

# United States Air Force

## Passive Solar Handbook Programming Guide

1. COMPONENT		FY 19_ MILITARY CONSTRUCTION PROJECT DATA			2. DATE	
3. INSTALLATION AND LOCATION				4. PROJECT TITLE		
5. PROGRAM ELEMENT		6. CATEGORY CODE	7. PROJECT NUMBER		8. PROJECT COST (\$000)	
9. COST ESTIMATES						
ITEM	UM	QUANTITY	UNIT COST	COST (\$000)		

10. DESCRIPTION OF PROP	Energy Cost Savings												Appendix D	
	REGION 2				Heat			Cool			Daylight		ATR	
	D-S	IND	DG	SUN	NM	NVN	WIN	SKY	SAW	MON				
A Admin, <5000 sf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
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C Admin, Multistory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
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E Dining Facility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
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J Maint, High-Bay	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
K Maint, HVAC	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
L Maint, Low-Bay	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
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P Training, Multistory	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Q Gymnasium	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
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No Savings

# Foreword

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The United States Air Force is committed to energy efficiency and the use of renewable forms of energy in all of its facilities when shown to be reliable and cost effective. In its response to the Military Construction Codification Act of 10 USC 2801, Executive Order 12003 and Office of the Secretary of Defense directives, the Air Force has implemented numerous policies and procedures to significantly reduce the usage of fossil fuel derived energy. Since the oil embargo of the early 1970's, the Air Force has encouraged and demonstrated the integration of a variety of energy conserving features, including solar applications, in its facilities. Passive solar systems represent one type of solar application that can be used in almost all facilities to improve their energy efficiency and to lower their energy costs.

The audience for this five-volume passive solar handbook is the numerous Air Force personnel and others responsible for programming, planning, designing, supervising construction, commissioning, and operating and maintaining Air Force commercial-type facilities worldwide. This handbook was developed in response to MAJCOM and base needs for information on the integration of passive solar systems into new Air Force commercial-type facilities.

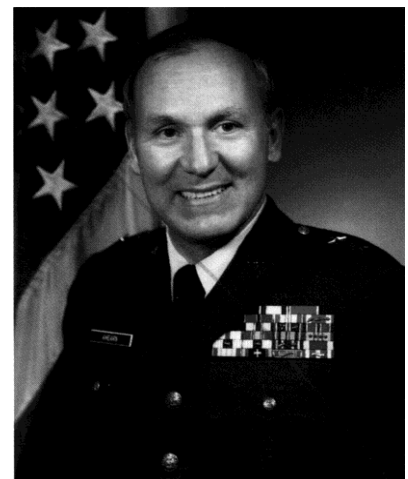
The goal of the Air Force Passive Solar Handbook series is to integrate passive solar concepts into the Air Force planning, programming, design, construction, and operation processes for commercial-type facilities.

The five volumes of the Passive Solar Handbook are as follows:

- Volume I: Introduction to Passive Solar Concepts*
- Volume II: Comprehensive Planning Guide*
- Volume III: Programming Guide***
- Volume IV: Passive Solar Design (proposed)*
- Volume V: Construction Inspection (proposed)*

This is the third volume of the series.

**Joseph A. Ahearn, Major General, USAF**  
Director of Engineering and Services



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Architectural Energy Corporation

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This volume of the handbook supports the process of programming Air Force commercial-type (nonfamily housing) facilities. Its focus is the inclusion of passive solar design information in standard Air Force facility programming documents. The goal is to reduce energy consumption in commercial-type facilities through the application of reliable and cost-effective passive solar design concepts. This goal can be achieved only if Air Force facility programmers are both knowledgeable and sensitive to the requirements of passive solar design, and also understand how to include passive solar design requirements in programming documents.

*Four key facility program documents are discussed in this volume of the handbook:*

DD Form 1391  
Project Book  
Design Instructions  
CBD Announcement

These documents represent the most important elements of the decision-making process for determining the need for, cost of, and design of Air Force commercial-type facilities. If passive solar design is to be included or considered in a new facility, it must be so stated consistently in each of these documents.

Each chapter discusses the preparation of one of these facility programming documents. Where passive solar design information should appear in these documents, it is presented along with examples. A checklist is presented in Chapter 6.0 as a reminder of the key points for preparing the program documents. This checklist can be referred to at a later time without the need to reread the entire manual.

Volume III, in total, represents Step 10 of the comprehensive planning process for passive solar facilities as presented in Volume II: Comprehensive Planning Guide. Step 10 is concerned with the appropriate application of passive solar design information in standard Air Force facility planning documents.

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Each of the four facility programming documents may be prepared by different organizational units within the Air Force facility construction program. Therefore, the simplest way of using this volume is for each Air Force organization to refer directly to the chapter that describes the document for which they are responsible. We recommend, however, that all chapters be read so that the relationship of the various programming documents is understood. This information will enable the facility programming staff to prepare clear, concise documents that effectively incorporate passive solar design information.

## Introduction

## Facility Planning Documents

## Step 10: Complete Documentation

## Preparing Documents Using This Volume

## Introduction

The proper and effective inclusion of passive solar design information in DD Form 1391 enhances the probability of project approval.

A DD Form 1391 is prepared at two distinct stages of the facility planning and procurement process. Upon definition of a facility need, a DD Form 1391 is prepared and included in the Base or MAJCOM five-year plan. Assuming the project is accepted by the Senior Air Staff and the Office of the Secretary of the Defense, a second DD Form 1391 is prepared at the 35% design stage for submission to Congress for construction funding approval. Obviously, the level of information is very general in the five-year plan submission and is more specific in the 35% design submission. The appropriate locations and types of information to include in each of the submissions are discussed below.

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## Five-Year Plan Submission

This DD Form 1391 submission initiates the multiyear process for justifying, designing, and constructing an Air Force facility. This occurs at the conclusion of Base or MAJCOM Comprehensive Planning where overall short-, mid-, and long-term facility requirements have been established. Volume II of the Passive Solar Handbook, Comprehensive Planning Guide, will be used to identify the most energy cost saving passive solar design features.

The portions of DD Form 1391 that are appropriate locations for including passive solar design information are *items 9 (Cost Estimates: Supporting Facilities), 10 (Description of Proposed Construction), and 11 (Requirement)*. Passive solar design information and examples for each of the items are presented below.

### Item 9

*Item 9* is divided into cost categories of Primary Facility, Supporting Facilities, Contingency, and Supervision - Inspection - Overhead. As a matter of general philosophy, all designs should incorporate passive solar design features and the costs for these features should be included in the Primary Facility budget. However, where additional funding is required, beyond the accepted unit cost per square foot guideline, and has been shown to save energy costs (from Volume II, Comprehensive Planning Guide), this amount should appear as a separate element within the Supporting Facilities cost category entitled Passive Solar Design. See Figure 2-1.

1. COMPONENT FY 19, MILITARY CONSTRUCTION PROJECT DATA		2. DATE	
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9. COST ESTIMATES			
ITEM	U/M	QUANTITY	COST (\$000)
10. DESCRIPTION OF PROPOSED CONSTRUCTION			
11. REQUIREMENTS			

**Item 9**  
Primary Facility, Supporting Facilities, Contingency, and Supervision

Figure 2-1: DD Form 1391, Item 9

Besides a general description of the proposed construction, special elements or features of the project are described in *Item 10*. Passive solar design features determined to save energy costs from Volume II can be discussed briefly. See Figure 2-2.

**Item 10**

1. COMPONENT FY 19, MILITARY CONSTRUCTION PROJECT DATA		2. DATE	
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ITEM	U/M	QUANTITY	COST (\$000)
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11. REQUIREMENTS			

**Item 10**  
General Description of Proposed Construction, Special Elements, or Features

Figure 2-2: DD Form 1391, Item 10

The following are examples of phrases that could be used:

*Perimeter and core daylighting techniques will be used.*

*Multistory building surrounding an atrium for daylighting, passive solar heating, and common services with combination steel frame and reinforced concrete structural elements and masonry exterior walls; elevators, communications, data-network prewiring, all utilities and vehicle parking.*

*Single-story building with steel frame, concrete slab floor, and clerestory windows for daylighting and passive solar heating.*

Volume I contains descriptions and examples of the various passive solar heating, cooling, and daylighting concepts.

**Item 11**

*Item 11* includes information on the Project Requirement, Current Situation, Impact, and Additions and typically is prepared by the facility's intended user (Figure 2-3). It represents the justification for the proposed facility. The compliance with public law, Executive Orders, and OSD directives should be highlighted in the justification. A few sample phrases are presented below.

*Energy savings of 50% will be achieved over current facilities housing these functions through the use of renewable forms of energy in compliance with PL 100-42 (S 1382).*

**Item 11**  
Project Requirement, Current  
Situation, Impact, and Additions

Figure 2-3: DD Form 1391, Item 11

*Consolidation of existing dispersed services into a central facility will improve mission efficiency and at the same time, reduce overall energy use by 55% as required by DOD criteria.*

At this stage, either through in-house staff or an A-E contract, a conceptual facility design has been developed. More detailed energy and economic analysis has been performed to assess the cost-effectiveness of the previously identified passive solar design features using Volume IV of the Passive Solar Handbook. Consequently, it is possible to be more specific in the DD Form 1391 concerning the cost and benefits of the passive solar design features.

## **35% Design Submission**

Based on the A-E's preliminary design cost estimate, any additional cost for the passive solar design features should be included under the Supporting Facilities cost category. *These costs can be specified as cost per square foot (SF) or as a lump sum (LS) cost.*

**Item 9:  
Cost Estimates**

The specific passive solar features included in the design should be summarized. Only the major passive solar features need to be presented. The phrasing examples from the five-year plan submission are also appropriate for the 35% design submission.

**Item 10:  
Description of Proposed Construction**

The overall justification for the facility likely will remain the same; however, you can be more exact regarding the anticipated energy savings. The A-E should have performed energy and economic analyses on the chosen passive solar design features. Consequently, you can include these results in the revised DD Form 1391. It may be useful to contrast the proposed building's energy performance with that of other such military facilities or with private sector facilities. An example is as follows:

**Item 11:  
Requirements**

*Facility predicted energy use is 30,000 Btu/sf-yr, whereas the military energy budget for this facility type is 50,000 Btu/sf-yr and typical private energy use is approximately 60,000 Btu/sf-yr. This energy performance greatly exceeds the DOD requirements for energy efficiency.*

## Introduction

The Project Book contains data, criteria, functional requirements, and cost information to support programming and design of Air Force facilities. Base or MAJCOM design engineers normally prepare the Project Book with the assistance of tenant and supported units. The Project Book is used by:

<b>HQ USAF/LEE</b>	<i>HQ USAF/LEE Staff</i> - to analyze project costs and to develop the Congressional proposal;
<b>AFRCE</b>	<i>AFRCE</i> - to ensure a clear, complete, and thorough statement of facility requirements and inclusion of all required Air Force policy directives;
<b>Design Agent</b>	<i>Design Agent</i> - to instruct and guide the in-house design staff or an A-E contractor during the design phase; and
<b>Project Designer</b>	<i>Project Designer</i> - to develop preliminary and final designs that meet all project requirements.

The table of contents of a Project Book is generally the same for all projects. See Table 3-1.

## Project Book

The Project Book is organized into two parts - Part I: Design Guidance and Part II: Project Support Data. The sections or tabs of each part are as shown in Table 3-1, although not all Project Books will have all sections/tabs.

The appropriate tabs in which passive solar design information should be included are B, C, D, E, F, J, N, and P. The type of information to include in these tabs and a few examples are described in succeeding sections.

<b>PART I - DESIGN GUIDANCE</b>		<b>PART II - PROJECT SUPPORT DATA</b>	
<b>Tab A</b>	Base Supplement	<b>Tab L</b>	Project Cost Estimate Worksheet
<b>Tab B</b>	User Requirements Summary	<b>Tab M</b>	Air-conditioning/Heat Load Estimates
<b>Tab C</b>	Site Description	<b>Tab N</b>	Energy Impact Statement
<b>Tab D</b>	Architectural and Structural Considerations	<b>Tab O</b>	MAJCOM Review Comments
<b>Tab E</b>	Mechanical Considerations	<b>Tab P</b>	Solar Energy System Application
<b>Tab F</b>	Electrical Considerations		
<b>Tab G</b>	Water Supply-Waste Water Treatment		
<b>Tab H</b>	Environmental Considerations		
<b>Tab I</b>	Fire Protection Considerations		
<b>Tab J</b>	Maintainability		
<b>Tab K</b>	Communications		

Table 3-1: Project Book, Part I and II

Design criteria related to the function and operation of the facility are described in this Tab, stated from the user's perspective. Issues of thermal comfort, lighting quality, and design character should be defined. These and other issues are important for defining the basic energy-related performance requirements that the facility must satisfy.

## Tab B

Example phrasing of passive solar design information is presented below:

*Individual user control of heating, cooling, and ventilation is desirable due to the wide variation of functions housed in the facility.*

*Daylighting is the preferred approach to the provision of general lighting requirements, supplemented by task lighting at the individual work stations.*

*An open plan arrangement is required to facilitate efficient communications among all staff, and maximize the potential of ventilative cooling possible in this mild climate.*

This Tab is a complete description of all project site considerations and proposed changes that can affect the design. Typically, a narrative description of the construction site utilities, adjacent facilities, landscaping, climatic and environmental conditions is discussed, and supporting data and maps are included.

## Tab C

Site characteristics that may influence passive solar design include size and shape of adjacent facilities and vegetation that affect solar access, wind patterns, ground cover, and topography. These passive solar design site characteristics should be identified so that the designer takes them into account during the design process.

Example phrasing of passive solar design information is presented below:

*An existing three-story office building east of the project site and a stand of coniferous trees west of the project site will cast winter shadows on portions of the site. The designer should position the building to maximize solar access for daylighting and passive solar heating.*

*15-20 mph winter winds from the northwest are common to the project site. The designer should attempt to minimize the impact of these winds through interior space zoning (buffer spaces) or with site vegetation and landscaping.*

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*Cool prevailing winds are common to the project site during the summer months. Natural ventilation should be evaluated in lieu of mechanical cooling for maintaining acceptable levels of comfort.*

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## **Tab D**

This Tab describes any unusual or special architectural and structural requirements that must be considered in designing the facility. The primary passive solar design information to be included in this Tab is as follows:

### **Energy Budget**

*Energy Budget for the Project* - in thousands of Btu/sf-yr of conditioned floor area.

### **Operating Schedule**

*Operating Schedule* - number of people expected to be housed in the facility and their anticipated work schedule.

### **Conservation Standards**

*Applicable Energy Conservation Standards or Requirements* - reference Air Force guidance or ASHRAE energy standards, if appropriate, or list any building siting or orientation requirements, insulation levels, glazing requirements, shading, or other fenestration-related requirements.

Passive solar design feature descriptions list those passive solar features found to save energy costs from Volume II analysis. The designer will be required to consider these passive features and conduct more detailed energy and economic analyses during the design process.

Example phrasing of passive solar design information is presented below:

*The building will be designed for a total energy budget figure of 40,000 Btu/sf-yr. Life-cycle cost analysis and computer energy analysis will be performed per the latest version of ETL: Computer Energy Analysis.*

*Air Force guidance on levels of insulation, ventilation, lighting, and mechanical system efficiency shall be used.*

*The building shall be designed for optimum use of daylighting and passive solar heating. See the United States Air Force Passive Solar Handbook, Volume I: Introduction to Passive Solar Concepts.*

This Tab describes any unusual or special mechanical requirements and conditions that must be considered during HVAC system design. Passive solar design information to be included in this Tab includes design integration of HVAC, energy management, and passive system controls; disaggregated energy budgets figures for heating, cooling, ventilation, lighting and process energy; and appropriate energy conservation measures.

## Tab E

Example phrasing of passive solar design information is presented below:

*The total energy use for the project is 50,000 Btu/sf-yr. (ETL: Energy Budget Figures), made up of the following estimated end use energy budget figures:*

<i>Heating</i>	<i>= 11,500 Btu/sf-yr</i>
<i>Cooling</i>	<i>= 11,000 Btu/sf-yr</i>
<i>Ventilation</i>	<i>= 3,500 Btu/sf-yr</i>
<i>Lighting</i>	<i>= 20,500 Btu/sf-yr</i>
<i>Process</i>	<i>= 3,500 Btu/sf-yr</i>

*Building Total = 50,000 Btu/sf-yr*

*The HVAC and passive system shall be designed to integrate with the existing base EMCS. Follow AFM 88-36 and guidance to be provided at the criteria review conference.*

This Tab describes any unusual or special electrical requirements and conditions that must be considered during lighting and electrical system design. Passive solar design information to be presented in this Tab includes lighting controls tied to daylighting systems, special motors, or fans that may be required for the passive system, and potential for task lighting and core daylighting concepts.

## Tab F

Example phrasing of passive solar design information is presented below:

*Where daylighting is used, provide lighting control systems, i.e., continuous dimmers or stepped, to reduce intensity levels of electric lighting when adequate daylight is available.*

*If general lighting is used, it shall be direct fluorescent with low-temperature energy efficient ballasts and lamps, as applicable. High-intensity discharge types may be used where practical. Incandescent lighting shall be minimal. Consider using task and accent lighting.*

*Core daylighting concepts shall be analyzed for any interior offices and common areas.*

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**Tab J**

Maintenance problems associated with previous passive solar projects should be identified in this Tab so that the designer avoids them in the current project. Examples of maintenance problems and phrasing for this Tab are presented below:

*Movable insulation shall not be used on this project due to inconsistent and ineffective use by typical building occupants and to numerous maintenance problems experienced in previous applications.*

*Exterior lightweight movable shading devices shall not be used on this project because of the high winds associated with the building site.*

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**Tab M**

Although this Tab contains only a preliminary estimate of the air conditioning load of the facility, it is important that impacts, both positive and negative, of the passive solar design features be recognized. Most simplified heating and cooling load calculation procedures do not account for the dynamic daily and seasonal performance of passive solar design features. *Therefore, a caution statement must be included in this Tab so that the designer recognizes that the specified loads are only a first approximation and do not consider the passive solar design features.*

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**Tab N**

This Tab is used when energy consumption or source availability will have a major impact on the project. The information to be addressed in this Tab includes: (a) types of energy to be used; (b) reasons for their selection over other types; (c) long-term costs and availability projections; (d) effect on the local market in the area surrounding the specific installation; and (e) alternative sources or systems which might reduce total demand or critical energy source.

Passive solar design information is discussed in this Tab only so far as it represents a major element in the energy impact of the project. Otherwise, it is assumed that the other tabs provide sufficient guidance and justification for energy conservation and passive solar design. An example would be a facility where a daytime interruption of power could not be tolerated and maximum use of daylighting and other passive systems is

necessary to maintain operations. The special conditions that lead to the unique passive solar design requirements would be discussed and justified in this Tab.

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This Tab specifically identifies the passive solar design features that must be evaluated by the designer. The information for the Tab comes from Volume II analysis. The designer should be given Volume I: Introduction To Passive Solar Concepts and Volume II: Comprehensive Planning Guide, so that he or she understands the assumptions used to determine passive solar design feasibility, and Volume IV, Passive Solar Design, so that the required passive solar design energy and economic evaluation methods are followed.

## **Tab P**

# 4.0

# Preparing Design Instructions

Design Instruction (DI) provides authority to the Design Manager, through the AFRCE or MAJCOM, to initiate the facility design process. DI's are issued by the Senior Air Staff through the computerized PDC system. The DI PDC screen identifies the project, provides key dates of authorizations, and presents the project budget and scope. Of concern to passive solar design is the inclusion of funds for the costs of passive solar design features. Listed as Solar Programmed Amount (PA), this budget represents an estimate of construction costs that will be associated with cost-effective passive solar design features beyond what must be considered in all designs. The Solar PA is determined in part through Volume II: Comprehensive Planning Guide, and will appear on the DD Form 1391.

An important point to remember is that *passive solar design features must be considered for all facility projects, whether or not funds are provided in the Solar PA*. The project Programmed Amount includes costs for passive solar design features assumed to involve no added construction costs. *The Solar PA is for passive solar design features that will involve added construction costs, but which have been determined from Volume II analysis to save energy costs.*

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          C U R R E N T   M C P   D E S I G N   I N S T R U C T I O N
PDC -----
FY ----- REG ----- STATUS-----
REQ MAJCOM ----- HOST MAJCOM ----- DM ----- CM ----- PKGNO -----
                                     DA             CA

AUTHORITY FOR DESIGN
          AF DI ISSUED          DM DI ISSUED          CURRENT DI ISSUED
          ON . . -----          ON . . . . -----          ON . . . . -----

          DESIGN AUTH          AF ADVERTISING          AF CONTR AWARD
          TO . . --- %          AUTH . . -----          AUTH . . -----

BUDGET AND SCOPE
          PROGRAMMED AMOUNT..... -----          SCOPE..... ----- SF
          PHASE PROGRAMMED AMOUNT.... -----          CATEGORY CODE: -----
          SOLAR PROGRAMMED AMOUNT.... -----

PROGRAM CODES:          (1) --          (2) --          (3) --
MISCELLANEOUS INFORMATION          MAJCOM          AIR FORCE          % DSGN
          PB DUE          2807 STATUS          PRIORITY          PRIORITY          ON ---
          -----          ---          ---          ---          ---          ---

AF DI COMMENT: -----
    
```

Figure 4-1: PDC Screen

When in-service capability is unable to provide the needed professional services, and procurement of such services is in the interest of national defense, the work must be accomplished by an architect-engineer (A-E) contract. For any A-E contract estimated to exceed \$10,000, an announcement must be published in the Commerce Business Daily (CBD).

## Introduction

The project must be listed with a brief statement concerning the location, scope of service needed, the significant evaluation factors, and the relative order of importance the government attaches thereto, the construction cost limitations, type of contract proposed, the estimated start and completion dates, and the date by which responses to the notice must be received, including submission of Standard Forms 254 and 255, if required. Appropriate statements must be made concerning any specialized qualifications, security classifications, and limitations on eligibility for consideration.

The design manager (DM) for the project is responsible for preparing the CBD announcement. The DM must review the Base Solar-Energy Cost PDC screen, the Project Book, and Volume II: Comprehensive Planning Guide analysis, before preparing the CBD announcement. *If passive solar design features are shown to save energy costs, then the CBD announcement must include a requirement for A-E expertise in passive solar design and analysis.*

Passive solar design information may be incorporated into the CBD announcement in two places: (1) project description, and (2) evaluation factors. Each of these is discussed below.

---

The requirement for energy efficiency and the use of passive solar design features may be included with the project description. The type of passive solar design features to be considered during the design phase may be listed. This information will assist the A-E firms in preparing Standard Form 255 in response to the CBD announcement.

## Project Description

Example phrasing of a project description that includes passive solar design features is presented below.

*The project includes a 28,000 sf building to support the following functions: administration, classrooms, storage, mechanical repair shop, security lighting, fencing, hardstands, and utility drops. The building shall be energy efficient and use cost-effective passive solar design features, especially daylighting. An EMCS and continuous dimming light controls shall be evaluated during the design phase.*

---

*The project involves the design of a 5,750 sf training support center. The facility will provide for the central management of audio-visual aids for base education and training. Energy conservation and cost-effective passive solar design features such as direct gain windows and daylighting will be included in the design.*

---

## **Evaluation Factors**

The factors to be used in evaluating and selecting the A-E firm are stated in the CBD announcement. If energy efficiency and passive solar design expertise are required in order to achieve the project design objectives, then one or more evaluation factors reflecting that requirement should be included on the list.

Example phrasing of energy conservation and passive solar design evaluation factors is presented below.

*Ability to determine the cost-effectiveness of energy conservation and passive solar design features.*

*Ability to design and analyze the energy savings associated with passive solar daylighting strategies.*

*Expertise in building energy and daylight analysis using detailed simulation and physical models.*

*Demonstrated experience in designing and analyzing daylighting systems with stepped or continuous dimmer lighting controls.*

The exact phrasing of the project description and evaluation factors is dependent on the type and detail of information that is available from the Volume II: Comprehensive Planning Guide analysis and the Project Book. However, it is recommended that the requirement for passive solar design be clearly stated in the CBD announcement. This will encourage all A-E firms who wish to work with the Air Force to develop in-house expertise or obtain the services of an energy consultant for the project.

---

## **A-E Forms 254 and 255 Evaluation**

Evaluation of Standard Forms 254 and 255 is made by a Preselection Board and a Selection Board. The Preselection Board develops and adopts an evaluation procedure and conducts the initial evaluation. The evaluation is based on qualifications data maintained by the responsible Air Force Civil Engineer, typically on a Standard Form 254, and data submitted by A-E firms responding to the CBD announcement and the evaluation

factors contained therein. The Preselection Board recommends qualified A-E firms to the Selection Board.

Many factors enter into the ultimate selection of an A-E for a specific project. The Preselection Board will address primarily the evaluation factors contained in the CBD announcement. The Selection Board considers the CBD evaluation factors as well as a broader set of issues. Consequently, energy and passive solar design considerations will represent only a portion of the overall evaluation and scoring of the A-E qualifications. However, expertise and experience of the A-E in energy and passive solar design may influence the final outcome of the A-E selection process. *Therefore, knowing how to evaluate an A-E's energy and passive solar design experience and expertise is essential for the fair and proper selection of the project A-E.*

In evaluating Standard Forms 254 and 255 for energy and passive solar design experience and capabilities, look for the following information:

## Standard Form 254

*Does the A-E firm or its associated consultants have personnel (Item 8) that typically would be required to perform energy and passive solar design analysis such as mechanical, electrical, and energy engineers?*

Item 8

*Does the A-E or its associated consultants identify project experience (Item 10) related to energy conservation and solar energy utilization?*

Item 10

*Does the A-E firm or its associated consultants identify specific projects (Item 11) where energy conservation and passive solar design were major design considerations?*

Item 11

*Does the A-E firm possess in-house energy analysis and passive solar design capabilities or will an energy consultant be used (Items 4 and 5)?*

## Standard Form 255

Items 4 and 5

*Do the resumes of key personnel (Item 7) show a level of education, training, and experience in the design and analysis of energy conservation and passive solar design? Are areas of special expertise noted, for example, daylighting design and analysis?*

Item 7

*Are the projects listed (Item 8) representative of the type of energy experience the A-E or its consultants have? Are the current projects for federal agencies (Item 9) responsive to energy conservation and passive solar design issues? Does the A-E firm specifically address the energy/passive solar design evaluation factors in its presentation of additional information and supporting resources for the project (Item 10)?*

Item 8

Item 9

Item 10

## Introduction

This chapter presents a summary in the form of a checklist, of the information presented in Chapters 2.0 through 5.0, describing the areas in which passive solar design information should be included in Air Force facility programming documents. The checklist can be used as a reminder of the key points for preparing the program documents without the need to reread the individual chapters.

---

## Preparing DD Form 1391

### Five-Year Plan Submission

#### Item 9 Cost Estimates

Five-Year Plan Submission



*Include any Solar Program Amount under a Support Facility Cost heading entitled Passive Solar Design.*

#### Item 10 Description of Proposed Construction



*Provide a description of the energy cost saving passive design features, determined from Volume II analysis within the general description of the project.*

#### Item 11 Requirement



*Indicate how passive solar design features enable the facility to meet or exceed Congressionally or Secretary of Defense mandated energy performance targets, or Air Force energy design criteria.*

35% design submission

#### 35% Design Submission

Same as Five-Year Plan Submission but present greater detail, based on A-E's energy and economic analysis.

---

## Preparing A Project Book

### Tab B User Requirements Summary



*Specify user requirements as they relate to passive solar design, such as thermal comfort, lighting quality, and design character.*

Tab C Site Description

*Identify all unique site features that may affect the design of the building's passive solar features.*



Tab D Architectural and Structural Considerations

*Identify passive solar design features that must be evaluated by the A-E for cost-effectiveness.*



*Specify the overall energy budget of the project.*



*Specify the anticipated occupancy schedule and load of the facility.*



*Identify any applicable energy standards or criteria that must be followed.*



Tab E Mechanical Considerations

*Identify any special HVAC requirements that may affect or be affected by the passive solar design features.*



*Specify a disaggregated energy budget consisting of heating and cooling, ventilation, lighting, hot water, and process loads.*



Tab F Electrical Considerations

*Identify any electrical or lighting requirements that may affect or be affected by the passive solar design features.*



## Tab J Maintainability



*Identify passive solar design features that should be avoided due to maintenance problems.*

## Tab M Air Conditioning/Heat Load Estimates



*If this Tab is used, insert a caution that specifies air conditioning loads are only a first approximation and do not typically account for the passive solar design features.*

## Tab N Energy Impact Statement



*Discuss the role passive solar design features may play if the project has a major energy impact on the location,*

## Tab P Solar Energy System Application



*Identify passive solar design features that must be evaluated by the A -E for cost-effectiveness.*

Refer designer to Volume I: Introduction To Passive Solar Concepts, Volume II: Comprehensive Planning Guide, and Volume IV: Passive Solar Design, for further information and assistance.

## Preparing Design Instructions

## Solar Program Amount



*Include any added costs associated with effective passive solar design features determined as part of the comprehensive planning process analysis and listed in DD Form 1391.*

---

Project Description

*Describe the primary passive solar design features that will have to be evaluated during the design phase.*



**Preparing a CBD Announcement**

Evaluation Factors

*List evaluation factors concerning A-E experience and expertise in passive solar design and analysis.*





# Index

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This index is a cross-reference for the information in the first three volumes of the Passive Solar Handbook. For each entry, the volume number is shown in parentheses, followed by the page number in that volume upon which the information is located. If the information is found in more than one volume, semicolons are used to separate volumes. For instance, for the entry **Air movement: (I) 26; (II) 5**, information about air movement is contained in Volume I on page 26 and in Volume II on page 5.

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