC P-970, AFM 19-10 (reference (3g)).

3. Noise Suppressors (Hush Houses and Test Cells).

a. Siting. The purpose for hush houses and engine test cells is to allow essential aircraft engine maintenance to be performed on fully operating engines in the near proximity of maintenance and administrative facilities without objectionable or harmful noise levels reaching nearby workers. The siting of noise suppressors, therefore, in addition to other factors (e.g., savings in land use through noise suppression versus open air testing), must consider the noise levels generated in adjacent buildings as in paragraph 2. above.

b. Standard Design. Recognizing that changing technology in acoustics engineering causes the design of noise suppressors to evolve over time, designs should be standardized within a service and across services to the extent practical.

c. Justification Criteria. Certain local factors inpact on the justification for acquiring one or more noise suppressors. Of these, it is essential that the following be considered:

(1) Workload. The numbers of engines or aircraft being or planned to be tested should be determined with the aim of efficient use of each noise suppressor.

(2) Environment. The noise levels generated in adjacent buildings (both on and off the facility) during engine testing must be a consideration. In some cases climatic conditions will form a portion of noise suppressor justification.

E. LANDSCAPING

Complete landscape designs should follow the guidance in the Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43 (reference (3c)) and be an integral part of the project site development.

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F. SITING OF UTILITIES

1. Existing and Required Utility Services. Utilities which are essential to efficient operation and adequately sized to serve future requirements should be considered in the early planning stages. This will avoid conflicts in the design and layout of the various utility lines and permit the early recognition of the need for additional production or supply capacity, or both. All projects should address the adequacy of existing utilities support and include any additional needs. Installation-wide master plan studies should include a major analysis of the integration of existing utility systems and future requirements. The planning of utility lines should minimize utility easements, capital investments, and operational cost for maintenance and repair.

2. Planning Considerations.

a. Appearance. Meters, poles, transformers, vaults, pressure reducing station piping and valving, and other utility items should be located so that they do not detract from the building's appearance. Design should also reduce the negative visual impact of utility items and communication lines in accordance with the Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43 (reference (3c)).

b. Security. Since utilities are essential to the operation of a military installation, their design, location, visibility, and access should be considered for protective construction measures to reduce their vulnerability to enemy action or sabotage. Particular attention should be given to commercial power access points and communication lines.

c. Underground Lines. Underground distribution lines should be located to minimize cost and effort of performing maintenance. Normally, utility lines of all types should not be located under buildings, parking lots, paved terraces, sidewalks, and other paved areas. All underground utility lines, mains, and conduits should be located at the minimum depth necessary and when possible, in common corridors to allow for ready access and maintenance.

G. SITING OF HAZARDOUS MATERIALS FACILITIES

1. Hazardous Materials. Special consideration should be given to the design and location of facilities that involve the handling, manufacture, storage, and transportation of hazardous materials such as ammunition, explosives, hazardous chemicals, and liquid propellants. Site planning for such facilities should be done as soon as the requirement is known with the siting being incorporated into the master plan of the military installation.

2. DoD Explosives Safety Board (DDESB). Facility designs including siting for the construction or modification of fixed or movable ammunition and explosives facilities, including facilities in their

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proximity, must be reviewed and approved by DDESB in accordance with DoD Directive 6055.9 (reference (3h)).

3. DoD Standard. For guidance in accomplishing this planning, refer to DoD Standard 6055.9-STD (reference (3i)).

H. PARKING FOR NONORGANIZATIONAL VEHICLES

1. Criteria for Parking Stalls. At a facility, the number of parking stalls needed depends on how many people drive to the facility. Criteria for estimating the appropriate number of parking stalls for nonorganizational vehicles are listed in table 3-1. These criteria are based on historical data from traffic analyses made at numerous military installations. However, during the planning of a new facility traffic engineering analyses of parking needs may be necessary to establish the actual required number of parking stalls. Where traffic engineering analyses are required or when the type of facility under design is not listed in the table, the necessary parking stalls shall be determined based on the estimated employment or number of users, or both, for the facility, level of ride sharing, available public transportation, potential future growth, and average employee absence.

2. Normal Space Criteria. Normally, 350 to 400 ft^2 [32.5 to 37.2 m^2] per vehicle (low turnover versus high turnover parking lots, respectively) shall be used. These figures include allowances for the parking stall, one-half of the aisle width behind each space, end and interior circulation aisles, dead zones for islands and landscaping, and driveways. Space that is provided for less than these recommended criteria is usually false economy due to increased accident potential, difficult traffic circulation patterns, and encroachment by parked vehicles on adjacent parking stalls.

3. Layout. Parking areas shall be designed for easy entrance and exit. Parking stalls arranged at 90 degrees to the aisles provide the most efficient design and the efficiency decreases as the parking angle decreases. With 90-degree parking stalls, traffic circulation is generally two-way within the parking lot aisles. At parking stall angles less than 90 degrees, aisle circulation shall be one-way. Dimensions of the various parking stalls and aisles depend on the parking angle and traffic circulation pattern. The minimum parking stall width should never be less than 9 ft [2.7 m] wide. Where high turnover parking exists, such as at commissaries and child development centers, parking stall widths of from 9 ft 6 inches to 10 ft [2.9 m to 3 m] are necessary for efficiency and safety. The Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43 (reference (3c)), should be used for detailed guidance.

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TABLE 3-1

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	Number of Parking Spaces
Administration, Headquarters, and Office Buildings	60 percent of assigned personnel
Bakeries	38 percent of civilian employees, largest shift
Bank and Credit Union, when not included in a Community Shopping Center	2 percent of authorized customers served
Cafeteria, Civilian, when not included in a Community Shopping Center	15 percent of seating capacity
Central Food Preparation Facilities	38 percent of military and civilian food service operating personnel, largest shift
Chapels	30 percent of seating capacity
Child Development Centers	8 percent of children, 80 percent of staff
Commissary Stores, Food Sales, when not included in a Community Shopping Center	2.5 percent of authorized customers served
Community Shopping Center, including such elements as Main Exchange, Miscellaneous Shops, Restaurant, Commissary Stores, Food Sales, Bank, Theater, Post Office	4 percent of authorized customers served
Enlisted Personnel Dining Facilities for:	
Basic and recruit training, advanced individual training, service schools, recruit reception stations	38 percent of military and civilian food service operating personnel, largest shift

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TABLE 3-1 (continued)

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	Number of Parking Spaces
Enlisted Personnel Dining Facilities for: (Continuation)	
Permanent party, garrison (including Army Table of Organization and Equipment (TOE) and Table of Distribution and Allowances (TDA) units) air installations (stations), support units, construction battalions, shipyards, weapon plants, personnel transfer and overseas processing centers	38 percent of military and civilian food service operating personnel, largest shift, plus 8 percent of enlisted personnel (patron parking) to be served during a meal period
Exchanges, Main, when not included in a Community Shopping Center	2.5 percent of authorized customers served
Family Housing	2 spaces per living unit
Field House, combined with Football and Baseball Facilities	1 percent of military strength
Fire Stations	
One-Company	7 spaces
Two-Company	10 spaces
Guard Houses, Brigs, Military Police Stations	30 percent of guard and staff strength
Gymnasiums (if only one at a military installation)	1 percent of military strength served
Gymnasium, Area (regimental)	10 spaces
Laundries and Dry Cleaning Plants	38 percent of civilian employees, largest shift

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TABLE 3-1 (continued)

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	**Number of Parking Spaces**
Libraries	
Central	1 space for each 500 ft^2 [46.5 m^2] gross area of floor area
Branch	8 spaces
Maintenance Shops	38 percent of assigned personnel, largest shift
Schools, Dependent	
Without auditorium	2 spaces per classroom
With auditorium	2 spaces per classroom, plus 15 percent of auditorium seats
Security Offices (at gates) for military installations of:	
100 to 2,000 population	5 spaces
2,001 to 4,000 population	10 spaces
4,001 to 6,000 population	15 spaces
6,001 to 10,000 population	20 spaces
10,001 and over	To be based on a special study
Service Clubs	2 percent of enlisted personnel or officer strength served
Swimming Pools	20 percent of design capacity of the swimming pool
Temporary Lodging Facilities	100 percent of bedrooms
Theaters, when not included in a Community Shopping Center	25 percent of seating capacity
Unaccompanied Enlisted Personnel Housing	70 percent of design capacity
Unaccompanied Officers Personnel Housing	100 percent of living suites

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TABLE 3-1 (continued)

PARKING SPACE GUIDELINES FOR NONORGANIZATIONAL VEHICLES [1]	
Facility	Number of Parking Spaces
Warehouses	1 space for each 500 ft^2 [46.5 m^2] gross area of office area, plus one space for 4 persons assigned to storage activities

[1] This table should be used only for broad master planning purposes. Planning for individual facilities should be based on actual requirements.

I. NOTIFICATION REGARDING PROJECTS AFFECTING THE USE OF AIRSPACE

Construction, expansion or reconstruction of airfields and missile or rocket launching facilities require the filing of certain notifications as stated in DoD Directive 5030.17 (reference (3j)).

J. CONSTRUCTION IN FLOODPLAINS OR ON WETLANDS

1. General. E.O. 11988 (reference (3k)) and E.O. 11990 (reference (3l)) direct federal agencies to recognize the full value of floodplains and wetlands and, to the extent possible, avoid adverse effects that would result from federal activities in such areas. These executive orders were promulgated for two different but complementary reasons:

a. To minimize the destruction, degradation, or loss of wetlands, and to enhance and preserve the beneficial and natural values of wetlands.

b. To reduce the risk of flood loss and to minimize the impact of floods on human health, safety, and welfare.

2. Construction Projects. To achieve these objectives, construction projects and substantial rehabilitation or modification projects (including Military Construction (MILCON), Operation and Maintenance (O&M), nonappropriated fund (NAF), other than appropriated fund, and contractor construction when DoD funding is involved) should conform to the following criteria. Civil works projects and civil works actions of the U.S. Army Corps of Engineers should be governed by separate guidance issued by the Secretary of the Army. The phrase "construction projects and substantial rehabilitation or modification projects" includes channeling, diking, draining, dredging, impounding, filling, and related activities in addition to facilities and structures.

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3. Definitions.

a. Floodplains. Floodplains are lowland and relatively flat areas adjoining coastal and inland waters including flood prone areas of offshore islands including, at a minimum, areas subject to a one percent or greater chance of flooding in any given year (the 100-year flood). For critical facilities such as bulk hazardous chemical or fuel storage, or hospitals where evacuation of patients would be difficult, the floodplain is any area subject to a 0.2 percent or greater chance of flooding in any given year (the 500-year flood).

b. Wetlands. Wetlands are areas inundated by ground or surface water with a frequency sufficient to support or to potentially support, a prevalence of aquatic or vegetative life. Wetlands generally include bogs, marshes, swamps, and similar areas such as potholes, river outflows, sloughs, wet meadows, and flats and natural ponds. Wetlands may be, but are not necessarily, located in floodplains.

4. Requirements.

a. Siting. Before undertaking a construction project, the responsible Military Department or Defense Component must determine whether or not the project will be sited in a floodplain or on wetlands. Appropriate guidance is contained in the Floodplain Management Guidelines published by the Water Resources Council (reference (3m)).

b. Alternatives. If the proposed siting is in a floodplain or on wetlands, the construction project may be undertaken only if none of the following alternatives are practicable:

(1) Carrying out the proposed action at a location outside of the floodplain or wetland (alternative sites).

(2) Other means that accomplish the purpose of the proposed action (alternative actions).

(3) No action.

c. National Flood Insurance Program. In evaluating these alternatives, the head of the responsible agency must take into account economic, environmental, and other pertinent factors. If the project is undertaken, it must be in accordance with the criteria and standards and consistent with the intent of the National Flood Insurance Program, Title 44, CFR 59-79 (reference (3n)), and may deviate from this only to the extent that the standards of the National Flood Insurance Program are demonstrably inappropriate for the project. This means that projects shall be designed and carried out as they would be to meet the full requirements for eligibility under this program. Individual projects must be separately assessed, but two examples of "demonstrably inappropriate" criteria could be (1) an aircraft hangar that cannot be

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raised above the apron elevation at an existing military installation in a floodplain, or (2) a waterfront pier to support naval ships. However, even in such cases, all reasonable actions must be taken to "flood proof" the project and to design or modify it to minimize potential harm to or within the floodplain. Elevation of the structure above the flood level is always to be preferred to filling in the land.

d. Required Actions. Before planning or undertaking a project in a floodplain, certain other actions must be taken as follows:

(1) Public Notice. A notice explaining why the project is proposed to be located in the floodplain must be prepared and circulated at an early date to ensure that public comment is considered in the decision making process. The Federal Register is appropriate for projects of national importance, but local advertising must always be used to ensure notification to those areas most affected. An opportunity for early public review of the plans and proposals together with the impacts of the proposed project on the floodplain must be provided in accordance with Section 2(b) of E.O. 11514 (reference (3o)), as amended, even if the project is not significant enough to require the preparation of an Environmental Impact Statement (EIS) under P.L. 91-190, Section 102(2) (c) of the National Environmental Policy Act of 1969 (reference (3p)), as amended. Environmental Impact Statements are required for projects meeting the criteria of DoD Directive 6050.1 (reference (3q)) and the EIS process, if used, is considered to meet the circularization and review requirements prescribed by this subparagraph.

(2) Coordination. For programs subject to E.O. 12372, (reference (3a)), a notice, not exceeding three pages in length, must be sent to state and area wide clearinghouses. The notice must include the reasons why the project is to be sited in a floodplain; a statement indicating whether the action conforms to applicable state or local floodplain protection standards; and a list of alternatives considered. DoD Directive 4165.61 (reference (3b)), provides the policy on the coordination process.

(3) Reevaluation of Alternatives. After public review, the EIS process, and coordination have been accomplished, all alternatives shall be reevaluated and if the decision is to proceed with the project in a floodplain or wetland, a further notice must be sent to all coordinating agencies and requesters, stating that the decision has been made, explaining why, and allowing 15 to 30 days for any further comment.

5. Programming. When all of the above actions have been completed, and a decision to proceed with the project in the floodplain or on wetland has been made, requests for authorizations or appropriations for that project sent to the Office of Management and Budget (OMB) (DD Form 1391, FY 19__ Military Construction Program) must indicate that the proposed project is located in a floodplain or on a wetland, and that it has complied with the requirements of this section K., and E.O. 11988 (reference (3k)), and E.O. 11990 (reference (3l)).

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K. PLANNING PROCEDURES FOR THE NATIONAL CAPITAL REGION

This section prescribes procedures to be followed with respect to the preparation of facility plans within the National Capital Region (NCR). The NCR is defined as the District of Columbia; Prince Georges and Montgomery Counties in Maryland; Arlington, Fairfax, Loudoun, and Prince William Counties in Virginia; and all cities and towns included within the outer boundaries of the foregoing counties.

1. National Capital Planning Commission (NCPC) and the Commission of Fine Arts (CFA). Master facility plans for military installations within the NCR shall be sent to the NCPC or the CFA, or both, as required by the policies issued by the commissions.

2. Requests for Exceptions. Projects normally should not be advertised before the resolution of any serious objections by either commission. Requests for exceptions should be sent to the DASD(I) along with a statement on the special circumstances involved.

3. Budget Proposals. The provisions of OMB Circular A-11 (reference (3r)) require consultation by the Military Departments and Defense Components with the NCPC and CFA, where appropriate, of all plans and programs in the NCR.

REFERENCES

(3a) Executive Order 12372, "Intergovernmental Review of Federal Programs," July 14, 1982, 47 Federal Register 30959
(3b) DoD Directive 4165.61, "Intergovernmental Coordination of DoD Federal Development Programs and Activities," August 9, 1983
(3c) Joint Service Manual, TM 5-803-5, NAVFAC P-960, AFM 88-43, "Installation Design," March 1, 1981
(3d) DoD Directive 4700.1, "Natural Resources-Conservation and Management," November 6, 1978
(3e) MTMC Pamphlet 55-10, "Traffic Engineering for Better Roads," June 1978
(3f) Joint Service Manual, AFR 86-14, TM 5-803-7, NAVFAC P-971, "Airfield and Heliport Planning Criteria," May 12, 1981
(3g) Joint Service Manual, TM 5-803-2, NAVFAC P-970, AFM 19-10, "Planning in the Noise Environment," June 15, 1978
(3h) DoD Directive 6055.9, "The DoD Explosives Safety Board," November 25, 1983
(3i) DoD Standard 6055.9-STD, "DoD Ammunition and Explosives Safety Standards," July 1984, authorized by DoD Directive 6055.9, November 25, 1983
(3j) DoD Directive 5030.17, "Development and Use of Military Facilities Affecting the Use of Airspace," November 6, 1978
(3k) Executive Order 11988, "Floodplains," May 24, 1977
(3l) Executive Order 11990, "Protection of Wetlands," May 24, 1977
(3m) "Floodplain Management Guidelines," 43FR6030, February 10, 1978

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REFERENCES (continued)

(3n) Title 44, CFR 59-79, "National Flood Insurance Program"
(3o) Executive Order 11514, "Protection and Enhancement of Environmental Quality," March 5, 1970 (as amended by Executive Order 11991, May 24, 1977)
(3p) Public Law 91-190,"National Environmental Policy Act of 1969," January 1, 1970
(3q) DoD Directive 6050.1, "Environmental Effects in the United States of DoD Action," July 30, 1979
(3r) OMB Circular A-11, "Preparation and Submission of Budget Estimates," May 27, 1979

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CHAPTER 4

BUILDING AND FACILITY PLANNING FACTORS

A. GENERAL

This chapter provides space and other special criteria applicable to individual repetitive-type buildings and facilities. Category codes, when shown, for the various buildings and facilities are in accordance with DoD Instruction 4165.3 (reference (4a)).

1. Space Criteria.

a. Requirements. Space criteria in this chapter represent the basic square footage and are provided for general guidance. These criteria are based on typical installation and historical data but should be altered as local and specialized conditions warrant. Facilities should be planned to meet the specific requirements of the particular military installation rather than arbitrarily planned to meet these criteria. Obviously, not every military installation will be provided all of the facilities listed in this chapter. When space criteria are not available, accepted design and experience factors should be used to determine space allocations for the various functional components of the facility.

b. Solar Energy Systems. P.L. 95-82, Section 607 (reference (4b)) authorizes variations in cost and floor area limitations for the use of solar energy systems. The use of solar energy is encouraged when it is economically feasible and practical. Increases in space allowances are allowed when such increases are required to permit solar energy systems.

2. Basis of Space Criteria.

a. Military Strength. Except as otherwise noted, the space criteria shown in this chapter are based on the authorized projected military strength assigned to the military installation concerned. In some cases, "military population" is used in lieu of "military strength" and is defined as the number of active duty military personnel assigned to a military installation plus a percentage of their dependents and others. Individual facility descriptions and footnotes to space criteria tables should be consulted for variations in the methods of calculating the military strength or military population.

b. Satellite Military Installations. When other military installations in the vicinity are satellited for specific support, the military strength or military population of the satellited military installation may be added to the military strength or military population of the support military installation. However, when a number of military installations or concentrations of military personnel are located in proximity to one another, as in a metropolitan area, the facilities provided should be related to, and governed by, the aggregate military strength or military population in the area.

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c. Transients. When a military installation serves a substantial number of transients (such as fleet based technicians, trainees, Temporary Duty (TDY) students of Reserve and National Guard personnel on active duty training assignments), the average daily transient strength based on a firm projection of the total yearly load of such transients may be added with the number of the permanent party personnel to arrive at a total military strength. When the transient load is clearly periodic rather than constant year round, the average daily military strength should be based on a firm projection of the total budget.

d. Overseas Areas. In overseas areas, when civilian employees and their dependents are authorized full use of certain facilities, such civilian employees and their dependents should be counted in determining the military population for those facilities. Foreign military personnel assigned or tenanted on the military installation should be counted when country-to-country agreements stipulate the authorized use of facilities on the military installation.

3. Computation of Areas. Gross and net areas of facilities (other than family housing) should be computed according to paragraphs A.3.a through e., below. Unless otherwise noted, the gross area criteria in this chapter do not include the required mechanical equipment room space. Mechanical equipment room spaces should be added, when not otherwise noted in the footnotes to each of the tables provided in this chapter, to the gross area criteria to ensure that the project DD Form 1391, FY 19__ Military Construction Program, reflects the total required building gross area. A single gross area figure should be identified on the project DD Form 1391 for all required spaces. Separate central energy plants or utility buildings serving large complexes should be in addition to the gross area criteria provided in this chapter and should be programmed as a separate line item on the project DD Form 1391.

a. Enclosed Spaces. The gross area includes the total area of all floors, including basements, mezzanines, and penthouses and other enclosed spaces as determined by the effective outside dimensions of the building.

b. One-Half Spaces. One-half of the area shall be included in the gross area for balconies and porches, covered raised loading platforms, covered ground level or depressed loading facilities, covered but not enclosed passageways or walks, covered and uncovered but open stairs, and covered ramps.

c. Excluded Spaces. Crawl spaces; exterior uncovered loading platforms or facilities, either depressed, ground level or raised; exterior insulation applied to existing buildings; open courtyards; open paved terraces; roof overhangs and soffits for weather protection; uncovered ramps; uncovered stoops; and utility tunnels and raceways should be excluded from the gross area.

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d. Net Floor Area. The net floor area includes the total gross area excluding:

(1) Basements not suited as office space.

(2) Elevator shafts and machinery space.

(3) Exterior walls.

(4) Interior partitions.

(5) Mechanical equipment and water supply equipment space.

(6) Permanent corridors and hallways.

(7) Stairs and stair towers.

(8) Toilet and cleaning gear space.

e. Net Office Area. Net office area is defined in Section B., below.

B. ADMINISTRATIVE FACILITIES (Category Code 600)

1. Space Criteria.

a. The building gross floor area per occupant normally should not exceed 162 ft^2 [15 m^2] except when special purpose spaces are required. The building net floor area per occupant normally should not be less than 115 ft^2 [10.7 m^2] and not exceed 130 ft^2 [12.1 m^2]. The net to gross conversion for administrative facilities normally should be 20 to 30 percent. The net office area per occupant normally should not be less than 80 ft^2 [7.4 m^2] and not exceed 90 ft^2 [8.4 m^2].

b. Special purpose spaces are those areas needed in administrative facilities in addition to the basic functional requirements of an office. Special purpose spaces, should be in addition to the 162 ft^2 [15 m^2] gross area per occupant, if properly justified as operational requirements, and should be included in an administrative facility.

2. Space Occupancy in the Washington, D.C. National Capital Region. Criteria and policies for the occupancy of administrative space in the National Capital Region (NCR) shall be stated in DoD Instruction 5305.3 (reference (4c)).

C. UNACCOMPANIED PERSONNEL HOUSING AND DINING FACILITIES (Category Code 720)

1. Unaccompanied Enlisted Personnel Housing (UEPH) (Category Code 721).

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a. Space Criteria and Accommodations. The space criteria given in column 2 of table 4-1 were established by the Secretary of Defense in ASD(MR&L) Memorandum (reference (4d)), persuant to public law.

TABLE 4-1

SPACE CRITERIA AND ACCOMMODATIONS FOR UEPH		
Grade [1]	Accommodations and [2] Net Living Areas	Bathroom Facilities
E1 Recruits	Open bay with minimum net living/sleeping area of 72 ft^2 [6.7 m^2] per person [1]	Central bathroom
E1 to E4	A room with net living/sleeping area of 180 ft^2 [17 m^2] based on a 2-person occupancy [2]	Connecting bathroom for the two rooms (See figures 4-1 and 4-2)
E5 and E6	The same net living/sleeping area per room as above but based on a 1-person occupancy	Connecting bathroom for the two rooms (See figures 4-1 and 4-2)
E7 to E9	A room or rooms with a 360 ft^2 [34 m^2] area, living/sleeping rooms and 1-person occupancy	Connecting bathroom for the two rooms (See figures 4-1 4-2)

[1] Net living area is defined as one equal share per recruit of the living/sleeping room area. The living/sleeping room area should be measured to the inside face of the peripheral walls.

[2] Net living area is defined as the clear area in the room available for beds and other furniture, wardrobe space and general living, but exclusive of bathrooms, entry foyer, and lavatory area.

b. Design.

(1) General Guidance. UEPH facilities normally should be composed of standard room modules and common use areas. All UEPH facilities, except those for recruits, should be designed using the standard building module shown in figure 4-1. This module should be used

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for developing the housing portion of the facility. Figure 4-2 may be used as a substitute for figure 4-1 at the discretion of the Military Departments. All designs should be approximately 564 ft^2 [52.4 m^2] maximum gross area for the standard "2 plus 2" person room module. The gross area shall be measured from the centerlines of the module's enclosing interior walls and to the outside face of the exterior wall.

(2) Common Use Areas. Development of UEPH facilities shall be based on providing "2 plus 2" person room modules and appropriate space allocated for common use and service type functions such as administrative space, central offices, central storage, central toilets, circulation, cleaning equipment rooms, entries, individual storage, laundry rooms, linen rooms, lounges, mechanical equipment, unit equipment storage, vending machines, and similar items as necessary. These spaces should be grouped with standard "2 plus 2" person room modules to permit maximum economies when developing UEPH buildings.

(3) Capacity of UEPH Projects. In the interest of economy, UEPH buildings normally shall be of large capacity (300 or more persons). Incremental construction of small capacity facilities shall not be undertaken when long-range requirements can be consolidated by adjustments in programing.

c. Improvement Projects for UEPH. The objective for all improvement projects for UEPH should be to achieve, approximately, new space criteria construction standards. Each project shall be based on sound engineering judgment to ensure the maximum use of existing assets compatible with reasonable costs. It is recognized, however, that due to the architectural configuration of existing buildings and other considerations, it will not be possible in all cases to meet new space criteria and construction standards. Accordingly, in those situations the following additional guidance is provided to assist in project development:

(1) While the goal is to achieve 90 ft^2 [8.4 m^2] net area per person for E1 to E4 personnel, under no circumstances shall rooms for these grades be less than 85 ft^2 [8 m^2] net area per person.

(2) Where two person rooms for E1 to E4 personnel cannot be feasibly provided, the maximum number of personnel to be housed in a room shall be limited to four.

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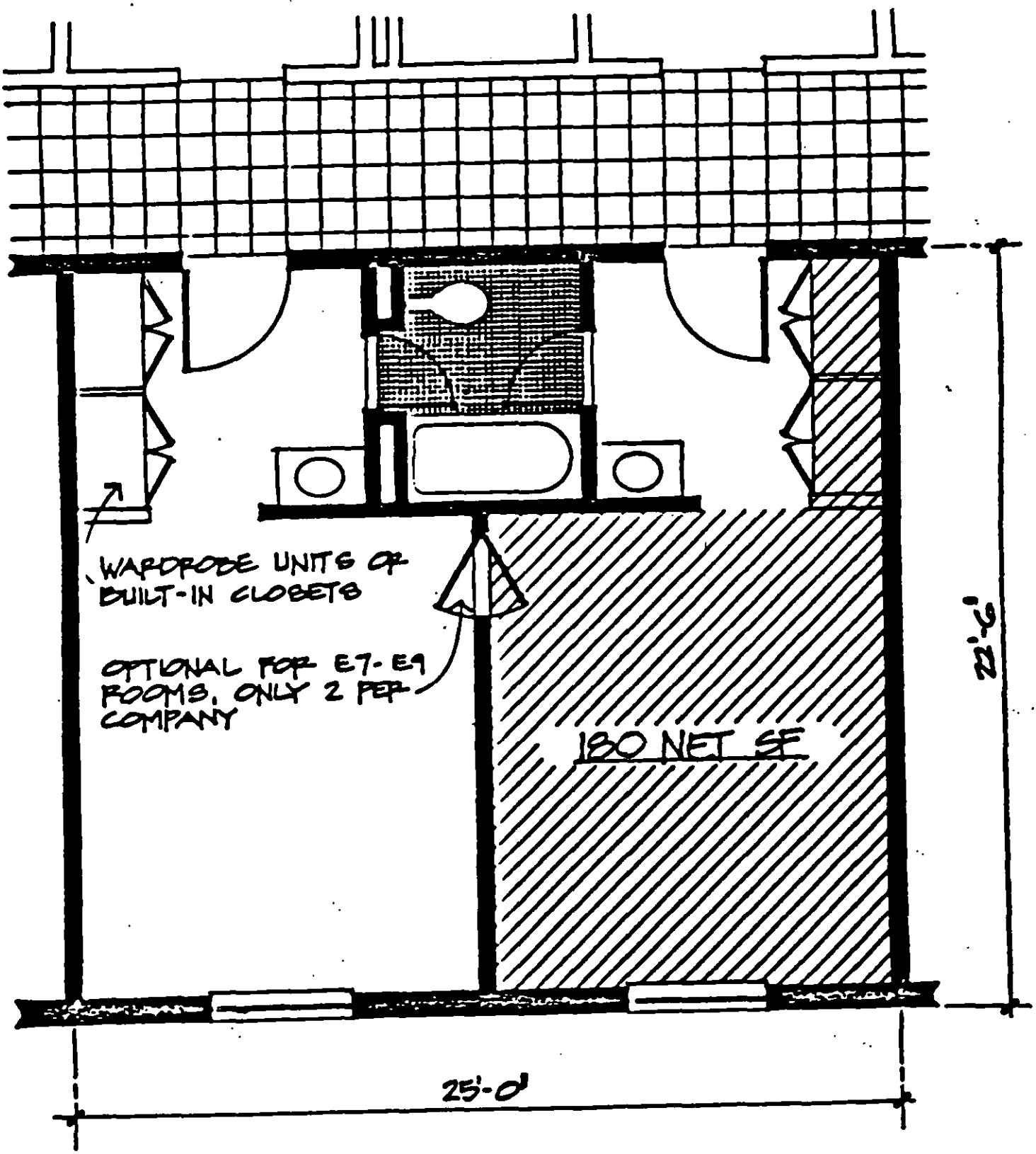

"2 Plus 2" person rooms module

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Figure 4-1. "2 Plus 2" person rooms module.

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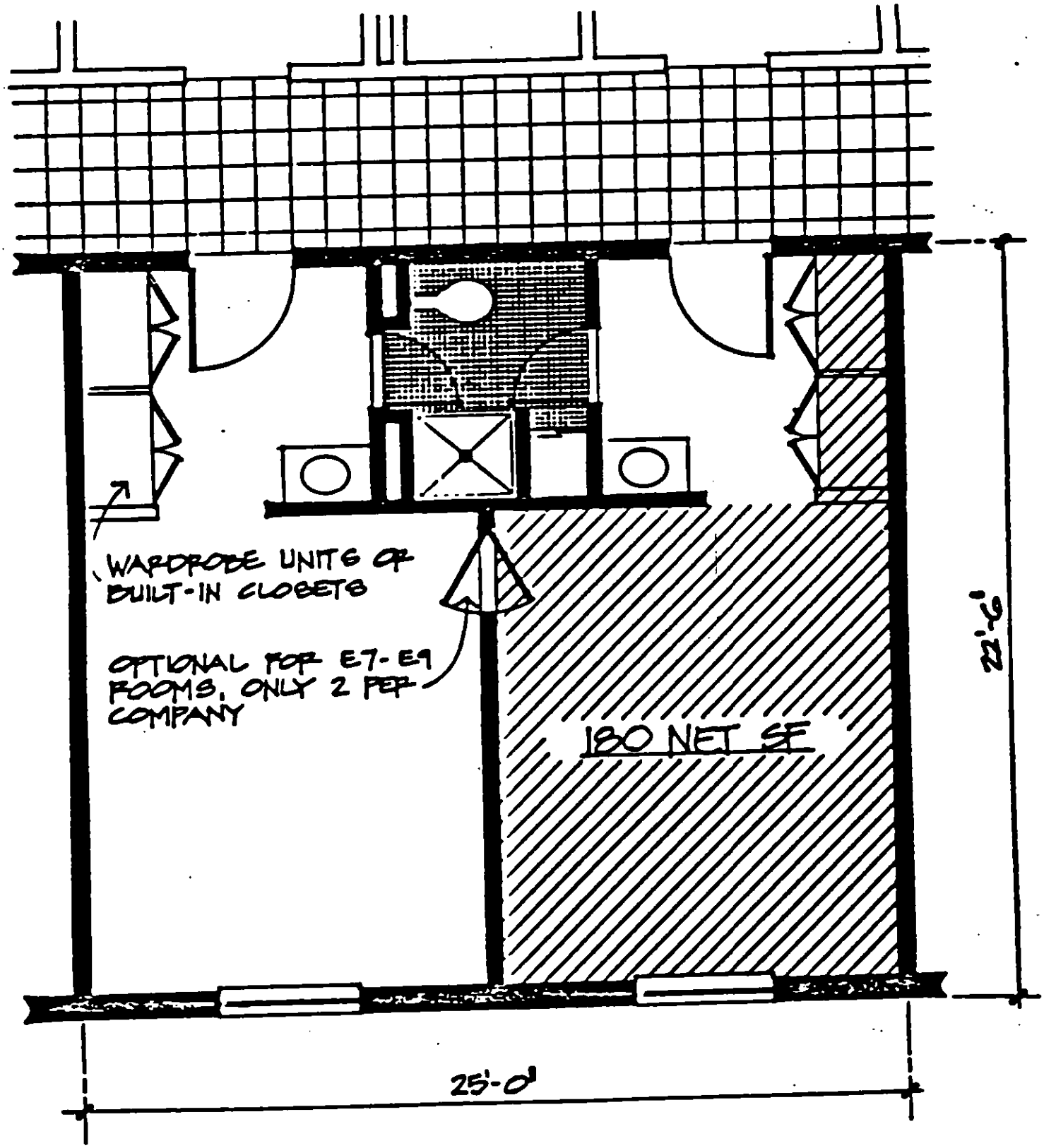

"2 Plus 2" person rooms module

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Figure 4-2. "2 Plus 2" person rooms module.

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2. Unaccompanied Officers Personnel Housing (UOPH) (Category Code 724).

a. Space Criteria. Space criteria and accommodations shall be as follows:

(1) Grades 02 and Below. The net living area of each private suite shall closely approximate 330 ft^2 [30.6 m^2]. The allowable gross building area shall approximate 475 ft^2 [44.1 m^2] per officer. Accommodations shall consist of a combination living room and bedroom, bathroom, and pullman-type kitchen.

(2) Grades 03 and Above. The net living area of each private suite shall closely approximate 460 ft^2 [42.7 m^2]. The allowable gross building area shall approximate 650 ft^2 [60.4 m^2] per officer. Accommodations shall consist of a living room, bedroom, bathroom, and kitchen.

(3) Net Living Area. The net area shall be measured from the inside face of the peripheral walls of the private suite and includes all spaces and partitions enclosed.

b. Design.

(1) Common Use and Service-Type Facilities. When designing specific projects, appropriate space should be allocated for common use and service-type facilities. These include central storage linen rooms, cleaning equipment rooms, control offices, entries and circulation, lounges, mechanical equipment rooms, vending machines, and other similar items that may be required, so that the complete facility reflects the lowest practicable gross area compatible with adequate accommodations.

(2) Capacity of UOPH Buildings. In the interest of economy, UOPH buildings shall normally be of large capacity (100 or more persons). Incremental construction of small capacity facilities should not be undertaken when long-range requirements can be consolidated by adjustments in programing.

c. Improvement Projects. The objective for all improvement projects should be to achieve new construction standards. Improvements should meet the criteria contained in this handbook.

3. Enlisted Personnel Dining Facilities (Category Code 722).

a. General.

(1) Establishment. The establishment of central bakeries, central food preparation facilities, central kitchens, central pastry kitchens, and meatcutting facilities for the appropriated fund food

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service program on a military installation should be subject to the policies contained in DoD Directive 1338.10 (reference (4e)) and DoD Instruction 4100.33 (reference (4f)).

(2) Policies and Procedures. The policies and procedures for Military Construction (MILCON), Operations and Maintenance (O&M), and minor construction programing established in DoD Directives and Instructions should be followed for enlisted personnel dining facilities.

(3) Consolidation. Maximum effort should be directed in planning enlisted personnel dining facilities toward the consolidation and modernization of existing permanent facilities, and the replacement of existing temporary facilities with permanent consolidated facilities, when appropriate.

(4) Conversions. Existing enlisted personnel dining facilities no longer required to support the mission of a military installation should be converted to other use, when the necessary funding is authorized for conversion.

(5) New Facilities. New enlisted personnel dining facilities should not be planned solely to support an additional UEPH increment but should be justified on the basis of an evaluation of the capacities and projected use of existing dining facilities.

(6) Type of Service. Dining facilities for enlisted personnel should employ cafeteria-style service and should be equipped to allow for service of both a regular menu and short order or fast food type of meal.

b. Planning Guidance.

(1) Operational Criteria. The design of enlisted personnel dining and supporting food service facilities should be based on the DoD Food Service Program and operational procedures and policies established by the appropriate food service management offices of the military departments.

(2) Serving Requirement. The maximum number of enlisted personnel to be served during a meal period should be determined by multiplying the normal UEPH housing capacity by the appropriate percentage(s) as provided table 4-2 below. However, enlisted personnel on separate rations should not be included in the serving requirement when planning new dining facilities, or retaining and modernizing permanent existing dining facilities. Officers and civilians should not be included in the serving requirement when planning, retaining, or modernizing enlisted personnel dining facilities, except in overseas or remote locations where support is authorized.

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TABLE 4-2

SERVING REQUIREMENT	
Type of Mission and Operation	Percentage of Unaccompanied Enlisted Personnel in UEPH To Be Served During a Meal Period
Training	
Basic and Recruit Training	95 percent
Mobilization and Annual Training	95 percent
Advanced Individual Training	90 percent
Service Schools, Recruit Reception Stations	85 percent
Permanent Party	
Remote Locations	90 percent
Garrison (including Army Table of Organization and Equipment (TOE) and Table of Distribution and Allowances (TDA) Units), Air Installations (Stations), Support Units, Construction Battalions, Shipyards, Weapon Plants	70 percent
Personnel Transfer and Overseas Processing Centers	50 percent
Confinement [1]	110 percent

[1] The percentage of 110 should be applied against the maximum facility capacity for administrative, confinement, and security personnel, to determine the serving requirement.

c. Space Criteria. An estimate of the gross floor areas needed may be made from table 4-3. Space for covered walks and other architectural devices for climate and comfort are not included in table 4-3. Space for in-flight kitchens is not included in table 4-3.

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TABLE 4-3

SPACE CRITERIA FOR ENLISTED PERSONNEL DINING FACILITIES		
Serving Requirement Number of Enlisted Personnel to be Served	Gross Area [1] ft^2	 $[m^2]$
40 to 80	3,700	344
81 to 150	5,300	492
151 to 250	6,800	632
251 to 400	8,900	827
401 to 650	12,900	1,198
651 to 1,000	17,200	1,598
1,001 to 1,500	20,800	1,932
1,501 to 2,200	29,500	2,741
2,201 to 3,000	36,300	3,372
3,001 to 4,000	44,900	4,171
4,001 to 5,000	52,000	4,831

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

d. Design.

(1) Functional Requirements. Designs for cafeteria-style dining facilities should include serving line(s) capability for regular full menu and short order or fast food meals and self-service areas for beverages, deserts, and salads. The major functional areas to be provided in dining facility designs are dining, dishwashing, employee lockers and toilets, food preparation and cooking, garbage and trash disposal, nonprovision storage, patron toilets, office(s), pot and pan washing, receiving platform, referigerated and dry storage, serving, and signature-headcount and cashier station(s). The interior decor should be a part of the basic design.

(2) No Smoking Area. No smoking area should be provided in accordance with DoD Instruction 6015.18 (reference (4g)).

(3) Health and Sanitation. All facets of design and construction of dining facilities should conform to the standards of the National Sanitation Foundation.

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D. MAINTENANCE-INSTALLATION, REPAIR AND OPERATION (Category Code 219)

1. Space Criteria.

a. Gross Areas. The gross areas for maintenance and installation, repair and operation facilities, including space for heating and mechanical equipment, based on the number of civilian or military employees, or both, permanently assigned to the maintenance organization are shown in table 4-4.

TABLE 4-4

SPACE CRITERIA FOR MAINTENANCE-INSTALLATION, REPAIR AND OPERATION

Total No. of Maintenance Personnel	Gross Area [1]	
	ft2	[m2]
Up to 30	8,700	808
31 to 50	12,100	1,124
51 to 100	16,700	1,551
101 to 150	21,100	1,960
151 to 300	28,300	2,629
301 to 500	34,800	3,234

[1] Gross area figures include required mechanical equipment room spaces. Additional space should not be added.

b. Functional Areas. The criteria shown in table 4-4 provide for the following functions. If other than the following functions are required, space may be appropriately increased if the justification is documented.

(1) Administrative offices, including drafting room space, and toilet and locker rooms.

(2) Air conditioning and refrigeration shop.

(3) Central tool issue, shop stores, and shop toilets, and locker rooms.

(4) Electric shop.

(5) Heating and plumbing shop.

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(6) Metal work shop, including blacksmith, iron work, machine, sheet metal, and welding facilities.

(7) Paint shop.

(8) Routine maintenance and service shops, including custodial, emergency service, insect and rodent control, moving and rigging, preventive maintenance, refuse collection, and road maintenance shops.

(9) Woodworking shop, including furniture repair, and packing and crating facilities.

2. Ceiling Heights. For administrative space, toilets and other nonshop areas, the effective ceiling height should not exceed 10 ft [3.0 m]. The effective ceiling height in shop areas should be limited to that essential to the functions of each shop.

E. COMMUNITY FACILITIES - PERSONNEL SUPPORT AND SERVICE FACILITIES (Category Code 730)

1. Space Criteria. Space Criteria for personnel support and service facilities are tabulated in this section.

a. Establishment. Establishment of bakeries, laundries, and dry cleaning plants are subject to the provisions for commercial and industrial activities of DoD Instruction 4100.33 (reference (4f)).

b. Space Criteria. Space criteria for personnel support and service facilities are provided in the following subsections. Mechanical equipment room space should be added to these space criteria as indicated in the footnotes to the tables.

2. Bakeries, Central or Installation-Type. Gross floor areas for bakeries, based on the number of persons to be served, are shown in table 4-5.

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TABLE 4-5

SPACE CRITERIA FOR BREAD AND PASTRY BAKERIES							
No. of Persons Served	Gross Bakery Area [1]				Rated Capacity of 8-hour Operation [2]		
	Bread		Pastry		Bread		Pastry Servings
	ft^2	[m^2]	ft^2	[m^2]	Pounds	[Kilograms]	
2,500	.....	...	1,800	167	.....	.....	5,000
3,000	4,500	418	.....	...	1,500	680	.....
5,000	.....	...	2,950	274	.....	.....	10,000
8,400	5,200	483	.....	...	4,200	1,905	.....
10,000	.....	...	3,350	311	.....	.....	20,000
16,000	8,200	762	.....	...	8,400	3,810	.....
20,000	.....	...	4,850	451	.....	.....	40,000
26,900	10,000	929	.....	...	13,425	6,090	.....

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[2] When operated 16 hours per day, plants will serve double the number of persons shown.

3. Confinement Facilities (Guard Houses or Brigs). The gross area per prisoner should not exceed the criteria shown in table 4-6. These gross areas include facilities for administration, housing, training, and welfare. When facilities are to include space for employment, they should be programed on the basis of equipment requirements, but should not exceed 75 ft^2 [7 m^2] gross area per prisoner.

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TABLE 4-6

SPACE CRITERIA FOR PRISONERS		
Number of Prisoners [2]	Gross Area Per Prisoner [1]	
	ft^2	[m^2]
Up to 25	550	51
26 to 50	440	41
51 to 150	350	33
151 to 250	330	31
251 to 400	300	28

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[2] Includes administration, housing, training, and welfare. When designs are for capacities not shown, space allowances may be based on the nearest capacity.

4. Dependent School Facilities.

a. Planning and Programing. The planning and programing of dependent school facilities should be based on projected enrollment and should be directly related to the educational specifications stipulating the program to be carried out. Appropriate educational specifications should be developed before starting the programing action for a new facility, or an addition to or major renovation of an existing building. These specifications should reflect the requirements of the program and the required space to meet the program needs.

b. Design. Designs should incorporate flexibility in order that facilities can be adapted to a changing educational program with a minimum requirement for additional capital investment. Overseas DoD schools can become excellent facilities for medical use during contingency operations if minimal considerations are taken before designing them. Therefore, before such schools are designed, their future use as medical facilities to include, should be considered but not be limited to, such items as doorways wide enough for litter patients; elevators in multistory schools and additional electrical considerations with hookups for emergency generators and survivability. When feasible

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within the educational program, general purpose classrooms should be configured to permit multiple level, cooperative, individualized, and team teaching by using acoustically appropriate movable walls in lieu of fixed partitions.

5. Education Centers (Navy: Education Services Offices). The space criteria shown in table 4-7 for education centers are intended to provide facilities for the advancing of the academic, technical, and vocational education of military personnel of all grades and ranks in order to enhance their potential to the military services. These criteria are based on the total functional requirements of centers for various size military installations, and represent gross areas that include space for the building structure, building service facilities, and circulation.

a. Joint Usage Facilities. Education centers should make joint use of existing classrooms or other suitable facilities on a military installation to the maximum extent practicable.

b. New Construction. All newly constructed education centers should provide, in addition to the gross areas indicated in table 4-7, office space for the personnel who manage the military installation level functions of the On-the-Job-Training (OJT) Activity, Career Advisory and Counseling (CAC) Section, and the Classification and Testing function. When justified by military installation requirements, provisions should be made to accommodate a branch library according to the criteria contained in paragraph G.14.b., below.

c. Space Criteria. The following space criteria normally should be enough for complete and separate education centers. However, the criteria may not be accurate for installations that have education programs that are much greater or less than the DoD average.

TABLE 4-7

SPACE CRITERIA FOR EDUCATION CENTERS

Military Strength [1]	Gross Area [2]					
	Edu. Ctr.		OJT [3]		CAC [4]	
	ft^2	[m^2]	ft^2	[m^2]	ft^2	[m^2]
Up to 250	Note 5	Note 5	None	None	None	None
251 to 1,000	4,125	383	300	28	500	46
1,001 to 3,000	8,700	808	500	46	500	46

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TABLE 4-7 (continued)

SPACE CRITERIA FOR EDUCATION CENTERS						
Military Strength [1]	Gross Area [2]					
	Edu. Ctr.		OJT [3]		CAC [4]	
	ft2	[m2]	ft2	[m2]	ft2	[m2]
3,001 to 5,000	13,500	1,254	700	65	500	46
5,001 to 7,000	16,100	1,496	900	84	500	46
7,001 to 10,000	19,800	1,839	1,200	111	500	46
10,001 to 15,000	26,300	2,443	1,700	158	500	46
15,001 to 20,000	31,800	2,954	2,200	204	500	46
20,001 to 25,000	36,300	3,372	2,700	251	500	46
25,001 to 30,000	40,500	3,762	3,200	297	500	46
30,001 to 40,000	48,000	4,459	3,700	344	500	46
40,001 to 50,000	55,000	5,110	4,200	390	500	46
50,001 to 60,000	60,000	5,574	4,700	437	500	46

[1] Military strength is defined as active duty military personnel assigned to a military installation.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Added space permitted only for new construction.

[4] Added space permitted only for new construction. If more than one counselor is required, 80 ft2 [7.4 m2] gross area should be added per counselor.

[5] Accommodate in other facilities.

6. Family and Community Support/Service Centers. Family and community support/service centers may be established as required to provide services to military personnel and their dependents. These services may include providing information on career counseling, emergency leave, family advocacy, grants, handicapped children, housing, insurance, legal matters, loans, military separation, passports, personal financial management, retirement, social work services, transportation, and voting. The facility should include space for administration, conference room, counseling rooms, household loan items, reception, storage, toilets

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facilities, and waiting room. Space for loan closets may be separate from the main facility but must be counted as a part of the total requirement. Space criteria for family and community support/service centers are shown in table 4-8.

TABLE 4-8

SPACE CRITERIA FOR FAMILY AND COMMUNITY SUPPORT/SERVICE CENTERS

Military Population [1]	Gross Area [2]	
	ft^2	[m^2]
Up to 1,000	Note 3	Note 3
1,001 to 3,500	4,500	418
3,501 to 7,000	6,500	604
7,001 to 10,000	8,000	743
10,001 to 15,000	9,500	883
15,001 and over	11,000	1,022

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents. Needs may vary greatly at installations with abnormal mixes of married/unmarried personnel, or large numbers of students or large numbers of unaccompanied married personnel. An additional 900 ft^2 [83.6 m^2] gross area may be provided for a classroom at military intallations when the military installation exceeds 7,000 personnel.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Accommodate in other facilities.

7. Fire Stations. The space criteria shown below should apply to fire stations with structural and brush fire missions and should be used as guidance when planning fire stations for air crash rescue missions.

a. One-Company Satellite Fire Stations. One-company satellite fire stations should provide two stalls for two or more pieces of fire fighting equipment; male and female shower and toilet facilities; and dormitory rooms for one fire company. The facility should also provide an alarm room; combination dayroom and training area; dining area; exercise room; fire inspector's office; hose dryer space; kitchen; medical supply storage area; shift supervisor's office; workroom; and storage space

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required for these functional areas. The gross area for these functions should not exceed 5,400 ft^2 [501.7 m^2].

b. One-Company Headquarters Fire Stations. One-company headquarters fire stations should provide all of the functions listed in paragraph E.7.a., above, plus a bedroom, office, and shower and toilet facilities for the fire chief. The gross area for these functions should not exceed 5,800 ft^2 [538.8 m^2].

c. Two-Company Satellite Fire Stations. Two-company satellite fire stations should provide three stalls for three or more pieces of fire fighting equipment; male and female shower and toilet facilities; and dormitory rooms for two fire companies. The facility should also provide an alarm room; dayroom; dining area; exercise room; fire inspector's office; hose dryer space; kitchen; medical supply storage area; shift supervisor's office; training room; workroom; and storage space required for these functional areas. The gross area for these functions should not exceed 7,800 ft^2 [724.6 m^2].

d. Two-Company Headquarters Fire Stations. Two-company headquarters fire stations should provide all of the functions listed in paragraph E.7.c., above, plus a bedroom, office, and shower and toilet facilities for the fire chief. The gross area for these functions should not exceed 8,200 ft^2 [761.8 m^2].

e. Mechanical Equipment Room Space. This type of space as required should be added to the gross areas shown above when determining a single gross area figure for each facility.

8. Laundry and Dry Cleaning Plants. Laundry and dry cleaning operations should normally be combined into one facility. Gross areas for laundries and dry cleaning plants, exclusive of boiler plants, are shown in table 4-9.

TABLE 4-9

SPACE CRITERIA FOR LAUNDRY AND DRY CLEANING PLANTS

Number of Persons Served [1]	Area Exclusive of Boiler Plants [2] Laundry and Dry Cleaning Plants	
	ft^2	[m^2]
2,001 to 4,000	8,500	790
7,001 to 10,000	11,000	1,022
15,001 to 30,000	45,000	4,181

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TABLE 4-9 (continued)

[1] For intermediate numbers, the next smaller plant with a two-shift operation should be used.

[2] Mechanical equipment room space, including boiler plant space as required, should be added to the gross areas shown when determining a single gross area figure for each facility.

9. Post Offices.

a. Central Post Offices. Space criteria for central post offices are shown in table 4-10. These figures represent the basic central post office square footage and are provided for general guidance. Additional space may be provided if a central post office serves specialized functions located on the military installation, such as:

(1) Activities generating a high volume of accountable mail that requires overnight vault storage.

(2) Carrier delivery to military family housing units.

(3) Major and subordinate headquarters, commands, personnel centers, service schools, hospitals, air material areas, and supply depots.

(4) Nonresident schools.

(5) Post directory.

(6) Self-service postal units installed within the lobby of the facility.

b. Postal Service Coordination. Determinations of specific total requirements and space provisions for specialized functions, as listed above, should be coordinated with the U.S. Postal Service Regional Postmaster General. This should be done during the initial planning stage to arrive at a mutually agreeable gross area. The coordination with the U.S. Postal Service Regional Postmaster General should be annotated on the project DD Form 1391, FY 19__ Military Construction Program.

c. Branch Post Offices. Branch post offices, each not exceeding 1,500 ft^2 [139.4 m^2] gross area, may be provided as required at large military installations to serve concentrations of personnel located at such a distance from the central post office that service through the latter is impracticable.

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TABLE 4-10

SPACE CRITERIA FOR CENTRAL POST OFFICES [1]						
Installation [2] Population	Central Post Office		Postal Service Center [1] Per Mailbox Area			
	Gross Area [3]		CONUS [4]		Overseas [5]	
	ft^2	[m^2]	ft^2	[cm^2]	ft^2	[cm^2]
Up to 500	400	37	0.60	557	0.60	557
501 to 1,000	600	56	0.60	557	0.60	557
1,001 to 2,500	1,755	163	0.60	557	0.50	465
2,501 to 4,500	2,925	272	0.60	557	0.50	465
4,501 to 7,500	4,500	418	0.60	557	0.45	418
7,501 to 11,500	6,325	588	0.60	557	0.40	372
11,501 to 16,500	8,250	766	0.60	557	0.40	372
16,501 to 22,500	10,125	941	0.60	557	0.40	372
22,501 to 28,500	12,525	1,164	0.60	557	0.40	372
28,501 to 34,500	14,925	1,387	0.60	557	0.40	372
34,501 to 40,500	17,325	1,609	0.60	557	0.40	372
40,501 to 46,500	19,725	1,832	0.60	557	0.40	372
46,501 to 52,500	22,125	2,055	0.60	557	0.40	372
52,501 to 58,500	24,525	2,278	0.60	557	0.40	372

[1] When justified, a postal service center may be provided at which mail may be picked up by individual post office mailbox holders, as opposed to bulk distribution of mail to the various elements on a military installation. A postal service center may be combined with, or separate from, a central or branch post office. The number of mailboxes should not exceed the number of unmarried and unaccompanied married military and civilian personnel assigned to a military installation, plus 25 percent to accommodate the official needs of specific key military and civilian personnel, and to compensate for the vacancy period required by the U.S. Postal Service before reassignment of a mailbox.

[2] Installation population is defined as active duty military personnel assigned to the military installation in CONUS and active duty military personnel and civilian employees assigned the military personnel in overseas areas.

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TABLE 4-10 (continued)

[3] Mechanical equipment room space and loading platforms as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[4] CONUS includes the 50 states and all other geographical areas in which the U.S. Postal Service operates.

[5] Use 0.60 of a square foot [557 cm^2] gross area per mailbox when the postal service center is geographically separated from the central post office.

10. Religious Activities Facilities.

a. Chapels.

(1) Size and Number. Space criteria for chapels should be based on the installation population as defined in Note 1 of table 4-11. The sizes of chapels should conform to table 4-12 based on the number of chapel seats authorized by table 4-11.

(2) Administrative Spaces. Adequate and appropriate individual offices and common administrative spaces required for chaplains of the various faiths should be provided within the criteria indicated here.

TABLE 4-11

NUMBER OF CHAPEL SEATS	
Installation Population [1]	Number of Chapel Seats [2]
Up to 500	Note 3
501 to 1,000	200
1,001 to 2,000	300
2,001 to 2,500	400
2,501 to 3,000	500
3,001 to 4,000	600
4,001 to 5,000	800
5,001 to 6,000	900
6,001 to 7,000	1,000
7,001 to 8,000	1,200
8,001 to 9,000	1,300
9,001 to 10,000	1,400
10,001 to 11,000	1,500

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TABLE 4-11 (continued)

NUMBER OF CHAPEL SEATS	
Installation Population [1]	Number of Chapel Seats [2]
11,001 to 12,000	1,600
12,001 to 13,000	1,700
13,001 to 14,000	1,800
14,001 to 15,000	2,000
15,001 to 17,000	2,100
17,001 to 19,000	2,200
19,001 to 20,000	2,300
20,001 to 22,000	2,400
22,001 to 24,000	2,500
24,001 to 25,000	2,600
25,001 to 27,000	2,700
27,001 to 28,000	2,800
28,001 to 29,000	2,900
29,001 to 30,000	3,000
For each additional 1,000, add	60

[1] Installation population is defined as the military strength assigned to the military installation, plus their dependents. For training installations, a weighted count of students at any given time should be included in the military strength. Civilian personnel may be included when they are dependent on the military installation for religious support.

[2] See table 4-12 for space criteria for individual chapels.

[3] 850 ft^2 [79 m^2] gross area should be provided for the chaplain, enlisted support personnel, and storage space for ecclesiastical material in a multipurpose facility with a room or auditorium of sufficient size for weekly divine services. Additionally, a small meditation chapel space of approximately 30 to 35 seats should be provided.

(3) Chapel Space Criteria. Table 4-12 should be used to convert the chapel seating to square footage requirements. Each chapel size should be calculated independently. The total military installation seating requirements should be the sum of the component chapels.

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TABLE 4-12

SPACE CRITERIA FOR INDIVIDUAL CHAPELS				
	Gross Area Authorized Per Seat		Total Gross Area [1]	
Number of Seats	ft^2	[m^2]	ft^2	[m^2]
200	32.5	3.0	6,500	604
300	26.5	2.6	8,550	794
400	25.5	2.4	10,200	948
500	23.0	2.1	11,500	1,068
600	22.2	2.1	13,320	1,237
700	21.0	2.0	14,700	1,366
800	20.0	1.9	16,000	1,486
900	19.0	1.8	17,100	1,589
1,000	18.0	1.7	18,000	1,672
1,100	17.0	1.6	18,700	1,737
1,200	17.0	1.6	20,400	1,895

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

b. Religious Educational Facilities. The gross area of religious education facilities, calculated independently of and exclusive of chapel requirements, that may be provided at a military installation, should be based on the total installation population as defined above. These facilities are normally operated in conjunction with a chapel and preferably should be attached to or in proximity to a chapel. For an installation population of up to 1,000, the gross area of the religious education facility should be 4,000 ft^2 [371 m^2]. For each additional 1,000 installation population, 840 ft^2 [78 m^2] gross area should be added.

(1) The gross area criteria indicated in table 4-12 apply to religious education facilities only. Chapel and religious education spaces should be calculated separately and independently of each other.

(2) Mechanical equipment room space as required should be added to the gross areas indicated above when determining a single gross area figure for each facility.

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11. Theaters and Multipurpose Auditoriums.

a. Number and Capacity. At military installations where entertainment motion picture service has been established, theaters with stages may be provided according to table 4-13.

TABLE 4-13

NUMBER OF THEATERS AND MULTIPURPOSE AUDITORIUMS		
Military Population [1,2]	Number of Theaters	Capacity of Authorized Theaters
Up to 300	1	Note 3
301 to 1,000	1	General purpose facility
1,001 to 2,000	1	350-seat with dressing rooms
2,001 to 3,000	1	500-seat with dressing rooms
3,001 to 7,000	1	1,000-seat with dressing rooms
7,001 to 10,000	1	1,000-seat with dressing rooms
	1	500-seat without dressing rooms
10,001 to 15,000	1	1,000-seat with dressing rooms
	2	500-seat without dressing rooms
15,001 to 20,000	1	1,000-seat with dressing rooms
	3	500-seat without dressing rooms
20,001 to 25,000	1	1,000-seat with dressing rooms
	1	1,000-seat without dressing rooms
	2	500-seat without dressing rooms

[1] Military population is defined as active duty military personnel assigned to a military installation, plus 50 of their dependents.

[2] When the military strength exceeds 25,000, the number and size of theater facilities authorized (that exceeds four theaters), should be determined by the conditions obtained at the military installation. Relevant factors, including dispersal of UEPH and military family housing areas, should constitute the basis for the requirement for additional facilities. The justification should be coordinated with the Army and Air Force Exchange Service (AAFES). Auditoriums, drama centers, and theaters should be combined use facilities practicable.

[3] Accommodate in other facilities.

b. Space Criteria. The gross areas of the theaters indicated above should not exceed the space criteria shown in table 4-14.

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TABLE 4-14

SPACE CRITERIA FOR THEATERS AND MULTIPURPOSE AUDITORIUMS				
Theater Capacity	Gross Theater Area [1]			
	With Dressing Rooms		Without Dressing Rooms	
	ft^2	$[m^2]$	ft^2	$[m^2]$
General purpose facility	3,500	325	3,500	325
350 seats	6,500	604	5,800	539
500 seats	10,900	1,013	9,600	892
1,000 seats	17,200	1,598	15,500	1,440

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

F. COMMUNITY FACILITIES - MORALE, WELFARE AND RECREATIONAL - INTERIOR (EXCHANGE AND SIMILAR FACILITIES) (Category Code 740)

1. Space Criteria. Space criteria for exchange and similar facilities are tabulated in this section.

2. Banking Offices. Banking institutions may be authorized to operate banking offices on military installations by their regulatory agencies or the Treasury Department with the concurrence of the head of the DoD Component concerned and according to DoD Directive 1000.11 (reference (4h)) and DoD Instruction 1000.12 (reference (4i)). Normally, there should be only one banking institution at each installation unless the installation commander feels more are needed. However, there is no restriction on the number of banking offices that may be authorized for operation by that banking institution.

a. Adequacy of Space. It is important that the banking office be located in a building that is accessible to the majority of personnel on the military installation and is so located as to permit maximum security. Adequate space should be made available to include space for:

(1) Burglar alarm system and other security features normally used by banking institutions.

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(2) Counters and teller space.

(3) Interview space.

(4) Lobby and reception space.

(5) Management office space.

(6) Operation (machine or record, or both) space.

(7) Record-holding space.

(8) Safes or a vault, or both.

b. Space Criteria. Space criteria for banking offices operating in federal buildings, on either a reimbursable or nonreimbursable basis, are shown in table 4-15.

c. Construction from Private Funds. When a banking institution is authorized to construct its own building, at its own expense, on government-owned land, the space criteria specified in table 4-15 do not apply. The building should conform to the installation master plan. It should be confined to the needs of the banking institution only and may not house other commercial enterprises or government instrumentalities unless approved by the installation commander. Land required for approved construction at the banking institution's expense shall be made available by a real estate lease according to DoD Directive 4165.6 (reference (4j)) and DoD Instruction 1000.12, Section B., enclosure 2.

TABLE 4-15

SPACE CRITERIA FOR BANKS

Population Served [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 1,000	1,500	139
1,001 to 2,000	2,375	221
2,001 to 3,000	3,250	302
3,001 to 4,000	3,625	337
4,001 to 5,000	4,000	372
5,001 to 6,000	4,375	406
6,001 to 7,000	4,750	441
7,001 to 9,000	5,560	517

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TABLE 4-15 (continued)

SPACE CRITERIA FOR BANKS		
Population Served [1]	Gross Area [2] ft^2	Gross Area [2] $[m^2]$
9,001 to 11,000	6,375	592
11,001 to 13,000	7,190	668
13,001 to 15,000	8,000	743
15,001 to 17,000	10,000	929
17,001 to 20,000	13,000	1,208
For each additional increment of 3,000, or portion thereof, add	1,000	93

[1] Population served is defined as active duty military personnel assigned to a military installation and stationed within a commuting area not served by another military banking office, plus civilian employees on the military installation, and other persons authorized to use the banking office.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

3. Credit Union Facilities. Although credit unions are private organizations that are not under the direct control of the military departments, a properly chartered credit union may be established on any military installation to serve military personnel and their dependents, and other personnel as permitted in the approved bylaws of the credit union. If the credit union on a military installation fails or refuses to permit unrestricted membership of installation personnel, it shall be denied free use of military installation facilities. In such instances, another credit union that meets the DoD requirements may be established on the military installation, and thus be qualified for authorized logistics support. Normally, credit unions will be a part of the community shopping center. Where space in the community shopping center is not available, space should be provided in a nearby convenient area. DoD Instruction 1000.10 (reference (4k)) establishes the policy governing the functioning of credit unions on military installations.

a. Space Criteria. Space criteria for credit unions operating in federal buildings are shown in table 4-16. The total factor is the sum of the factors determined by the size of the credit union's membership, the

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number of transactions handled per day, and the number of persons employed, as shown in table 4-17. Data used to determine these factors should relate solely to the military installation providing space and should not be an aggregate of the total membership, transactions, and employees of a credit union that function at other sites not located on the installation or that has a broad membership located away from the geographical area generally served by that military installation. A credit union may be authorized to operate at more than one location on a military installation. However, when this is done, the space criteria authorized under tables 4-16 and 4-17 applies in aggregate (see DoD Instruction 1000.10, enclosure 3, paragraph E.8.). The area may be increased by 10 percent to allow for future business expansion.

b. Construction from Private Funds. When a credit union is authorized to construct its own building, at its own expense, on government-owned land, tables 4-16 and 4-17 do not apply. Land required for approved construction at credit union expense should be made available.

TABLE 4-16

SPACE CRITERIA FOR CREDIT UNIONS

Factor Totals	Gross Area [1]		Factor Totals	Gross Area [1]	
	ft^2	$[m^2]$		ft^2	$[m^2]$
Minimum	800	74	18	6,200	576
5	1,000	93	19	7,200	669
6	1,300	121	20	8,200	762
7	1,700	158	21	9,200	855
8	2,200	204	22	10,200	948
10	2,800	260	23	11,200	1,040
12	3,500	325	24	12,200	1,133
14	4,300	399	25	13,200	1,226
16	5,200	483	For each additional factor, add	1,000	93

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

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TABLE 4-17

SPACE CRITERIA FOR CREDIT UNIONS					
Members	Factors	Employees	Factors	Transactions Per Day	Factors
Up to 1,000	2	2 to 5	1	Up to 99	1
1,001 to 2,500	4	6 to 9	2	100 to 299	2
2,501 to 7,500	6	10 to 13	3	300 to 499	3
7,501 to 12,000	8	14 to 17	4	500 to 749	4
12,001 to 20,000	10	18 to 21	5	750 to 999	5
		22 to 25	6		
For each additional 10,000 or portion thereof, add	2	For each additional 3, add	1	For each additional 500, add	1

4. Exchange Facilities.

a. General.

(1) Authorized Facilities. The exchange facilities listed below are authorized by DoD Directive 1330.9 (reference (41)) as facilities that may be exchange-operated.

(a) Administrative facilities.

(b) Amusement centers.

(c) Automobile parts sales stores.

(d) Branch exchanges (Navy: Location exchanges).

(e) Cafeterias, snack bars, and snack stands.

(f) Central support facilities.

(g) Food stores, overseas.

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(h) Gasoline and service stations, service centers, and car wash facilities.

(i) Laundry and dry cleaning plants, exchange-operated.

(j) Main retail stores.

(k) Maintenance shops, installation.

(l) Service outlets.

(m) Warehouses (installation and central).

(2) Basis of Space Criteria. Space criteria should be based on subparagraph F.4.a.(3), below, augmented as follows:

(a) Subordinate Exchange Facilities. Subordinate exchange facilities operated for the convenience of separate specialized activities, and established as an integral part of these activities, such as barber shops in clubs; food, retail and personnel services in air terminals and hospitals; food service in academic buildings, colleges, and dependent schools; food service in bowling alleys, operations buildings, and service clubs; and snack facilities in theaters should be provided out of the space allowances authorized for the separate specialized activities themselves, rather than deducted from the authorized space criteria.

(b) Military Strength in Overseas Commands. When computing the military strength figure for an overseas command, as outlined in subsection A.2., above, the number of civilian employees (U.S. and other than host country nationals), including their dependents, paid from either appropriated or nonappropriated U.S. dollar funds and afforded full exchange service privileges should be included.

(c) Temporary Exchange Facilities. Space criteria for construction of permanent exchange facilities should be based on the authorized projected assigned military strength. However, space criteria for temporary exchange facilities to be located in buildings of temporary construction, relocatable buildings, or available semipermanent or permanent buildings, excess to all requirements, other than exchange, recreational and welfare facility needs of the same priority, may be based on the current or impending military strength provided the selected military strength is not projected to materially decline for at least 24 months.

(3) Application of Space Criteria. Application of these space criteria should conform with subparagraph F.4.a.(2), above, augmented as follows:

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(a) Space Adjustments. Except when otherwise exempted or limited here, increases not to exceed 20 percent of the space criteria outlined in subparagraph F.4.a.(2), above, may be made in the size of the various types of exchange facilities provided the aggregate total authorized for all types of exchange facilities at the military installation is not exceeded.

(b) Conversions. When an existing building is converted to use as an exchange facility, the space criteria may be increased by not more than 20 percent when necessary to effect economical and efficient use of the existing building. Such an increase should not affect criteria, but may be combined with the space adjustment permitted in subparagraph F.4.a.(3)(a), above.

(c) Covered and Enclosed Malls and Sidewalks. When elements of a community shopping center, such as the bank, commissary, credit union, exchange main retail store, exchange service outlets, and snack bar, are combined into a common structure and connected by an enclosed mall, space occupied by the mall should not be charged against (deducted from) space criteria for the respective elements. Likewise, when such elements are in proximity to each other and are connected by a covered walkway, space occupied by the covered walkway should not be charged against space criteria for the respective elements. Similarly, space occupied by public toilet rooms and janitor closets located off the malls shall not be charged against (deducted from) space criteria for the respective elements.

(d) Elevators, Escalators, and Stairs. Normally, exchange facilities will be constructed on a single level. When existing building configurations or site constraints, or both, dictate multistory stores, space occupied by elevators, escalators, stairs, and other vertical transportation systems should not be charged against space criteria for the respective elements.

(e) Mechanical Equipment Rooms. The gross area criteria in subsection F.4. do not include the required mechanical equipment room space. These spaces should be added to the gross area criteria.

(4) Construction from Private Funds.

(a) Private Funds. The construction of exchange facilities on military installations may be accomplished from funds of commercial concerns or private individuals subject to the approval of the Secretary of the cognizant Military Department, when pertinent contracts between commercial concerns or private individuals and the exchange specifies that immediately upon completion title thereto passes to the government and stipulate conditions and restrictions that should prevent any future conflict with military requirements, and eliminate any future obligations against appropriated funds. The requirement for passage of the title should not apply to portable or relocatable buildings.

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(b) Commercial Space Practices. Buildings for regular exchange service outlets, and special sales and service outlets are not limited by space criteria when they are erected as exchange concession facilities from private funds. However, the sizing of these facilities should be consistent with commercial practices. Space occupied by these concession facilities should not be deducted from other space provided for in these criteria, except that facilities authorized here should not duplicate activities directly operated by exchanges.

(5) Relocatable Buildings. Relocatable buildings provided from exchange nonappropriated funds for temporary use as exchange facilities should be maintained and operated entirely from exchange nonappropriated funds. Ownership of these relocatable buildings should remain with the exchange service (AAFES, Navy, or Marine Corps), and shall be so reported in real property inventories required by DoD Instruction 4165.14 (reference (4m)).

b. Community Shopping Centers.

(1) Common Structure. For optimum availability and convenience, major exchange facilities should be planned, when practicable, as elements of a military installation community shopping center, and combined for economy when feasible into a common structure housing other elements of the shopping center.

(2) Overseas Area Community Shopping Centers. In overseas commands where a group of military installations are located within a geographical area with a radius of up to 25 miles [40 km], an area community shopping center may be provided to serve these military installations. The community shopping center should preferably be located at one of the military installations in the center of the area and should obviate the need for other comparable main exchange facilities at that military installation. The exchange main retail store at the area community shopping center should feature a complete selection of merchandise, thus permitting the retail stores at the served military installations to feature limited selections, such as items of general convenience and necessity. This should serve to reduce space requirements for these secondary stores which should be planned to meet the specific requirements at the particular military installation rather than arbitrarily planned to the maximum space criteria.

c. Administrative Facilities, Exchange. Space required for the central administrative facilities of a military installation exchange, area exchange, or regional exchange should be provided under section B, above. Administrative space required for an individual exchange facility, such as office space in the main retail store or branch (or location exchange), should be provided out of the space criteria for the individual facility.

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d. Amusement Centers. Amusement centers are entertainment activities that combine coin-operated games and refreshments. They basically consist of a drink and food vending machine area, a game area (pinball, pool tables, and skill games), a limited snack counter in larger activities, and toilet facilities. Amusement centers may be provided as independent activities or operated within a branch exchange, cafeteria, or snack bar. Total gross areas for amusement centers should not exceed the space criteria shown in table 4-18, unless local conditions warrant.

TABLE 4-18

SPACE CRITERIA FOR EXCHANGE AMUSEMENT CENTERS

Military Strength	Gross Area [1,2]	
	ft^2	[m^2]
501 to 1,000	1,200	111
1,001 to 3,000	1,800	167
3,001 to 5,000	2,400	223
5,001 to 7,000	3,800	353
7,001 to 10,000	5,000	465
10,001 to 15,000	6,500	604
15,001 to 20,000	8,500	790
20,001 to 25,000	11,000	1,022
25,001 to 30,000	12,800	1,189
For each additional 5,000, add	1,800	167

[1] If the exchange amusement center is not located contiguous to a branch exchange, cafeteria, or snack bar, then the space for a food service facility, if required, should be provided out of the space criteria for exchange amusement centers.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

e. Automobile Parts Sales Stores. Automobile parts sales stores may be operated independently or with other retail outlets, service stations, or garages. Total floor areas for automobile parts sales stores should not exceed the space criteria shown in table 4-19.

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TABLE 4-19

SPACE CRITERIA FOR EXCHANGE AUTOMOBILE PARTS SALES STORES		
Number of Registered Vehicles Owned by Authorized Customers	Gross Area [1]	
	ft^2	[m^2]
Up to 300	1,000	93
301 to 600	1,750	163
601 to 1,800	3,100	288
1,801 to 3,000	4,300	399
3,001 to 4,300	5,800	539
4,301 to 6,100	7,650	711
6,101 and over	10,000	929

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

f. Branch Exchanges (Navy: Location Exchanges).

(1) At military installations having a military strength of 2,500 or more personnel, a branch exchange (Navy: Location exchange), located so as to provide convenient exchange coverage of the military installation may be provided as shown in table 4-20.

(2) A gross area of 7,000 ft^2 [650.3 m^2] is authorized for each branch exchange. However, space criteria for individual branch exchange facilities may be adjusted upward or downward provided the total space authorized for all branch exchanges is not exceeded. Branch exchange facilities may be used for any of the exchange activities or service outlets as required.

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TABLE 4-20

SPACE CRITERIA FOR BRANCH EXCHANGES			
Military Strength	Number of Authorized Branch Exchanges [1]	Gross Area [1]	
		ft^2	$[m^2]$
2,500 to 5,000	1	7,000	650
5,001 to 7,500	2	14,000	1,300
7,501 to 10,000	3	21,000	1,951
For each additional increment of 2,500 or portion thereof, add	1	7,000	650

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

g. Central Support Facilities, Exchange. Central support facilities not otherwise identified here (central kitchens, and mobile and vending units, and in overseas areas: bakeries, central repair shops, depots, processing plants, and refrigerated storage plants) should be considered on an individual basis. These types of facilities should be located and sized according to the dispersion and magnitude of the exchange activities to be supported. It is recognized that these determinations are based on a combination of economic, management, and operating factors; therefore, requests for the establishing of these facilities should be sent to an Assistant Secretary of the Military Department concerned for approval.

h. Food Service Facilities, Exchange.

(1) Exchange Food Service. These types of facilities include, but are not limited to, bake shops, cafeterias, ice cream shops, flight line snack bars (for air terminal food service see subparagraph F.4.a.(2)(a)), snack bars, snack stands, and specialty shops similar to deli, fast food franchises, and pizza (see subparagraph F.4.a.(4) for construction from private funds). The total space should not exceed the criteria shown in tables 4-21, 4-22, 4-23, and 4-24. Space occupied for food service facilities in facilities such as administrative buildings, air terminals, bowling alleys, golf club houses, hospitals, and training buildings should be provided from space criteria established for that facility and not deducted from space criteria provided for those types of facilities.

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TABLE 4-21

SPACE CRITERIA FOR INSTALLATION EXCHANGE FOOD SERVICE				
Military Strength	Gross Area [1]			
	CONUS		Overseas [2]	
	ft2	[m2]	ft2	[m2]
Up to 500	1,850	172	2,200	204
501 to 1,000	2,700	251	3,200	297
1,001 to 3,000	5,400	502	6,300	585
3,001 to 5,000	7,400	687	8,000	743
5,001 to 7,000	9,300	864	9,800	910
7,001 to 10,000	10,700	994	11,300	1,050
10,001 to 15,000	12,600	1,171	13,300	1,236
15,001 to 20,000	16,800	1,561	17,800	1,654
20,001 to 30,000	18,600	1,728	19,600	1,821
For each additional 5,000, add	500	46	500	46

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[2] Space for overseas area community shopping center food service should be provided according to table 4-22 and shall not be deducted from the space criteria shown above.

(2) Food Service at Area Community Shopping Center, Overseas. Food service may be provided as an element of an overseas area community shopping center (see subparagraph F.4.b.(2)(b)). Space criteria are shown in table 4-22.

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TABLE 4-22

SPACE CRITERIA FOR EXCHANGE FOOD SERVICE AT AREA COMMUNITY SHOPPING CENTERS, OVERSEAS		
Number of Authorized Customers In the Area [1]	Gross Area [2]	
	ft^2	[m^2]
1,000 to 3,000	5,400	502
3,001 to 5,000	6,300	585
5,001 to 7,000	8,000	743
7,001 to 10,000	9,800	910
10,001 and over	11,300	1,050

[1] Authorized customers is defined as the military strength, authorized civilians, and all of their dependents within the area served by the area community shopping center (10 or 25 miles [16 or 40 km]).

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

(3) Exchange Supplementary Food Service. Supplementary food service may be provided at military installations having a military strength of 3,000 or more personnel. A gross area of 900 ft^2 [83.6 m^2] is authorized for each unit of supplementary food service. However, space criteria for individual units of supplementary food service may be adjusted upward or downward. Supplementary food service units may be used for any of the authorized activities as required. The total space allocated for supplementary food service should not be deducted from the space criteria shown in table 4-23.

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TABLE 4-23

SPACE CRITERIA FOR EXCHANGE SUPPLEMENTARY FOOD SERVICE			
Military Strength	Number of Supplementary Food Service Units, 900 ft² [83.6 m²] each	Total Gross Area [1]	
		ft²	[m²]
3,000 to 5,000	1	900	84
5,001 to 10,000	2	1,800	167
10,001 to 20,000	3	2,700	251
20,001 to 30,000	4	3,600	334
For each additional 10,000, add	1	900	84

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

(4) Flight Line Snack Bars. In addition to other authorized food service facilities, each airfield is authorized one flight line snack bar in, or adjacent to, the operations building. Food service space provided for flight line snack bars should not exceed the criteria shown in table 4-24. (See subparagraph F.4.h.(1)).

TABLE 4-24

SPACE CRITERIA FOR FLIGHT LINE SNACK BARS		
Military Strength	Gross Area [1]	
	ft²	[m²]
Up to 1,000	500	46
1,001 to 5,000	1,100	102
5,001 to 10,000	2,090	194
10,001 and over	2,670	248

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

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i. *Food Stores, Overseas.* Food retail sales outlets may be provided with other exchange retail outlets, food facilities, and snack bars, or as independent sales stores. The total space provided for these sales outlets should not exceed the criteria shown in table 4-25.

TABLE 4-25

SPACE CRITERIA FOR EXCHANGE FOOD STORES, OVERSEAS		
Military Strength	Gross Area [1]	
	ft^2	$[m^2]$
500 to 1,000	1,000	93
1,001 to 3,000	1,400	130
3,001 to 5,000	1,800	167
5,001 to 7,000	2,600	242
7,001 to 10,000	3,000	279
10,001 to 15,000	3,500	325
15,001 to 20,000	3,850	358
20,001 to 25,000	4,000	372
25,001 and over	4,100	381

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

j. Gasoline, Car Wash, and Service Stations and Service Centers.

(1) Space Criteria. Space criteria for gasoline and service stations and service centers, supplemental gasoline stations, and car wash facilities may be on the basis of either the installation military strength or the number of registered vehicles owned by authorized customers when this number can be substantiated. Military strength should only be used as a basis when the number of registered vehicles owned by authorized customers cannot be substantiated. Space criteria are shown in tables 4-26, 4-27, and 4-28.

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TABLE 4-26

SPACE CRITERIA FOR GASOLINE AND SERVICE STATIONS AND SERVICE CENTERS					
Military Strength	OR Number of Registered Vehicles Owned By Authorized Customers	Gasoline and Service Stations Area		Service Centers Additional Area	
		Gross Area [1]			
		ft^2	$[m^2]$	ft^2	$[m^2]$
Up to 500	Up to 300	600	56	None	None
501 to 1,000	301 to 600	1,740	162	None	None
1,001 to 3,000	601 to 1,800	2,160	201	380	35
3,001 to 5,000	1,801 to 3,000	2,830	263	950	88
5,001 to 7,000	3,001 to 4,300	3,250	302	1,140	106
7,001 to 10,000	4,301 to 6,100	4,140	385	2,100	195
10,001 to 15,000	6,101 to 9,100	4,560	424	4,300	399
15,001 to 20,000	9,101 to 12,200	6,500	604	4,610	428
20,001 and over	12,201 and over	9,750	906	4,800	446

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

TABLE 4-27

SPACE CRITERIA FOR SUPPLEMENTAL GASOLINE STATIONS				
Military Strength	OR Number of Registered Vehicles Owned by Authorized Customers	Number of Stations at 600 ft^2 $[56m^2]$ each	Total Gross Area [1]	
			ft^2	$[m^2]$
3,000 to 7,000	1,800 to 4,300	1	600	56
7,001 to 15,000	4,301 to 9,100	2	1,200	111
15,001 and over	9,101 and over	3	1,800	167

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TABLE 4-27 (continued)

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

TABLE 4-28

SPACE CRITERIA FOR CAR WASH FACILITIES

Military Strength	OR Number of Registered Vehicles Owned by Authorized Customers	Number of Wash Bays	Total Gross Area [1]	
			ft^2	$[m^2]$
800 to 3,000	500 to 1,800	1	720	67
3,001 to 5,000	1,801 to 3,000	2	1,180	110
5,001 to 7,000	3,001 to 4,000	3	1,640	152
7,001 to 10,000	4,001 to 6,000	4	2,100	195
10,001 to 15,000	6,001 to 9,000	5	2,560	238
15,001 to 20,000	9,001 to 12,000	6	3,020	281
20,001 and over	12,001 and over	7	3,480	323

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

(2) Canopies. Canopies required to protect the pump islands from inclement weather may be provided without a deduction in the space criteria shown above in table 4-26. Authorized space criteria for exchange service stations and service centers may be increased by not more that 20 percent when a "drive-thru" design is used when one entrance to and one exit from a common interior driveway serves all repair bays.

k. Laundry and Dry Cleaning Plants, Exchange-Operated. Laundry and dry cleaning plants, which may be operated under the exchange service, normally should be limited to the performance of other than appropriated fund laundering and dry cleaning. Space criteria are shown in table 4-29.

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TABLE 4-29

SPACE CRITERIA FOR EXCHANGE LAUNDRY AND DRY CLEANING PLANTS [1]				
Military Strength	Laundry Plant		Dry Cleaning Plant	
	Gross Area [2]			
	ft^2	[m^2]	ft^2	[m^2]
Up to 500	3,000	279	1,000	93
501 to 1,000	6,000	557	1,000	93
1,001 to 3,000	7,000	650	1,000	93
3,001 to 5,000	8,000	743	2,000	186
5,001 to 7,000	9,000	836	3,000	279
7,001 to 10,000	9,500	883	3,500	325
10,001 to 15,000	10,000	929	4,000	372
15,001 to 30,000	15,000	1,394	7,000	650
For each additional 5,000, add	1,000	93	500	46

[1] On those military installations where both appropriated fund and nonappropriated fund facilities are to be provided, the total space should not exceed the criteria established for appropriated fund facilities shown in table 4-10.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

1. Main Retail Stores. The exchange main retail store is basically comprised of entrance facilities, office space, sales area, stock area, and toilet facilities, as required. Space criteria for main retail stores are projected by the Services' Exchange Agencies.

m. Maintenance Shops, Installation. The recommended amount of shop space provided on a military installation for the maintenance and repair of exchange equipment and fixtures is shown in table 4-30.

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TABLE 4-30

SPACE CRITERIA FOR EXCHANGE MAINTENANCE SHOPS		
Military Strength	Gross Area [1]	
	ft^2	(m^2)
Up to 500	None	None
501 to 1,000	380	35
1,001 to 3,000	600	56
3,001 to 5,000	750	70
5,001 to 7,000	1,100	102
7,001 to 10,000	1,500	139
10,001 to 15,000	2,250	209
15,001 to 20,000	3,000	279
20,001 to 30,000	3,700	344
For each additional 5,000, add	350	33

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

n. Service Outlets.

(1) General. Service outlets facilities may be provided as shown in tables 4-31, 4-32, and 4-33 for the basic services indicated, normally as adjuncts of the main retail store. When a service outlet is being installed in an existing building, the space may be increased by 20 percent or 100 ft^2 [9.3 m^2] gross area, whichever is greater, if such increase is necessary to effect economical and efficient use of the existing building. Additional service outlets over and above those listed in tables 4-31, 4-32, and 4-33 may be provided according to subsection F.4.

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TABLE 4-31

SPACE CRITERIA FOR SERVICE OUTLETS - GROSS SQUARE FOOT AREA [1]

Military Strength [2]	Barber Shops [3] 1st	Barber Shops [3] 2nd	Shoe Repair	Tailor [4]	Valet [4]	Coin-operated Laundry and Dry Cleaning
Up to 500	300	None	None	200	300	None
501 to 1,000	390	None	225	200	650	1 ea 750
1,001 to 3,000	580	None	350	220	1,100	1 ea 1,150
3,001 to 5,000	680	300	500	400	1,100	1 ea 1,150
5,001 to 7,000	780	390	625	650	1,300	1 ea 1,900
7,001 to 10,000	840	460	750	700	1,300	1 ea 2,150
10,001 to 15,000	900	580	900	800	1,300	1 ea 2,150
15,001 to 20,000	960	680	900	900	1,500	2 ea 1,190
20,001 to 25,000	960	780	900	900	1,500	2 ea 1,900
25,001 to 30,000	960	840	900	900	1,500	2 ea 2,150
For each additional 5,000, add	60	60	50	50	100	1 ea 1,150

Military Strength [2]	Radio-TV Repair	Portrait Studio	Watch Repair	Optical Shop	Personal Services [5]
Up to 500	None	None	None	None	None
501 to 1,000	460	740	150	460	150
1,001 to 3,000	600	740	240	460	240
3,001 to 5,000	840	740	310	460	310
5,001 to 7,000	1,060	740	310	460	310
7,001 to 10,000	1,280	930	400	460	400
10,001 to 15,000	1,280	930	400	600	400
15,001 to 20,000	1,480	1,010	460	780	460
20,001 to 25,000	1,480	1,010	460	780	460
25,001 to 30,000	1,680	1,010	460	910	460
For each additional 5,000, add	120	80	60	130	60

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TABLE 4-32

SPACE CRITERIA FOR SERVICE OUTLETS - GROSS SQUARE METER AREA [1]						
Military Strength [2]	Barber Shops [3]		Shoe Repair	Tailor	Valet	Coin-operated Laundry and Dry Cleaning
	1st	2nd				
Up to 500	28	None	None	19	28	None
501 to 1,000	36	None	21	19	60	1 ea 70
1,001 to 3,000	54	None	33	20	102	1 ea 107
3,001 to 5,000	63	28	46	37	102	1 ea 107
5,001 to 7,000	72	36	58	60	121	1 ea 177
7,001 to 10,000	78	43	70	65	121	1 ea 200
10,001 to 15,000	84	54	84	74	121	1 ea 200
15,001 to 20,000	89	63	84	84	139	2 ea 111
20,001 to 25,000	89	72	84	84	139	2 ea 177
25,001 to 30,000	89	78	84	84	139	2 ea 200
For each additional 5,000, add	6	6	5	5	9	1 ea 107

Military Strength [2]	Radio-TV Repair	Portrait Studio	Watch Repair	Optical Shop	Personal Services [4]
Up to 500	None	None	None	None	None
501 to 1,000	43	69	14	43	14
1,001 to 3,000	56	69	22	43	22
3,001 to 5,000	78	69	29	43	29
5,001 to 7,000	98	69	29	43	29
7,001 to 10,000	119	86	37	43	37
10,001 to 15,000	119	86	37	56	37
15,001 to 20,000	137	94	43	72	43
20,001 to 25,000	137	94	43	72	43
25,001 to 30,000	156	94	43	85	43
For each additional 5,000, add	11	7	6	12	6

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

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TABLE 4-32 (continued)

[2] Total customer strength in overseas areas.

[3] For military installations over 2,500 strength, additional barber shops may be provided within the criteria for branch exchanges. Barber shops need not be collocated and may vary in size within the total space allowances.

[4] Includes gift and package wrapping, flower and fruit ordering, money orders, newspaper and periodical subscriptions, telegraph, theater tickets, traveler's checks, and services of a similar nature.

(2) Exchange Beauty Shops. Exchange beauty shops should be sized as shown in table 4-33.

TABLE 4-33

SPACE CRITERIA FOR EXCHANGE BEAUTY SHOPS		
CONUS and Overseas Customers	Gross Area [1]	
	ft^2	$[m^2]$
Up to 250	400	37
251 to 500	800	74
501 to 1,000	1,200	111
1,001 to 1,500	1,750	163
1,501 to 2,000	2,220	206
2,001 to 2,500	2,480	230
For each additional 500, add	250	23

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

(3) Special Sales and Service Outlets.

(a) Outlet Activities. Special sales and service outlets may include exchange or other activities as needed. Typical examples of these activities include, but are not limited to, automobile repair garages, baggage checkpoints, bus and taxicab service, flower shops, garages, toylands; and in the overseas areas exclusively: book and furniture stores, new car sales points, steam bath facilities, and stock investment offices.

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(b) Conditional Requirements. Facilities for special sales and service outlets may be provided when the following conditions are met:

1 When it has been firmly established that no appropriated funds will be expended and that no future obligation of appropriated funds will be involved in the maintenance and operation of exchange-furnished operating equipment and finishes, except that utility services should be provided in overseas areas without reimbursement.

2 When the use of an existing facility is involved, the space to be occupied should be the minimum needed for efficient operations. This space should be surplus to all requirements other than exchange, recreational, and welfare facility needs of the same priority.

3 When the facility is to be provided through new construction from nonappropriated funds and when the project has been authorized under such provisions as the Secretary of the cognizant Military Department may direct.

4 When the facility is to be provided through new construction from private funds and when the provisions of subparagraph F.4.a.(4), above, have been complied with.

(c) Deduction Restriction. Space occupied by special sales and service outlets should not be deducted from the other space allowances provided for in these criteria.

o. Warehouses (Installation and Central). Exchange-operated warehouses are categorized as installation exchange warehouses and central warehouses. Mezzanines created as part of a self-supported fixture should not be charged against space criteria for the respective elements. The space authorized for these warehouses should be determined by the following:

(1) Installation Exchange Warehouses. The total storage space provided for installation exchange warehouses used to accommodate backup storage for a main exchange on a military installation should be computed in CONUS at 33 percent; and in Alaska, Hawaii, and overseas at 50 percent of the space authorized for the installation exchange main retail store. Whenever practicable, the military installation exchange warehouse should be located contiguous to the exchange main retail store in order to reduce the cost of moving stock from the warehouse to the exchange main store sales area.

(2) Central Warehouse. This type of warehouse may be provided for bulk backup storage (exchange stock and operating supplies) to supply exchange activities on several military installations within a certain geographical area, or at one activity when the installation is

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isolated geographically from other military installations within CONUS. This central warehouse criteria does not void the need for the military installation exchange warehouse, preferably located contiguous to the exchange main retail store. Space criteria for central warehouses should be determined by the Services' Exchange Agency.

5. Thrift Shops. Thrift shops may be established according to the criteria shown in table 4-34 to provide a nonprofit facility for the purchase and sale by military personnel and their dependents of used apparel and household furniture, equipment, furnishings, and other items.

TABLE 4-34

SPACE CRITERIA FOR THRIFT SHOPS		
Military Population [1]	Gross Area [2,3]	
	ft^2	[m^2]
Up to 2,000	1,400	130
2,001 to 4,000	2,000	186
4,001 to 6,000	2,700	251
6,001 to 8,000	3,400	316
8,001 to 10,000	4,000	372
10,001 to 12,000	4,500	418
12,001 to 14,000	4,905	456
14,001 and over [4]	5,350	497

[1] Military population is defined as active duty military personnel, plus 50 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross figure for each facility.

[3] The Environmental Adjustment Factors (EAF) for thrift shops shown in table 4-35 should be applied to space criteria shown in table 4-34 for those military installations having a military strength of over 2,000. These EAF are predicated on the availability of military family housing on the military installation.

[4] Only one thrift shop is authorized per military installation.

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TABLE 4-35

ENVIRONMENTAL ADJUSTMENT FACTORS FOR THRIFT SHOPS	
Percent Living on Installation [1]	Environmental Adjustment Factors
Up to 51	0.70
52 to 75	0.80
76 to 90	0.95
91 to 100	1.00

[1] The Unmarried and Family Housing Survey should be used to determine these percentages.

G. COMMUNITY FACILITIES - MORALE, WELFARE AND RECREATIONAL - INTERIOR (EXCEPT EXCHANGE AND SIMILAR FACILITIES) (Category Code 740)

1. Space Criteria. Space criteria for morale, welfare and recreation facilities are tabulated in this section, except for exchange and similar facilities (See section F.).

a. Application of Space Criteria.

(1) Environmental Adjustment Factors. Because of the ever increasing need for prudent expenditure of appropriated, nonappropriated, and Operations and Maintenance (O&M) funds, environmental adjustment factors have been included with the space criteria for selected welfare and recreation facilities. These factors should be used in sizing the subject facilities when the availability of similar existing military and civilian community support-type facilities make such an adjustment possible.

(2) Conversion of Existing Facilities. Maximum practicable use should be made of existing facilities. A new facility should be provided only when no existing available facilities will satisfy the requirement. When an existing facility is converted to use as a welfare or recreation facility, the space criteria authorized here may be increased by not more than 20 percent when necessary to effect economical and efficient use of the existing facility.

(3) Computation of Gross Areas. The gross area of facilities should be computed according to the definition in subsection A.3., above. Unless otherwise noted, mechanical equipment room space as required should be added to the gross areas shown in this section when determining a single gross area figure for a project DD Form 1391, FY 19__ Military Construction Program.

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b. Approval of Facilities Not Listed. The space criteria shown below are considered ample under normal circumstances to provide the number and types of facilities and space required for adequate welfare and recreation activities at military installations.

2. Funding Policy. Funding for the establishment, construction, maintenance, and operation of certain welfare and recreation facilities shall be according to DoD Directive 1015.6 (reference (4n)).

3. Aero Club Facilities. An Armed Forces Aero Club is a recreational flying activity located on or near military installations, used by authorized personnel, and approved by the Military Department concerned. The Armed Forces Aero Club space criteria shown in table 4-36 are intended to provide hangar space to be used to maintain aircraft and for aircraft storage during inclement weather, and to provide multipurpose space for administration, classrooms, flight planning, operations, safety meetings, scheduling, and training. Space requirements are based on the number of aircraft operated by the club.

TABLE 4-36

SPACE CRITERIA FOR AERO CLUB FACILITIES

Number of Aircraft	Gross Area [1]			
	Hangar Space		Multipurpose Space	
	ft^2	$[m^2]$	ft^2	$[m^2]$
1	900	84	500	46
2 to 5	2,300	214	1,000	93
6 to 10	3,800	353	1,200	111
11 to 15	5,300	492	1,500	139
16 to 20	6,800	632	1,700	158
For each additional 5 aircraft, add	1,500	139	375	35

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

4. Arts and Crafts/Skill Development Centers. The space criteria shown in table 4-37 for arts and crafts/skill development centers are intended to provide facilities for the free time pursuit of ceramic and

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pottery work, drawing and painting, electronics, jewelry and metal work, leather work, model design and construction, photography, and woodworking.

TABLE 4-37

SPACE CRITERIA FOR ARTS AND CRAFTS/SKILL DEVELOPMENT CENTERS

Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 100	Note 3	Note 3
101 to 250	2,000	186
251 to 500	3,000	279
501 to 1,000	4,000	372
1,001 to 3,000	6,000	557
3,001 to 5,000	7,500	697
5,001 to 7,000	10,000	929
7,001 to 10,000	14,000	1,301
10,001 to 15,000	20,000	1,858
15,001 to 20,000	25,000	2,323
20,001 to 25,000	30,000	2,787
25,001 to 30,000	35,000	3,252
30,001 to 40,000	40,000	3,716
40,001 to 50,000	45,000	4,181
50,001 to 60,000	50,000	4,645
60,001 to 70,000	55,000	5,110
70,001 to 80,000	60,000	5,574
80,001 to 90,000	65,000	6,039
90,001 to 100,000	70,000	6,503

[1] Military population is defined as active duty military strength assigned to the military installation, plus 70 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area for each facility.

[3] This requirement should be accommodated in other facilities.

5. Automotive/Skill Development Centers. Automotive/skill development centers are intended to provide facilities for the self-help improvement, maintenance, modification, and repair of automobiles

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belonging to the military population. A small classroom may be added when desired. Space criteria are shown in table 4-38. In overseas locations more space may be appropriate.

TABLE 4-38

SPACE CRITERIA FOR AUTOMOTIVE/SKILL DEVELOPMENT CENTERS

Military Population [1]	Gross Area [2,3,4]	
	ft^2	[m^2]
Up to 25	None	None
26 to 50	1,000	93
51 to 100	1,500	139
101 to 250	2,250	209
251 to 500	3,000	279
501 to 1,000	4,200	390
1,001 to 3,000	6,000	557
3,001 to 5,000	9,000	836
5,001 to 7,000	12,000	1,115
7,001 to 10,000	15,000	1,394
10,001 to 15,000	18,000	1,672
15,001 to 20,000	21,000	1,951
20,001 to 30,000	24,000	2,230
30,001 to 40,000	30,000	2,787
40,001 to 50,000	36,000	3,344
50,001 to 60,000	42,000	3,902

[1] Military population is defined as active duty military strength assigned to the military installation, plus 10 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Gross areas are based on 500 ft^2 [46.5 m^2] per automobile for fully enclosed automotive/skill development centers.

[4] Outside automotive work stalls either covered, open, or shielded are not chargeable to the authorized space.

6. Bowling Centers. The gross area and number of lanes that may be provided for bowling centers may be estimated from table 4-39.

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However, local demand for bowling varies greatly; check the market before building a bowling center.

TABLE 4-39

SPACE CRITERIA FOR BOWLING CENTERS

Military Population [1,2]	Number of Lanes	Gross Area [3,4,5]	
		ft^2	$[m^2]$
All Locations			
Up to 250	2	2,700	251
251 to 1,000	4	4,500	418
1,001 to 1,800	6	6,600	613
1,801 to 2,500	8	8,500	790
2,501 to 3,200	10	10,750	999
3,201 to 3,800	12	12,800	1,189
CONUS			
3,801 to 4,900	14	14,600	1,356
4,901 to 6,300	16	16,500	1,533
6,301 to 7,700	18	18,400	1,709
7,701 to 9,800	24	24,700	2,295
9,801 to 12,600	30	31,000	2,880
Overseas			
3,801 to 4,900	16	16,500	1,533
4,901 to 6,300	20	20,500	1,904
6,301 to 7,700	24	24,700	2,295
7,701 to 9,800	32	32,800	3,047
9,801 to 12,600	40	40,700	3,781

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 40 percent of their dependents.

[2] For each increment increase of 700 military population above 12,600, two additional lanes totaling 1,900 ft^2 [177 m^2] gross area may be provided. Additional lanes should not be provided for any increase below

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TABLE 4-39 (continued)

a full increment and no additional lanes should be provided at military installations in the 48 contiguous states without a complete and full study of the needs and the economic factors involved.

[3] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[4] CONUS includes space for equipment and storage. For each increment of four lanes, an additional 300 ft^2 [27.9 m^2] gross area may be added for a game room for amusement games, billiards, and pool.

[5] Overseas includes space for equipment and storage. For each increment of four lanes, 500 ft^2 [46.5 m^2] gross area may be added for a game room for amusement games, billiards, and pool.

7. Child Development Centers. Child development centers may be established as required to provide child care for children ages four weeks to 12 years of age for full-day, part-day, and hourly care.

a. Minimum and Maximum Sizes. The minimum size of facility should accommodate no less than 25 children. The maximum size of facility should not exceed a capacity of 305 children. If the projected military installation requirement exceeds 305 children, then a sufficient number of sites should be selected so that no site supports more than 305 children.

b. Functional Areas. Space criteria should be provided for food service; infant, toddler, preschool age, school age activity rooms and spaces; isolation area; laundry; lobby and reception; offices; staff workroom; storage; and toilet facilities.

c. Experience Data. The capacity of the facility should be based on historical experience when applicable. When no previous experience data are available, the number of anticipated children should be determined by one of the following methods:

(1) The number of married military families receiving direct installation support, multiplied by 20 percent, plus the number of children of single parent military families receiving direct installation support; or

(2) A needs assessment that includes a survey of the military installation population and an examination of the installation demographics, to include historical data as well as waiting lists and the unmet demand; projected military installation population; changes in mission; and an extrapolation of eligible target users.

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d. Space Criteria. Space criteria for child development centers are shown in table 4-40.

TABLE 4-40

SPACE CRITERIA FOR CHILD DEVELOPMENT CENTERS		
Number of Children	Gross Area Per Child [1]	
	ft^2	[m^2]
25 to 60	90	8
61 to 100	80	7
101 to 305	75	7

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

e. Playgrounds. A minimum of 100 ft^2 [9.3 m^2] of outdoor play area should be provided per child using the playground during any period. This area should be capable of supporting a minimum of 50 percent of the children in a center with a capacity of 100 or more children, and all of the children in smaller centers.

8. Combined Facilities. In general, construction and maintenance costs should be lowered and convenience to the users enhanced in recreation facilities if the use of multipurpose recreation and fitness and athletic centers is encouraged. The following general guidance on types of combined facilities is furnished:

a. Multipurpose Recreation Building. A multipurpose recreation building provides space for recreational activities that are not authorized any space criteria at military installations with a military strength of 500 or less and when separate buildings are not authorized or economically advantageous to the government for construction, energy savings, operation, and user convenience.

(1) Morale, Welfare and Recreation (MWR) Activities. The building may include space for MWR activities such as clubs, drama and music center, library, physical fitness, recreation center, theater, youth center, and other activities depending on the military strength to

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be served. The facility should serve as a center for physical fitness, recreation, and social activities to enhance the life of the military installation.

(2) Space Criteria. The size of the building should be determined from a study of the actual needs of the military installation. In the absence of other data, table 4-41 should be used as a guide for small military installations.

TABLE 4-41

SPACE CRITERIA FOR MULTIPURPOSE RECREATION BUILDINGS

Military Strength [1]	Gross Area [2] ft^2	Gross Area [2] [m^2]
Up to 49	Note 3	Note 3
50 to 100	7,000	650
101 to 200	8,000	743
201 to 300	9,000	836
301 to 400	10,500	975
401 to 500	12,500	1,161

[1] Military strength is defined as active duty military personnel assigned to the military installation.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Provide in other facilities. If new construction is required, the gross area should not exceed 100 ft^2 [9.3 m^2] per the military strength.

b. Community Activity Centers. Community Activity Centers (CAC) are multipurpose recreation facilities for military installations with a military strength of 501 or more. The concept of a CAC is the same as a multipurpose recreation building in that there are economic savings in construction, energy, and operating costs through the joint use of space when several MWR activities are collocated in the same facility. Another benefit is user convenience and the synergistic effect of many varied activities being conducted in the same place. There is no specific combination of MWR activities prescribed for a CAC. The types of activities should be based on the needs of the military installation,

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condition of existing facilities, and the master plan. There are no specific space criteria for CAC facilities. Space criteria should conform to the authorizations for each MWR facility type and category code at a military installation to be included in a CAC.

c. Physical Fitness and Athletic Complex. These complexes are a combination of physical fitness and athletic facilities at large military installations.

(1) Types of Activities. These types of facilities combine together such activities as administrative support areas, exercise and weight conditioning rooms, gymnasium, indoor sports courts, locker and toilet facilities, storage space, and swimming pool. Bowling, jogging tracks, and skating rinks (ice and roller) may be added to the complexes at large military installations. These types of activities combined with outdoor courts and fields, stadium, or swimming pool should create an athletic complex. These types of facilities should be the location for intra and inter mural competitions, tournaments, and other spectator events. Therefore, appropriate seating and support functions should be provided.

(2) Space Criteria. Space criteria shall conform to the authorizations for each MWR facility type and category code at a military installation to be included in a physical fitness and athletic complex.

9. Drama Centers and Music Centers. The space criteria shown in table 4-42 for drama centers and music centers are intended to provide facilities for the preparation and performance of theatrical and musical programs, shows, and activities that are produced and performed as part of the military installation drama and music programs. Only one drama center and one music center should be constructed at a military installation, and only when there is no existing facility that can be used for these purposes on a joint use basis. When both are built, they shall be combined into a single performing arts center. Programing of these facilities should be accompanied by a complete justification that stipulates why existing facilities cannot be used on a joint use basis.

a. Drama Centers. These facilities should include auditoriums with seating, director's office, equipment checkout, practice and rehearsal rooms, projection booths for multimedia use, property storage, recording rooms, sound and lighting booths, stages, and technical scene and costume shops.

b. Music Centers. These facilities should include auditoriums with seating and stage, costume storage, director's office, group and individual practice rooms, instrument repair shop, listening areas, music education room, musical instrument and equipment checkout rooms, recording area, and audiovisual rooms.

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TABLE 4-42

SPACE CRITERIA FOR DRAMA CENTERS AND MUSIC CENTERS				
Military Population [1]	Gross Area [2]			
	Drama Center		Music Center	
	ft²	[m²]	ft²	[m²]
Up to 500 501 to 5,000	Combine With Recreational Center Provided By Unit Entertainment Centers			
5,001 to 15,000 15,001 and over	14,000 20,000	1,301 1,858	14,000 20,000	1,301 1,858

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

10. Golf Facilities. At military installations where the necessary land is available for the purpose and when there are no foreseeable operational requirements for the land, golf facilities may be provided as shown in table 4-43. Each military installation is authorized a driving range in addition to the golf facilities shown in table 4-43.

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TABLE 4-43

SPACE CRITERIA FOR GOLF FACILITIES					
Military Population [1]	Golf Course [2] No. of Holes	Golf Club House [3,4,5]		Equipment Building [3,4]	
		ft^2	[m^2]	ft^2	[m^2]
Up to 2,000	None	None	None	None	None
2,001 to 4,000	9	6,500	604	1,500	139
4,001 to 8,000	18	8,000	743	2,000	186
8,001 to 12,000	27	9,000	836	2,500	232
12,001 and over	36	10,000	929	3,000	279

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 35 percent of their dependents, plus 25 percent of retired personnel served by the military installation.

[2] A pitch-and-putt course should be considered as the equivalent of a golf course of the same number of holes.

[3] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[4] Separate facilities may be provided for each separate golf course. However, the total combined space shall not exceed these allowances.

[5] Additional area as required may be provided in golf club houses for the storage of carts.

11. Gun, Skeet, and Trap Facilities. Space may be provided in one facility or divided between facilities. This facility includes gun and ammunition maintenance, lounge, operator's office, projector area, sales and storage areas, and toilet facilities. Space criteria are shown in table 4-44.

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TABLE 4-44

SPACE CRITERIA FOR GUN, SKEET, AND TRAP FACILITIES			
Military Population [1]	Land Area [2]		Gross Area of Facility [3]
	Skeet Range	Trap Range	
Up to 100	None	None	None
101 to 10,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 1,800 ft [335 m x 548 m]	3,950 ft^2 [367 m^2]
10,001 to 15,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 1,890 ft [335 m x 576 m]	4,300 ft^2 [399 m^2]
15,001 to 20,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 1,980 ft [335 m x 604 m]	4,550 ft^2 [423 m^2]
20,001 to 25,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 2,070 ft [335 m x 631 m]	4,800 ft^2 [446 m^2]
25,001 to 30,000	1,100 ft x 2,400 ft [335 m x 732 m]	1,100 ft x 2,160 ft [335 m x 658 m]	5,100 ft^2 [474 m^2]
30,001 to 40,000	1,100 ft x 2,550 ft [335 m x 777 m]	1,100 ft x 2,250 ft [335 m x 686 m]	5,300 ft^2 [492 m^2]
40,001 and over	1,100 ft x 2,700 ft [335 m x 823 m]	1,100 ft x 2,340 ft [335 m x 713 m]	5,500 ft^2 [511 m^2]

[1] Military population is defined as active duty military strength assigned to the military installation, plus 10 percent of their dependents, plus 15 percent of retired military supported by the installation.

[2] Land area recommendations were made by the National Shooting Sports Foundation and National Rifle Association.

[3] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

12. Physical Fitness Centers (Gymnasiums). Space criteria for physical fitness centers may be estimated from table 4-45. However, demand for use of gymnasiums may vary greatly according to climate and to

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the availability of other places to exercise nearby. Such facilities generally include gear issue control, gymnasium, locker rooms, office, exercise room(s), spectator area, storage, and toilet facilities. This type of facility is intended to be capable of supporting basic physical fitness skill training requirements.

TABLE 4-45

SPACE CRITERIA FOR PHYSICAL FITNESS CENTERS (GYMNASIUMS)

Military Population [1]	No. of Gyms	Gross Area for Each [2]	
		ft^2	[m^2]
Up to 250	Note 3	None	None
251 to 1,000	1	15,000	1,394
1,001 to 3,000	1	21,000	1,951
3,001 to 6,000	2	21,000	1,951
6,001 to 10,000	3	21,000	1,951
10,001 to 15,000 [4]	4	21,000	1,951

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] None authorized, physical activities should be combined with a multipurpose recreation building.

[4] For each active duty military strength increment of 3,300 personnel above 15,000, an additional gymnasium of 21,000 ft^2 [1,951 m^2] gross area may be provided.

13. Indoor Courts. Combined criteria for indoor handball, racquetball, and squash courts are shown in table 4-46.

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TABLE 4-46

CRITERIA FOR INDOOR COURTS	
Active Duty Military Strength [1]	Total Number of Courts [2,3]
Up to 100	1
101 to 250	2
251 to 1,000	4
1,001 to 2,000	6
2,001 to 3,500	8
3,501 to 5,500	10
5,501 to 7,500	12
7,501 to 10,000	14
For each additional 3,000, add	2

[1] Military strength is defined as active duty military personnel assigned to the military installation.

[2] Each court facility should not exceed 1,200 ft^2 [111.5 m^2] gross area, and, when possible, have common walls. These courts are in addition to the space authorized when combined with a gymnasium and physical fitness center. Any combination of indoor courts is allowed. However, the combined total for the military installation should not exceed the number of courts authorized in table 4-46.

[3] When there are separate indoor court buildings of four or more courts, an additional 1,500 ft^2 [139.4 m^2] gross area is authorized for administrative, exercise space, lockers, storage, toilet facilities, and viewing area functions. For each additional increment of two courts, an additional 250 ft^2 [23.2 m^2] gross area is authorized.

14. Libraries.

a. Main Libraries. Space criteria for main libraries are shown in table 4-47. Space criteria may be increased by 10 percent when the facility is designated as a command reference center. Space criteria include provisions for a military installation library service center for centralized processing of library materials. If one or more bookmobiles are operated from the main library, a minimum of 300 ft^2 [27.9 m^2] gross area per bookmobile should be required in addition for sorting the bookmobile collections, book trucks, and work space for the bookmobile staff.

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TABLE 4-47

SPACE CRITERIA FOR MAIN LIBRARIES		
Military Population [1]	Gross Area [2]	
	ft^2	[m^2]
Up to 500 [3]	2,500	232
501 to 1,500	4,500	418
1,501 to 2,500	6,250	581
2,501 to 4,000	8,000	743
4,001 to 6,000	10,500	975
6,001 to 8,000	12,000	1,115
8,001 to 12,000	18,000	1,672
12,001 to 16,000	20,000	1,858
16,001 to 20,000	24,000	2,230
20,001 to 26,000	30,000	2,787
26,001 to 32,000	36,000	3,344
32,001 to 40,000	44,000	4,088
40,001 to 50,000	54,000	5,017
50,001 to 60,000	64,000	5,946
60,001 to 70,000	72,800	6,763
70,001 to 80,000	81,000	7,525
80,001 to 90,000	90,000	8,361
90,001 to 100,000	98,000	9,104

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 40 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Accommodate in other facilities.

b. Branch Libraries. When justified by the requirements of a particular military installation, branch libraries, not exceeding 4,000 ft^2 [371.6 m^2] in gross area, may be provided in support of an education center or for each increment of 3,000 military strength over 10,000. When military concentrations permit consolidation, the gross area authorized for each increment of 3,000 military strength over 10,000 may be combined into one branch library. The space allocation for branch libraries are in addition to the space criteria for main libraries.

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c. Library Service Centers. When justified by the requirements of a particular area or command, a library service center may be authorized. This is a specialized activity and the functions vary from one center to another. Basically, a library service center is a place where library materials are received, cataloged, processed, recorded, distributed, and redistributed to library outlets and also held in reserve for use as needed. The building size should be determined by the maximum quantity of library materials to be on hand at any one time (that is, the total number of books or other items held in reserve, plus the number of items on hand to be processed for distribution). Space criteria for library service centers are shown in table 4-48.

TABLE 4-48

SPACE CRITERIA FOR LIBRARY SERVICE CENTERS

Library Materials to be Housed by Volumes	Gross Area [1]	
	ft^2	$[m^2]$
Up to 40,000	6,000	557
40,001 to 60,000	10,000	929
60,001 to 80,000	13,000	1,208
80,001 to 100,000	16,000	1,486
100,001 to 120,000	19,000	1,765
120,001 to 140,000	22,000	2,044
140,001 to 160,000	24,000	2,230
160,001 to 180,000	26,000	2,415
180,001 to 200,000	28,000	2,601

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

15. Marina Support Centers. This facility provides space for an office, and equipment checkout, repair and storage. It does not include docks, marina slips, and walkways that are subject to a special requirements study. This is a special facility, required only at outdoor recreational areas, that have waterfront facilities available for boating activities. Space criteria are shown in table 4-49.

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TABLE 4-49

SPACE CRITERIA FOR MARINA SUPPORT CENTERS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 100	None	None
101 to 1,000	3,500	325
1,001 to 3,000	5,800	539
3,001 to 5,000	8,450	785
5,001 to 7,000	10,500	975
7,001 to 10,000	12,650	1,175
10,001 to 15,000	15,600	1,449
15,001 to 20,000	18,700	1,737
20,001 to 25,000	20,800	1,932
25,001 to 30,000	22,000	2,044
30,001 to 40,000	23,600	2,192
40,001 to 50,000	25,400	2,360
50,001 to 60,000	27,000	2,508
60,001 to 70,000	28,300	2,629
70,001 to 80,000	29,500	2,741
80,001 to 90,000	30,600	2,843
90,001 to 100,000	31,600	2,936

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 15 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

16. Mess/Club for Enlisted Personnel. Space criteria for lower grade enlisted personnel messes/clubs are shown in table 4-50, but local demand may vary.

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TABLE 4-50

SPACE CRITERIA FOR MESS/CLUB FOR LOWER GRADE ENLISTED PERSONNEL		
Military Population [1] E1 through E3	Gross Area [2]	
	ft^2	[m^2]
Up to 500	Note 3	Note 3
501 to 1,000	10,000	929
1,001 to 3,000	19,000	1,765
3,001 to 5,000	30,000	2,787
5,001 to 7,000	40,000	3,716
7,001 to 10,000	50,000	4,645
10,001 to 15,000	60,000	5,574
15,001 to 20,000	70,000	6,503
20,001 to 25,000	80,000	7,432
25,001 to 30,000	90,000	8,361
30,001 to 40,000	110,000	10,219
40,001 to 50,000	130,000	12,077
50,001 to 60,000	150,000	13,935

[1] Military population is defined as active duty enlisted personnel assigned to the military installation, grades E1 through E3, plus 50 percent of their spouses. An enlisted personnel mess/club operating an annex or branch to accommodate noncommissioned officers (grades above E3 or E4) may use the combined space allowances for the noncommissioned officers' mess/club and enlisted personnel mess/club to determine the total allowance.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Space requirements will be accommodated in other facilities at 30 ft^2 [2.8 m^2] gross area per member.

17. Mess/Club For Noncommissioned Officers. Space criteria for noncommissioned officers' messes/clubs are shown in table 4-51, but local demand may vary.

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TABLE 4-51

SPACE CRITERIA FOR NONCOMMISSIONED OFFICERS' MESS/CLUB		
Military Population [1]	Gross Area [2,3] ft²	Gross Area [2,3] [m²]
Up to 50	Note 4	Note 4
51 to 150	4,400	409
151 to 250	6,500	604
251 to 400	8,000	743
401 to 750	14,000	1,301
751 to 1,250	16,800	1,561
1,251 to 2,000	22,000	2,044
2,001 to 3,000	27,800	2,583
3,001 to 4,000	36,000	3,344
4,001 to 5,000	42,000	3,902
5,001 to 6,000	49,000	4,552
6,001 to 8,000	59,200	5,500
8,001 to 10,000	68,000	6,317
10,001 to 12,000	78,100	7,255
12,001 to 14,000	87,800	8,157
14,001 to 16,000	98,800	9,179
16,001 to 18,000	105,400	9,792
18,001 to 20,000	113,100	10,507
20,001 to 22,000	120,800	11,222
22,001 to 24,000	128,800	11,966
24,001 to 26,000	136,300	12,662
26,001 to 28,000	141,800	13,173
28,001 to 30,000	149,000	13,842

[1] Military population is defined as active duty noncommissioned officers in the top six grades assigned to the military installation, plus 50 percent of their spouses, plus 50 percent of the retirees supported by the military installation. A noncommissioned officers' mess/club operating an annex or branch to accommodate lower grade enlisted personnel (grades E1 to E3) or as a combined mess/club for all enlisted grades (which is recommended) may use the combined space allowances for the noncommissioned officers' mess/club and the enlisted personnel mess/club to determine space allowances. Space criteria may be divided to provide separate facilities for grades E7 through E9, if required.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

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TABLE 4-51 (continued)

[3] The space criteria should be reduced by the following factors depending on the distances to major metropolitan areas:

Distance to a metropolitan center with a population of 100,000 or more	Percent Reduction
More than 30 miles [48 km]	0
Less than 30 miles [48 km], but more than 15 miles [24 km]	5
Less than 15 miles [24 km]	10

[4] Provide in other facilities at 44 ft^2 [4.1 m^2] gross area per member.

18. Mess/Club for Officers. Space criteria for officers' messes/clubs are shown in table 4-52, but local demand may vary.

TABLE 4-52

SPACE CRITERIA FOR OFFICERS' MESS/CLUB		
Military Population [1]	Gross Area [2,3]	
	ft^2	[m^2]
Up to 50	Note 4	Note 4
51 to 150	4,400	409
151 to 250	8,000	743
251 to 400	12,000	1,115
401 to 750	16,000	1,486
751 to 1,000	22,000	2,044
1,001 to 2,000	27,800	2,583
2,001 to 3,000	36,000	3,344
3,001 to 4,000	42,500	3,948
4,001 to 5,000	48,500	4,506
5,001 to 6,000	53,900	5,007
6,001 to 7,000	59,500	5,528
7,001 to 8,000	64,000	5,946
8,001 to 9,000	68,000	6,317
9,001 to 10,000	72,700	6,754

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TABLE 4-52 (continued)

[1] Military population is defined as active duty officers assigned to the military installation, plus 50 percent of their spouses, plus 50 percent of the retired officers supported by the military installation.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] The space criteria shall be reduced by the following factors depending on the distances to major metropolitan areas:

Distance to a metropolitan center with a population of 100,000 or more	Percent Reduction
More than 30 miles [48 km]	0
Less than 30 miles [48 km], but not more than 15 miles [24 km]	5
Less than 15 miles [24 km]	10

[4] Provide in other facilities at 44 ft^2 [4.1 m^2] gross area per member.

19. MWR/Recreation Supply/Support Facilities. Space criteria for MWR, recreation supply and support facilities include administrative, check-out, equipment storage, and recreational support facilities are shown in table 4-53.

TABLE 4-53

SPACE CRITERIA FOR MWR/RECREATION SUPPLY/SUPPORT FACILITIES				
Military Population [1]	Gross Area [2]			
	Supply Facilities		Administrative	
	ft^2	[m^2]	ft^2	[m^2]
Up to 1,000	3,500	325	Not less than 80 ft^2 [7.4 m^2] and not more than	
1,001 to 2,000	5,000	465		
2,001 to 4,000	7,500	697		
4,001 to 8,000	10,000	929		

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TABLE 4-53 (continued)

SPACE CRITERIA FOR MWR/RECREATION SUPPLY/SUPPORT FACILITIES				
Military Population [1]	Gross Area [2]			
	Supply Facilities		Administrative	
	ft^2	$[m^2]$	ft^2	$[m^2]$
8,001 to 12,000	12,500	1,161	90 ft^2 [8.4 m^2] of net space per office employee.	
12,001 to 20,000	16,000	1,486		
20,001 to 50,000	20,500	1,904		
50,001 to 100,000	30,000	2,787		

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

20. Outdoor Recreation Operations Activity Center. This type of facility includes administrative space, display area, storage, classrooms, demonstration areas, and meeting rooms for use in conducting instructions for beginners and more advanced participants in outdoor recreation activities such as archery, camping, kayaking, nature interpretation, and rapelling; and subject areas such as firearms safety, lifesaving, and wilderness survival. Space criteria for outdoor recreation operations activity centers are shown in table 4-54.

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TABLE 4-54

SPACE CRITERIA FOR OUTDOOR RECREATION OPERATIONS ACTIVITY CENTERS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 100	300	28
101 to 500	600	56
501 to 1,000	1,250	116
1,001 to 5,000	2,500	232
5,001 to 10,000	5,000	465
10,001 to 30,000	10,000	929
30,001 to 60,000	15,000	1,394
60,001 to 100,000	20,000	1,858

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

21. Outdoor Recreation Pavilions. The purpose of this facility is to support recreational areas such as beaches, parks, picnic areas, and playgrounds. This facility may include a concession stand, lounge, snack bars, storage areas, and toilet facilities, or all of those facilities for limited and related items as required. Space criteria may be used in varying numbers and sizes of pavilions. Space criteria are shown in table 4-55.

TABLE 4-55

SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS		
Military Population [1]	Gross Area [2]	
	ft^2	$[m^2]$
Up to 1,000	800	74
1,001 to 3,000	1,350	125

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TABLE 4-55 (continued)

SPACE CRITERIA FOR OUTDOOR RECREATION PAVILIONS		
Military Population [1]	Gross Area [2]	
	ft^2	[m^2]
3,001 to 7,000	2,600	242
7,001 to 10,000	3,200	297
10,001 to 15,000	4,000	372
15,001 to 20,000	4,900	455
20,001 to 25,000	5,600	520
25,001 to 30,000	6,300	585
30,001 to 40,000	7,300	678
40,001 to 50,000	8,500	790
50,001 to 60,000	9,600	892
60,001 to 70,000	10,600	985
70,001 to 80,000	11,500	1,068
80,001 to 90,000	12,400	1,152
90,001 to 100,000	13,300	1,236

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 50 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

22. Package Beverage Stores/Class VI. This type of facility provides for retail sales to authorized customers and the transfer (wholesale) of alcoholic beverages to clubs and open messes. Space criteria for these facilities are shown in table 4-56.

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TABLE 4-56

SPACE CRITERIA FOR PACKAGE BEVERAGE STORES/CLASS VI			
CONUS/Anmual Cases Sales [1]	Overseas/Authorized Customers [2]	Gross Area [3]	
		ft^2	$[m^2]$
2,000	500	900	84
5,000	1,000	1,950	181
10,000	1,500	2,950	274
15,000	2,000	3,900	362
20,000	3,000	5,900	548
30,000	4,000	7,800	725
40,000	6,000	10,000	929

[1] Includes Alaska and Hawaii. Anmual total case sales both retail and transferred to clubs and open messes.

[2] Authorized customers should be as defined by Military Department regulations.

[3] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

23. Recreation Centers. This type of facility serves as a center for recreation to enhance the life of the military community through leisure time activities: competitive, cultural, educational, and social. Programs will be provided to serve individuals, families, groups, units, and community-wide interests. At some military installations, other recreation programs such as arts and crafts, libraries, or music and theater, may be collocated because of economies of construction and convenience of the users. In such cases, space allocated to these other programs must conform to the total military installation authorization for each type of facility included. Space criteria for recreation centers are shown in table 4-57.

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TABLE 4-57

SPACE CRITERIA FOR RECREATION CENTERS		
Military Population [1]	Gross Area [2,3]	
	ft²	[m²]
Up to 250	Note 4	Note 4
251 to 500 [5]	4,000	372
501 to 2,000	12,700	1,180
2,001 to 4,000	19,800	1,839
4,001 to 5,000	27,800	2,583
5,001 to 10,000	55,600	5,165
10,001 to 15,000	83,400	7,748
For each additional 5,000	27,800	2,583

[1] Military population is defined as active duty personnel assigned to the military installation, plus 10 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[3] Gross areas may be provided in more than one facility provided the total maximum authorized area is not exceeded.

[4] Accommodate in other facilities.

[5] Gross area should be combined with other recreation facilities when possible.

24. Recreation Lodging. This type of facility provides space for private, semiprivate, or dormitory-type, or all three types of sleeping quarters plus bathrooms, dining and kitchen facilities, lounge, and storage areas. Space allowances may be used in varying numbers and sizes of buildings such as cabins, cottages, and dormitories to support outdoor activities and recreation areas. The number of authorized users should be determined for individual military installations based on a survey and analysis that will establish the average number of users requiring lodging in the recreation area during an average week of the season. The determination of the number of users should take into account the limitations on the occupancy of the recreation area resulting from its physical and recreation characteristics. The total gross area of lodging facilities for each military installation recreation area should not

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exceed that derived by multiplying the projected user requirement by the area criteria for each person corresponding to that provided in UEPH for enlisted personnel in the grades E2 through E4.

25. Restaurants, Installation (Post). When a substantial number of civilians are regularly employed at a military installation and it has been determined that adequate food service facilities are not available for them, a military installation restaurant may be established. Normally, installation restaurants should not be established when the number of civilians to be served is less than 500. However, consideration should be given to providing snack bar or vending machine service, or both. When it becomes necessary to provide food service for more than 5,000 civilian employees, two or more restaurants may be provided as determined by an economic study to ensure financial stability. Space criteria for installation restaurants are shown in table 4-58.

TABLE 4-58

SPACE CRITERIA FOR INSTALLATION RESTAURANTS

Number of Civilian Employees	Gross Area [1]	
	ft^2	(m^2)
Up to 500	None	None
501 to 700	4,900	455
701 to 1,000	8,700	808
1,001 to 1,500	12,500	1,161
1,501 to 2,000	15,700	1,459
2,001 to 2,500	19,200	1,784
2,501 to 3,000	22,800	2,118
3,001 to 3,500	27,000	2,508
3,501 to 4,000	30,500	2,833
4,001 to 4,500	33,900	3,149
4,501 and over	37,000	3,437

[1] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

26. Riding Stables. These types of facilities provide space for administration offices, box or double stalls, grain room, hay storage area, quarantine areas, quarters for one operator, single stalls, sweat pad and blanket drying area, tack lockers, tack room, toilet facilities, and treatment stalls. Local demand varies; estimates may be made from table 4-59.

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TABLE 4-59

SPACE CRITERIA FOR RIDING STABLES			
Military Population [1]	Number of Stalls	Gross Area [2]	
		ft^2	[m^2]
Up to 100	None	None	None
101 to 1,000	5	2,100	195
1,001 to 3,000	7	2,500	232
3,001 to 5,000	12	3,600	334
5,001 to 7,000	16	4,700	337
7,001 to 10,000	21	5,900	548
10,001 to 15,000	29	7,700	715
15,001 to 20,000	37	9,600	892
20,001 to 25,000	43	11,250	1,045
25,001 to 30,000	50	12,800	1,189
30,001 to 40,000	60	17,800	1,654
40,001 to 50,000	72	18,600	1,728
50,001 to 60,000	85	20,400	1,895
60,001 to 70,000	91	22,800	2,118
70,001 to 80,000	105	24,900	2,313
80,001 to 90,000	110	27,000	2,508
90,001 to 100,000	124	29,000	2,694

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 25 percent of their dependents.

[2] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

27. Skating Rinks. This type of facility serves as an ice and roller skating rink requiring a hard surface floor with a potential for multipurpose use. The facility may include administrative offices, equipment storage area, locker rooms, maintenance area, snack bar with kitchen area, and spectator areas. The minimum rink size should be 10,000 ft^2 [929 m^2] gross area with additional space as required for support functions and any increases based on the military population as shown in table 4-60.

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TABLE 4-60

SPACE CRITERIA FOR SKATING RINKS		
	Gross Area [3]	
Military Population [1,2]	ft^2	[m^2]
Up to 2,000	10,000 [4]	929 [4]
2,001 to 20,000	15,000 [5]	1,394 [5]
20,001 and over	20,000 [5]	1,858 [5]

[1] Military population is defined as active duty military strength assigned to the military installation, plus 50 percent of their dependents.

[2] One skating rink per military installation is generally sufficient.

[3] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[4] Additional space as required shall be provided for support functions.

[5] These gross areas include space for support functions.

28. Swimming Facilities (Indoor Pool and Outdoor Pool/Beaches).

a. Indoor Swimming Pool. One installation swimming pool may be enclosed to allow for year around use. The building should not exceed 14,200 ft^2 [1,319 m^2] gross area for a 25-meter swimming pool with locker rooms and should not exceed 22,800 ft^2 [2,118 m^2] gross area for a 50-meter swimming pool exclusive of the locker rooms.

b. Bathhouse. A bathhouse should include a check-in area, equipment storage area, lifeguard room, office, showers, toilet facilities and dressing room areas, including wall lockers for both male and female swimmers. One bathhouse not to exceed 4,000 ft^2 [371.6 m^2] gross area may be provided for each military installation with a beach. One bathhouse of 4,000 ft^2 [371.6 m^2] gross area may be provided with each 25-meter outdoor swimming pool. One bathhouse of 6,500 ft^2 [603.9 m^2] gross area may be provided with each 50-meter outdoor swimming pool. A bathhouse is normally required only at outdoor recreation areas that have an outdoor swimming pool or beach facilities.

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c. Diving Areas and Boards. Diving area allocations are additive to the water surface areas shown in table 4-61. Diving areas of swimming pools may be equipped with from one to three diving boards.

d. Swimming Lanes. The specified swimming pool dimensions in table 4-61 permit the development of either six- or eight-lane facilities.

e. Safety Deck. Minimum safe deck widths of 12 ft [3.7 m] indoors and 15 ft [4.6 m] outdoors with a 15 ft [4.6 m] indoor and 20 ft [6.1 m] outdoor clearance at the diving board end of the swimming pool should be incorporated within the criteria for the overall sizing of swimming pool facilities.

f. Other Criteria. Wading and splash pools may be added to each outdoor swimming pool and are additives to the basic swimming pool areas shown in table 4-61.

g. Criteria. The number of authorized standard size swimming pools with bathhouses normally provided is shown in table 4-61.

TABLE 4-61

CRITERIA FOR INSTALLATION INDOOR AND OUTDOOR SWIMMING POOLS

Military Population [1]	Number of Pools	
	25-Meter [20.7 m x 25 m] 68 ft x 82 ft 2 in	50-Meter [20.7 m x 50 m] 68 ft x 164 ft
Up to 250	Note 2	Note 2
251 to 3,000	1	None
3,001 to 6,000	1	1 [3]
6,001 to 10,000 [4]	2	1

[1] Military population is defined as active duty military personnel assigned to the military installation, plus 70 percent of their dependents.

[2] One swimming pool not to exceed 1,250 ft^2 [116.1 m^2] of water surface area and an 800 ft^2 [74.3 m^2] gross area bathhouse may be provided as required.

[3] Outdoor swimming pool only.

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TABLE 5-69 (continued)

[4] One 25-meter outdoor swimming pool with a 4,000 ft^2 [371.6 m^2] gross area bathouse may be provided for each increment of 5,000 military population over 10,000. In lieu of a 25-meter outdoor swimming pool, one 50-meter outdoor swimming pool with a 6,500 ft^2 [603.9 m^2] gross area bathhouse may be provided for each increment of 10,000 military population over 10,000. For military installations exceeding 20,000 military population, a second indoor swimming pool is with bathhouse may be provided.

29. Temporary Lodging Facilities (TLF) and Guest Houses. Temporary lodging facilities include living units constructed to provide short-term housing accommodations as stipulated in DoD Directive 4165.55 (reference (4o)). When such facilities are authorized for new construction, the facilities should be hotel- or motel-type units with bathrooms, with or without kitchenettes, as required.

a. Living Area. Living units with kitchenettes should contain no more than 450 ft^2 [41.8 m^2] of gross living area per unit including the bathroom, and those living units without kitchenettes should contain no more than 425 ft^2 [39.5 m^2] of gross living area per unit including the bathroom.

b. Supporting Space. In addition to the maximum gross area stipulated per living unit, appropriate supporting space should be provided for administration offices, circulation space, lounges, mechanical and facility service requirements, and recreational areas. The space required for the support functions will vary depending on the number of living units, building configuration, and the availability of nearby facilities to support the required functions.

c. Exception. These criteria should not apply to government-owned or leased-commercial facilities constructed before this handbook was issued.

30. Unit Entertainment Centers. The space criteria for unit entertainment centers are intended to provide facilities for the organization, preparation, and performance of unit entertainment activities and should include an auditorium with seating and a stage, equipment checkout and repair, office, practice rooms, and technical shops. The provision of facilities should be based on the number and disposition of military units on the particular military installation. Normally, one 9,000 ft^2 [836.1 m^2] gross area center plus mechanical equipment room space should be provided for each UEPH complex of 3,000 military personnel, or one 3,500 ft^2 [325.2 m^2] gross area center plus mechanical equipment room space for a complex of 850 personnel, except that this facility may be provided only when it has been conclusively demonstrated that no facility exists that can meet the requirement on a joint use basis.

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31. Youth Centers. Youth centers may be established as required to accommodate the cultural, physical, and social activities of youths six to 19 years old. The space criteria shown in table 4-62 are intended to provide facilities for classes, dancing, listening to music, meetings, movies, parties, sports, watching television, and other related cultural and self-development youth activities.

TABLE 4-62

SPACE CRITERIA FOR YOUTH CENTERS [1]

Youth Population [2]	Gross Area [3] ft^2	Gross Area [3] $[m^2]$
Up to 250	Note 4	Note 4
251 to 600	6,700	622
601 to 1,200	9,000	836
1,201 to 2,400	11,340	1,053
2,401 to 4,800	18,500	1,719
For each additional 600, add	2,310	215

[1] Environmental Adjustment Factor. This table provides maximum criteria when no such facilities are available in the local community. Facilities in the local community should be considered in justifications for youth centers.

[2] Youth population should be established by determining the school enrollment of the active duty military personnel assigned to the military installation and the authorized civilian employee dependent youths ages six to 19 in the local school districts, on or off the military installation.

[3] Mechanical equipment room space as required should be added to the gross areas shown when determining a single gross area figure for each facility.

[4] Accommodate in other facilities.

H. COMMUNITY FACILITIES - MORALE, WELFARE AND RECREATIONAL - EXTERIOR (Category Code 750)

1. Criteria. Criteria for exterior morale, welfare and recreational facilities are provided in this section.

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2. Family Camps (FAMCAMPS)/Travel Camps/Recreation Campgrounds. These types of facilities are family campsites located on government-owned land and used by authorized personnel for brief camping tours. FAMCAMPS may be established when there is a justifiable demand for the accommodations. Factors to consider in determining a requirement are land availability, average daily transient population, recreational resources and attractions within the surrounding geographical area, and access to an interstate highway system.

3. Off-Installation Recreation Areas. When government land is available, consideration may be given to the development of recreational areas off the military installation subject to a special study and the approval of the head of the military component involved. When such recreation areas are developed, they should be available on a first-come-first-serve basis to members of all military departments.

4. Parks, Trails, and Athletic Facilities. On military installations where the land area is available, the development of parks should be considered. Parks may range from small play areas to large military installation parks and should be the subject of special studies. Consideration may be given to developing trails for archery, bicycles or off road vehicles, fitness, hiking, horseback riding, jogging, nature study, or other use, either with or separate from other outdoor athletic facilities.

5. Outdoor Athletic Facilities. Although local needs vary greatly, for a military population (active duty military personnel assigned to the military installation, plus 35 percent of their dependents) up to 500, one tennis court should be sufficient. One additional tennis court should be provided for each 500 military population up to 5000 population. For each additional 1,000 military population above 5,000, one additional tennis court should be considered. Other facilities should be considered as follows.

a. Running Track and Baseball Field. One 400-meter (1,312 ft) running track and one regulation baseball field may be provided at military installations with a military strength of 1,000 and over.

b. Athletic Facilities. For active duty military strength assigned to the military installation up to 750, and for each increment of 1,000 thereafter, the following facilities may be provided:

1 Badminton Court
2 Basketball Courts
1 Combination Football and Soccer Field
1 Handball and Racquetball Court
2 Regulation Softball Fields
2 Volleyball Courts

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c. Baseball Field and Soccer Field. For a dependent population, ages six to 19, up to 500 and for each increment of 500 thereafter up to 2,500, one youth baseball field and one youth soccer field may be provided. An additional youth baseball and soccer field may be provided for each additional increment of 750 dependent population ages six to 19.

6. Stadiums. At military installations with a military strength over 10,000, a stadium with a seating capacity not to exceed one-third of the installation military strength may be provided for a combination football and soccer field (see paragraph H.5.b., above). In addition, bleachers with a seating capacity not to exceed one-third of the installation military strength may be provided for a separate regulation baseball field (see paragraph H.5.a.). Both the stadium and baseball field may be provided with night lighting.

REFERENCES

(4a) DoD Instruction 4165.3, "Department of Defense Facility Classes and Construction Categories," October 24, 1978
(4b) Public Law 95-82, Section 607, "Military Construction Authorization Act of 1978"
(4c) DoD Instruction 5305.3, "Department of Defense Space Occupancy Guide for the National Capitol Region," May 23, 1966
(4d) ASD(MR&L) Memorandum, "Design of Unaccompanied Enlisted Personnel Housing," April 1, 1983
(4e) DoD Directive 1338.10, "Department of Defense Food Service Program," June 12, 1979
(4f) DoD Instruction 4100.33, "Operation of Commercial and Industrial-Type Activities," September 9, 1985
(4g) DoD Instruction 6015.18, "Smoking in DoD Occupied Buildings and Facilities," August 18, 1977
(4h) DoD Directive 1000.11, "Banking Offices on DoD Installations," September 27, 1982
(4i) DoD Directive 1000.12, "Procedures Governing Banking Offices on DoD Installations," September 27, 1982
(4j) DoD Directive 4165.6, "Real Property Acquisition, Management and Disposal," December 22, 1976
Costs," September 1, 1966
(4k) DoD Directive 1000.10, "Credit Unions Serving DoD Personnel," December 23, 1981
(4l) DoD Directive 1330.9, "Armed Services Exchange Regulations," May 12, 1982
(4m) DoD Instruction 4165.14, "Inventory of Military Real Property," December 21, 1966
(4n) DoD Directive 1015.6, "Funding of Morale, Welfare and Recreation (MWR) Programs", August 3, 1984
(4o) DoD Directive 4165.55, "Temporary Lodging Facilities (TLFs)," December 1, 1972

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CHAPTER 5

ARCHITECTURAL CRITERIA

A. GENERAL DESIGN PROVISIONS

1. Design Excellence. Achievement of excellence in architectural design should be a prime goal for all military construction projects. Reaching this goal requires a commitment by administrators and designers to architectural quality, which includes the relationship of architecture to the surrounding community, as well as the details of design that affect the users of the buildings. Proper attention should be paid to architectural compatibility with the local environment, economy of construction, energy conservation, functional requirements, interior and exterior details, life-cycle cost, and siting. New facilities shall be designed in harmony with the architectural character of those existing facilities that are to remain and that are considered to be historically significant or architecturally proper for the environment. Special emphasis should be placed on the quality of the architectural design since it vitally affects the attractiveness, economics, efficiency, livability, longevity, and usefulness of most facilities. It should be recognized that quality design does not imply added expense and often results in economies.

2. Functional Design. All military facility planning should employ economical, functional architectural and engineering design. This design should be closely tailored to the actual requirements of the project, with particular attention to the selection of exterior and interior finishes, and to the extent and type of equipment and services to be provided. Special studies may be necessary for specific projects to determine the most economical equipment, finishes, materials, methods of construction, services, and practical structure to be provided. Designs should be governed by functional requirements, conform to existing criteria and standards, and be consistent with applicable congressional cost limitations. Facilities should be provided at the lowest reasonable construction cost while achieving the optimum life-cycle cost.

3. Design for Flexibility. Flexibility in architectural design is the ability of an existing structure to accommodate a change in use with a minimum of cost. The Department of Defense usually operates and owns its facilities from the time of construction until the end of the useful life of the structure. During this long tenure of use, it is inevitable that the functional requirements of a building will change and often drastically, for example, under mobilization conditions, potential modifications that would have to be accomplished quickly should be considered. For this reason, flexibility is a major design requirement for all buildings, except for those with highly specialized functions that are prevented for economic reasons.

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4. Design Criteria and Standards. Designs for military facilities should follow normal industry practices and standards for similar facilities except when specific requirements are stipulated in this handbook. The military departments should provide appropriate design criteria to supplement the criteria included in this handbook. Definitive drawings, modular designs, and site adaption of previous project designs should be used for projects involving repetitive-type facilities. The use of standard designs should be encouraged by the military departments when there are cost benefits.

5. Space Allocations. Space allocation studies shall include a detailed analysis of the functional requirements of the activities to be housed to determine the actual space required. Functional areas shall be organized to obtain the most economical and efficient use of space.

6. Solar Design. All projects shall conform to P.L. 97-214, Section 2857 (reference (5a)). This law requires that the use of solar energy systems should be considered for all construction projects when practical and economically feasible. See chapter 11 for specific criteria.

B. INTERIOR FINISHES

1. Finishes and Materials. Interior finishes should be appropriate for the design function of the building and spaces. Low maintenance materials should be used to the extent possible with the selection being based on the anticipated use, fire and other safety requirements, life-cycle cost, and suitability for the environment being created.

2. Carpet. Carpet may be provided for the facility types and functional areas listed below. The listing of facility types or areas does not indicate that carpet is necessarily the most appropriate floor covering for all such facilities and areas. The selection of the most appropriate floor covering should be the product of an evaluation of the requirements of each project. The quality of carpet will be selected using U.S. Army Corps of Engineers Guide Specification CEGS 09682, "Carpet" (reference (5b)), and Naval Facilities Guide Specifications NFGS 09682, "Carpet", and NFGS 09690, "Carpet Tile" (reference (5c)).

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Administrative Facilities (including administrative areas in other facility types

- Closed Private Offices
- Conference Rooms
- Corridors
- Open Plan Offices

ADP and Computer Support Areas, Dedicated

- (Applies only to dedicated ADP and computer support spaces. The presence of isolated ADP or computer equipment incidental to the primary purpose and use of the space does not justify the use of carpet if not otherwise permissible.)

Banks and Credit Unions

- Entrance and Customer Bank Space
- Offices
- Open Spaces

Bowling Alleys

- Concourse (excluding food service working and storage areas)

Chapels and Other Religious Facilities

- Educational Wing
- Worship Areas

Child Development Centers

Clubs - Officers', CPO, NCO, Enlisted Personnel and Service

Enlisted Personnel Dining Facilities (excluding work spaces and serving areas)

- Dining Areas

Exchange Facilities

- Offices
- Restaurant and Cafeteria Dining Areas
- Sales Areas

Golf Course Clubhouse

- Dining Areas
- Pro Shop and Administrative Spaces

Libraries

Music or Drama Centers, or both

Temporary Lodging Facilities (except kitchen and dining areas)

- Combination Living and Sleeping Rooms
- Public Areas (Lobbies)

Theaters

Training Buildings and Educational Facilities, including Dependent Schools

- Classrooms
- Corridors
- Staff Offices

Unaccompanied Enlisted Personnel Housing (UEPH)

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Offices	Dining Facilities
Public Areas (lobbies, lounges, and TV rooms)	Offices
Sleeping Rooms	Public Areas (lobbies, lounges, and TV rooms)
Unaccompanied Officers Personnel Housing (UOPH)	Sleeping Rooms
Combination Living and Sleeping rooms	Youth Centers

C. WINDOWS AND OTHER GLAZED AREAS

1. Selection of Windows. Appearance, function, heat gain and loss, maintenance and operation experience, safety, structural requirements, and suitability for the environment should be considered when selecting windows. Stock window sizes should be used to the maximum extent practicable. The quality of windows should be selected consistent with the function, life cycle cost, and quality of the building.

2. Operable Windows. All UEPH, UOPH, and military family housing should be provided with operable windows in the exterior walls of living and sleeping areas. The sash, when fully opened, should allow for emergency egress. Fixed windows may be used in fully air-conditioned building areas, except UEPH, UOPH, and military family housing, provided the proper means of emergency egress is furnished. However, operable windows should be considered for all buildings where climatic conditions offer the potential for significant energy savings by using natural ventilation, and when natural ventilation can be compatible with the heating, ventilation, and air-conditioning system design.

D. VENDING FACILITY PROGRAM FOR THE BLIND

Any DoD acquired (constructed, leased, purchased, or rented) or substantially altered or renovated building should have one or more satisfactory sites for a blind-operated vending facility if such building will have 100 or more federal employees located therein or is 15,000 ft^2 [1,394 m^2] or more in gross area except in certain specific cases. Specifics of the vending program for the blind are stated in DoD Directive 1125.3 (reference (5d)). This Directive should be consulted before developing designs for any building that might be affected.

E. PROVISIONS FOR PHYSICALLY HANDICAPPED PERSONS

1. General: *Facilities of the Department of Defense* required to be accessible to physically handicapped persons shall be designed and constructed or retrofitted in accordance with the Uniform Federal Accessibility Standards (UFAS), Federal Register, (49 FR 31528 dated

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August 7, 1984, as amended by 51 FR 18647 dated May 21, 1986) (reference (5e)). Requirements for new construction, additions, and alterations vary and are specified in the standards. In general, all facilities worldwide which are open to the public, or to limited segments of the public, or which may be visited by the public in the conduct of normal business, shall be designed and constructed to be accessible to physically handicapped persons including facilities constructed with nonappropriated funds, privately financed facilities on military installations, and contractor-owned facilities where the Department of Defense is funding all or any part of the construction. In fact, every facility should be designed to assure access to physically handicapped persons unless its intended use is specifically restricted to able-bodied military personnel. Able-bodied military personnel is defined as those military personnel considered to be physically fit for duty. At least 5 percent of family housing units at an installation and not less than 1 unit shall be accessible.

2. General Exclusions for Certain Overseas Buildings and Facilities. Buildings and facilities for which the United States contributes a portion of the construction cost but does not control the design criteria (such as North Atlantic Treaty Organization (NATO) funded facilities) need not be accessible. Buildings and facilities funded by host nations, or being leased by the United States in other coutries, need not be accessible. However, every effort should be made to obtain the cooperation required to provide accessibility in the buildings and facilities that would be covered by the UFAS if they were located in the United States.

3. Waivers. If a waiver of these requirements is considered necessary, the waiver shall be obtained through the military department from ODASD (I) specifiying the full particulars. Waivers will be granted only in extraordinary circumstances.

F. FIRE PROTECTION Refer to Military Handbook, MIL-HDBK-1008 Fire Protection For Facilities Engineering, Design, and Construction (reference (5f)).

REFERENCES

(5a) Public Law 97-214, Section 2857, "Use of Solar Energy Systems"
(5b) U.S. Army Corps of Engineers Guide Specification CEGS 09682 "Carpet," January 1986 (available from USACE Publication Depot, 2803 52nd Avenue, Hyattsville, MD 20781)
(5c) Naval Facilities Guide Specifications, NFGS 09682, "Carpet," January 1983, NFGS 09690, "Carpet Tile," July 1981 (available from Commander, NAVFAC, Alexandria, VA 22332)
(5d) DoD Directive 1125.3, "Vending Facility Program for the Blind on Federal Property," April 7, 1978
(5e) Uniform Federal Accessibility Standards in Federal Register, (49 FR 31528 dated August 7, 1984, as amended by 51 FR 18647 dated May 21, 1986
(5f) MIL-HBK-1008, Fire Protection for Facilities Engineering, Design, and Construction

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CHAPTER 6

STRUCTURAL CRITERIA

A. SELECTION OF STRUCTURAL SYSTEMS AND MATERIALS

The structural systems and materials to be selected for design of military facilities at Department of Defense installations should be suitable for permanent-type construction; capable of carrying the required loads; and compatible with fire protection requirements, and architectural and functional concepts. Materials used may be any of those listed in table 6-1, or any combination thereof, selected for desirability, economy, general availability, low maintenance costs over the design life of the facility, and resistance to fire.

1. Design Considerations. It is important at the inception of the design that the structural system layout be coordinated properly with the architect to develop an overall effective plan. This joint effort is particularly essential in seismic and high wind areas where the distribution of lateral forces and layout of load-resistant elements are critical in establishing the earthquake and wind resistance for structures.

2. Cost Considerations. In selecting the type of structural system, the total facility should be considered, since the choice will influence the cost of such features as heating, ventilation or air-conditioning, or all three, as well as architectural, lighting, and utility requirements.

3. Structural Materials. When choosing structural materials for a specific project, consideration should be given to:

a. Availability of labor and materials.

b. Design life of the facility and maintenance costs over this period.

c. Experience of design and inspection personnel.

d. Experience and skill of prospective contractors.

e. Feasibility of preassembling or precasting major structural elements.

f. Site environment, including accessibility, climate, seismic loadings, subsurface conditions, and wind velocity.

4. Tests of Structural Systems. When the structural system cannot be analyzed on a rational basis, acceptability of the load carrying

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capacity of the system shall be determined by suitable load or model tests.

B. DESIGN REQUIREMENTS

1. Design Codes. Design methods and stress allowances or load factors for the various structural materials should be in accordance with the current editions of the codes and specifications listed in table 6-1, except where these codes and specifications are modified or expanded by published design criteria of the Military Departments.

2. Design Loads. The load assumptions for the design of buildings and other structures, including chimneys, tanks, and related structures should conform to the guidance provided in the Joint Army-Air Force Manual, TM 5-809-1, AFM 88-3, Chapter 1 (reference (6a)), and to the corresponding guidance contained in NAVFAC design manuals.

3. Seismic Design. The seismic design of facilities should be in accordance with the following guidance. The seismic design requirements for essential facilities other than health care facilities in high seismicity areas should be required to have post-disaster recovery and continuous operation capability during and after a major earthquake.

a. New Construction. The seismic design should be in accordance with the Joint Services Manual, TM 5-809-10, NAVFAC P-355, AFM 88-3, Chapter 10 (reference (6b)), except new essential facilities in seismic zone 3 or greater should be in accordance with the Joint Services Guidelines Manual, TM 5-809-10.1, NAVFAC P-355.1, AFM 88-3, Chapter 13, Section A (reference (6c)).

b. Modifications to Existing Structures. Major additions, alterations, and modernization of existing structures should be in conformance with the criteria in the Joint Services Manual (reference (6b)). When the basic structure to which the modification is being made does not meet current seismic criteria, the project should include funds for improving the structure to withstand seismic forces as follows:

(1) Critical Operational Facilities. Facilities that are critical from an operational viewpoint should be provided seismic strengthening for structural and nonstructural elements to that degree feasible and practicable for assuring life safety and continued post-earthquake operations. Essential facilities in seismic zones 3 and 4 shall be in accordance with the Joint-Service Guidelines Manual, Upgrading Existing Buildings, TM 5-809-10.2, NAVFAC P-355.2, AFM 88-3, Chapter 13, Section B (reference 6d).

(2) Other Facilities. For other than the above facilities, as a minimum, the safety of personnel should be assured by structural

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improvements that will prevent building collapse under seismic forces and preclude damage to equipment or utility systems that would endanger life.

c. Existing Structures. For existing structures having a high loss potential or having critical operational requirements such as communications centers, defense mission essential facilities, and fire stations, studies should be undertaken in order to determine the required strengthening to withstand earthquake forces. These investigations should be initiated in areas where the seismic risk is greatest and proceed to areas of lower risk to the extent warranted. A phased and orderly plan should be developed for providing the structural improvements for these high loss critical facilities and essential post-earthquake operational facilities.

d. Design Development of New Facilities.

(1) Building Design. Seismic structural design and siting considerations may conflict with functional considerations in building design. For instance, shear walls may limit horizontal flexibility and diaphragms may limit vertical circulation. Faults or soil instability may preclude sitings that otherwise would be desirable. Therefore, for all major or complex buildings, including, but not limited to, large administrative buildings, command centers, communications centers, and other similar facilities, and for installation master plans, concept studies at the start of design should include seismic considerations. In addition, they should include functional, flexibility, and siting considerations in order that all requirements may be optimally integrated. Where necessary, trade-off studies based on life cycle costing should be made to determine the optimum building design. In such studies, the cost of lost efficiency through less than desirable functional design and the risk cost of less than ideal seismic design should be included if quantification of such costs is feasible.

(2) Building Configuration. Seismic considerations may require limits on the height of structures and design configurations. Consolidation of several small facilities, possibly serving widely different functions, may be desirable in limiting structural and foundation costs. Since different functions in the same building may be of different criticality (some required to operate post-earthquake, and some not), functions should be studied to group those of greater or lesser criticality in order to separate the building into different occupancy types for seismic design. It should be noted that the building configuration plays an important role in the performance of the structure when subjected to seismic ground motion. To obtain optimal seismic resistance and performance, a symmetrical configuration of the structural system with properly placed lateral resisting structured elements should be considered. Further, the nonstructural elements should be seismic resistant in order to maintain a post-earthquake operational capability.

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(3) Siting. Structures should normally not be sited over active geological faults, in areas of instability subject to landslides, where soil liquefaction is likely to occur, or in areas subject to tsunami damage. In seismic zones 3 and 4, a seismic geotechnical report should be prepared only when the seismic design requirements for the facility are based on the Joint Services Guidelines Manual (reference (6c)).

(4) Master Plans. The above seismic design requirements should be considered with the functional requirements in developing master plans of military installations.

4. Climatic Considerations. Wind loads, snow loads, and frost penetration should be carefully established for each structure according to the Joint Army-Air Force Manual, TM 5-809-1, AFM 88-3, Chapter 1 (reference (6a)), and with the local climatic conditions as appropriate.

5. Design for Typhoon and Hurricane Areas. Structures to be constructed in typhoon and hurricane areas should be designed so that structural integrity and continuity are provided from the foundation to the roof, irrespective of the materials selected for the facility. All components of the structure should be positively tied together in order to establish an overall integrated resistance to high wind effects. In designing drag sensitive structures, such as guyed towers, stacks, or suspended pipelines, the effect of maximum wind forces, including pulsating forces on such structures, must be considered. Design criteria for structural framing, openings, and flashing should conform to the provisions of the Joint Army-Air Force Manual, TM 5-809-11, AFM 88-3, Chapter 14 (reference (6e)), or corresponding guidance contained in NAVFAC design manuals.

6. Design for Explosives Storage Facilities. When it is necessary to design explosives storage facilities in such a manner as to ensure against propagation of explosions between adjacent or nearby facilities, design should conform to the Joint Army-Navy-Air Force Manual, TM 5-1300, NAVFAC P-397, AFM 88-22 (reference (6f)).

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TABLE 6-1

STRUCTURAL DESIGN METHODS AND STRESS ALLOWANCES	
Materials	**Codes or Specifications**
Aluminum	The Aluminum Association, "Specifications for Aluminum Structures"
Concrete	American Concrete Institute (ACI), "Building Code Requirements for Reinforced Concrete"
Masonry	American National Standards Institute (ANSI), "American Standard Building Code Requirements for Reinforced Masonry" Brick Institute of America (BIA), "Recommended Building Code Requirements for Engineered Brick Masonry" National Concrete Masonry Association (NCMA), "Specifications for the Design and Construction of Load Bearing Concrete Masonry"
Steel	American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings"
Steel Joists	Steel Joist Institute (SJI), "Standard Specifications and Load Tables, Open Web Steel Joists and Longspan Steel Joists," and similar publications covering deep longspan steel joists
Steel, Light Gage	American Iron and Steel Institute (AISI), "Specifications for the Design of Cold-Formed Steel Structural Members"
Wood	National Forest Products Association, "National Design Specifications for Stress Grade Lumber and its Fastenings"

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REFERENCES

(6a) Joint Army-Air Force Manual, TM 5-809-1, AFM 88-3, Chapter 1, "Load Assumptions for Buildings," September 27, 1966

(6b) Joint Services Manual, TM 5-809-10, NAVFAC P-355, AFM 88-3, Chapter 13, "Seismic Design for Buildings," February 15, 1982

(6c) Joint Services Guidelines Manual, TM 5-809-10.1, NAVFAC P-355.1, AFM 88-3, Chapter 13, Section A, "Seismic Design Guidelines for Essential Building," 1986

(6d) Joint Services Guidelines Manual, TM 5-809-10.2, NAVFAC P-355.2, AFM 88-3, Chapter 13, Section 13, "Seismic Design Guidelines for Upgrading Existing Buildings," 1987

(6e) Joint Army-Air Force Manual, TM 5-809-11, AFM 88-3, Chapter 14, "Design Criteria for Facilities in Areas Subject to Typhoons and Hurricanes," June 21, 1983

(6f) Joint Army-Navy-Air Force Manual, TM 5-1300, NAVFAC P-397, AFM 88-22, "Structures to Resist the Effects of Accidental Explosions," March 1, 1971

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CHAPTER 7

PROTECTIVE CONSTRUCTION CRITERIA

A. DEFINITIONS

1. Passive Measures. Protective construction is defined as those passive measures that can be effected by construction-related activities to reduce or nullify the effects of an attack upon Department of Defense installations or enhance the recouperability of the military installation after an attack, or both. The term includes camouflage or "tone-down" painting; physical protection against biological, chemical, and radiological agents; physical security or anti-terrorism protection; and strengthening (hardening) of structures. It does not fully embrace all elements of passive defense such as control of electronic emissions, immunization programs, and protective clothing.

2. Types of Facilities. Some of the facilities that should be considered for protective construction are:

a. Aircraft shelters.

b. Ammunition and weapons storage facilities according to DoD 6055.9-STD (reference (7a)).

c. Command and control facilities.

d. Communications facilities.

e. Petroleum, oils, and lubricants (POL) facilities.

f. Other facilities when a requirement is established by the responsible Military Department.

B. POLICY FOR PROVIDING PROTECTION

Protective construction is one alternative among many that are available to reduce the vulnerability to attack on forces and missions. When preparing projections of future force requirements and postures, the need for protective construction measures and the benefits to be derived therefrom should be considered. Protective construction costs vary from near zero for such items as proper site selection for new facilities and the proper choice of colors for painting to reduce the ease with which an attacker can identify targets, to the extreme expense of such items as the hardening of command posts to withstand direct or near direct impacts of large scale nuclear weapons. When planning facilities, a complete range of probable hostile actions should be considered along with costly alternatives and the importance of the facility to be protected. Importance of facilities can first be determined using the criteria shown in paragraph 060506, JCS Publication 3, Volume 1 (reference (7b)). Then a

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realistic enemy attack should be assumed that is consistent with intelligence information and extrapolations to the time period during which the facility is to function effectively. It should be noted that a "realistic" enemy attack changes with protective measures employed, and is related to the total enemy capability as well as other targets that could be attacked. However, consideration should be given to providing minimal protective measures in all facilities where there is a significant risk to personnel.

C. PROTECTION OF POL FACILITIES

All future construction of military bulk petroleum installations and related facilities should provide suitable protection against enemy action or sabotage, or both. The facilities covered include rail and water terminal facilities, tankage, transfer facilities, and the major appurtenances thereto that are necessary to ensure a continued operational capability commensurate with the overall protection afforded.

1. Existing Military Facilities. Each Military Department should examine its existing military bulk petroleum installations and related facilities to determine if protection is required, the degree necessary, and a relative priority for accomplishment.

2. Existing Leased Facilities. Each Military Department should examine its existing leased commercial bulk petroleum installations and related facilities in military use to determine (1) the feasibility of adding protective measures, (2) the degree required, and (3) the relative priority for accomplishment, or the transfer of petroleum products to other dispersed or protected facilities according to DoD Directive 4140.25 (reference (7c)).

D. FALLOUT PROTECTION

1. Policy Guidance. Fallout protection for Department of Defense personnel, their dependents, and the general public should be provided in military facilities according to the policy guidance given in DoD Directive 3020.35 (reference (7d)). This directive implements the applicable laws and executive orders that require, with certain exceptions, that all military facilities be designed using techniques developed by the Federal Emergency Management Agency (FEMA), to optimize the fallout protection that can be provided by the facility. This requirement is not limited to the protection of Department of Defense personnel, but is intended to further the inclusion of fallout protection in all new facilities and to make such protection available to the public at large when military considerations permit.

2. Architect-Engineer Firms. Because of the training and educational programs of the FEMA, most Architect-Engineer (A-E) firms have developed a familiarity and competence with these design techniques, as have the architectural and engineering organizations of the Military

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Departments. It is necessary, however, when engaging an A-E firm to design a facility containing fallout protection, to determine that the A-E firm does, in fact, have the required technical competence in this area and, when required, a high degree of competency in radiation shielding technology. The fallout protection analysis should be made by a qualified architect or engineer who has been certified by the FEMA as being proficient in fallout shelter analysis.

E. DESIGN AGAINST THE EFFECTS OF NUCLEAR OR HIGH EXPLOSIVES

Almost any design which includes strengthening of a facility to protect against the effects of nuclear or high explosive weapons will require structural strength of a degree so far beyond normal design that no standard or well understood technique will be available. The lack of realistic environments in which to test designs has resulted in a much higher degree of dependence on analytic techniques and mathematical modeling than is permitted in normal design. The tendency is to be very conservative in the approach to design, which is incompatible with the achievement of maximum economy. Nearly every problem is unique and requires the highest degree of mechanical competence and mathematical facility in both design and review. The Tri-Service Manual, TM 5-1300, NAVFAC P-397, AFM 88-22 (reference (7e)) should be used during the design of military facilities.

F. PHYSICAL SECURITY

Physical security should be considered in the design of all new military facilities. DoD 5100.76-M (reference (7f)) and DoD 5210.41-M (reference (7g)) provide requirements for weapons storage facilities.

G. DECOMMISSIONING OF NUCLEAR FACILITIES

All facilities which handle, maintain, produce, store, or use radioactive materials should be designed to facilitate decommissioning at the end of its useful life. The facility and site must be secured to protect public health and safety or decontaminated to acceptable residual contamination levels.

REFERENCES

(7a) DoD 6055.9-STD, "DoD Ammunition and Explosives Safety Standards," July 31, 1984, Authorized by DoD Directive 6055.9, November 25, 1983
(7b) JCS Publication 3, Volume 1, "(C) Joint Logistics and Personnel Policy and Guidance (U)" (available through military publication channels on a need-to-know basis)
(7c) DoD Directive 4140.25, "Management of Bulk Petroleum Products, Storage, and Distribution Facilities," May 15, 1980
(7d) DoD Directive 3020.35, "Development, Use, Marking, and Stocking of Fallout Shelters," July 31, 1972

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REFERENCES (continued)

(7e) Tri-Service Manual, TM 5-1300, NAVFAC P-397, AFM 88-22, "Structures to Resist the Effects of Accidental Explosions," March 17, 1971

(7f) DoD 5100.76-M, "Physical Security of Sensitive Conventional Arms, Ammunition, and Explosives," February 1983, Authorized by DoD Directive 5100.76, 1 June 1978

(7g) DoD 5210.41-M (C), "Nuclear Weapons Security Manual (U)," March 9, 1983, Authorized by DoD Directive 5210.41, September 12, 1978

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CHAPTER 8

ENERGY CONSERVATION CRITERIA

A. PURPOSE

This chapter references policy, standards, and minimum criteria to ensure that energy conserving designs are developed for new construction and major renovation projects. Energy conservation features required in other chapters of this handbook should be incorporated into project designs unless a life cycle cost analysis indicates that other alternatives are more effective. Energy efficient designs shall satisfy the requirements for human comfort and the operational requirements of facilities at the lowest life cycle cost.

B. GENERAL REQUIREMENTS

1. Within the limits of functionality and life cycle cost effectiveness, all facilities shall be designed to meet the Design Energy Targets shown in table 8-1.

2. Each design project shall include all life cycle cost effective energy conserving alternatives which do not adversely affect the functions of the facility.

3. Each design project shall maximize the use of renewable energy sources and minimize fossil energy usage to the maximum extent of life cycle cost-effectiveness.

4. The energy life cycle cost analyses for any new building or major renovation project that is heated and exceeds 20,000 ft^2 [1,858 m^2], or is heated and air-conditioned only and exceeds 8,000 ft^2 [743.2 m^2] shall be performed using a professionally recognized and proven computer program that allows for the integration of architectural features and heating and air conditioning systems to determine that such features and systems will result in the lowest life cycle cost.

C. STEP-BY-STEP PROCEDURE FOR THIRTY-FIVE PERCENT DESIGN

The procedures indicated below should be followed to ensure that each design includes all cost-effective energy conservation alternatives. Steps one through three of the life cycle cost analysis should reflect the actual use of the facility, including the building occupancy, hours of operation, internal loads, and process loads. Step four of the analysis is a measure of the energy efficiency of the design for comparison purposes. This analysis shall not include process loads but shall be based on the hours of operation shown in table 8-1.

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1. Step-One Analysis.

a. Standard 90A. The analysis should be based on the energy conservation criteria of the latest edition of ASHRAE/IES Standard 90A (reference (8a)), except that illumination levels and design temperature criteria should be in accordance with chapters 9 and 10 respectively of this handbook.

b. "Baseline" Design. In addition, the analysis should evaluate other traditional design options, such as the building orientation, type of heating, ventilation and air conditioning (HVAC) system, type of windows, and horizontal and vertical projections, to determine the most cost-effective baseline design. Life cycle cost studies conducted as part of the step-one analysis shall be based on the general economic studies criteria of OMB Circular A-94 (reference (8b)) (that is, 10 percent discount rate, constant-dollars approach, project calendar and times costs incurred based on actual projections). Previous energy life cycle cost analyses that are updated or revised, or both, or analyses prepared of generic-type energy alternatives may be used for the step-one analysis to the extent that they are applicable to the project under design. The step-one analysis should be the "baseline" design for the step-two analysis.

2. Step-Two Analysis. The analysis should use the design team approach and compare the "baseline" design from step-one to all special energy conserving features and systems that appear appropriate to the project under design. The features and systems should include insulation thickness (roof and wall), improved electrical and mechanical equipment, and passive solar alternatives such as natural lighting. The life cycle cost analysis shall be based on Department of Energy (DOE) Federal Energy Management Program (FEMP) criteria according to the provisions of the latest version of 10 CFR 436A (reference (8c)). Guidance on the methodology may be obtained from NBS Handbook 135 (reference (8d)). Previous energy life cycle cost analyses may be updated or revised, or both, or generic studies may be used for the step-two analysis to the extent that they are applicable to the project under design. The results of this analysis should modify the "baseline" design of step-one. This modified design should become the new "baseline" design for the step-three analysis.

3. Step-Three Analysis. The "baseline" design from step-two shall be compared to a similar design, including active solar domestic hot water and space heating systems. The life cycle cost analysis shall use the FEMP criteria. The Savings to Investment Ratio (SIR) and the discounted payback period shall also be calculated. If active solar is shown to be cost effective, the step-two "baseline" design shall be modified accordingly and become the new "baseline" design. Previous life cycle cost analyses of active solar domestic hot water and space heating

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systems may be updated or revised, or both, or generic studies may be used for the step-three analysis to the extent that they are applicable to the project under design.

4. Step-Four Analysis. The Design Energy Target for the building shall be calculated and compared with the assigned Design Energy Target in table 8-1. Nonpurchased energy, such as active solar, shall not be included in the comparison of calculated and assigned Design Energy Targets.

D. FINAL DESIGN PROCEDURE

The concept level life cycle cost analyses for the 35 percent design should be reviewed and revised as necessary. Any energy conservation feature identified during final design and not addressed in the 35 percent design analyses should be investigated. If cost effective, the 35 percent design life cycle cost analysis, including calculation of the Design Energy Target, shall be revised accordingly and the feature incorporated into the design.

E. SPECIAL STUDIES

1. Photovoltaic. A photovoltaic power generation study comparing the "baseline" design with prospective photovoltaic applications shall be performed for applicable projects. Such projects include cathodic protection of pipelines, cathodic protection of bridges and water towers, data links, emergency and rescue communications, lighting, load center power, marking and warning devices, military range monitoring and conditioning equipment, monitoring and sensing devices, navigational aids, perimeter security devices, remote communication sites, remote instrumentation, remote weather stations and transmitters, repeater stations, and water pumping and purification. The life cycle cost analysis shall use the FEMP criteria.

2. Wind Energy Conversion Systems (WECS). The use of wind power should be considered only if an evaluation demonstrates that a sufficient mean annual wind exists for WECS to economically meet all or a significant fraction of the load demand. The most economical application of WECS is the generation of electricity using small wind turbine generators, with or without storage, located at remote sites. The lack of a demonstrated reliability of these machines to date indicates that extreme caution should be used before application, especially for critical loads at remote sites. Also, cost projections for maintenance and repair are critical items in the economic analysis.

3. Geothermal Energy. The use of geothermal energy should be considered in areas of proven reserves or in areas that have a high potential for geothermal resources.

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TABLE 8-1

DEPARTMENT OF DEFENSE
DESIGN ENERGY TARGETS - (000) BTU/SQ FT/YR [1]

BUILDING CATEGORY / CDD / HDD	Region 1 <2000 >7000	Region 2 <2000 5500-7000	Region 3 <2000 4000-5500	Region 4 <2000 2000-4000	Region 5 <2000 0-2000	Region 6 >2000 0-2000	Region 7 >2000 2000-4000
HOUSING [7]							
710 Family	60	50	45	45	40	60	60
720 Unaccompanied Personnal	60	50	45	45	40	55	60
INDUSTRIAL [6]	85	80	75	70	60	65	75
220 Production 890 Other (Use Local Description)							
INSTITUTIONAL							
730 Community Facilities - Personnel [6], Fire Station [7]	65	60	50	45	35	40	45
740 Community Facilities - Morale [6], Welfare and Recreational, Interior	65	60	50	45	40	45	45
Gymnasiums [8]	55	55	50	50	45	50	50
Clubs [8]	70	70	70	65	60	70	70
Theaters [9]	60	60	55	55	50	55	55
Dining Facilities [8]	70	65	65	60	60	70	75
Auditoriums [12]	50	45	40	30	30	30	35
760 Museums and Memorials [3,6]	50	45	35	30	20	25	30

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TABLE 8-1 (continued)

DEPARTMENT OF DEFENSE DESIGN ENERGY TARGETS - (000) BTU/SQ FT/YR [1]								
BUILDING CATEGORY	CDD HDD	Region 1 <2000 >7000	Region 2 <2000 5500-7000	Region 3 <2000 4000-5500	Region 4 <2000 2000-4000	Region 5 <2000 0-2000	Region 6 >2000 0-2000	Region 7 >2000 2000-4000
OFFICE [6] (Less Than 8,000 ft^2 [743.2 m^2])		50	50	40	40	40	45	45
(Greater Than 8,000 ft^2 [743.2 m^2])		45	45	40	40	35	40	40
610 Administrative Bldgs 620 Administrative Structures Underground 690 Other (Use Local Description)								
PRISON		55	55	50	50	45	50	55
730 Confinement Facility (Stockade) [2,7]								
RESEARCH AND DEVELOPMENT [6]		75	75	60	55	45	50	65
310 R&D and Test Facilities 390 Other (Use Local Description)								
SERVICE		90	80	70	60	55	60	70
210 Maintenance Facilities [10]								
730 Laundry and Dry Cleaning [4,6]								
740 Commissary [5,11]		75	75	70	60	60	60	70

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TABLE 8-1 (continued)

DEPARTMENT OF DEFENSE
DESIGN ENERGY TARGETS - (000) BTU/SQ FT/YR [1]

BUILDING CATEGORY	CDD / HDD	Region 1 <2000 >7000	Region 2 <2000 5500-7000	Region 3 <2000 4000-5500	Region 4 <2000 2000-4000	Region 5 <2000 0-2000	Region 6 >2000 0-2000	Region 7 >2000 2000-4000
SCHOOL [6]		65	60	50	40	40	45	50
171 Training Facilities (Includes Flight Simulation Facilities)								
730 Dependent Nursery School								
730 Dependent Kindergarten School								
730 Dependent Grade School								
730 Dependent High School								
STORAGE [7]								
440 (Heated or Humidity Control, or Both)		60	55	45	40	30	35	50
430 Cold Storage		95	95	95	90	80	85	100
440 (Minimum Heating and Ventilation to Protect Storaged Merchandise)		35	30	25	15	15	20	20
UTILITIES [7]		30	25	20	20	15	20	25
811 Electric Power								
820 Heat and Refrigeration (Air-Conditioning)								

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TABLE 8-1 (continued)

[1] Applies only to energy consumed within the building 5-ft [1.5-m] line, based on the Department of Energy (DOE) building categories and weather zones.

[2] Use only that portion relating to confinement facilities. Use applicable Military Department five- or six-digit category code to identify. For example, the Air Force will use 730 831 and other appropriate subcategory codes.

[3] Use only that portion relating to buildings. Use applicable Military Department five- or six-digit category code to identify.

[4] Use only that portion pertaining to laundry and dry cleaning facilities. Use applicable Military Department five- and six-digit category code to identify.

[5] Use only that portion pertaining to exchange and commissary facilities. Use applicable Military Department five- or six-digit category code to identify.

Operational hours upon which Design Energy Targets have been based are as follows. Energy target calculations shall be based on these operating times, even though actual operating times may differ.

[6] 10 hours per day, 5 days per week.

[7] 24 hours per day, 7 days per week.

[8] 16 hours per day, 7 days per week.

[9] 8 hours per day, 7 days per week.

[10] 24 hours per day, 6 days per week.

[11] 12 hours per day, 6 days per week.

[12] 3 hours per day, 5 days per week.

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REFERENCES

(8a) ASHRAE/IES Standard 90A (Available from the American Society of Heating, Refrigeration and Air Conditioning Engineers)

(8b) OMB Circular No. A-94, "Discount Rates to be Used in Evaluating Time-Distributed Costs and Benefits," March 27, 1972, Office of Management and Budget, Washington, D.C. 20500

(8c) Code of Federal Regulations (CFR), Title 10 (Energy), Part 436, Subpart A

(8d) NBS Handbook 135, "Life Cycle Cost Manual for the Federal Energy Management Program," National Bureau of Standards, Building 101, Route 270, Gaithersburg, MD 20899

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CHAPTER 9

ELECTRICAL CRITERIA

A. LIGHTING

1. Design Requirements. The design of interior, exterior, and sports lighting should be according to the fundamentals of the IES Lighting Handbook (reference (9a)), published by the Illuminating Engineering Society (IES).

2. Lighting Intensities for Facilities. Recommended intensities required for the predominant specific visual tasks in an area may be provided by the general illumination for the area.

a. Conservation Requirements. Illumination levels, in conjunction with energy conservation, should be obtained by the most life cycle cost-effective techniques including, but not limited to, the following:

(1) Multiple switching of multilamp fixtures or multiple switching of fixture groups in large rooms, or both, to permit lights to be turned off at unoccupied work stations and installing two lamps in four-lamp fixtures having integral toggle switches capable of disconnecting one ballast (two lamps) from the supply source.

(2) Time clock or photoelectric control, or both, of general indoor and outdoor lighting.

(3) Multilevel switched ballasts to provide nonuniform general lighting.

(4) More efficient lighting sources, fixtures, lamps, and use of solid-state ballasts.

(5) Grid-type ceilings with the capability of interchanging relocatable panels and lighting fixtures without rewiring. This type of ceiling should provide the flexibility to accommodate changes in functional requirements of the occupants.

(6) Lower wattage lamps (35-watt versus 40-watt fluorescent lamps).

b. Special Requirements. If an intensity greater than 75 footcandles [807 lux] is required for a particular task, the additional footcandles should be provided by localized (supplementary) lighting. The ratio between general and supplementary illumination should not exceed those recommended by the IES. Supplementary lighting normally should be provided by the user of the facility. However, power for such lighting should be provided.

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c. Environmental Factors. The finish and color of surrounding surfaces, equipment, and furniture should be selected for reduced glare, increased light use, and acceptable brightness balance. Lighting equipment and layout should be coordinated with other building design features to prevent interferences and to promote a good appearance.

d. Cross-Reference of DoD Facilities to IES Tables. In some instances, the names and functions of facilities used by the Department of Defense are *not* the same names and functions of similar facilities given in the IES Tables of Recommended Levels of Illumination IES Lighting Handbook (reference (9a)). For the purpose of comparison, the following cross-references of types of facilities are shown in table 9-1.

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TABLE 9-1

DOD - IES CROSS-REFERENCE OF FACILITIES

DoD Facility Designation - Name or Function	IES Tables Designation - Name or Function
Administrative Areas	Offices, Drafting, Conference, and Accounting Rooms
Chapels	Churches and Synagogues
Classroom Buildings	Schools
Dining Facilities	Food Service Facilities
Exchange Facilities	Stores
Guard Houses and Brigs	Municipal Buildings - Fire and Police
Parking for Military Vehicles (with minor repair areas)	Parking Areas and Service Stations
Service Clubs	Applicable Areas of Auditoriums, Food Service Facilities, Offices, Schools, and Stores
Unaccompanied Personnel Housing	Hotels
Vehicle Maintenance Facilities	Garages and Service Stations
Warehouses	Storage Rooms or Warehouses

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e. Hangar Illumination. The maintained general illumination level of hangars should not exceed 75 foot candles [807 lux].

f. Warehouse Illumination. The general illumination level in warehouses should not exceed the values shown in table 9-2 as measured at 4 ft [1.2 m] above the finished floor.

TABLE 9-2

ILLUMINATION IN WAREHOUSES		
Types of Warehousing	Intensity	
	Footcandles	[Lux]
Active-Bulk [1]	10	108
Bin [2]	5	54
Inactive	5	54
Mechanical Material Handling:		
Accumulation Conveyor Lines (Unmanned)	10	108
Control Centers and Stations	30	323
Loading and Unloading Areas	20	215
Rack	20	215

[1] Main aisles may be lighted to 15 footcandles [161 lux].

[2] Specialized lighting designed to illuminate the bins, as required, shall be provided by the building user.

g. Exterior Sports Illumination. Outdoor sports lighting shall conform to the classifications stated in the IES Lighting Handbook (reference (9a)), as shown in table 9-3.

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TABLE 9-3

IES SPORTS CLASSIFICATIONS	
Sports Activity	IES Classification
Baseball	Municipal and Semiprofessional
Football	Class III or IV
Softball	Industrial League
Other	Recreational

h. Illumination in Functional Areas of Other Facilities. The general illumination levels in functional areas of other facilities should not exceed the intensities shown in table 9-4.

TABLE 9-4

ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES		
Functional Areas	Intensity	
	Footcandles	[Lux]
Accounting Rooms	75	807
Auditoriums	20	215
Cafeterias	25	269
Computer Rooms	50	538
Conference Rooms	30	323
Corridors	10	108
Drafting Rooms	75	807
Elevator Machine Rooms	15	161
Emergency Generator Rooms	15	161

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TABLE 9-4 (continued)

ILLUMINATION IN FUNCTIONAL AREAS OF OTHER FACILITIES		
Functional Areas	Intensity	
	Footcandles	[Lux]
Garage Driving and Parking Areas	5	54
Garage Entrances	30	323
General Office Space	50	538
Janitor's Closets	5	54
Kitchens	70	753
Lobbies	15	161
Lounges	15	161
Mechanical and Electrical Equipment Rooms	15	161
Parking Lots	0.5	5
Stairways	20	215
Storage Rooms	5	54
Switchgear Rooms	15	161
Toilet Facilities	20	215
Transformer Vaults	15	161

1. Special Facility Illumination. When fluorescent or high-intensity discharge lighting is prohibited and the required intensity exceeds 30 footcandles [323 lux], the general lighting system should be designed for incandescent lighting of 30 footcandles [323 lux] with supplementary incandescent lighting for specific tasks where required.

3. Emergency Lighting. Emergency lighting systems should be provided in accordance with the requirements of NFPA 101 (reference (9b)). In

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buildings with large electrical loads, full consideration should be given to the possible economies from the use of higher voltages or frequencies, or both, for the lighting system.

4. Exit Lighting. Exit lighting and exit signs should conform to NFPA 101 (reference (9b)).

B. INTERIOR ELECTRICAL FACILITIES

1. Codes. Electric lighting and power systems within buildings and facilities should be installed according to the latest revisions to the applicable National Fire Protection Association (NFPA) Codes (reference (9b)).

2. System Characteristics. System characteristics should provide for the most economical and efficient distribution of energy.

a. Voltages. Voltages should be of the highest order consistent with the load served. Single-phase 120/240 or three-phase 208Y/120 volts should generally be used to serve combined incandescent and fluorescent, high-intensity discharge lighting, and small power loads. Where practical and economically feasible, a three-phase 480Y/277-volt system should be used. Other voltages may be used where required.

b. Frequencies. Where other than 60 Hz power is supplied, for example 50 Hz, the frequency supplied should be used where practical. Where frequencies other than that locally available are required for technical purposes, frequency conversion equipment may be provided, or if economically justified, generation equipment may be installed. Such equipment normally should be provided by the user of the facility. For special facilities where in-house prime generation must be provided and gas turbines are used, consideration should be given to higher frequency generation, for example 800 Hz, to achieve greater efficiency from fluorescent lighting and to simplify the speed reduction from turbine to generator.

3. Alternative Power Sources.

a. General. Various systems and functions require alternate power sources and related wiring systems to provide emergency power to essential loads during periods of interruption of normal power sources.

b. Types. Alternate power sources may consist of fixed or portable prime-mover-driven electric power generators or batteries. The types of sources selected should be based on the economics, feasibility, and requirements of the application. Spare generator sets, fixed or portable types, are not authorized for backup to alternate power sources.

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c. Provisions. The systems and functions listed below are authorized to have alternate power sources and related wiring systems for serving essential loads:

(1) Air and Sea Navigational Aids (NAVAIDS), both visual and electronics.

(2) Air traffic control towers.

(3) Aircraft and aircrew alert facilities.

(4) Central fire stations, including associated communications and central station equipment.

(5) Cold storage warehouses and major refrigerated storage areas.

(6) Command and control facilities.

(7) Communications facilities, including base central telephone exchange facilities.

(8) Critical computer and automatic data processing systems.

(9) Critical munitions and research processing systems, including associated safety, alarm, and shutdown systems.

(10) Critical utility plants.

(11) Dining facilities, one per overseas military installation.

(12) Director of Engineering and Housing, base civil engineering, and public works office control centers.

(13) Disaster preparedness centers.

(14) Fire protection and alarm systems.

(15) Hospitals.

(16) Law enforcement and security police facilities, including associated communications systems.

(17) Mission, property, and life support facilities at remote and not readily accessible sites, such as "top camps" for aircraft warning and surveillance installations.

(18) Nuclear power plants.

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(19) Photographic laboratories providing critical and essential support to tactical missions.

(20) Petroleum, oils, and lubricants (POL) storage and dispensing facilities.

(21) Security lighting, and surveillance and warning systems.

(22) Weapons systems.

(23) Weather stations.

d. Loads Served. Loads served by alternate power sources should be limited to those required to directly support essential or mission-critical equipment, illumination, environmental control, safety, alarm, shutdown and start up equipment necessary for mission accomplishment. Loads within different structures or at various locations should be consolidated so as to be served by the same alternate power source when practicable.

e. Existing Load Consolidation. Load consolidation should occur when (1) cost effective and practicable (2) existing alternate power sources are to be replaced for such reasons as age or insufficient capacity, or (3) mission changes result in an emergency load decrease beyond 50 percent of the initial requirement upon which the alternate source capacity for that mission was based. The practicability of load consolidation should be based upon a survey of all emergency loads and other alternate sources in the immediate area of the affected sources. When load consolidation is practicable, excess alternate power sources should be removed. When load consolidation is not practicable, alternate power source capacity should be appropriately reduced.

f. Alternative Power Supply. For facilities having emergency generating systems with capacities in excess of 200 kilowatts, or when central supervisory, monitoring, and control systems exist or are planned for a military installation, an economic analysis shall be performed, and, when cost effective, installation of a demand controller shall be considered. Cost-effectiveness shall be based upon the practicality of reducing demand charges by peak-shaving with the emergency generator or generators normally provided for such facilities as communications installations.

4. Specifications. Equipment and materials shall conform to federal specifications, or commercial standards as promulgated by such organizations as the Underwriters' Laboratories, Inc (reference 9c)); National Electrical Manufacturers Association; Institute of Electrical and Electronic Engineers; and American National Standards Institute.

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5. Wiring.

a. General. In general, wiring should consist of insulated conductors installed in rigid conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT). Aluminum conduit should not be used underground or embedded in concrete or masonry. Metal-enclosed feeder or plug-in busways or surface metal raceways may be used when required. Flexible metallic armored or nonmetallic sheathed cables may be provided for concealed branch circuits installed in areas not subject to mechanical injury in frame and hollow block construction above finished grade. Conductors shall be copper, except that aluminum may be used in sizes equivalent to No. 6 AWG copper and larger.

b. Ducting and Cabling System. Underfloor ducts or overhead raceways for electrical wiring, telephone and office automation cabling systems shall be provided in administrative facilities. Underfloor electrical ducts, cable space, or raised floors shall be used in electronic data processing (EDP) or automated data processing (ADP) machine rooms and in research facilities when anticipated changes or large equipment requirements can justify their use.

6. Telephone Service. Telephone service may be provided as required.

C. EXTERIOR ELECTRICAL FACILITIES

1. Codes. Systems and facilities should be according to the National Electrical Safety Code and the NFPA National Electrical Code (reference (9d)).

2. Exterior Appearance and Location. Underground service should be provided to those buildings on a military installation when overhead service would conflict with the desired architectural effect; to avoid interference with overhead equipment, such as cranes; or when the building service exceeds 600 volts. Transformers, substations, poles, meters, and other electrical equipment should be located outside of buildings so as to not detract from the appearance of the facility, particularly nonindustrial facilities. When necessary, architectural screening may be used to provide a pleasing appearance, but the screening should assure no loss in the equipment efficiency. Electrical equipment should be mounted to the windward side of water spray or heat-producing mechanical equipment, such as cooling towers, evaporative condensers, and air-cooled condensers.

3. Distribution.

a. Overhead and Underground. When practicable, overhead electrical distribution lines should be located along roads and streets to avoid the use of separate poles for street lights (see subsection C.2., above). Underground distribution shall conform to chapter 3. New distribution systems and extensions of existing systems should provide for the proper coordination of protective devices.

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b. Transformers. Power transformers normally should not be installed within buildings unless the size of the loads and length of the secondary feeders would make the arrangement advantageous. Air-cooled transformers may be installed in adequately ventilated spaces where required.

4. Power Supply. The design of the power supply for all facilities should ensure maximum continuity of operation, especially for primary mission requirements. Provisions should be made for maintenance needs and for connections to portable generators where required.

a. Total Energy (TE) Systems. When the standby power requirements of any new facility or complex exceed 70 percent of the total power requirement and the standby power is redundant, a study should be made to determine if it would be more economical to provide 100 percent standby and a TE system. Such systems should be provided if economical. A realistic review should also be made of the long-term availability of electric energy in the area of the proposed construction. The Federal Energy Regulatory Commission should be consulted regarding the availability of electric power in any particular area. Consideration should be given to TE for major additions and alterations of existing facilities or complexes that operate 24 hours per day and use large amounts of electric power.

b. Selective Energy (SE) Systems. In any area where (1) gaseous or liquid fuels are economical in relation to electric energy; (2) there may be a question regarding the reserves of the commercial source; (3) natural disasters such as high winds, ice and sleet are frequent problems, and in seismic zones; a study should be made to determine whether the critical requirements should be served by a SE system with the remainder of the facility served by a commercial source. The selected system should be based on the results of the study.

REFERENCES

(9a) "Illuminating Engineering Society (IES) Lighting Handbook," Illuminating Engineering Society, 345 East 47th Street, New York, NY 10017

(9b) NFPA 101, "National Fire Protection Association Life Safety Code," National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

(9c) Underwriters' Laboratories, Inc., Publications (available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120)

(9d) NFPA 70, "National Electrical Code," National Fire Protection Association, See reference (9b) above

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CHAPTER 10

AIR CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, MECHANICAL VENTILATION, AND REFRIGERATION

A. GENERAL POLICY

1. Criteria Intent.

a. Objective. The basic objective of these criteria is to provide an appropriate level of environmental conditioning at the optimum cost.

b. Life Cycle Cost.

(1) All practical architectural and mechanical component alternatives, and associated maintenance and operational costs should be included in life cycle cost analyses. Alternate choices should be based on life cycle costs, rather than first cost. All mechanical equipment should be installed with future maintenance needs taken into account, such as adequate accessibility, and according to established commercial practices.

(2) The life cycle cost analyses should be conducted as prescribed in chapter 8.

c. Work Classification. Any size space conditioning equipment is real property and the installation of such equipment shall be funded as construction work for new facilities and alteration work for existing facilities. In existing facilities the work is classified as nonconstruction (reference (10k)) under the following circumstances:

(1) Clean Rooms. For prefabricated clean rooms installed in nonair-conditioned spaces or when the central system of the facility cannot meet the humidity and temperature requirements of the clean room operation.

(2) Equipment Operation. For types of equipment where the manufacturer of the equipment specifically states that the equipment must be operated in an air-conditioned space.

(3) Operator Comfort. For operator comfort when the equipment to be installed will increase the humidity or temperature beyond reasonable comfort levels in the immediate area of such equipment.

d. Energy Conservation. Air conditioning, dehumidification, evaporative cooling, heating, mechanical ventilation, and refrigeration should be selected, designed, and installed according to the requirements for energy conservation. Where a history of air temperature, prevailing wind direction and speed are such that a detailed engineering analysis shows that satisfactory comfort conditions can be maintained without air conditioning, mechanical ventilation or natural ventilation should be provided.

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2. Weather Data. Weather data should be obtained from the current edition of the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (10a)).

3. Use of Mechanical Ventilation and Ventilation Requirements for Occupants. The minimum outdoor air supply rates for occupants in heated or air-conditioned facilities, or both, should be according to the current ASHRAE Ventilation Standard (reference (10b)).

4. Energy Monitoring and Control Systems. Consideration should be given to designing all new facilities to be compatible with the future application of energy monitoring and control systems.

5. Special Exception to Policy in Hawaii. Prior to the start of design, a ventilation feasibility study should be conducted for all facilities over 5,000 ft^2 [464.5 m^2] gross area. The study should evaluate the feasibility of using mechanical or natural ventilation, or both, in lieu of air conditioning. Ambient noise levels and the availability of prevailing winds should be addressed in the study. Where found feasible, mechanical or natural ventilation, or both, should be installed in lieu of air conditioning.

B. SPACE CONDITIONING DESIGN

1. Design Basis.

a. ASHRAE Handbook of Fundamentals. Heat gain and loss calculations should be as a minimum according to the current edition of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals (reference (10d)). The "U" or overall heat transmission factor should be determined as prescribed in chapter 8.

b. Comfort Cooling. The air-conditioned inside design temperature for personnel comfort should be 15 degrees F [9.4 degrees C] less than the 2-1/2 percent outside dry bulb weather condition, (see subsection A.5., above), but should not exceed 78 degrees F [25.6 degrees C] dry bulb or be less than 75 degrees [23.9 degrees C] dry bulb. The design relative humidity should be 50 percent minimum or the design temperature equal to the outside air dew point design temperature, whichever is less. (See section E., below).

c. Comfort Heating. The heating inside design temperature for personnel comfort should be 68 degrees F [20 degrees C] for administrative (inactive employment) and living areas, 55 degrees F [12.8 degrees C] for working areas (active employment), and 40 degrees F [4.4 degrees C] for storage areas for the prevention of freezing.

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d. General Purpose Warehouses. Warehouse facilities for the storage of materials not subject to freezing should not be heated. Warehouse facilities containing materials subject to freezing should be designed to maintain an inside temperature of 40 degrees F [4.4 degrees C]. Warehouse areas with active employment should be designed to maintain an inside temperature of 55 degrees F [12.8 degrees C]. Areas with inactive employment or where administrative functions are performed should be partitioned and maintained at 68 degrees F [20 degrees C].

e. Facilities With and Without Attic Space.

(1) Facilities With Attic Space. All facilities with attic space, which are to be air-conditioned, should be designed to achieve maximum natural ventilation. When air conditioning is to be added to existing facilities with attic space, insulation should be added in the attic space to meet the current requirements.

(2) Existing Facilities Without Attic Space.

(a) Dropped Ceilings. When air conditioning is to be added to existing facilities without attic space, and where there is a dropped ceiling, insulation should be added above the ceiling to meet the current requirements. In addition, the space between the hung ceiling and the roof should be ventilated when possible to achieve a minimum of 1.5 cfm/ft^2 [28 $m^3/h-m^2$] of ceiling area. When there are engineering reasons for not ventilating an entire area, ventilation should be used to the maximum extent possible. Attic areas between fire walls should be ventilated individually.

(b) High-Bay Buildings. When hangars, shops, warehouses, or other high-bay buildings are modified in part, or as a whole, by the internal installation of normal ceiling heights to create administration, training or similar facilities, the ceilings should be insulated according to current requirements.

f. UEPH and UOPH. Air conditioning compressor equipment or chilled water supply from a central plant for air conditioning in UEPH and UOPH should be sized on the basis of the expected lighting and occupancy loads.

g. Chilled Water Systems. All comfort air conditioning systems using chilled water should use the two-pipe system only. Generally, three- and four-pipe systems cannot be justified for comfort applications and should not be used unless shown to be life-cycle-cost effective through a detailed computer analysis.

h. Corridors. Corridors in all new construction should conform to NFPA 90A (reference (10e)). In existing facilities, excluding medical facilities, corridors may be used as return air plenums for air conditioning systems. When corridors are so used in UEPH and UOPH,

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products of combustion-type detectors should be installed at strategic locations not more than 50 ft [15.2 m] apart in corridors. Detectors should be electrically interlocked so as to activate the facility fire alarm and to secure the air handling equipment.

1. Duct Work and Termiticides. The following types of construction are prohibited where subterranean termite infestations are known to exist:

(1) Buildings with subslab or intra-slab Heating, Ventilation, or Air-Conditioning (HVAC) ducts.

(2) Buildings with plenum-type, subfloor HVAC systems, as currently defined in Federal Housing Administration minimum acceptable construction criteria guidance.

(3) Buildings with HVAC ducts in enclosed crawl spaces that are exposed to the ground.

(4) Buildings with other HVAC system where any part of the ducting is in contact with or exposed to the ground.

2. Weather Design Conditions. Air conditioning for all facilities should be designed on the basis of a 2.5 percent dry bulb temperature and corresponding 2.5 percent mean coincident wet bulb temperature as specified in the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (10a)), except for those critical areas where specialized technical requirements demand exact humidity or temperature control, or both, at all times. Areas for specialized technical requirements should be based on the one percent dry bulb temperature and one percent mean coincident wet bulb temperature. Heating for all facilities should be designed on the basis of a 97.5 percent dry bulb temperature, except for those critical areas where specialized technical requirements demand exact temperature at all times. Areas for specialized technical requirements should be based on the 99 percent dry bulb temperature.

3. Mechanical Equipment Design. A central plant normally should be provided unless specific engineering cost analyses indicate subcentral plants to be more economical on a life cycle cost basis. Critical facilities, such as communication or computer areas, or similar unique loads that require year around, highly reliable air conditioning and are served by a central system, may be provided with an auxiliary system so that the critical partial load can be provided when the central system is down for repairs.

4. Nonpermanent Construction. The design of air conditioning for semipermanent or temporary facilities should be on a minimum cost basis with exposed duct work, electrical work, and refrigerant or water piping and all other possible economies used. Every consideration should be given to the use, or expansion, of existing central plants in adjacent permanent facilities that are air-conditioned.

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5. Combined Summer and Winter Air Conditioning Loads.

a. Equipment Sizes and Zoning. In facilities when there is a combination of normal summer air conditioning loads and year around air conditioning loads, careful consideration should be given to the sizing of equipment and zoning so that the central plant can support the entire facility load during warm weather and a portion of the central plant may be essentially fully loaded during winter operations.

b. Refrigeration Systems. In facilities where, because of the small size of the off-hours or the small winter load, it is impractical to operate the primary equipment in the central plant, a secondary (auxiliary) refrigeration system may be provided.

(1) Chilled Water. When the central plant uses chilled water, this auxiliary system also should be a chilled water system so that it may be cross connected with the primary equipment in the plant. In such cases, during the summer operation, the auxiliary system should be sized to be needed only at night and over weekends, and other periods when the central plant is not being operated for reasons of economy or inadequate loading.

(2) Direct Expansion. When the central plant uses direct expansion, the auxiliary system also may be direct expansion, but the design should be based on using the same duct work.

(3) Critical Operations. For critical operations requiring a separate air conditioning system, the need for back-up equipment can be avoided by proper design of the central system so that it can function as the alternate system by shedding noncritical loads during emergencies.

6. Equipment Limitations and Size Selection. Air-conditioning refrigeration machines should be absorption, centrifugal, helical rotary screw or reciprocating types based on life cycle cost analyses. Individual reciprocating machines should not exceed 200 tons capacity, and the total capacity of all reciprocating machines used for air-conditioning a single facility shall not exceed 400 tons. When packaged air conditioning units, packaged air-cooled air conditioning units, or packaged water chillers are equipped with reciprocating compressors, the total capacity of any one packaged unit should not exceed 200 tons. A single packaged unit of any type should not contain more than eight compressors. A life cycle cost study shall be made to determine whether multiple centrifugal or helical rotary screw machines may be more economical than a single machine. In no case, when only personnel comfort is involved, should consideration be given to a standby machine. Similarly, standby chilled water and condensing water pumps are not appropriate.

7. Location of Equipment. To the greatest extent possible, air conditioning equipment, including air handlers, compressors, pumps and associated equipment, should be of the weatherized-type and installed

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outside of the facility. Such exterior installations save costly interior mechanical equipment room space in new construction, or eliminate the requirement for erecting a mechanical equipment room for installations in existing facilities. Proper design is required in such cases for water chilling or water cooling equipment, or both, to ensure adequate drainage for winterizing. Full consideration should be given to the exterior installation of all direct expansion air-cooled systems.

a. Enclosures. When it is essential that air conditioning equipment be covered or protected, a simple sheet metal enclosure similar to that now used by the industry for packaged roof-top units should be given first consideration. Air-cooled condensers, evaporative condensers, and cooling towers should be located on the exterior and should not be enclosed except where heavy snowfalls or windblown particles (sand) could prevent operation of systems for critical facilities required to operate year around. In such cases, the enclosure should be the minimum necessary to prevent snow or sand from clogging the condenser and fan.

b. Corrosion. Special consideration of corrosion problems should be made for any air-conditioning (including heating and ventilating) equipment that is to be installed within 10 miles [16 km] of the ocean or other salt water body.

8. Heat Pumps. Air-to-air heat pumps up to 60,000 Btuh [17,584 W] cooling capacity may be used provided such units are certified under the Heat Pump Program of the Air Conditioning and Refrigeration Institute (ARI) (reference (10f)). Either air or water source 60,000 Btuh [17,584 W] up to 135,000 Btuh [39,565 W] should meet the requirements of the Air Conditioning and Refrigeration Institute certification program as well as Section 6 of NSI/ASHRAE/IES 90A (reference (10g)), unless a detailed life cycle cost analysis indicates selection of a less efficient unit would be more cost-effective. Larger systems, including built-up systems, should be used where economically feasible. Air-to-air heat pumps should be used only in locations with heating design temperatures (97.5 percent basis) greater than 12 degrees F [-11.1 degrees C]. This restriction should not apply to those locations in which 30 percent or more of the total annual heating hours below 65 degrees F [18 degrees C] occur during the period of May through October. Heating only air-to-air heat pumps may be used in areas not authorized air conditioning based on the lowest life-cycle-cost analysis.

a. Replacement Units. Any existing air-to-air heat pump that fails should be replaced only with a unit meeting the requirements outlined above. Replacement of any major component or any modification of existing air-to-air heat pumps should be done only according to the written recommendations of the manufacturer. The requirements of subsection B.1., above, apply to the installation of heat pumps as well as to air conditioning.

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b. Water Source Heat Pumps. The most efficient method of using electric power for heating is the water source heat pump while the air source heat pump is second choice. Accordingly, when consideration is being given to the use of heat pumps, the water source should be evaluated first. Water source units are particularly well suited for use in heating the perimeter spaces of buildings that have interior spaces that must be cooled concurrently. In such cases, the heat rejected from the interior space is carried in a closed water loop to serve as the heat source for the heat pumps.

c. Air-To-Air Heat Pumps. The use of air-to-air heat pumps should be allowed only after a thorough engineering analysis of all available energy sources and systems. The current, short-term (five years) and long-term availability of electric power should be carefully evaluated. Full consideration should be given to the requirement for any additional power transmission and substation capacity either by the military installation or a public utility. Similarly, the possible need for additional distribution lines or facilities on the military installation should be considered and costed. When calculating energy costs, the added impact of demand charges should receive special consideration. Estimated peak demands and power consumption of air-to-air heat pumps for new military installations should be based only on the records of such units at other military installations. When applied to heat pump applications, auxiliary electric heat should be limited to the capacity needed to supplement the heat pump. When power suppliers use natural gas to generate over 10 percent of the total annual output, the probability of increased "fuel adjustment charges" caused by conversion to higher priced fuels should be a cost consideration.

9. Insulation of Underground Lines. In those cases when a central chilled water system is supplying other facilities through direct burial underground lines, an analysis should be made to determine the most economical thickness of insulation for the supply and return lines.

C. EVAPORATIVE COOLING DESIGN

Evaporative cooling should be designed to provide an indoor condition of 80 degrees F [26.7 degrees C] dry bulb.

D. INDUSTRIAL MECHANICAL VENTILATION DESIGN

1. Industrial Mechanical Ventilation. Systems should be designed, installed, and protected according to the applicable volume of ASHRAE Guide and Data Book (reference (10h)) or Industrial Ventilation, A Manual of Recommended Practices (reference (10i)). Mechanical ventilation and exhaust systems for flammable, hazardous, and toxic gases or fumes should follow the codes of practice of the National Fire Protection Association (NFPA) (reference (10j)).

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2. Heat Recovery for Dining Facilities. Heat recovery systems should be considered to reduce the cost of heating dining facilities and kitchens. When heat in kitchens rejected by refrigeration equipment exceeds 36,000 Btuh [10,551 W], heat recovery systems should be considered to augment the building heating system, water heating requirement, or to supply make-up air to the kitchen exhaust hoods.

E. SPECIALIZED CRITERIA FOR AIR-CONDITIONED FACILITIES IN HUMID AREAS

1. Design Criteria. The following criteria should be used in the design of air-conditioned facilities located in areas having over 3,000 hours of 67 degrees F [19.4 degrees C] wet bulb temperature in combination with an outside design condition of 50 percent design relative humidity or higher, or 1,500 hours of over 73 degrees F [22.8 degrees C] wet bulb temperature in combination with an outside design condition of 50 percent relative humidity or higher, based on 2.5 percent dry bulb and corresponding Mean Coincident Wet Bulb (MCWB) temperatures.

2. Mechanical Equipment Criteria.

a. Fan-Coil Units. Room fan-coil units should not be used unless dehumidified ventilation air is supplied to each unit and positive pressure is maintained in the space. Optionally, conditioned ventilation air may be supplied into the space separately.

b. Air-Type System. Air conditioning should be provided by an all air-type system. The system may be a central air-handling type with chilled water coils or a unitary (multiple or single) direct expansion-type unit capable of controlling the dew point of the supply air for all conditions of load. Face and by-pass dampers should not be used for temperature control. Reheat, when required, should be applied centrally using recovered heat.

c. Air Handling Units. Air handling units should be the draw through type in order to use the fan energy for reheat. Coils shall have low by-pass factors.

d. Outside Air. Outside air should be conditioned at all times through a continuously operating air conditioning system. Outside air should be adequate in quantity to slightly pressurize the building under varying external and internal loads.

e. Calculations. In addition to calculating the cooling load at maximum design temperature, cooling load calculations should also be made for the low temperature, high humidity conditions to determine the greatest dehumidification load that may be encountered on cloudy and humid days.

f. Air and Water Temperatures. The supply air temperature and quantity, and chilled water temperature should be based on the sensible heat factor, coil by-pass factor, and apparatus dew point.

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g. Latent Heat Gain. Latent heat gain due to water vapor flow through roofs and walls should be included in the cooling load analysis when the ambient design dew point exceeds the room design dew point by more than 20 degrees F [11.1 degrees C].

h. Latent Cooling Load. The one percent wet bulb temperature from the approved weather data source of subsection A.2., above, should be used in calculating the latent cooling load and for equipment sizing.

i. Chilled Water Systems. The cooling capacity of chilled water systems of 100 tons and over should be divided between two or more chillers to ensure reliability and constant chilled water supply without temperature fluctuations, to prevent short cycling, and to minimize hot gas by-pass. The combined capacity of the chillers should not exceed the total requirement including diversity. The selection of the number of chillers should be based on the analysis of part load operating hours for extended periods of low load conditions.

j. Packaged Units. Packaged unitary units with multiple reciprocating compressors (not to exceed eight) should be used for systems between 35 tons and 200 tons. Each compressor should have separate, independent, refrigerant circuits and cycles to provide multiple steps of capacity control. Two compressors may be combined into one independent refrigerant circuit. For systems up to 35 tons, single compressors with a minimum of three-step capacity unloading may be used.

F. ELIGIBILITY OF FACILITIES FOR AIR CONDITIONING, DEHUMIDIFICATION, EVAPORATIVE COOLING, HEATING, OR MECHANICAL VENTILATION

1. Personal Comfort. Space conditioning normally is unnecessary for comfort cooling and heating in facilities indicated below except where similar facilities off-post are conditioned.

a. Air conditioning is not normally appropriate for the following types of facilities in areas where the wet bulb temperature is 67 degrees F [19.4 degrees C] or higher for less than 800 hours and the dry bulb temperature is 80 degrees F [26.7 degrees C] or higher for less than 650 hours during the six warmest months of the year.

(1) Auditoriums.

(2) Banks.

(3) Bowling alleys.

(4) Chapels.

(5) Child development centers.

(6) Clothing sales stores.

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(7) Commissary stores. Air conditioning may be provided for humidity control when essential to efficient display case operation.

(8) Enlisted personnel clubs and open messes.

(9) Exchange facilities.

(10) Libraries.

(11) NCO and officers' clubs and open messes.

(12) Post offices.

(13) Service clubs.

(14) Fire station dormitories.

(15) Military family housing.

(16) Unaccompanied enlisted personnel housing.

(17) Unaccompanied officer personnel housing.

(18) Temporary lodging facilities (including the administrative areas).

b. Air conditioning is not normally appropriate for the following types of facilities in areas where the dry bulb temperature is 80 degrees F [26.7 degrees C] or higher for less than 350 hours per year:

(1) Administrative facilities.

(2) Dining facilities.

(3) General classrooms.

(4) Indoor target ranges.

2. Industrial and Other Facilities. Industrial and other facilities may be appropriate for air conditioning except: (Industrial facilities are based on functional use and do not specifically identify each type of facility in the Department of Defense.)

a. Limited Requirement. The following types of facilities having limited air conditioning requirements:

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(1) Active Warehouses. Evaporative cooling may be provided where the effective temperature control can be maintained.

(2) Aircraft Maintenance Shops (Avionics). Evaporative cooling is appropriate where effective. Limited air conditioning may be provided for those functional areas that require air conditioning for quality control of equipment, material, and task. In all cases, localized or spot air conditioning may be provided at individual work stations; however, the entire shop area should not be air-conditioned.

(3) Bakeries, Laundry, and Dry Cleaning Plants. Evaporative cooling is appropriate where effective.

(4) Dining Facility Kitchens, Deep-Fat Fryers, Dishwashing Areas, and Fat-Rendering Facilities. Evaporative cooling may be provided where effective for special localized or spot cooling to provide temperature reduction in the immediate area of the hot equipment. Spot air conditioning may be provided from the central system for work stations if the main portion of the facility is eligible for air conditioning and the criteria for exhaust ventilation are met.

(5) Gymnasiums.

(a) Handball, squash, and similar small and completely enclosed playing areas may be air-conditioned on the same basis as personnel living spaces in paragraph F.1.a., above.

(b) Air conditioning should be provided in new gymnasiums when 93 degrees F [33.9 degrees C] dry bulb exceeds 1,300 hours and 73 degrees F [22.8 degrees C] wet bulb exceeds 800 hours during the year, or when the wet bulb exceeds 73 degrees F [22.8 degrees C] over 4,000 hours during the year.

(6) Hobby Shops and Youth Centers. Arts and crafts facilities of hobby shop areas may be air-conditioned provided that the functions requiring above minimum ventilation rates (metal and woodworking shops) and having excessive heat releases (kilns and welding equipment) are not air conditioned.

(7) Maintenance Shops. Maintenance shops not requiring humidity and temperature control. Administrative offices in maintenance shops are authorized air conditioning for comfort cooling.

(8) Special Process Spaces. Special process spaces requiring a greater degree of ventilation than can be provided by gravity methods because of dust, gases, or vapors injurious to the health of personnel. Mechanical ventilation is appropriate.

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b. Not Conditioned. The following types of facilities are not ordinarily air-conditioned regardless of weather conditions:

(1) Boiler plants and rooms.

(2) Building mechanical equipment rooms.

(3) Dehumidified shops and warehouses where temperature control is not essential.

(4) Greenhouses.

(5) Indoor swimming pools.

(6) Locker rooms.

(7) Motor vehicle storage garages.

(8) Showers.

(9) Special areas requiring high ventilation rates.

(10) Vehicle storage areas of crash and fire stations.

REFERENCES

(10a) Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29, "Engineering Weather Data," July 1978, (this reference may be obtained from: The U.S. Army Adjutant General Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220)

(10b) ASHRAE Ventilation Standard 62 (Latest Edition), American Society of Heating, Refrigeration and Air Conditioning Engineers

(10c) DoD Directive 7040.2, "Program for Improvement in Financial Management in the Area of Appropriations for Acquistion and Construction of Military Real Property," January 18, 1961 with Changes

(10d) ASHRAE Handbook of Fundamentals, American Society of Heating, Refrigeration and Air Conditioning Engineers

(10e) National Fire Protection Association, NFPA 90A (See Reference (13k) below)

(10f) Air Conditioning and Refrigeration Institute (ARI) Heat Pump Program may be obtained from: Air Conditioning and Refrigeration Institute, 1501 Wilson Boulevard, Arlington, VA 22209

(10g) NSI/ASHRAE/IES 90A: Section 6, "Energy Conservation in New Buildings"

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(10h) ASHRAE Guide and Data Book (Systems, Fundamentals, Applications, Equipment), American Society of Heating, Refrigeration and Air Conditioning Engineers

(10i) ASHRAE "Industrial Ventilation, A Manual of Recommended Practices," American Society of Heating, Refrigeration and Air Conditioning Engineers

(10j) National Fire Protection Association (NFPA) Codes may be obtained from: National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

(10k) DoD Instruction 7040.5, "Definitions of Expense and Investment Costs," September 1966 with changes

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CHAPTER 11

ENERGY SOURCE SELECTION AND CENTRAL HEATING CRITERIA

A. ENERGY SOURCE SELECTION AND APPLICATION CRITERIA (DEFENSE FACILITIES LOCATED IN THE CONTIGUOUS UNITED STATES)

1. General. All facilities should be tied into installation-wide heat distribution systems unless economically or operationally unjustified. The primary energy source selected for all new Defense facility uses (including major rehabilitation efforts which provide an opportunity to evaluate energy alternatives) should be the lowest life cycle costly alternative which meets the basic quantity, quality and reliability requirements of the mission supported, within specific limits and guidelines imposed by law.

2. Pollution Abatement: All Federal, State, local and Host Nation pollution abatement regulations shall be complied with in all energy applications, new and existing, to the maximum extent possible. (See chapter 2).

3. Fuels Use Act: The Fuels Use Act, Public Law 95-62, which required that all new plants for use in the United States with a combined total input energy rating of 100 mega Btu or greater be designed and constructed to burn coal, has been rescinded by Public Law 100-42. Present fuel use policy is contained in the FY 1987 Defense Authorization Act (Section 1205 of PL-99-661) which requires that the primary fuel source to be used in any new heating system constructed on lands under the jurisdiction of the Military Department be the most cost afffective fuel for that heating system over the life cycle of the system. The corollary to this requirement which pertains to fuel conversions is found in the FY 1987 Defense Appropriations Act (Section 9099 of PL-99-500) which also requires that conversion fuel selection be the most life-cycle-cost effective for the proposed system.

4. Nonconventional Energy Sources: The use of nonconventional energy sources (solar, geothermal, wind, tidal, biomass, refuse or refuse derived fuel, waste oil and synthetic fuels) is strongly encouraged wherever life cycle cost effective and where there is confidence in the ability of the technology or source of supply to provide adequate mission support reliability.

5. Economic Analysis: Energy related economic analysis procedures have been directed by the National Energy Conservation Policy Act, 92 Stat., 3275 and implemented by the National Bureau of Standards handbook 135, "Life-Cycle Cost Manual." In order to determine the most life cycle cost effective alternative energy source an economic analysis from the perspective of cash flow to the Federal Government shall be performed for each viable alternative, including the status quo if appropriate. The following criteria should be followed in conducting the anlysis:

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IN-HOUSE CONSTRUCTION ALTERNATIVES:

- Constant dollar, present worth discounting of all alternatives should be done using a 10 percent discount factor.
- The actual current energy costs paid, or which would be expected to be paid, at the installation will be used as the starting point of all economic analysis. The stock fund rate charged by DFSC to facilities purchasing petroleum products under a DFSC contract should not be used.
- The latest official regional average, industrial sector, energy cost escallation rates provided by the Energy Information Administration will be used for projecting future energy costs and developing appropriate present worth values.

THIRD PARTY CONTRACTS:

Title 10 USC section 2394 permits military departments to enter into long term (up to 30 years) with a third party who may build, own and operate with private venture capital, a plant to furnish either energy or fuel to a military installation. The House of Representatives in its Conference Report on the 1984 Military Construction Authorization Act, stated that the Services are to aggressively pursue third party financing before any future large scale heating or power plants are authorized. Because of the disparate viewpoints of various Congressional and Administrative groups it is necessary to evaluate these alternative financing projects using a range of economic analysis criteria. In addition to an analysis using the factors above for in-house construction, a life cycle comparison of such third party contracts in comparison with budgeted construction or the status quo must be conducted using the following constraints;

- A current dollar present worth discounting analysis should be done using the most current 30 year Treasury Securities rate from Federal Reserve statistical release H.15.
- In light of the Tax Reform Act of 1986, corporate income taxes paid by the venture capital proposer of third party contracts will be considered as benefits to the Government and shall be calculated using the maximum corporate rate of the appropriate period, i.e., 40 percent in 1987 and 34 percent in 1988 and beyond.
- A sensitivity analysis must be developed to enable approving officials to evaluate the impact on the economic ranking of alternatives brought about by the changes in pertinent cost elements.

B. APPLICATION CRITERIA

1. Energy Storage. In order to prevent mission support disruption from liquid fuel supply problems, Defense liquid fueled thermal plants will be provided with a minimum supply level of no less than 30 days of the maximum continuous expected demand. All coal fired plants shall be provided with a minimum supply level of no less than 90 days.

2. Dual Fuel Capability. Since the primary objective of Defense heating and power plants is to provide mission support during all conditions, all major plants and systems shall be installed with dual (or triple fuel capability where economically feasible. This backup

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capability will allow the installation commander flexibility to provide mission support during specific fuel supply interruptions and to take advantage of temporary fuel cost savings.

3. Fuel Substitution. Fuel shortages have in the past created situations requiring the consideration of alternative substitute fuels for power generation, construction, transportation and heating purposes. Numerous tests and extensive operating experience have demonstrated that successful substitute fuels are available for diesel fuel, heating oil and gasoline. It is important that each installation determine those alternative fuels which can be acceptably fired in existing equipment and what modifications are needed to implement the substitution. Installation contingency plans should include an implementation plan detailing the mechanical system alterations and changes in maintenance policy required to use alternative fuels.

C. CENTRAL HEATING CRITERIA

1. Applicability and Requirements. The provisions contained in this section apply to new construction and existing facilities at military installations and activities, DoD-operated industrial plants, and projects accomplished by either appropriated or nonappropriated funds when all or part of the equipment maintenance and operating costs are funded from appropriated funds.

2. Weather Data.

a. Basis. Weather data used according to these criteria should be obtained only from the current edition of the Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29 (reference (11a)). Revised weather data or weather data for new military installations should be supplied only by the headquarters of the single authorized weather service for the military department concerned. Local or regional weather activities should not be used as a source of data unless such data or applicable data from a climatologically nearby military installation are not contained in the Joint Services Manual.

b. Winter Design Temperature. Heating for all facilities should be designed on the basis of 97.5 percent Winter Design Data Heating Column of the Joint Services Manual, except for those critical areas where specialized technical requirements demand an exact temperature.

3. Heating Plant Capacity.

a. Design.

(1) Central plants consisting of heat generators or multiple boilers should be designed to be expandable, when facilities are expected to require future expansion.

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(2) The number and size of units should be selected to efficiently handle both the maximum winter design load and the minimum summer load. With one unit off the line, the remaining unit or units should be capable of carrying not less than 65 percent or more than 75 percent of the maximum winter design load. Values above 75 percent of the maximum winter load should be justified by a study that should be forwarded to the headquarters of the military department involved for approval.

b. Heating Load. Heat losses should be calculated according to the method specified in the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Guide and Data Book (reference (11b)). For building interior design temperatures, see chapter 10. The "U" or overall Heat Transmission Factors should be in accordance with chapter 8.

c. Standby Heating Equipment. Heat generators, heating pumps, and standby boilers should not be provided unless approved by the military department.

D. HEAT TRANSMISSION AND DISTRIBUTION LINES

Steam and medium or high temperature (above 200° F) water distribution and transmission lines from the source to points of use within a facility for new or replacement lines should preferably be installed above ground. If installed underground, direct-buried lines shall conform to the Federal Construction Guide Specification FCGS 15705 (reference (11c)), or military service equivalent implementation specification. FCGS 15705 should be used for determining site conditions appropriate for concrete trenches. Corps of Engineers Guide Specification CEGS 15709 (reference (11d)), should be used for concrete shallow trench systems. For low temperature heat (200°F and below) Corps of Engineers Guide Specification 15704 may be used.

E. AUTOMATED HEATING PLANTS

Gas-fired and oil-fired heating units shall be equipped with automatic controls and firing systems, and safety devices to the extent necessary to provide nonattended operation as practicable. Such plants shall be equipped with surveillance equipment for monitoring operations at a centrally manned location as practicable.

REFERENCES

(11a) Joint Services Manual, TM 5-785, NAVFAC P-89, AFM 88-29, "Engineering Weather Data," July 1978
(11b) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Guide and Data Book
(11c) Federal Construction Guide Specification FCGS 15705, "Underground Heat Distribution Systems (Prefabricated or Pre-Engineered Types)
(11d) Corps of Engineers Guide Specification CEGS 15709, "Heat Distribution Systems Outside of Buildings, Concrete Shallow Trench Systems"

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CHAPTER 12

PLUMBING EQUIPMENT CRITERIA

POLICY

Water supply, backflow prevention, and drainage at Department of Defense installations should comply with the National Standard Plumbing Code (reference (12a)) and other national codes as approved by the using Military Department. Plumbing fixtures should conform generally to Federal Specification WW-P-541 (reference (12b)) or American National Standards Institute (ANSI) Standards (reference (12c)).

REFERENCES

(12a) "National Standard Plumbing Code," National Association of Plumbing-Heating-Cooling Contractors, P.O. Box 6808, Falls Church, VA 22046

(12b) Federal Specifications WW-P-541 (available from Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120)

(12c) American National Standards Institute, 1430 Broadway, New York, NY 10018

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CHAPTER 13

FAMILY HOUSING FACILITIES CRITERIA

A. APPLICABILITY

1. Standards and Criteria. This chapter outlines the standards and criteria pertaining to the acquisition, design, construction, and improvement of military family housing in the United States, its possessions, and foreign countries. General criteria presented in the preceding chapters are applicable where specific criteria are not included in this chapter.

2. Improvements Based on Criteria. Current criteria should be used to the extent that it corrects or remedies health and safety or major livability problems, or both. Projects that are created for the sole purpose of meeting the criteria in this handbook should be discouraged.

B. OBJECTIVES

The goal of the military family housing construction program is to provide at the earliest practical beneficial occupancy date, new housing of high quality within the space and cost limitations established by Congress, and at the most reasonable cost considering both initial investment and the life cycle cost of operation and maintenance. Special emphasis should be placed on obtaining the best, practical, functional, and esthetic design for each project, both with respect to living units and the site. Another goal is to pursue a vigorous program for the improvement of existing military family housing in order that obsolescence may be avoided.

C. LIMITATIONS ON SPACE AND COST

Title 10 U.S.C., Section 2826 (reference (13a)) establishes net area limitations for military family housing. An increase of 5 percent is allowed to permit award of turnkey construction contracts. The intent is to permit turnkey proposers to use "off-the-shelf" designs currently being constructed in the commercial marketplace. This 5 percent increase is not permitted when plans submitted by turnkey proposers are designed specifically for the military family housing project or where designs are not currently being offered in the commercial marketplace. Proposers' submissions reflecting a decrease in the statutory net areas that are not greater than 5 percent are also considered fully acceptable and should not be penalized for the lesser area. Where solar energy systems are economical and feasible, area criteria may be exceeded to the extent required by a solar energy system if it is to be installed.

a. Net Area Definition. Net area is defined as that space inside the exterior and party walls. The net area excludes:

(1) Carports.

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(2) Common stairways, halls, and entries in multifamily living units.

(3) Garages.

(4) Open or screened porches.

(5) Passive solar trombe and mass walls, and sun space(s), or both.

(6) Stairwells and landings.

(7) Unfinished attics.

(8) Unfinished basements, or service and bulk storage space, in lieu of a basement.

b. Enclosed Porches. In localities subject to adverse weather conditions, such as wind driven mist or noxious atmosphere, or both, open porches may be enclosed with appropriate fenestration or screening, or both, and not considered to increase the net area of the living units, provided that air conditioning or heating, or both, is not added and the basic character of the enclosed area is still that of a porch.

c. Size of Living Units by Bedroom Count. Statutory floor area limitations for living units shall be as shown in table 13-1.

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Table 13-1

MAXIMUM SIZE OF LIVING UNITS			
Pay Grade	Number of Bedrooms	Net Floor Area [1]	
		ft^2	[m^2]
O-7 and above	4	2,100	195
O-6	4	1,700	158
O-4 and O-5	4	1,550	144
	3	1,400	130
O-1 to O-3, W-1 to W-4, and E7 to E9	5	1,550	144
	4	1,450	135
	3	1,350	125
	2	950	88
E1 through E6	5	1,550	144
	4	1,350	125
	3	1,200	111
	2	950	88

[1] Net floor area may be increased by 10 percent for officers holding special command positions as designated by the Secretary of Defense, commanding officers of military installations, and senior noncommissioned officers of military installations. The combined total of the increase allowed for the above designations and turnkey shall not exceed 10 percent.

D. DESIGN STANDARDS AND CRITERIA

1. Site Planning.

a. Master Plans. Family housing projects shall be sited according to current installation master plans. When sited beyond the boundaries of the military installation, family housing projects shall conform to local land use practice or zoning.

b. Off-Installation Housing. Site selection procedures for off-installation sites should consider rush hour commuter times as a major evaluation criteria. Site shall consider commuting time and distance criteria for private housing in DoD Instruction 4165.45 (or DoD 4165.63-M).

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c. Off Street Parking. Living unit parking should be located off street to the extent possible. The minimum parking per living unit should be for two vehicles, one in the driveway and one in the carport or garage.

d. Garbage and Trash Collection. Appropriate architecturally treated screening of garbage and trash containers should be provided. Cans should be stored in a manner to prevent the attraction of rodents.

e. Recreational Facilities. Recreational facilities may be provided for the exclusive use of military families when the military family housing area is located outside of a military installation and when there are no comparable public facilities available, or when the walking distance from the on-installation housing project to installation recreational facilities is excessive. Indoor or sheltered recreational facilities may be provided when extreme weather conditions prohibit the use of outdoor facilities for the majority of the time.

2. Types of Living Units. Multistory, row-type townhouses, single-story or two-story duplex, or all four, or individual living units may be provided. Single-story living units may be either in duplex configurations or connected to the ends of two-story, row-type or townhouses, and apartment structures. When three-story, flat-type buildings are contemplated, the design should be such that entry to any living unit does not exceed one flight of stairs. At project sites involving steep gradients, extreme care should be taken to select living unit types that most economically and efficiently adapt to the site with a minimum change in existing contours. Single living units and apartment units are suggested when:

a. Single Living Units. Single living units may be appropriate in all cases where land is available.

b. Apartment Houses. Consideration should be given to apartment-type living units at military installations with missions that include schools or special training activities, or both, requiring permanent change of station, but less than a full length tour.

3. Complete Projects of Basic Adequacy. A completely adequate, and fully equipped military family housing project according to the provisions of this chapter, including all required elements, equipment, finishes, and basic site improvements, should be provided in all cases.

a. Living Units. Living units should include the following items:

(1) Air conditioning or mechanical ventilation when suggested in chapter 10.

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(2) Bulk storage

(3) Dishwasher.

(4) Double glazing or storm windows when authorized.

(5) Garbage disposer, except at those military installations with inadequate sewage disposal systems.

(6) Kitchen counters and cabinets.

(7) Kitchen exhaust fan to the exterior.

(8) Patio or balcony, privacy screening, paving, and landscaping.

(9) Provisions for future metering of energy consumption.

(10) Range.

(11) Refrigerator.

(12) Seamless resilient or ceramic tile floor finish in kitchen, bath(s), and powder rooms.

(13) Smoke detector(s).

(14) Telephone outlets and wiring

(15) Utility connections and dryer vent for occupant provided washer, dryer, and upright freezer.

(16) Venetian blinds, window shades, or drapes.

(17) Window screens.

b. Site Improvements. Site improvements should include the following features:

(1) Adequate drainage.

(2) Basic landscaping.

(3) Complete utility services.

(4) Project master meters for electric, gas, and water utilities when required to obtain "bulk" utility rates.

(5) Required roads, driveways, parking, walks, and street lighting.

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(6) Safety fencing when required.

(7) Screened pads or racks, and enclosures for refuse cans.

4. Architectural Considerations.

a. Basements. Basements should be considered when sites and costs permit, especially for two-story living units and in cold climates requiring deep footings.

b. Car Shelters. Carports should be provided at the rate of one per living unit. Garages in lieu of carports are appropriate in locations where the winter design temperature is -10 degrees F [-23.3 degrees C] or colder, and in locations where constant exposure to salt air or high winds require enclosed shelters. Garages offered by turnkey proposers in other climates are acceptable provided they do not penalize the other essential items of the project.

c. Outdoor Living. A patio or balcony, screened for visual privacy, may be provided for each living unit.

d. Bulk Storage Requirements. General storage space may be provided for living units that do not have basements, or have basements without easy outdoor access, or do not have usable attic space. The storage space should be divided between the exterior and interior of the living unit.

e. Bathrooms. The number of bathrooms in any single living unit should be as shown in table 13-2.

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TABLE 13-2

BATHROOMS		
Living Unit Size or Designation	Number of Bathrooms [1]	
	One-Story	Two-Story
Two Bedrooms	1 Full	1 1/2
Three, Four, or Five Bedrooms	2 Full	2 1/2
06 (CO) and 07 (CO) and above	3 Full	3 1/2

[1] An 1/2 bathroom is equivalent to a powder room with a water closet and a lavatory.

f. Energy Conservation. Appropriate energy conservation considerations and criteria when available should be included in all new construction and major rehabilitation projects when they are cost-effective on a life cycle basis.

g. Occupant Provided Freezer. Floor space and an electrical outlet for an occupant provided vertical style food freezer should be provided in all living units.

5. Electrical Criteria. Completed projects should comply with all applicable requirements of the National Electrical Code (reference (13b)).

6. Television (TV) Antenna Criteria.

a. Master Television (TV) Antenna System. A master television (TV) antenna system may be provided when adequate reception of the nearest TV station(s) cannot be obtained on the most efficient type of indoor TV antenna.

b. Community Antenna Television or Cable Television Facilities. The provision of TV distribution service to military personnel on military installations is normally a matter between local business interests and occupants of military family housing. As a general rule, where the service is provided, it is paid for by the individual subscriber in a manner similar to the payment for telephone service. Appropriated funds must not be used in providing this service.

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7. Telephone Facilities. The furnishing of telephone facilities for military family housing is excluded from the Defense Family Housing Property Account. However, thin-wall conduit may be provided to a telephone outlet plate to facilitate the future installation of a telephone.

a. Telephone Company Participation. Experience indicates that normally when the local telephone company is given notice of the forthcoming construction, the telephone company will wire the outlets at no cost to the contractor or to the government during construction. This practice is encouraged.

b. Government-Furnished Telephone Service. Government-furnished telephone service to family housing units may be provided be according to DOD Directive 4640.3 (reference (13c)) and DoD Directive 4640.4 (reference (13d)).

8. Heating, Cooling, and Ventilation Criteria. Heating systems and air conditioning systems should be combined in locations where air conditioning is appropriate (see chapter 10).

a. Heating. Selection of the method of heating for military family housing should be based upon an economic study of all locally available fuels including electricity, and according to the provisions of chapter 11 and available systems including heat pumps where permitted. The local public utilities commission or appropriate regulatory agency should be consulted regarding the history of rate increases and the possibility of increases in the foreseeable future. The lowest life cycle cost source of heat, considering all factors, should be selected.

b. Cooling and Ventilation. Air conditioning (central-type) or mechanical ventilation may be provided in accordance with chapter 10.

c. Humidification. Humidification equipment may be installed in all warm air heating systems in military family housing units located in areas having more than 3,000 F [1,648 C] heating-degree days. Humidistats or direct on-off controls may be provided.

d. Solar. All new construction and major rehabilitation projects should be analyzed for both passive and active solar energy use, and if found to be life-cycle-cost effective may be included in the project.

(1) Passive Solar. Passive solar architectural application should be routinely considered as a part of all project designs. Elaborate or unique applications such as attached sun spaces; earth sheltering; mass or water "trombe" walls; solar chimneys; solar dehumidifer; solar envelopes; and other innovations may be provided if supported by the same rigorous life-cycle-cost analysis as an active system.

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(2) Active Solar. Active solar applications proposed for domestic water heating, space heating, or a combination, should be evaluated for life cycle cost-effectiveness using a recognized process design program. The analysis should be made for 25 years or the known useful life of the system, whichever is less, using the most current consistent guidance on discount factors, escalation rates, and other factors to be included. The system should be designed based on the optimum cost-effective size and percentage of load provided on a year around basis. Because of the state of current technology, solar cooling systems need not be considered.

(3) Maintenance and Compatibility. Whether site mounted or unit mounted, systems should be designed for maximum ease of maintenance and to be architecturally compatible with the total military family housing environment.

9. Plumbing Criteria. The plumbing system should be installed according to the provisions of chapter 12.

10. Termite Protection. In areas of known infestation, positive measures should be taken to protect living units against damage by termites. Soil treatment and the treatment of lumber are the preferred and most effective methods. Sub-slab or in-slab ducts for heating and cooling should not be provided where soil treatment will be provided.

11. Fencing.

a. Safety and Perimeter Fencing. Safety fencing may be installed in military family housing areas as a safeguard against physical hazards or to discourage vandalism. Perimeter fencing should not be installed merely to define government property or to separate private sector housing from military family housing.

b. Privacy Fencing. Privacy fencing or screen fencing should be an integral part of the project design but be minimized to the extent necessary to achieve the required privacy.

12. Master Metering of Military Family Housing. Master meters should continue to be installed as a part of all new construction projects, in addition to individual living unit meters (see subparagraph D.3.b.(4), above) as follows:

a. Individual Utility Meters. All new detached single military family housing units should have individual utility meters.

b. Master Meters. It is intended that military family housing projects, both existing and planned, should be master metered to the maximum extent that is economically practicable. Master electric meters

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should have an integrated demand indicator. Normally for any one project, no more than two-line meters should be provided for the metering of a specific utility.

c. Alteration or Rehabilitation Projects. All significant alteration or rehabilitation projects should provide electric meter drops and heating fuel meter points for each living unit.

d. Continuous Sampling. When existing military family housing units are not covered by master meters, consideration should be given to continuous sampling of electrical consumption by use of a portable recording watt-hour meter.

13. Fire Protection. Housing projects should be designed to ensure the maximum feasible fire protection to life and property. Protective features should be provided according to the requirements of pertinent recognized fire safety codes. Noncombustible materials should be employed for interior finishes to the greatest extent practicable. Adequate means of exit to afford prompt and unobstructed egress should be provided for each living unit. Refer to Military Handbook MIL-HDBK-1008, Fire Protection for Facilities Engineering Design and Construction (reference (13e)).

E. UTILITIES

Electric, gas, and water utilities for military family housing should be provided according to the policy stated in DoD Instruction 4165.37 (reference (13f)).

F. PROJECT DEVELOPMENT

1. General.

a. Mandatory Features. Each project should be complete according to subsection D.3., above. Within this framework, it is desirable to provide, to the extent practicable, comparable and adequate military family housing units at all locations military service wide. Deductive bid items may be developed to permit flexibility of contract award in the event the lowest bid exceeds the government estimate.

b. Deductive Bid Items. When establishing deductive bid items, special consideration should be given to the impact on Operation and Maintenance (O&M) costs, and to the requirements of the area based on climatic conditions and local customs in housing construction and site development. Deductive bid items should be only for those items that may be eliminated without jeopardizing function and without an undue adverse impact upon O&M costs.

2. Consolidation of Projects. Consolidation of projects in areas of dual or tri-service needs should be considered for development as joint construction projects. The advertisement of groupings of projects on a

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combined basis in an effort to get the best bidding effort, as well as expediting development of the program, may have considerable merit.

3. Conventional and Industrialized Methods. Military family housing projects should permit construction by conventional (stick-build) or industrialized (prefabricated or componentized) methods.

4. Value Engineering. Project review for conventionally designed projects should include value engineering as a routine procedure and such review should be applicable to the site development portion, as well as to the living units.

5. Procurement Procedures. Turnkey (one-step) advertising (see FAR 14-501 (also DoD FAR Supplement 14.5) (reference (13g))) procurement procedures will normally be used in military family housing.

G. SCHOOL FACILITIES

1. Planning. Concurrent with the planning of new military family housing projects, consideration should be given to the resulting increased demand placed on existing educational facilities. For military family housing projects within the United States, it is important that representatives of the Military Department concerned, including the military installation commander, work closely with federal, state, and local authorities.

2. Coordination and Scheduling. In those instances where additional school facilities are determined to be required, the necessary actions, including site selection and required application to federal or state agencies, or both, should be made at the earliest possible date to ensure the availability of adequate school facilities at the time of beneficial occupancy of the new military family housing units. For overseas projects, the proper Military Department representative should consult with the school area superintendent regarding the need for additional educational facilities.

REFERENCES

(13a) Public Law 97-214, Title 10 U.S.C., Section 2826
(13b) "National Electrical Code," National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
(13c) DoD Directive 4640.3, "Unofficial Telephone Service at DoD Activities," August 20, 1979
(13d) DoD Directive 4640.4, "Standard Rates for Unofficial Telephone Service at DoD Installations," December 22, 1982
(13e) MIL-HDBK-1008, Fire Protection for Facilities Engineering, Design, and Construction

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REFERENCES (continued)

(13f) DoD Instruction 4165.37, "Policy for Provision of Utility Services for Military Family Housing," January 17, 1961
(13g) "The Federal Acquisitions Regulation (FAR)," for sale by the Superintendent of Documents, Washington, D.C. 20402

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PREPARING ACTIVITY

NAVY - YD

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(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-HDBK-1190	FACILITY PLANNING AND DESIGN GUIDE 1 Sep 1987

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
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	☐ USER
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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