Users Guide for ENVSTD™ Program Version 2.0 and LTGSTD™ Program Version 2.0

February 1989

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**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

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USERS GUIDE FOR
ENVSTD™ PROGRAM VERSION 2.0
AND LTGSTD™ PROGRAM VERSION 2.0

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SUMMARY

On January 30, 1989, the U.S. Department of Energy (DOE) promulgated 10 CFR Part 435, Subpart A, an Interim Rule entitled "Energy Conservation Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for New Federal Buildings." As a consequence, federal agencies must design all future federal commercial and multi-family high rise residential buildings in accordance with the Standards, or show that their current standards already meet or exceed the energy-efficiency requirements of the Standards.

Although these newly enacted Standards do not regulate the design of nonfederal buildings, DOE recommends that all design professionals use the Standards as guidelines for designing energy-conserving buildings. To encourage private sector use, the Standards were presented in the January 30, 1989, *Federal Register* in the format typical of commercial standards rather than a federal regulation. As a further help, DOE supported the development of various microcomputer programs to ease the use of the Standards.

Two of these programs--ENVSTD™ (Version 2.0) and LTGSTD™ (Version 2.0)--are detailed in this users guide and provided on the accompanying diskette. This package, developed by Pacific Northwest Laboratory (PNL), is intended to facilitate the designer's use of the Standards dealing specifically with a building's envelope and lighting system designs. Using these programs will greatly simplify the designer's task of performing the sometimes complex calculations needed to determine a design's compliance with the Standards.

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1.0 INTRODUCTION

In accordance with Title III of the Energy Conservation and Production Act of 1976, the U.S. Department of Energy (DOE) is developing energy conservation performance standards for new buildings. The law provides that the standards will be voluntary for new nonfederal buildings but mandatory for new federal buildings.

On January 30, 1989, DOE promulgated interim energy conservation performance standards for new commercial and multi-family high rise residential buildings (54 FR 4538-4720). Within 180 days of the promulgation date, federal agencies are required to design all future federal commercial and multi-family high rise residential buildings in accordance with the interim Standards or show that their current standards satisfy the energy-efficiency requirements of the interim Standards. The interim Standards do not regulate the design of nonfederal buildings, although DOE recommends the use of the Standards to the design professions as guidelines for the design of energy-conserving buildings.

The interim Standards represent a significant federal effort to assist the private sector in developing energy conservation standards without regulatory intrusion. Congress has directed federal agencies to regulate their own design practice instead of someone else's by setting an example that may be transferred to the private sector by adoption of similar standards.

For this reason, the interim Standards issued on January 30, 1989, are presented in the format of commercial standards instead of a federal regulation. A more conventional regulatory format could easily serve to regulate federal design practices but it would not be as easy to transfer to private sector design practices. To facilitate such transferability, DOE has used the commercial standards format for the interim Standards that can be better understood and more readily used in the private sector. For the same reason, the interim Standards also contain extensive explanatory material not normally included in federal standards.

In support of DOE's efforts, the Pacific Northwest Laboratory (PNL)^(a) has developed two microcomputer programs to help ease the use of the Standards. The two programs, ENVSTD™ (Version 2.0) and LTGSTD™ (Version 2.0), are designed to help building designers and other users of the interim Standards determine the building envelope and lighting requirements and calculate if a building design is in compliance with these requirements.

This users guide explains what each program does and how to run it. Section 2.0 contains generic instructions for installing and using the programs on a microcomputer. The data required by each program and the operation of special function and cursor control keys are described in Section 3.0 for ENVSTD™ and in Section 4.0 for LTGSTD™.

Diskettes containing the programs are included at the back of this users guide.^(b) The files contained on the program diskettes are listed in Appendix A. ***If your diskettes do not contain the files shown there, contact us at once.***

Other appendices to this guide provide useful support information. Appendices B and C contain patterns for function key overlay templates that will enhance the ease of entering the data required for each program. Hard-copy examples of data files created using each program are provided in Appendices E and F. The tables in Appendix G explain the various codes needed as input to run the LTGSTD™ program. Finally, although the PNL developers have endeavored to provide you with bug-free programs, problems may nevertheless emerge. Consequently, Appendix H--a form on which user comments and program problems may be reported--is included.

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- (a) Operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.
 - (b) If you requested 3-1/2-in., 720-kbyte diskettes, you will receive a single diskette with two directories--ENVELOPE and LIGHTING. If you requested 5-1/4-in., 360-kbyte diskettes, you will receive one diskette for each program.

2.0 INSTALLING AND USING THE PROGRAMS

Both ENVSTD™ (Version 2.0) and LTGSTD™ (Version 2.0) are written in the C computer language. The compiled versions of the programs provided on the diskettes will run on virtually any MS-DOS compatible microcomputer using the MS-DOS 2.0 (or later) operating system. However, be forewarned that ***data files created with previous versions (1.0, 1.1, 1.2, 1.4, and 1.5) of ENVSTD™ and LTGSTD™ are not compatible with Version 2.0.***

2.1 REQUIRED EQUIPMENT

To run these programs, you will need the following equipment:

- an IBM-DOS or other MS-DOS compatible microcomputer that has
 - at least 384K RAM
 - two floppy disk drives or one floppy disk drive and a hard disk.
- a monochrome or color monitor^(a)
- a math coprocessor^(b)
- MS-DOS Version 2.0 or later.

2.2 INSTALLING THE PROGRAMS

Before you install or use the programs, make a copy of both diskettes. Refer to your computer's DOS reference manual for instructions on formatting and copying diskettes.

Your own computer's configuration will determine which installation instructions to follow. Section 2.2.1 gives instructions for the microcomputer with two floppy disk drives. Section 2.2.2 gives instructions for a microcomputer with one floppy disk drive and a hard disk drive. Both sets

-
- (a) The programs use color to make it easier to distinguish data and entry positions from other parts of the programs. You do not need a color monitor; the colors will appear as shades of grey on monochrome monitors.
 - (b) The math coprocessor, often called an 8087, 80287, or 80387 chip, is optional but significantly increases the speed with which the programs perform the calculations.

of instructions were written assuming that you have already started your microcomputer with the operating system (DOS) diskette^(a) and have a DOS prompt on the screen.

2.2.1 Computers with Two Floppy Diskette Drives

To run either program on a computer with two disk drives, insert the copy of the program diskette in Drive A. To start a program, type the name of the program, **ENVSTD20** or **LTGSTD20**, and press **Enter**. After the title and disclaimer screens appear, press any key to continue; the first input screen will then appear.

2.2.2 Computers with Hard Disk Drives

If your computer has a hard disk drive, we recommend that you copy the programs onto your hard disk. This speeds up the loading and saving of data files in the programs and allows you to organize your data files more easily.

The first step in copying the **ENVSTD™** or **LTGSTD™** program files to your hard disk is to create a directory for those files. Directories allow you to organize files into related groups. You should put all the files on each program diskette into the same directory. The following instructions assume that the directory name is **STANDARD**, but you can use any name allowed by DOS for the directory. You should create separate directories for each program.

- Make sure that the **C>** prompt is on the screen. Type **C:** and press **Enter**.
- Type **MKDIR \STANDARD** and press **Enter**. This DOS command creates a directory on the hard disk called **STANDARD** under the main root directory. Your DOS manual contains more information about creating and using directories.

-
- (a) For microcomputers with two diskette drives, insert the DOS diskette in Drive A and turn on the computer. After you provide the time and date information requested on the screen, the screen will show an **A>** prompt.

For microcomputers with a hard disk drive that have DOS installed on the hard disk, simply turn on the computer. The screen will then show a **C>** prompt. The instructions given for computers with hard disk drives assume that the DOS is already on the hard disk and the hard disk is designated as Drive C.

- Type **CHDIR \STANDARD** and press **Enter**. This DOS command makes **STANDARD** the current default directory.

Now copy the files from the program diskette to the hard disk:

- Make sure that the **C>** prompt is on the screen. If it is not, type **C:** and press **Enter**.
- Insert the program diskette in Drive **A**.
- Type **COPY A:*.*** and press **Enter**. This DOS command copies every file from the diskette in Drive **A** to the current default directory on the hard disk Drive **C**.

To run either program, first change your current default directory to the directory you created for the program. Then, to start either program, type the name of the program, **ENVSTD20** or **LTGSTD20**, and press **Enter**. After the title and disclaimer screens appear, press any key to continue. The first input screen will then appear.

2.3 USING THE PROGRAMS

Throughout the remainder of this users guide, the following conventions are used:

- When a special function key is shown, it is indicated by **bold** typeface (e.g., the **F1** function key).
- When a cursor control key appears, it also is indicated by **bold** typeface. These keys are as follows:

- ← left arrow cursor key
- right arrow cursor key
- ↑ up arrow cursor key
- ↓ down arrow cursor key

Home Home key

PgUp Page Up key

PgDn Page Down key

Esc Escape key

Del Delete key

Ins Insert key

Enter Enter or Return key

BS Backspace key.

Instructions for using the special function and cursor control keys specific to each program are provided in Sections 3.0 and 4.0.

3.0 ENVSTD™ PROGRAM

In this section, instructions for using the ENVSTD™ program are provided. This program, named for ENvelope STandards, was designed to help you assess whether your building design meets the envelope system performance requirements set out in Section 5.5 of the Standards (54 FR 4538-4720). The calculations performed by the ENVSTD™ program ***exactly duplicate the requirements and compliance calculations contained in Section 5.5 of the Standards.***

To evaluate compliance of a proposed design with the envelope requirements of the Standards, you must enter data on the proposed wall, roof, and foundation configurations. You will enter these data on two input screens, designated as follows:

- Exterior Wall
- Other Requirements.

Instructions for interacting with each input screen are spelled out in Sections 3.1 and 3.2.

To help you use ENVSTD™, this users guide also provides you with

- function key template patterns for your computer keyboard
- sample data files generated by ENVSTD™.

Before you begin to run this program, turn to Appendix B. There you will find two keyboard template patterns, one each for personal computer keyboards with 84 keys (e.g., IBM PC/XT with 10 functions) and 101 keys (e.g., IBM PC/AT or PS/2 with 12 functions). You may want to photocopy and cut out the template appropriate for your computer. Because the ENVSTD™ program assigns functions to specific keys on the keyboard, the template will make using the program easier.

Actual data files created by using ENVSTD™ are included in Appendix E in hard-copy form and on your program diskette, to demonstrate how the program works. The PNL program designers created these files by first applying the Standards to two buildings and then using the data from those buildings as input to the ENVSTD™ program. To review either data file using the program,

press F1; the current directory will appear. You will be prompted for a filename; type the name of the file (MEDOFFIC or APARTMEN) and press Enter. The program will then load the information contained in the file.

3.1 EXTERIOR WALL INPUT SCREEN

In this section, the input requirements, cursor control keys, and special function keys for the Exterior Wall screen are described. The Exterior Wall screen is shown in Figure 3.1.

	CITY: BUILDING: CODE <B,C,H>: DATE:								WEIGHTED AVERAGE CRITERIA
	N	NE	E	SE	S	SW	W	NW	
WL AREA									
GL AREA									
SCx									
PF									
VLT									
Uof									
WALL Uo									
HC									
INS POS									
EQUIP									
LIGHTS									
DLCF									
L O A D S									
HEATING									
COOLING									
TOTAL									
F1 Load F2 Save	F3 Clear Input F4 Directory	F5 Other Screen F6 List Cities	F7 Help F9 Calculate	F10 Copy Across Esc Exit to DOS					

FIGURE 3.1. Exterior Wall Input Screen

3.1.1 Input Requirements

The program automatically checks the input data to ensure that it is within the ranges allowed by the Standards. *The program will not attempt to calculate compliance with the exterior wall requirements of the Standards if any value is beyond the allowable ranges indicated in the category descriptions that follow.*

Data in 16 categories must be entered on the Exterior Wall input screen:

- CITY** Enter a city code for one of the 234 available sites. Press F6 and enter a state postal abbreviation to view available sites and their numeric codes. If the exact project location is not listed, select the code for the city having the climate that is most similar. The city codes are also listed alphabetically by state in Appendix D.
- BUILDING** Use this space to identify the project being evaluated. The name or description is limited to 25 characters.
- CODE** Enter 'B', 'C', or 'H'.
- B indicates that the building will be both heated and cooled.
C indicates that the building will be cooled only.
H indicates that the building will be heated only.
- DATE** Use this space to identify the date and other information such as the initials of the individual conducting the evaluation. A maximum of 25 characters may be entered.
- WL AREA** Enter the total wall area (both glazed and opaque) for the orientation. Zero values may be left blank. If the actual direction the wall faces falls between available increments, use the closest orientation. The program accepts values from 0.0 to 99,999. The units may be either ft^2 or m^2 but must be consistent with those used for glazing area.
- GL AREA** Enter the glazed wall area including window frames for the orientation. Zero values may be left blank. The program accepts values from 0 to 99,999. The units may be either ft^2 or m^2 but must be consistent with those used for wall area.
- SCx** Enter the shading coefficient (SCx) of the glazing, including interior and exterior shading devices other than horizontal overhangs. Use projection factors (PF) to describe horizontal overhangs. The program accepts values from 0.0 to 1.0. See manufacturer literature or the *ASHRAE Handbook* (ASHRAE 1985) for appropriate values.
- PF** If there is a horizontal overhang over the windows, enter a projection factor (PF) for the orientation. Projection factor is the ratio of the depth of the external shading projection to the height of the projection above the bottom of the window. The program accepts values from 0.0 to 2.0; however, no credit is given in the Standards for a PF greater than 0.5.

- VLT** If automatic electric lighting controls for daylight utilization are used, enter the visible light transmittance (VLT) of the glazing. Visible light transmittance is the decimal fraction of visible light that is transmitted through the glazing. The program accepts values from 0.0 to 1.0. See manufacturer literature for appropriate values.
- Uof** Enter the glazing assembly U-value (Uof), in $\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$, including the effects of sash, frames, and spacers in multiple-glazed units. Section 5.3 of the Standards describes procedures for determining these values. The program accepts values from 0.0 to 1.4. For locations with greater than 15,000 HDD65, Uof must not exceed 0.45.
- WALL Uo** Enter the U-value of the opaque exterior wall (WALL Uo), in $\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$, including the effects of parallel-path conduction. Section 5.3 of the Standards describes procedures for determining the effect of parallel paths. The program accepts values from 0.0 to 1.4.
- HC** Enter the heat capacity (HC) of the opaque exterior wall, in $\text{Btu}/\text{ft}^2\cdot^\circ\text{F}$. Heat capacity is calculated by summing the products of the thickness, density, and specific heat of each material that makes up the exterior wall. The program accepts values from 1.0 to 100.0. No additional credit is given in the Standards for heat capacity above 21.0.
- INS POS** Enter the integer code that best describes the location of insulating material in the opaque exterior wall. Codes for insulation position (Ins Pos) are
- 1 - Exterior - insulation outside of the wall's thermal mass
 - 2 - Integral - insulation integral with the wall's thermal mass
 - 3 - Interior - Insulation inside of the wall's thermal mass
- EQUIP** Enter the equipment power density as determined by Section 5.3.B.1.1 of the Standards. The program accepts values from 0.0 to 10.0 W/ft^2 .
- LIGHTS** Enter the electric lighting power density as determined by Section 5.3.B.1.1 of the Standards. The program accepts values from 0.0 to 10.0 W/ft^2 .

DLCF Enter the fraction of the lighting power within 15 ft of the exterior wall that will be automatically controlled for daylight utilization. The program accepts values from 0.0 to 1.0. If the lights will not be controlled for daylight utilization, you can either leave this line blank or enter zero.

3.1.2 Cursor Control Keys

With the following six keys, you can move the cursor around the Exterior Wall input screen:

- Enter** Moves the cursor to the first row and column or to the next row in the same column.
- BS** Deletes the last character or, if at the first character of a column, moves the cursor to the previous column.
- ←** Moves the cursor one column to the left or, if at the left-most column, moves the cursor to the last column of the previous row.
- Moves the cursor one column to the right or, if at the right-most column, moves the cursor to the first column of the next row.
- ↑** Moves the cursor up one row in the same column.
- ↓** Moves the cursor down one row in the same column.

3.1.3 Special Function Keys

The following special function keys for the Exterior Wall screen enable you to calculate compliance, save and recall exterior wall compliance calculations, and access additional features.

- F1** Lists all ENVSTD™ data files on current directory (all files with .ENV extension). You are then prompted for a filename to load into the ENVSTD™ program.

Any legal DOS filename can be used (up to eight characters in length). The program will read up to 20 characters to allow the use of disk drive and path designations. Enter the disk drive, path, and filename without the .ENV extension.
- F2** Saves a ENVSTD™ data file to disk. The files are saved as ASCII files, allowing you to print them using a text editor or word processor. Enter the disk drive, path, and filename without the .ENV extension.

- F3** Clears all input data from the screen and re-initializes all variables.
- F4** Lists files in the current default directory with the .ENV extension.
- F5** Switches the display from the Exterior Wall screen to the Other Requirements screen. The Other Requirements screen displays requirements for walls next to unconditioned spaces and below grade roofs, floors and slabs, and skylight requirements. (The Other Requirements screen is described in Section 3.2.) Pressing **F5** again switches the display back to the Exterior Wall screen.
- F6** Displays a list of available climate data. Enter the two-letter state postal abbreviation to view available locations for a given state. Entering the city code or pressing **Enter** will return you to the Exterior Wall screen.
- F7** Displays a context-sensitive Help message for the information required at the current cursor position. Press any key to return to the Exterior Wall screen.
- F9** Recalculates the cooling and heating totals using the data entered on the screen, calculates the criteria, calculates the weighted averages, and determines if the exterior envelope configuration PASSES or FAILS for the given location and space conditioning code (heating, cooling, or both).
- If the Exterior WALL Uo value or the Uof value exceeds the maximum allowed by the Standards for the location, the program will not calculate the criteria. Enter a new WALL Uo or Uof value that does not exceed the maximum value.
- F10** Copies an entry across the row to all columns. **F10** does not work on the first row, WL AREA. The program uses this row to determine which orientations are used for copying GL AREA, WALL Uo, HC, INS POS, EQUIP, and LIGHTS. The program uses GL AREA to determine which orientations are copied across for SCx, PF, VLT, Uof, and DLCF.
- Del** Deletes the entry at the current cursor position.
- Esc** Exits from the program.

3.2 OTHER REQUIREMENTS INPUT SCREEN

The input requirements, cursor control keys, and special function keys for the Other Requirements screen are described in this section. The Other Requirements screen is shown in Figure 3.2.

CITY:		BUILDING:	
DATE:			
MAXIMUM PERCENTAGE OF ROOF AREA IN SKYLIGHTS:		DESIGN	LIMIT
Visible Transmittance of Skylight		0.500	0.500
Design lighting Footcandles of Space		50	50
Percentage of Roof Area in Skylights:		=	=
MAXIMUM ALLOWABLE Uo:			
Roof		=	=
Wall Adjacent to Unconditioned Space		=	=
Floor Over Unconditioned Space		=	=
MINIMUM ALLOWABLE R-VALUE:			
Well Below Grade		Unheated	Unheated
Slab on Grade (Heated or Unheated)		Horizontal	Horizontal
Insulation Position		24 in.	24 in.
Depth or Width (Inches)		=	=
R-Value of Concrete Slab Insulation		=	=
F5 Return to Wall Screen	F9 Calculate	Arrows Move	
F7 Help	Del Delete Entry		

FIGURE 3.2. Other Requirements Input Screen

3.2.1 Input Requirements

The following data are required to use the Other Requirements screen. **All data on the Exterior Wall screen must be within allowable ranges and you must have entered a value for lights before the allowable skylight area can be calculated correctly.**

Visible Transmittance of Skylight If skylights are used, enter the visible light transmittance of the skylight glazing. Visible transmittance is the decimal fraction of visible light that is transmitted through the glazing. The program accepts values from 0.0 to 1.0. However, skylight area limits are constant for visible transmittances below 0.50 and above 0.75 and are interpolated between these two values. See manufacturer literature for appropriate values of visible transmittance.

Design Lighting Footcandles of Space	If skylights are used, enter the illumination level (in footcandles) that the electric lighting system in the space below the skylights will be designed to provide. The program accepts values of 30, 50, or 70. Only the first character (3, 5, or 7) need be entered.
Percentage of Roof Area in Skylights	Enter the percentage of total building roof area that consists of skylights, including the skylight frame. The program accepts values from 0 to 100. If the skylight area in the design does not exceed the limit, the condition in Section 5.3.10.3.1 of the Standards has been met. If the other conditions in Section 5.3.10.3 are met, skylight conductance can be excluded from the roof conductance (U_o) entry below. To receive daylight credit, electric lighting fixtures must be automatically controlled for daylight utilization and certain standards for skylight thermal integrity must be met. The program uses the average lighting wattage that you enter on the Exterior Wall screen.
Roof (and Skylights Not Qualifying for Daylight Credit)	Enter the conductance (U_o), in $\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$, of the roof including any skylights that do not qualify for the daylight credit. The program accepts values from 0.0 to 1.4. Section 5.3 of the Standards describes how to calculate the total conductance of combinations of materials. To determine whether skylights are eligible for the daylight credit, enter values under "Limit on Skylight Area for Daylight Credit" and check the requirements of Section 5.3.10.3 of the Standards.
Wall Adjacent to Unconditioned Space	Enter the overall conductance (U_o), in $\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$, of opaque walls that enclose conditioned spaces and are adjacent to interior unconditioned spaces. The program accepts values from 0.0 to 1.4. Section 5.3.1 of the Standards describes how to calculate the overall conductance of combinations of assemblies. Requirements related to walls adjacent to unconditioned space can be found in Section 5.5.3.
Floor over Unconditioned Space	Enter the overall conductance, in $\text{Btu}/(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})$, of floor areas of conditioned spaces that are over unconditioned spaces. The program accepts values from 0.0 to 1.4. Section 5.3.1 of the Standards describes how to calculate the overall conductance of combinations of assemblies. Requirements related to floors over unconditioned space can be found in Section 5.5.2.1.1.
Wall Below Grade	Enter the thermal resistance (R), in $(\text{h}\cdot\text{ft}^2\cdot^\circ\text{F})/\text{Btu}$, of walls below grade. The program accepts values from 0 to 100. No insulation is required in climates with fewer than 3,000 HDD65 or for those portions of walls more than one story below grade. Requirements related to walls below grade can be found in Section 5.5.4.

- Slab on Grade** Enter "H" for heated or "U" for unheated to indicate whether concrete slabs are heated or unheated. Requirements for heated slabs on grade are higher by 2 (h·ft²·°F)/Btu than those for unheated slabs. Requirements related to insulation of slab on grade can be found in Section 5.5.2.1.2.
- Insulation Position** Enter "V" for vertical or "H" for horizontal to indicate the position of the insulation. Vertical insulation extends from the top of the slab downward. Horizontal insulation extends from the top of the slab downward to the bottom of the slab and then horizontally beneath the slab. Vertical insulation is not required to extend below foundation footings.
- Depth or Width** Enter, in inches, the depth of insulation (if placed vertically) or the width of insulation beneath the slab (if placed horizontally). The program accepts values of 24, 36, or 48 inches. Only the first character (i.e., 2, 3, or 4) need be entered. The R-value requirement for slab insulation varies depending on insulation position and depth (or width).
- R-Value of Concrete Slab Insulation** Enter the resistance (R), in (h·ft²·°F)/Btu, of slab insulation. The program accepts values from 0.0 to 100. There are no insulation requirements for slab-on-grade in locations with fewer than 3,000 HDD65 or where footings extend less than 18 inches below grade.

3.2.2 Cursor Control Keys

The following keys allow you to move the cursor around the Other Requirements screen:

- BS** Deletes the character to the left of the cursor.
- ↑** Moves the cursor up one row.
- ↓** Moves the cursor down one row.

3.2.3 Special Function Keys

The following special function keys are used on the Other Requirements screen:

- F5** Moves to the Exterior Wall screen from the Other Requirements screen and vice-versa.
- F7** Displays a context-sensitive Help message related to data input at the current cursor position.

- F9** Recalculates design limits and compliance states for the Other Requirements screen.
- Del** Deletes the entry at the current cursor position.

4.0 LTGSTD™ PROGRAM

Instructions for using the LTGSTD™ program are given in this section. The LTGSTD™ program (from LighTing SStandards) was designed to help you calculate whether your design complies with the lighting-related requirements detailed in Sections 3.3, 3.4, and 3.5 of the Standards (54 FR 4538-4720). The calculations performed by LTGSTD™ ***exactly duplicate the requirements and compliance calculations contained in Sections 3.3, 3.4, and 3.5 of the Standards.***

The program has four input screens, designated as follows:

- Main
- Space Data
- Controls Data
- Exterior Data.

Sections 4.1 through 4.4 explain what you must do to operate each screen and what you will obtain as a result of those operations.

Two additional aids are provided in this guide to help you use LTGSTD™:

- function key template patterns for your computer keyboard
- sample data files generated by LTGSTD™.

Before you begin to run the LTGSTD™ program, turn to Appendix C. There you will find two keyboard template patterns that may be photocopied and cut out to use on personal computer keyboards with either 84 keys (e.g., IBM PC/XT) or 101 keys (e.g., IBM PC/AT, PS/2). The template will enhance using the LTGSTD™ program because functions have been assigned to specific keys on the keyboard.

The second user aid is in Appendix F, in the form of sample data files for the LTGSTD™ program. The PNL program designers applied the Standards to three buildings and then entered the data from those buildings into the LTGSTD™ program. The resulting three data files, included in Appendix F as hard copy and on the diskette, exemplify how the program works. To review any of these data files using the program, press F1. A listing of the

LTGSTD™ data files in the current default directory will appear, and you will be prompted for a filename. Type the name of the file (**BANK**, **CHURCH**, or **MEDOFFIC**) and press **Enter**. The LTGSTD™ program will then load the information contained in the file.

Before you enter your own data, please note that LTGSTD™ *does not calculate power adjustment factors allowed for automatic control devices* as noted in Section 3.3 of the Standards. You will have to consider these adjustment factors separately.

4.1 MAIN INPUT SCREEN

On the Main input screen, you will typically enter information about the building type, building gross floor area, interior and exterior design lighting power (watts), and a building/project description and date. The LTGSTD™ program automatically calculates the compliance values for Interior Lighting Power Allowance (ILPA) and Exterior Lighting Power Allowance (ELPA). If the design lighting power does not exceed the compliance values, the building design complies. The Main input screen is shown in Figure 4.1. The cursor control keys, special function keys, and data required for this screen are described in the following sections.

4.1.1 Input Requirements

The Main screen has two required entries: building type code(s) and building gross area(s). Two other entries, building description and date, are optional.

BUILDING TYPE If you plan to use the prescriptive compliance path (Section 3.4 of the Standards), enter a character from A to K to designate the appropriate building occupancy. Alternatively, press **F6**, move the cursor to the appropriate building type/area code, and press **Enter**. The prescriptive path is available only for the building type/area codes listed. This option is intended primarily for use with core and shell buildings or during the preliminary design phase. The building type codes are also listed in Table G.1, in Appendix G of this users guide.

BUILDING TYPE	AREA	BUILDING
NA	0 ft ²	DATE
NA	0 ft ²	YEAR
NA	0 ft ²	
	0 Gross ft ²	
BUILDING DESIGN		
Interior Lighting Power	0 W	0 W/Gross ft ²
Exterior Lighting Power	0 W	

PRESCRIPTIVE CRITERIA	
Unit Lighting Power Allowance	NA W/Gross ft ²
Interior Lighting Power Allowance	NA W
SYSTEM PERFORMANCE CRITERIA	
Unit Power Density	0 W/Gross ft ²
Interior Lighting Power Allowance	0 W
EXTERIOR LIGHTING CRITERIA	
Exterior Lighting Power Allowance	0 W

F1 Load	F3 Clear	F5 Space Screen	F7 Help	F9 Calc /F10 Year
F2 Save	F4 Directory	F6 Bldg Type Codes	F8 Ext. Screen	Esc Exit to Dos

FIGURE 4.1. Main Input Screen

- AREA** Enter either the gross area of the entire building or, if significant amounts of different building/occupancy types are present, the gross area of each. The program and the Standards require that different building/occupancy types be at least 10% of the gross building area to be considered. The units are ft², and the program accepts values from 0 to 99,999,999.
- BUILDING** Use this space to identify the project being evaluated. The building name or description is limited to 30 characters.
- DATE** Use this space to record the date and other information such as the initials of the individual conducting the evaluation. A maximum of 30 characters may be entered.
- INTERIOR LIGHTING POWER** Enter the total interior lighting power for the building as it has been designed. Include the power required for supplemental and task-related lighting provided by plug-in luminaires as well as permanently installed lighting. The program accepts values from 0 to 999,999,999 W.

EXTERIOR LIGHTING POWER Enter the total exterior lighting power for the building as it has been designed. Include all power used for illumination of roads, grounds, and building exteriors that is energized through the building electrical service. The program accepts values from 0 to 999,999,999 W.

4.1.2 Cursor Control Keys

The keys described below allow you to move the cursor around the Main input screen.

- BS** Deletes the last character of a column.
- ←** Moves the cursor one column to the left or, if at the left-most column, moves the cursor to the last column of the previous entry.
- Moves the cursor one column to the right or, if at the right-most column, moves the cursor to the first column of the next entry.
- ↑** Moves the cursor up one row to the start of the entry above it or, if on the top row, moves the cursor to the bottom row.
- ↓** Moves the cursor down one row to the start of the entry below or, if on the bottom row, moves the cursor to the top row.

4.1.3 Special Function Keys

Special function keys allow you to calculate compliance, save and recall lighting compliance calculations, and access other features.

- F1** Lists all LTGSTD™ data files in the current default directory (all files with .LTG extension). You are then prompted for a filename to load into the LTGSTD™ program.

Any legal DOS filename can be used (up to eight characters in length). The program will read up to 20 characters to allow the use of disk drive and path designations. Enter the disk drive, path, and filename without the .LTG extension.

- F2** Saves a LTGSTD™ data file to disk. The files are saved as ASCII files, allowing you to print them later using a text editor or word processor. Enter the disk drive, path, and filename without the .LTG extension.

- F3** Clears all data from the Main screen, the Space Data screen, the Controls Data screen and the Exterior Data screen. Initializes all values to zero.
- F4** Lists all LTGSTD™ data files in the current default directory with an .LTG extension.
- F5** Switches the display from the Main screen to the Space Data screen.
- F6** Displays the building type descriptions and codes in a window. From this information you can select the appropriate space type code by pressing **Enter** when the cursor is moved over the desired building type. To return to the Main screen, press **Esc** or the space bar.
- F7** Displays a context-sensitive Help message for the information required at the current cursor position. Press any key to return to the Main screen.
- F8** Changes the display from the Main screen to the Exterior Data screen.
- F9** Calculates the interior lighting power allowance for both the prescriptive and system performance compliance path, and the exterior lighting power allowance. The program also shows if the design values comply with these requirements.
- F10** Changes the requirements calculated for the criteria from 1989 values to 1993 values.
- Esc** Exits from the program.

4.2 SPACE DATA INPUT SCREEN

The cursor control keys, special function keys, and input requirements for the Space Data screen are described in this section. The Space Data screen is shown in Figure 4.2. On this screen, you enter information about the building space--space number designation (optional), space type code, ceiling height, area or dimensions, and number of spaces. The space type description corresponding to the cursor position is displayed at the top of the screen as shown in Figure 4.2. The program automatically calculates the Area Factor (AF), Unit Power Density (UPD), Base Unit Lighting Power Allowance (Pb), Lighting Power Budget (LPB) based on the space data, and Total Lighting Power Budget (TOTAL LPB). It also sums the total building area.

SPACE TYPE DESCRIPTION:						TOTAL AREA:				
SPACE NO.	TYPE	DIMENSIONS	AREA	CLG HT	NO SPACES	AF	UPD	Pb	LPB	TOTAL LPB
Arrows, PgUp, PgDn, and Home Move Ins Insert Record / Del Delete Record						F6 Space Type Codes F7 Help / F8 Main Screen F10 Year:				

FIGURE 4.2. Space Data Input Screen

4.2.1 Input Requirements

You can enter up to 500 spaces for a single building. You need not completely enter one record before you move to a new record. However, incomplete records will not be included in the compliance calculations.

- SPACE NO.** Enter space numbers to identify individual spaces within the building. Combinations of up to four characters are allowed.
- SPACE TYPE** Enter an integer from 1 to 131 to designate the appropriate space type code. Alternatively, press F6, move the cursor to the appropriate space type code, and press Enter. If the space type or activity is not represented in the list, select the code with the most similar space type or activity. Space type codes are also listed in Appendix G of this guide.
- DIMENSIONS** Enter the length and width of the space, in ft. The program will automatically calculate the floor area. Alternatively, the length and width of the space can be left blank and the area entered directly. The program accepts values from 0 to 999 ft.
- AREA** Enter the floor area of the space, in ft². Alternatively, the length and width of the space, in ft, can be entered under the Dimensions column and the floor area will be calculated automatically. The program accepts values from 0 to 999,999 ft².

CLG HT Enter the height of the ceiling, in ft. The program uses the ceiling height to calculate the Area Factor (AF) for each space. The program accepts values from 0 to 500 ft.

Alternatively, enter all other data, then return to the first data line and enter the typical ceiling height. Then press **Ctrl F10**. The program will automatically copy the ceiling height to all lines with data.

NO. SPACES Enter the number of spaces in the building that are like the one described. This value serves as a multiplier, allowing you to enter multiple similar spaces in a single entry. The program accepts values from 0 to 99.

4.2.2 Cursor Control Keys

The keys listed below allow you to move the cursor around the Space Data input screen.

BS	Deletes the last character of a column.
←	Moves the cursor one column to the left or, if at the leftmost column, moves the cursor to the first column of the same row.
→	Moves the cursor one column to the right or, if at the rightmost column, moves the cursor to the last column of the same row.
↑	Moves the cursor up one row in the same column and, if on the top row of the Space Data screen, scrolls the records up one row.
↓	Moves the cursor down one row in the same column and, if on the bottom row of the Space Data screen, scrolls the records down one row.
Ins	Inserts a blank record line at the current position of the cursor. This function can be used at any record line of the space data.
Del	Deletes a record line at the current position of the cursor. This function can be used to delete any record line of the space data file.
PgUp	Moves the cursor up 17 record lines or, if near the beginning of the space input data, advances the cursor to the first record line.
PgDn	Moves the cursor down 17 record lines.
Home	Moves the cursor to the first record line.

4.2.3 Special Function Keys

The special function keys allow you to move to the other program screens, view and select space type codes, and access Help messages.

- F5** Changes the display from the Space Data screen to the Controls Data screen.
- F6** Displays the space types and their descriptions in a window when the cursor is in the space type entry column. F6 allows you to cursor through the types and select one by pressing **Enter**. If no space type is desired, press the space bar or **Esc** to return to the Space Data screen.

When in the space type code window, you can search for a specific space type by pressing **F1**, entering a character string, and then pressing **Enter**. If you press **F1** and **Enter** again, the program will search for the next occurrence of the character string.
- F7** Displays a context-sensitive Help message for the information required at the current cursor position. Press any key to return to the Space Data screen.
- F8** Switches the display from the Space Data screen to the Main screen.
- F10** Changes the requirements calculated for the criteria from 1989 values to 1993 values.
- Ctrl F10** Copies the ceiling height on the line where the cursor is currently located down to all lines where data has been entered.

4.3 CONTROLS DATA INPUT SCREEN

The Standards provide designers with incentives for efficiently controlling electric lighting. The Controls Data screen enables you to record your design's lighting controls and assess their contribution toward compliance with the Standards.

The cursor control keys, special function keys, and input requirements for the Controls Data screen shown in Figure 4.3 are described below. On this screen, you will enter information about the number of tasks or groups of tasks and the type(s) of control(s) installed in the space. The requirements for minimum number of equivalent control points and the credits

SPACE			NO. CONTROLS			TOTAL EQUIVALENT		
NO.	DESCRIPTION	AREA	TASKS	TYPE	NO.	TYPE	NO.	CONTROL POINTS
								INSTLD. REGD.

NO. Enter the number of controls installed in the space for
CONTROLS the control type entered in the column to the left. The
 program accepts values from 0 to 99.

4.3.2 Cursor Control Keys

The following keys allow you to move the cursor around the Controls Data input screen:

BS	Deletes the last character of a column.
←	Moves the cursor one column to the left or, if at the leftmost column, moves the cursor to the first column of the same row.
→	Moves the cursor one column to the right or, if at the rightmost column, moves the cursor to the last column of the same row.
↑	Moves the cursor up one row in the same column and, if on the top row of the Controls Data screen, scrolls the records up one row.
↓	Moves the cursor down one row in the same column and, if on the bottom row of the Controls Data screen, scrolls the records down one row.
PgUp	Moves the cursor up 17 record lines or, if near the beginning of the space input data, advances the cursor to the first record line.
PgDn	Moves the cursor down 17 record lines.
Home	Moves the cursor to the first record line.

4.3.3 Special Function Keys

The special function keys allow you to move to other program screens, view and select controls codes, and access Help messages.

F5	Switches the display from the Controls Data screen to the Space Data screen.
F6	Displays the lighting control types and their descriptions in a window when the cursor is sitting in the controls type columns. You can move the cursor through the controls types and choose one by pressing Enter , or you can return to the Controls Data screen by pressing Esc or the space bar.

AREA CODE Enter an integer from 1 to 13 indicating the appropriate code for each illuminated exterior area. Alternatively, press F6, move the cursor to the appropriate area code, and press Enter. If the exterior area or activity is not represented by the list, select the code with the most similar area or activity. The exterior area codes are listed in Table G.2.

AREA OR LENGTH Enter either the area or the length corresponding with the illuminated exterior area or surface. For exterior area codes 1, 2 and 6, the values are in linear feet; for other area codes, the values are in square feet. The program accepts values from 0 to 999,999,999. The program uses the area or length in calculating the allowance wattage for each exterior illumination area.

4.4.2 Cursor Control Keys

The following keys allow you to move the cursor around the Exterior Data input screen:

BS	Deletes the last character of a column.
←	Moves the cursor one column to the left or, if at the leftmost column, moves the cursor to the first column of the same row.
→	Moves the cursor one column to the right or, if at the rightmost column, moves the cursor to the last column of the same row.
↑	Moves the cursor up one row in the same column and, if on the top row of the Exterior Data screen, scrolls the records up one row.
↓	Moves the cursor down one row in the same column and, if on the bottom row of the Exterior Data screen, scrolls the records down one row.
Ins	Inserts a blank record line at the current position of the cursor. This function can be used at any record line of the exterior data.
Del	Deletes a record line at the current position of the cursor. This function can be used at any record line of the exterior data.
PgUp	Moves the cursor up 17 record lines or, if near the beginning of the space input data, advances the cursor to the first record line.

PgDn Moves the cursor down 17 record lines.

Home Moves the cursor to the first record line.

4.4.3 Special Function Keys

The special function keys allow you to view and select exterior area codes, get help information for the required data, and change the display from the Exterior Data screen to the Main screen.

F6 Displays a window with exterior area type codes and descriptions. You can move the cursor through the codes and select a code by pressing **Enter**. Pressing any other key will bring you back to the Exterior Data screen.

F7 Displays a context-sensitive Help message for the information required at the current cursor position. Press any key to return to the Controls Data screen.

F8 Changes the display from the Exterior Data screen to the Main screen.

5.0 REFERENCES

American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE). 1985. *ASHRAE Handbook, 1985 Fundamentals Volume*. Atlanta, Georgia.

Energy Conservation and Production Act. Public Law 94-385, August 14, 1976. 90 Stat 1144 *et seq.*, 42 USC 6831, as amended.

54 FR 4538-4720. January 30, 1989. "Energy Conservation Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for New Federal Buildings; Interim Rule." *Federal Register*.

APPENDIX A

FILES CONTAINED ON PROGRAM DISKETTES

APPENDIX A

FILES CONTAINED ON PROGRAM DISKETTES

ENVSTD™ FILES

The ENVSTD™ program diskette includes the files listed below.

- **ENVSTD20.EXE** - Compiled Envelope Program
- **ENVELOPE.DOC** - Section 3.0 of this users guide.

The ENVSTD™ program diskette also includes two sample data files:

- **MEDOFFIC.ENV** - Data file for an office building (48,664 ft², 3-story, El Paso, Texas)
- **APARTMEN.ENV** - Data file for a high-rise apartment building (496,976 ft², 9-story, Milwaukee, Wisconsin).

The sample data files for the ENVSTD™ program are also shown in Appendix E.

LTGSTD™ FILES

The files included on the LTGSTD™ program diskette are

- **LTGSTD20.EXE** - Compiled Lighting Program
- **LIGHTING.DOC** - Section 4.0 of this users guide.

The LTGSTD™ program diskette also includes three sample data files:

- **BANK.LTG** - Data file for a branch bank building (2,250 ft², single story)
- **CHURCH.LTG** - Data file for a church building (12,920 ft², single story)
- **MEDOFFIC.LTG** - Data file for a medium office building (48,664 ft², 3-story).

The sample data files for the LTGSTD™ program are also shown in Appendix F.

APPENDIX B

FUNCTION KEY TEMPLATES FOR ENVSTD™ PROGRAM

APPENDIX B

FUNCTION KEY TEMPLATES FOR ENVSTO™ PROGRAM

A template that can be photocopied and cut out for use with computer keyboards with 10 function keys is shown in Figure B.1. A template for use with keyboards having 12 function keys is shown in Figure B.2.

F1 LOAD FILES	F2 SAVE FILES	
F3 CLEAR DATA	F4 DIRECTORY (*_ENV)	
F5 OTHER SCREEN	F6 LIST CITIES	
F7 HELP	F8	
F9 CALCULATE	F10 COPY DATA ACROSS	

Function Keys
ENVELOPE SYSTEM PERFORMANCE COMPLIANCE CALCULATION PROGRAM
VERSION 2.0 February 1989 DOE Interim Commercial Standards

FIGURE B.1. Template for Computer Keyboards with 10 Function Keys

FIGURE B.2. Template for Computer Keyboards with 12 Function Keys

APPENDIX C

FUNCTION KEY TEMPLATES FOR LTGSTD™ PROGRAM

APPENDIX C

FUNCTION KEY TEMPLATES FOR LTGSTD™ PROGRAM

A template that can be photocopied and cut out for use with computer keyboards having 10 function keys is shown in Figure C.1. A template for use with keyboards having 12 function keys is shown in Figure C.2.

F1 LOAD FILES	F2 SAVE FILES	
F3 CLEAR SCREEN	F4 DIRECTORY (* .LTG)	
F5 SPACE/ CONTROLS SCREENS	F6 TYPE CODES	
F7 HELP	F8 EXTENSION SCREEN	
F9 CALCULATE	F10	

Function Keys
LIGHTING COMPLIANCE CALCULATION PROGRAM
VERSION 2.0 February 1989 DOE Interim Commercial Standards

FIGURE C.1. Template for Computer Keyboards with 10 Function Keys

FIGURE C.2. Template for Computer Keyboards with 12 Function Keys

APPENDIX D

LIST OF CITIES AND CLIMATE DATA FOR ENVSTD™ PROGRAM

APPENDIX D

LIST OF CITIES AND CLIMATE DATA FOR ENVSTD™ PROGRAM

NO	CITY	STATE	HDD50	HDD65	VSN	VSEW	VSS	CO050	CO065	COH80	DR	NO HRS T<55	8AM-4PM 55≤T≤69
<u>Alabama</u>													
28	Birmingham	AL	765	2882	464	789	908	5182	1825	6272	17.5	720	760
143	Mobile	AL	164	1580	486	816	919	6478	2419	7479	16.6	408	774
145	Montgomery	AL	491	2261	462	823	981	5821	2116	8473	19.5	609	734
<u>Alaska</u>													
2	Adak	AK	3562	8913	280	434	652	124	0	0	9.9	2754	156
9	Anchorage	AK	5301	10540	272	538	926	236	0	0	13.8	2398	521
10	Annette Island	AK	2545	7277	285	482	739	756	12	0	10.1	2169	719
24	Bethel	AK	8285	13449	252	453	789	312	0	0	14.3	2555	347
25	Big Delta	AK	9355	14069	249	527	989	777	16	25	19.0	2141	606
76	Fairbanks	AK	9841	14414	241	492	919	922	19	8	18.2	2083	682
93	Gulkana	AK	8865	13846	257	522	943	498	4	6	18.5	2225	615
105	Juneau	AK	4223	9350	254	410	642	348	0	0	12.7	2367	540
106	King Salmon	AK	6843	11992	270	499	860	330	4	6	15.4	2395	502
109	Kodiak	AK	3775	8896	276	509	852	360	6	0	10.6	2519	384
132	McGrath	AK	9967	14868	246	467	841	578	3	0	15.9	2265	596
152	Nome	AK	9061	14418	242	478	871	119	0	0	9.0	2710	210
208	Summit	AK	9210	14530	247	488	893	155	0	0	13.6	2616	298
231	Yakutat	AK	4486	9714	247	402	650	248	0	0	9.3	2471	439
<u>Arizona</u>													
163	Phoenix	AZ	90	1382	488	1116	1310	7830	3647	34521	21.2	373	746
171	Prescott	AZ	1477	4462	473	1090	1334	3385	895	3973	24.0	1021	725
218	Tucson	AZ	178	1601	500	1112	1280	6822	2769	19657	21.9	399	716
229	Winslow	AZ	1695	4603	471	1092	1338	3708	1141	7347	27.7	1130	634
234	Yuma	AZ	43	782	493	1151	1330	8921	4186	37892	23.5	247	697
<u>Arkansas</u>													
79	Fort Smith	AR	1149	3394	462	842	1005	5307	2077	10413	22.4	925	547
121	Little Rock	AR	912	3091	465	831	981	5351	2055	8450	17.5	865	626
<u>California</u>													
12	Arcata	CA	582	5020	407	724	926	1038	1	0	8.9	1396	1509
19	Bakersfield	CA	305	2194	474	1053	1211	5879	2294	15447	28.9	645	848
48	China Lake	CA	409	2444	468	1091	1312	6222	2782	26739	27.4	582	772
58	Daggett	CA	237	1916	475	1102	1309	6516	2720	22302	27.0	472	841
71	El Toro	CA	32	1577	486	977	1163	4764	834	2391	22.3	215	1474
82	Fresno	CA	492	2700	459	1029	1199	5070	1803	13085	31.8	780	785
122	Long Beach	CA	54	1483	482	956	1144	4947	900	1616	16.1	263	1502
123	Los Angeles	CA	3	1494	482	962	1146	4456	472	136	14.1	145	1849
146	Mount Shasta	CA	1947	5583	419	909	1153	2395	556	2073	16.2	1544	756
156	Oakland	CA	157	2922	453	909	1102	2792	82	23	16.4	770	1905
167	Point Mugu	CA	8	2193	477	936	1131	3435	145	70	12.3	209	2146
176	Red Bluff	CA	589	2884	428	951	1177	5110	1930	14404	29.5	860	810
185	Sacramento	CA	381	2753	444	987	1185	4274	1171	7315	34.6	834	990
191	San Diego	CA	2	1275	490	950	1121	4865	662	383	11.5	102	1911
192	San Francisco	CA	186	3238	454	941	1146	2496	73	204	20.2	782	1796
194	Santa Maria	CA	138	3041	476	950	1128	2663	92	513	20.9	414	2016
209	Sunnyvale	CA	142	2708	456	947	1145	3112	204	421	16.9	610	1794
<u>Colorado</u>													
50	Colorado Springs	CO	2587	5996	435	976	1321	2557	491	2075	24.0	1357	725
62	Denver	CO	2652	6083	428	971	1321	2611	567	2934	25.5	1329	739
68	Eagle	CO	4232	8317	432	976	1296	1480	90	1008	35.4	1650	660
86	Grand Junction	CO	2616	5701	438	1003	1303	3611	1221	6147	27.4	1383	518
173	Pueblo	CO	2223	5285	442	992	1309	3384	971	5899	27.5	1077	720

NO	CITY	STATE	HDD50	HDD65	VSN	VSEW	VSS	CD050	CD065	CD080	DR	NO HRS T<55	8AM-4PM 55<T<69
<u>Connecticut</u>													
95	Hartford	CT	2953	6277	384	646	834	2857	706	2197	23.7	1459	598
<u>Delaware</u>													
227	Wilmington	DE	2133	5084	414	726	921	3602	1078	2188	17.2	1289	617
<u>District of Columbia</u>													
223	Washington	DC	2004	4828	419	724	905	3734	1083	3592	18.6	1205	657
<u>Florida</u>													
11	Apalachicola	FL	163	1366	508	887	971	6967	2695	8289	14.3	322	778
60	Daytona	FL	81	787	503	860	953	7404	2635	5252	14.8	177	641
104	Jacksonville	FL	206	1357	495	849	943	7045	2721	7488	16.4	354	674
136	Miami	FL	3	185	527	874	936	9338	4045	9166	12.4	55	259
160	Orlando	FL	33	532	511	881	974	8288	3312	9757	17.1	131	571
211	Tallahassee	FL	307	1721	495	845	944	6462	2401	7323	16.1	421	747
212	Tampa	FL	37	575	518	890	974	7985	3047	8905	14.9	147	592
224	West Palm Beach	FL	0	177	519	846	906	9203	3904	10324	13.1	22	308
<u>Georgia</u>													
15	Atlanta	GA	866	3070	467	807	930	4837	1566	3799	17.6	915	749
16	Augusta	GA	664	2584	468	803	933	5458	1904	6904	21.3	690	774
128	Macon	GA	514	2330	476	822	939	5769	2111	8097	18.7	667	787
196	Savannah	GA	410	1967	474	805	926	6112	2194	6308	16.6	529	725
<u>Hawaii</u>													
22	Barbers Point	HI	0	3	592	978	965	9314	3842	3617	11.2	1	97
97	Hilo	HI	0	0	557	817	805	8494	3019	1112	11.0	0	153
98	Honolulu	HI	0	0	588	953	932	9625	4150	4537	9.8	0	69
120	Lihue	HI	0	2	567	895	893	9219	3746	1912	9.6	0	140
<u>Idaho</u>													
30	Boise	ID	2276	5667	399	916	1228	2828	744	4512	28.9	1542	647
117	Lewiston	ID	2015	5426	370	729	988	2709	645	4121	29.7	1467	748
166	Pocatello	ID	3404	7075	405	935	1262	2330	526	3293	32.8	1681	546
<u>Illinois</u>													
47	Chicago	IL	3000	6151	402	729	936	3339	1015	3190	16.6	1426	613
144	Moline	IL	3085	6250	405	736	959	3204	894	2808	19.5	1357	640
207	Springfield	IL	2490	5448	422	768	962	3675	1158	4038	20.2	1260	600
<u>Indiana</u>													
75	Evansville	IN	1948	4625	426	736	890	4063	1265	4288	18.4	1141	611
80	Fort Wayne	IN	3023	6145	395	664	826	3096	743	1629	17.7	1400	601
101	Indianapolis	IN	2624	5620	407	692	851	3430	951	2263	18.0	1375	602
204	South Bend	IN	3038	6280	396	690	857	2917	684	1840	21.1	1415	635
<u>Iowa</u>													
35	Burlington	IA	3009	6094	419	802	1030	3393	1002	2598	17.1	1354	649
63	Des Moines	IA	3275	6447	413	788	1027	3116	812	2383	17.5	1423	667
130	Mason City	IA	4311	7735	400	783	1053	2708	658	1882	20.8	1548	610
202	Sioux City	IA	3608	6750	406	794	1064	3326	993	3488	18.6	1438	602
<u>Kansas</u>													
66	Dodge City	KS	2280	5131	450	942	1196	4008	1384	7186	26.0	1252	637
84	Goodland	KS	2757	6090	434	935	1228	3047	905	5147	26.3	1358	625
215	Topeka	KS	2458	5201	434	837	1068	4120	1388	5212	22.3	1192	608
<u>Kentucky</u>													
56	Covington	KY	2154	5030	408	687	843	3656	1057	2638	18.3	1316	661
119	Lexington	KY	1921	4649	425	729	872	3904	1157	2853	15.6	1211	618
124	Louisville	KY	1851	4539	424	727	883	4144	1357	4716	17.6	1192	636

NO	CITY	STATE	HDD50	HDD65	VSN	VSEW	VSS	ODD50	ODD65	CDH80	DR	NO HRS T<55	BAM-4PM 55<T<60
<u>Louisiana</u>													
23	Baton Rouge	LA	237	1573	488	806	889	6682	2543	8814	17.2	440	677
113	Lake Charles	LA	214	1455	489	795	864	6849	2615	7883	14.8	396	668
148	New Orleans	LA	179	1392	497	838	923	6840	2578	7380	15.1	324	789
201	Shreveport	LA	447	2265	484	843	954	6022	2365	10039	18.1	687	697
<u>Maine</u>													
21	Bangor	ME	4132	7998	378	693	950	1853	243	454	21.5	1721	669
38	Caribou	ME	5297	9483	357	649	922	1410	121	203	18.1	1862	692
169	Portland	ME	3531	7305	376	643	856	1946	245	399	19.6	1604	665
<u>Maryland</u>													
20	Baltimore	MD	2020	4946	419	739	932	3683	1134	3825	18.6	1268	593
161	Patuxent	MD	1418	4002	429	758	943	4180	1289	2966	12.9	1118	729
<u>Massachusetts</u>													
31	Boston	MA	2416	5775	387	659	849	2810	695	1601	16.5	1495	713
<u>Michigan</u>													
7	Alpena	MI	4282	8164	371	661	862	1928	335	894	17.3	1707	695
64	Detroit	MI	2799	5997	390	676	858	3199	922	2238	18.8	1404	632
78	Flint	MI	3471	6917	379	641	811	2502	473	921	18.1	1563	634
87	Grand Rapids	MI	3392	6777	390	688	872	2680	590	1461	22.2	1562	622
195	Sault Sainte Marie	MI	5087	9282	359	640	858	1399	119	246	21.0	1838	733
216	Traverse City	MI	3934	7654	369	642	818	2193	438	1124	21.0	1651	679
<u>Minnesota</u>													
67	Duluth	MN	5797	9918	355	633	886	1511	157	258	20.0	1882	650
102	International Falls	MN	6414	10535	351	669	962	1473	119	167	22.0	1870	656
140	Minneapolis	MN	4563	8060	380	709	972	2751	773	2509	20.7	1620	566
181	Rochester	MN	4544	8100	383	691	927	2360	442	590	18.8	1584	652
<u>Mississippi</u>													
103	Jackson	MS	546	2424	481	833	942	5927	2330	8789	17.2	646	640
135	Meridian	MS	546	2446	480	811	905	5723	2148	9508	20.2	613	719
<u>Missouri</u>													
51	Columbia	MO	2225	4994	431	790	972	3940	1234	4242	21.5	1189	633
186	Saint Louis	MO	2111	4860	432	797	983	4193	1467	5379	18.7	1124	614
206	Springfield	MO	1839	4509	446	812	982	4115	1311	4170	20.4	1215	544
<u>Montana</u>													
26	Billings	MT	3627	7156	380	814	1160	2544	598	2695	25.6	1650	617
57	Cutbank	MT	4718	8941	357	768	1150	1368	117	702	27.6	1834	672
65	Dillon	MT	4140	8210	386	838	1187	1564	159	784	28.6	1814	639
83	Glasgow	MT	5082	8828	361	752	1115	2272	543	2642	26.0	1688	570
88	Great Falls	MT	3728	7454	366	776	1133	2199	450	1886	26.7	1684	641
96	Helena	MT	3926	7817	372	771	1098	1911	328	1771	28.3	1784	651
118	Lewistown	MT	4027	8089	368	753	1084	1629	216	1270	29.8	1740	673
138	Miles City	MT	4435	7989	374	800	1156	2694	773	4364	26.9	1588	565
142	Missoula	MT	3492	7560	363	704	957	1629	221	1513	30.8	1843	658
<u>Nebraska</u>													
85	Grand Island	NE	3315	6477	420	843	1115	3309	996	4580	24.5	1431	611
155	North Platte	NE	3447	6905	419	880	1183	2731	715	3468	26.2	1514	592
159	Omaha	NE	2981	5968	414	806	1066	3618	1130	3883	19.6	1355	586
197	Scottsbluff	NE	3335	6900	413	861	1168	2603	693	3745	28.3	1457	620
<u>Nevada</u>													
72	Elko	NV	3345	7178	420	1000	1332	1997	355	4065	37.8	1540	569
73	Ely	NV	3683	7666	432	1014	1350	1650	157	1317	30.1	1529	683
116	Las Vegas	NV	449	2399	456	1136	1417	6567	3043	26408	25.5	604	719
125	Lovelock	NV	2438	5845	418	1094	1452	2813	745	6659	34.7	1358	606
178	Reno	NV	2181	5841	428	1068	1401	2180	365	4059	39.3	1306	752
214	Tonopah	NV	2308	5652	427	1130	1502	2742	611	3777	28.4	1257	660
228	Winnemucca	NV	2774	6471	418	1014	1350	2264	486	6366	41.0	1383	608
233	Yucca Flats	NV	1664	4802	450	1112	1399	3378	1041	11568	35.9	1004	670

NO	CITY	STATE	HDD50	HDD65	VSN	VSEW	VSS	CD050	CD065	CDH80	DR	NO HRS T<55	8AM-4PM 55<T<69
<u>New Hampshire</u>													
54	Concord	NH	3742	7425	375	630	824	2254	463	1865	22.6	1533	683
<u>New Jersey</u>													
114	Lakehurst	NJ	2174	5265	407	712	917	3299	915	3019	20.5	1312	645
151	Newark	NJ	2027	4956	406	710	912	3556	1009	2487	17.7	1325	644
<u>New Mexico</u>													
5	Albuquerque	NM	1633	4423	469	1105	1361	3942	1257	5705	25.3	1148	703
49	Clayton	NM	2138	5176	457	1019	1310	3122	685	2093	20.0	1150	770
184	Roswell	NM	1008	3486	490	1081	1280	4536	1539	11135	26.1	825	677
217	Truth or Consequences	NM	1074	3592	488	1113	1326	4457	1500	6882	23.4	889	744
219	Tucumcari	NM	1344	3922	470	1046	1300	4451	1554	8424	26.9	914	710
<u>New York</u>													
4	Albany	NY	3488	6770	395	719	942	2812	619	1308	19.7	1487	605
27	Binghamton	NY	3885	7397	370	592	733	2373	410	672	18.5	1657	662
34	Buffalo	NY	3213	6721	371	609	746	2476	509	779	19.2	1571	697
131	Messena	NY	4583	8397	380	708	942	2026	365	913	20.9	1674	627
149	New York (Central Pk)	NY	1986	5022	392	650	817	3273	834	911	12.5	1335	790
150	New York (LAG)	NY	1986	5022	392	650	817	3273	834	911	12.5	1335	790
182	Rochester	NY	3482	6995	374	622	771	2557	595	1642	20.1	1612	608
210	Syracuse	NY	3448	6856	371	611	764	2579	513	926	20.2	1521	730
<u>North Carolina</u>													
13	Asheville	NC	1407	4203	449	782	946	3442	763	1298	21.1	1083	915
37	Cape Hatteras	NC	635	2745	460	819	972	4978	1613	2039	10.0	765	820
43	Charlotte	NC	1086	3412	456	809	968	4698	1549	4299	19.6	892	777
45	Cherry Point	NC	569	2556	461	826	996	5277	1788	3614	15.2	690	757
90	Greensboro	NC	1261	3760	449	810	994	4274	1298	3642	17.4	1018	718
174	Raleigh	NC	1131	3509	445	774	935	4485	1389	3697	16.5	918	740
<u>North Dakota</u>													
29	Bismarck	ND	5196	8992	371	766	1114	2175	496	2067	27.8	1724	556
77	Fargo	ND	5582	9242	371	751	1077	2388	573	2288	22.2	1730	546
141	Minot	ND	5336	9178	358	724	1059	2064	431	1570	24.5	1800	581
<u>Ohio</u>													
3	Akron	OH	2881	6172	396	664	812	2845	661	1100	17.3	1460	680
53	Columbus	OH	2424	5493	401	671	819	3195	789	2268	22.6	1375	708
59	Dayton	OH	2573	5549	408	696	855	3367	868	1346	17.1	1388	611
213	Toledo	OH	3132	6514	393	676	853	2791	698	1794	17.8	1500	652
232	Youngstown	OH	3129	6557	383	624	760	2593	546	1128	21.4	1523	679
<u>Oklahoma</u>													
157	Oklahoma City	OK	1417	3825	465	873	1053	4901	1834	8878	20.8	980	733
220	Tulsa	OK	1429	3732	453	820	991	5244	2072	10065	19.7	983	591
<u>Oregon</u>													
14	Astoria	OR	1080	5226	350	588	782	1357	29	145	12.3	1571	1236
133	Medford	OR	1531	4893	405	814	1005	2681	568	4081	32.9	1442	749
154	North Bend	OR	629	4678	392	740	977	1429	2	0	11.8	1351	1553
170	Portland	OR	1151	4577	364	647	841	2321	272	1086	22.8	1421	1060
177	Redmond	OR	2535	6665	395	835	1127	1573	228	2390	34.4	1631	695
187	Salem	OR	1128	4926	373	680	874	1849	172	1224	29.3	1499	916
<u>Pennsylvania</u>													
6	Allentown	PA	2692	5760	401	682	864	3105	698	1146	17.0	1335	710
18	Avoca	PA	2931	6236	389	646	811	2823	652	1547	19.7	1505	705
74	Erie	PA	3006	6426	384	646	792	2527	472	378	14.8	1532	716
94	Harrisburg	PA	2302	5251	404	687	864	3518	992	2860	20.1	1342	648
162	Philadelphia	PA	2044	4923	408	701	889	3661	1065	3172	17.1	1286	646
165	Pittsburgh	PA	2773	5907	392	642	780	2989	648	1040	19.0	1426	700

NO	CITY	STATE	HDD50	HDD65	VSH	VSEW	VSS	CDD50	CDD65	CDH80	DR	NO HRS T<55	8AM-4PM 55≤T≤69
<u>Rhode Island</u>													
172	Providence	RI	2610	6022	393	677	874	2756	693	1284	16.8	1429	684
<u>South Carolina</u>													
41	Charleston	SC	435	2194	467	796	925	5722	2005	5249	16.4	570	767
52	Columbia	SC	694	2666	467	816	953	5613	2110	8541	19.5	741	705
91	Greenville	SC	907	3220	459	814	971	4563	1400	3494	17.7	866	851
<u>South Dakota</u>													
100	Huron	SD	4820	8351	390	769	1044	2718	774	3739	24.5	1630	545
164	Pierre	SD	4028	7358	392	822	1147	3079	934	5262	24.2	1564	557
175	Rapid City	SD	3672	7229	394	819	1142	2581	663	3477	28.2	1530	572
203	Sioux Falls	SD	4240	7683	394	778	1078	2811	779	3029	20.2	1553	599
<u>Tennessee</u>													
44	Chattanooga	TN	1232	3595	444	738	869	4652	1541	5079	17.6	1050	684
108	Knoxville	TN	1283	3818	446	762	898	4455	1514	3840	17.8	1076	703
134	Memphis	TN	1034	3259	460	806	935	5319	2069	7807	19.2	865	851
147	Nashville	TN	1165	3609	443	749	863	4583	1552	5078	18.2	897	749
<u>Texas</u>													
1	Abilene	TX	792	2714	494	924	1066	5968	2416	13206	21.5	760	648
8	Amarillo	TX	1592	4331	471	1013	1253	4113	1377	6763	23.9	1109	680
17	Austin	TX	271	1735	503	877	972	6873	2862	14093	19.3	564	664
32	Brownsville	TX	35	642	547	908	908	8531	3664	12218	14.8	191	422
55	Corpus Christi	TX	106	889	529	906	946	8200	3508	13109	17.2	249	543
61	Del Rio	TX	186	1397	511	903	1008	7376	3112	14870	19.8	474	732
70	El Paso	TX	522	2605	503	1133	1306	5617	2225	13224	21.3	660	735
81	Fort Worth	TX	605	2354	485	875	994	6174	2448	13682	20.5	673	772
99	Houston	TX	195	1344	490	805	883	7215	2891	10569	18.2	352	703
107	Kingsville	TX	49	874	527	881	922	8302	3652	15512	19.2	260	523
115	Laredo	TX	65	842	532	900	936	8827	4130	25225	21.4	286	598
126	Lubbock	TX	1173	3643	488	1070	1267	4754	1749	9827	25.1	917	743
127	Lufkin	TX	370	1846	492	848	942	6667	2668	11737	21.5	478	681
137	Midland	TX	634	2573	504	1079	1247	5695	2159	11177	25.9	698	729
168	Port Arthur	TX	167	1416	497	824	900	6888	2662	8837	17.4	384	697
189	San Angelo	TX	538	2110	503	944	1076	6522	2619	14621	20.6	641	619
190	San Antonio	TX	261	1579	510	878	955	7170	3013	13841	20.1	462	690
200	Sherman	TX	699	2708	476	862	996	5844	2378	12065	20.2	785	721
221	Waco	TN	488	2166	495	874	972	6676	2879	15658	21.1	651	622
226	Wichita Falls	TX	984	3049	480	911	1077	5708	2299	14487	18.8	802	723
<u>Utah</u>													
33	Bryce Canyon	UT	4709	9288	445	1063	1386	899	4	69	30.0	1660	841
40	Cedar City	UT	2592	5888	447	1054	1342	2802	624	3119	27.1	1392	629
188	Salt Lake City	UT	2570	5975	422	975	1266	3011	941	7030	29.1	1426	586
<u>Vermont</u>													
36	Burlington	VT	4211	7932	382	698	925	2118	365	490	18.3	1697	637
<u>Virginia</u>													
153	Norfolk	VA	1185	3609	443	792	964	4636	1586	4554	15.0	1014	685
179	Richmond	VA	1322	3895	430	745	923	4225	1323	4021	17.6	996	716
180	Roanoke	VA	1520	4192	433	763	946	3986	1183	3306	19.0	1148	713
<u>Washington</u>													
158	Olympia	WA	1546	5550	351	619	819	1550	79	466	26.4	1577	985
198	Seattle/Tacoma	WA	1382	5281	350	621	828	1683	106	256	16.5	1700	982
205	Spokane	WA	2983	6727	363	758	1064	2094	363	1595	25.3	1669	640
225	Whidbey Island	WA	1179	5274	344	630	878	1403	22	7	14.8	1671	1169
230	Takima	WA	2323	5877	373	790	1091	2370	449	3285	31.2	1413	703
<u>West Virginia</u>													
42	Charleston	WV	1816	4587	409	667	798	3712	1008	3054	20.8	1215	704

NO	CITY	STATE	HDD50	HDD65	VSN	VSEW	VSS	CDD50	CDD65	CDH80	DR	NO HRS T<55	8AM-4PM 55≤T≤69
<u>Wisconsin</u>													
69	Eau Claire	WI	4751	8285	376	683	923	2545	603	1898	18.2	1565	661
89	Greenbay	WI	4310	8039	380	696	947	2172	426	957	22.1	1604	651
112	La Crosse	WI	3838	7243	386	701	937	2786	716	2121	18.9	1568	644
129	Madison	WI	4009	7466	391	717	955	2559	542	1329	19.1	1511	658
139	Milwaukee	WI	3586	7121	396	724	941	2627	487	1013	17.1	1587	618
<u>Wyoming</u>													
39	Casper	WY	3824	7617	403	961	1343	2177	495	2699	29.8	1670	535
46	Cheyenne	WY	3435	7218	416	906	1267	1963	271	1040	26.4	1618	608
183	Rock Springs	WY	4407	8391	411	1012	1395	1698	207	702	29.1	1828	552
199	Sheridan	WY	3605	7366	387	806	1133	2074	360	2105	30.8	1650	574
<u>Other Locations Outside U.S.A.</u>													
92	Guantanamo Bay	CU	0	0	612	1045	1018	11071	5596	18452	15.5	0	17
110	Koror Island	PN	0	0	662	890	827	11435	5960	14548	9.5	0	0
111	Kirajelein Island	PN	0	0	678	961	888	11635	6160	16217	8.2	0	0
193	San Juan	PR	0	0	608	963	931	10648	5173	11563	12.7	0	14
222	Wake Island	PN	0	0	609	1002	977	10869	5394	10167	9.7	0	0

REFERENCE

National Climatic Center. 1981. *Typical Meteorological Year User's Manual*. TD-9734. Hourly Solar Radiation-Surface Meteorological Observations. Asheville, North Carolina.

APPENDIX E

EXAMPLE DATA FILES FOR ENVSTD™ PROGRAM

APPENDIX E

EXAMPLE DATA FILES FOR ENVSTD™ PROGRAM

To illustrate the data files produced using the ENVSTD™ program, two examples are included. The first, **MEDOFFIC.ENV**, is for a 48,664-ft² three-story office building in El Paso, Texas. The second example, **APARTMEN.ENV**, illustrates the data file created for a nine-story high-rise apartment building with 496,976 ft² in Milwaukee, Wisconsin.

MEDOFFIC.ENV

ENVELOPE SYSTEM PERFORMANCE COMPLIANCE CALCULATION PROGRAM
 VERSION 2.0

U.S. DEPARTMENT OF ENERGY
 VOLUNTARY PERFORMANCE STANDARDS FOR NEW COMMERCIAL AND MULTI-FAMILY
 HIGH RISE RESIDENTIAL BUILDINGS; MANDATORY FOR FEDERAL BUILDINGS

CITY: 70 El Paso TX BUILDING: Medium Office Building
 CODE <B,C,H>: Both Heated and Cooled DATE: February 28, 1989

	WALL ORIENTATION							WEIGHTED	
	N	NE	E	SE	S	SW	W	NW	AVERAGE CRITERIA
WL AREA	4113		7137		4299		6023		0.28 0.281
GL AREA	1096		1950		1170		1914		WWR WWR
SCx	0.482		0.482		0.482		0.482		0.48 0.500
PF	0.20		0.18		0.18		0.20		0.19 0.0
VLt	0.36		0.36		0.36		0.36		0.36 N/A
Uof	1.042		1.042		1.042		1.042		1.04 1.150
WALL Uo	0.22		0.22		0.22		0.22		0.22 0.158
HC	5.33		5.33		5.33		5.33		5.33 1
INS POS	3		3		3		3		3 N/A
EQUIP	0.50		0.50		0.50		0.50		0.50 0.500
LIGHTS	1.73		1.73		1.73		1.73		1.73 1.730
DLCF	0		0		0		0		0.00 0.0
----- L O A D S -----									
HEATING	2.008		2.594		1.355		2.400		8.357> 6.986
COOLING	7.697		17.731		10.028		16.059		51.515< 59.433
TOTAL	9.706		20.325		11.383		18.458		59.872< 66.420

***** PASSES *****

OTHER ENVELOPE REQUIREMENTS

MAXIMUM PERCENTAGE OF ROOF AREA IN SKYLIGHTS:	DESIGN	LIMIT
Visible Transmittance of Skylight	0.500	0.500
Design lighting Footcandles of Space	50	50
Percentage of Roof Area in Skylights:	0.0	= 5.4

MAXIMUM ALLOWABLE Uo:

Roof	0.050	=	0.061
Wall Adjacent to Unconditioned Space	0.200	=	0.249
Floor Over Unconditioned Space	0.100	=	0.115

MINIMUM ALLOWABLE R-VALUE:

Wall Below Grade	0.000	=	0.000
Slab on Grade (Heated or Unheated)	Unheated		Unheated
Insulation Position	Horizontal		Horizontal
Depth or Width (Inches)	24 in.		24 in.
R-Value of Concrete Slab Insulation	0	=	0

***** MEETS OTHER ENVELOPE REQUIREMENTS *****

APARTMEN.ENV

ENVELOPE SYSTEM PERFORMANCE COMPLIANCE CALCULATION PROGRAM VERSION 2.0 U.S. DEPARTMENT OF ENERGY VOLUNTARY PERFORMANCE STANDARDS FOR NEW COMMERCIAL AND MULTI-FAMILY HIGH RISE RESIDENTIAL BUILDINGS; MANDATORY FOR FEDERAL BUILDINGS

CITY: 139		Milwaukee WI		BUILDING: Apartment						
CODE <8,C,H>: Both Heated and Cooled				DATE: February 28, 1989						
WALL ORIENTATION								WEIGHTED		
	N	NE	E	SE	S	SW	W	NW	AVERAGE CRITERIA	

WL AREA	17158		59646		20896		58800		0.23	0.300
GL AREA	3410		14130		4720		13800		WWR	WWR
SCx	0.83		0.83		0.83		0.83		0.83	0.630
PF	0		0		0		0		0.00	0.0
VLT	0.79		0.79		0.79		0.79		0.79	N/A
Uof	0.520		0.520		0.520		0.520		0.52	0.480
WALL Uo	0.08		0.08		0.08		0.08		0.08	0.077
HC	10		10		10		10		10.00	1
INS POS	3		3		3		3		3	N/A
EQUIP	.38		.38		.38		.38		0.38	0.380
LIGHTS	.67		.67		.67		.67		0.67	0.670
DLCF	0		0		0		0		0.00	0.0
----- L O A D S -----										
HEATING	2.913		7.818		2.106		7.956		20.792<	22.611
COOLING	1.771		9.710		3.389		10.080		24.951>	24.780
TOTAL	4.684		17.528		5.495		18.036		45.743<	47.390

***** PASSES *****

OTHER ENVELOPE REQUIREMENTS

MAXIMUM PERCENTAGE OF ROOF AREA IN SKYLIGHTS:	DESIGN	LIMIT
Visible Transmittance of Skylight	0.500	0.500
Design lighting Footcandles of Space	50	50
Percentage of Roof Area in Skylights:	0.000	= 3.9

MAXIMUM ALLOWABLE Uo:

Roof	0.050	=	0.053
Wall Adjacent to Unconditioned Space	0.100	=	0.125
Floor Over Unconditioned Space	0.040	=	0.045

MINIMUM ALLOWABLE R-VALUE:

Wall Below Grade	10.00	=	9.841
Slab on Grade (Heated or Unheated)	Unheated		Unheated
Insulation Position	Vertical		Vertical
Depth or Width (Inches)	24 in.		24 in.
R-Value of Concrete Slab Insulation	18	=	8

***** MEETS OTHER ENVELOPE REQUIREMENTS *****

APPENDIX F

EXAMPLE DATA FILES FOR LTGSTD™ PROGRAM

APPENDIX F

EXAMPLE DATA FILES FOR LTGSTD™ PROGRAM

Three files included in this appendix illustrate the calculations possible with the LTGSTD™ program:

- **BANK.LTG** - a single-story, 2,250-ft² branch bank building
- **CHURCH.LTG** - a single-story, 12,920-ft² church building
- **MEDOFFIC.LTG** - a three-story, 48,664-ft² medium office building.

BANK.LTG

LIGHTING PRESCRIPTIVE AND SYSTEM PERFORMANCE COMPLIANCE CALCULATION PROGRAM
 VERSION 2.0
 U.S. DEPARTMENT OF ENERGY
 VOLUNTARY PERFORMANCE STANDARDS FOR NEW COMMERCIAL AND MULTI-FAMILY
 HIGH RISE RESIDENTIAL BUILDINGS; MANDATORY FOR FEDERAL BUILDINGS

BUILDING Branch Bank
 DATE February 28, 1989
 VERSION 1989

BUILDING TYPE	AREA
C Offices	2250 ft²
NA	0 ft²
NA	0 ft²

	2250 Gross ft²

BUILDING DESIGN		
Interior Lighting Power	4874 W	2.166 W/Gross ft²
Exterior Lighting Power	200 W	

PRESCRIPTIVE CRITERIA

Unit Lighting Power Allowance	1.810 W/Gross ft²
Interior Lighting Power Allowance	4073 W

SYSTEM PERFORMANCE CRITERIA

Unit Power Density	2.167 W/Gross ft²
Interior Lighting Power Allowance	4875 W

EXTERIOR LIGHTING CRITERIA

Exterior Lighting Power Allowance	221 W
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PASSES

SPACE			SPACE		NO.		NO.		CONTROL				CONTROL		PTS.				TOTAL
NO.	TYPE	DESCRIPTION	DIMENSIONS	AREA	CLG	HT	SPACES	TASKS	TYPE	NO.	TYPE	NO.	INST.	REQD.	AF	UPD	Pb	LPB	LPB
1101	30	Drafting		48	10.0		1	1	0	0	0	0	0	2	1.80	1.00	1.80	86	86
1102	7	Leisure Dini		109	10.0		1	1	0	0	0	0	0	2	1.76	2.50	4.40	479	479
1103	9	Kitchen		176	10.0		1	2	0	0	0	0	0	2	1.52	1.40	2.13	375	375
1104	13	Toilet and W		45	10.0		1	1	0	0	0	0	0	2	1.80	0.80	1.44	65	65
1105	2	Corridor		60	10.0		1	1	0	0	0	0	0	2	1.00	0.80	0.80	48	48
1106	13	Toilet and W		60	10.0		1	1	0	0	0	0	0	2	1.80	0.80	1.44	86	86
1107	35	Conference/M		160	10.0		1	1	0	0	0	0	0	2	1.56	1.80	2.81	450	450
1108	17	Audio Visual		198	10.0		1	3	0	0	0	0	0	2	1.48	1.80	2.66	527	527
1110	44	Inactive Sto		99	10.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	53	53
1111	44	Inactive Sto		15	10.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	8	8
1112	44	Inactive Sto		15	10.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	8	8
1113	17	Audio Visual		80	10.0		1	1	0	0	0	0	0	2	1.55	1.80	2.79	223	223
1114	54	Banking Acti		240	10.0		1	6	0	0	0	0	0	2	1.41	2.80	3.95	949	949
1115	44	Inactive Sto		52	10.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	28	28
1116	17	Audio Visual		680	10.0		1	10	0	0	0	0	0	3	1.18	1.80	2.13	1446	1446

EXTERIOR LIGHTING REQUIREMENTS			
AREA CODE	AREA DESCRIPTION	AREA OR LENGTH	ALLOWANCE WATTS
4	Entrance (with canopy) Light Traffic	24.00 ft²	96.00

CHURCH.LTG

LIGHTING PRESCRIPTIVE AND SYSTEM PERFORMANCE COMPLIANCE CALCULATION PROGRAM VERSION 2.0 U.S. DEPARTMENT OF ENERGY VOLUNTARY PERFORMANCE STANDARDS FOR NEW COMMERCIAL AND MULTI-FAMILY HIGH RISE RESIDENTIAL BUILDINGS; MANDATORY FOR FEDERAL BUILDINGS

BUILDING Church
DATE February 28, 1989
VERSION 1989

BUILDING TYPE AREA
NA 12920 ft²
NA 0 ft²
NA 0 ft²

12920 Gross ft²

BUILDING DESIGN
Interior Lighting Power 25881 W 2.003 W/Gross ft²
Exterior Lighting Power 4000 W

PRESCRIPTIVE CRITERIA
Unit Lighting Power Allowance NA W/Gross ft²
Interior Lighting Power Allowance NA W

SYSTEM PERFORMANCE CRITERIA
Unit Power Density 2.228 W/Gross ft²
Interior Lighting Power Allowance 28792 W

EXTERIOR LIGHTING CRITERIA
Exterior Lighting Power Allowance 4325 W

PASSES

SPACE		SPACE		NO.		NO.		CONTROL		CONTROL		PTS.				TOTAL		
NO.	TYPE DESCRIPTION	DIMENSIONS	AREA	CLG	HT	SPACES	TASKS	TYPE	NO.	TYPE	NO.	INST.	REQD.	AF	UPD	Pb	LPB	LPB
1001	3 Classroom/Le		528	8.0		1	1	0	0	0	0	0	2	1.13	2.00	2.26	1195	1195
1002	3 Classroom/Le		80	8.0		1	1	0	0	0	0	0	2	1.60	2.00	3.19	255	255
1003	3 Classroom/Le		80	8.0		1	1	0	0	0	0	0	2	1.60	2.00	3.19	255	255
1004	3 Classroom/Le		216	8.0		1	1	0	0	0	0	0	2	1.28	2.00	2.55	552	552
1005	84 Lobby		49	8.0		1	1	0	0	0	0	0	2	1.80	1.90	3.42	168	168
1006	3 Classroom/Le		83	8.0		1	1	0	0	0	0	0	2	1.58	2.00	3.16	262	262
1007	3 Classroom/Le		96	8.0		1	1	0	0	0	0	0	2	1.52	2.00	3.03	291	291
1008	3 Classroom/Le		80	8.0		1	1	0	0	0	0	0	2	1.60	2.00	3.19	255	255
1009	3 Classroom/Le		80	8.0		1	1	0	0	0	0	0	2	1.60	2.00	3.19	255	255
1010	3 Classroom/Le		96	8.0		1	1	0	0	0	0	0	2	1.52	2.00	3.03	291	291
1011	3 Classroom/Le		240	8.0		1	1	0	0	0	0	0	2	1.25	2.00	2.51	602	602
1012	3 Classroom/Le		630	8.0		1	1	0	0	0	0	0	2	1.11	2.00	2.22	1400	1400
1013	2 Corridor		135	8.0		1	1	0	0	0	0	0	2	1.00	0.80	0.80	108	108
1014	13 Toilet and W		155	8.0		1	1	0	0	0	0	0	2	1.36	0.80	1.09	168	168
1015	2 Corridor		68	8.0		1	1	0	0	0	0	0	2	1.00	0.80	0.80	54	54
1016	13 Toilet and W		56	8.0		1	1	0	0	0	0	0	2	1.79	0.80	1.43	80	80
1017	45 Bulky Active		28	8.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	15	15
1018	11 Active Traff		44	8.0		1	1	0	0	0	0	0	2	1.80	0.60	1.08	48	48
1019	2 Corridor		354	8.0		1	1	0	0	0	0	0	2	1.00	0.80	0.80	283	283
1020	44 Inactive Sto		32	8.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	17	17
1021	84 Lobby		336	8.0		1	1	0	0	0	0	0	2	1.19	1.90	2.27	762	762
1022	2 Corridor		745	8.0		1	1	0	0	0	0	0	2	1.00	0.80	0.80	596	596
1023	46 Fine Active		28	8.0		1	1	0	0	0	0	0	2	1.80	1.00	1.80	50	50
1123	44 Inactive Sto		32	8.0		1	1	0	0	0	0	0	2	1.80	0.30	0.54	17	17
1024	3 Classroom/Le		96	8.0		1	1	0	0	0	0	0	2	1.52	2.00	3.03	291	291
1025	3 Classroom/Le		80	8.0		1	1	0	0	0	0	0	2	1.60	2.00	3.19	255	255
1026	3 Classroom/Le		128	8.0		1	1	0	0	0	0	0	2	1.41	2.00	2.83	362	362
1027	17 Audio Visual		132	8.0		1	1	0	0	0	0	0	2	1.40	1.80	2.53	334	334
1028	17 Audio Visual		136	8.0		1	1	0	0	0	0	0	2	1.40	1.80	2.51	342	342
1029	30 Drafting		77	8.0		1	1	0	0	0	0	0	2	1.61	1.00	1.61	124	124
1030	17 Audio Visual		128	8.0		1	1	0	0	0	0	0	2	1.41	1.80	2.55	326	326
1031	17 Audio Visual		128	8.0		1	1	0	0	0	0	0	2	1.41	1.80	2.55	326	326

CHURCH.LTG (contd)

SPACE		SPACE		NO.		NO.		CONTROL		CONTROL		PTS.						TOTAL
NO.	TYPE DESCRIPTION	DIMENSIONS	AREA	CLG	HT	SPACES	TASKS	TYPE	NO.	TYPE	NO.	INST.	REQD.	AF	UPD	Pb	LPB	LPB
1032	44 Inactive Sto		32	8.0	1	1	0	0 0	0	0	0	0	2	1.80	0.30	0.54	17	17
1033	84 Lobby		49	8.0	1	1	0	0 0	0	0	0	0	2	1.80	1.90	3.42	168	168
1034	84 Lobby		336	8.0	1	1	0	0 0	0	0	0	0	2	1.19	1.90	2.27	762	762
1035	3 Classroom/Le		83	8.0	1	1	0	0 0	0	0	0	0	2	1.58	2.00	3.16	262	262
1036	3 Classroom/Le		96	8.0	1	1	0	0 0	0	0	0	0	2	1.52	2.00	3.03	291	291
1037	44 Inactive Sto		32	8.0	1	1	0	0 0	0	0	0	0	2	1.80	0.30	0.54	17	17
1038	2 Corridor		354	8.0	1	1	0	0 0	0	0	0	0	2	1.00	0.80	0.80	283	283
1039	3 Classroom/Le		240	8.0	1	1	0	0 0	0	0	0	0	2	1.25	2.00	2.51	602	602
1040	48 Unlisted Spa		48	8.0	1	1	0	0 0	0	0	0	0	2	1.80	0.20	0.36	17	17
1041	9 Kitchen		156	8.0	1	1	0	0 0	0	0	0	0	2	1.36	1.40	1.90	296	296
1042	3 Classroom/Le		502	8.0	1	1	0	0 0	0	0	0	0	2	1.14	2.00	2.28	1142	1142
1043	2 Corridor		135	8.0	1	1	0	0 0	0	0	0	0	2	1.00	0.80	0.80	108	108
1044	3 Classroom/Le		93	8.0	1	1	0	0 0	0	0	0	0	2	1.53	2.00	3.06	285	285
1045	84 Lobby		49	8.0	1	1	0	0 0	0	0	0	0	2	1.80	1.90	3.42	168	168
1046	84 Lobby		178	8.0	1	1	0	0 0	0	0	0	0	2	1.32	1.90	2.51	447	447
1047	56 Worship/Cong		86	20.0	1	1	0	0 0	0	0	0	0	2	1.80	2.30	4.14	356	356
1048	2 Corridor		52	8.0	1	1	0	0 0	0	0	0	0	2	1.00	0.80	0.80	42	42
1049	13 Toilet and W		180	8.0	1	1	0	0 0	0	0	0	0	2	1.32	0.80	1.06	190	190
1050	46 Fine Active		44	8.0	1	1	0	0 0	0	0	0	0	2	1.80	1.00	1.80	79	79
1051	56 Worship/Cong		2847	20.0	1	1	0	0 0	0	0	0	0	5	1.22	2.30	2.82	8019	8019
1052	56 Worship/Cong		1505	20.0	1	1	0	0 0	0	0	0	0	3	1.37	2.30	3.15	4741	4741
1053	45 Bulky Active		48	8.0	1	1	0	0 0	0	0	0	0	2	1.80	0.30	0.54	26	26
1054	44 Inactive Sto		32	8.0	1	1	0	0 0	0	0	0	0	2	1.80	0.30	0.54	17	17

EXTERIOR LIGHTING REQUIREMENTS				
AREA CODE	AREA DESCRIPTION	AREA OR LENGTH		ALLOWANCE WATTS
3	Entrance (with canopy) High Traffic	240.00	ft²	2400.00
1	Exit (with or without canopy)	48.00	ft	1200.00
12	Private parking lots	5000.00	ft²	600.00

MEDOFFIC.LTG

LIGHTING PRESCRIPTIVE AND SYSTEM PERFORMANCE COMPLIANCE CALCULATION PROGRAM VERSION 2.0

U.S. DEPARTMENT OF ENERGY
VOLUNTARY PERFORMANCE STANDARDS FOR NEW COMMERCIAL AND MULTI-FAMILY
HIGH RISE RESIDENTIAL BUILDINGS; MANDATORY FOR FEDERAL BUILDINGS

BUILDING Medium Office
DATE February 1989
VERSION 1989

BUILDING TYPE AREA
C Offices 48664 ft²
NA 0 ft²
NA 0 ft²

48664 Gross ft²

BUILDING DESIGN
Interior Lighting Power 82640 W 1.698 W/Gross ft²
Exterior Lighting Power 7500 W

PRESCRIPTIVE CRITERIA
Unit Lighting Power Allowance 1.650 W/Gross ft²
Interior Lighting Power Allowance 80296 W

SYSTEM PERFORMANCE CRITERIA
Unit Power Density 1.698 W/Gross ft²
Interior Lighting Power Allowance 82640 W

EXTERIOR LIGHTING CRITERIA
Exterior Lighting Power Allowance 7720 W

PASSES

SPACE		SPACE		NO.		NO.		CONTROL		CONTROL		PTS.								TOTAL
NO.	TYPE DESCRIPTION	DIMENSIONS	AREA	CLG	HT	SPACES	TASKS	TYPE	NO.	TYPE	NO.	INST.	REQD.	AF	UPD	Pb	LPB	LPB	LPB	LPB
1001	9 Kitchen		500	8.7	1	1	0	0	0	0	0	0	2	1.17	1.40	1.64	819	819		
1002	45 Bulky Active		84	8.7	1	1	0	0	0	0	0	0	2	1.69	0.30	0.51	43	43		
1003	11 Active Traff		160	8.7	1	1	0	0	0	0	0	0	2	1.42	0.60	0.85	136	136		
1004	47 Material Han		399	8.7	1	1	0	0	0	0	0	0	2	1.21	1.00	1.21	481	481		
1005	38 Mail Room		216	8.7	1	1	0	0	0	0	0	0	2	1.33	1.80	2.40	518	518		
1006	23 Atrium First		848	8.7	1	1	0	0	0	0	0	0	2	1.00	2.20	2.20	1866	1866		
1007	2 Corridor		416	8.7	1	1	0	0	0	0	0	0	2	1.00	0.80	0.80	333	333		
1008	9 Kitchen		522	8.7	1	1	0	0	0	0	0	0	2	1.16	1.40	1.63	851	851		
1009	6 Fast Food/Ca		2030	8.7	1	1	0	0	0	0	0	0	2	1.03	1.30	1.35	2731	2731		
1010	12 Emergency Ex		189	8.7	1	1	0	0	0	0	0	0	2	1.37	0.40	0.55	104	104		
1011	17 Audio Visual		189	8.7	1	1	0	0	0	0	0	0	2	1.37	1.80	2.47	466	466		
1012	45 Bulky Active		294	8.7	1	1	0	0	0	0	0	0	2	1.26	0.30	0.38	111	111		
1013	17 Audio Visual		348	8.7	1	1	0	0	0	0	0	0	2	1.23	1.80	2.21	770	770		
1014	16 Laboratory		400	8.7	1	1	0	0	0	0	0	0	2	1.20	2.30	2.77	1109	1109		
1015	30 Drafting		55	8.7	1	1	0	0	0	0	0	0	2	1.80	1.00	1.80	99	99		
1016	25 Locker Room		162	8.7	1	1	0	0	0	0	0	0	2	1.00	2.70	2.70	437	437		
1017	44 Inactive Sto		55	8.7	1	1	0	0	0	0	0	0	2	1.80	0.30	0.54	30	30		
1018	36 Computer/Off		589	8.7	1	1	0	0	0	0	0	0	2	1.15	2.10	2.41	1420	1420		
1019	2 Corridor		192	8.7	1	1	0	0	0	0	0	0	2	1.00	0.80	0.80	154	154		
1020	9 Kitchen		66	8.7	1	1	0	0	0	0	0	0	2	1.80	1.40	2.52	166	166		
1021	13 Toilet and W		144	8.7	1	1	0	0	0	0	0	0	2	1.46	0.80	1.16	168	168		
1022	13 Toilet and W		177	8.7	1	1	0	0	0	0	0	0	2	1.39	0.80	1.11	197	197		
1023	44 Inactive Sto		60	8.7	1	1	0	0	0	0	0	0	2	1.80	0.30	0.54	32	32		
1024	44 Inactive Sto		20	8.7	1	1	0	0	0	0	0	0	2	1.80	0.30	0.54	11	11		
1025	30 Drafting		40	8.7	1	1	0	0	0	0	0	0	2	1.80	1.00	1.80	72	72		
1026	30 Drafting		40	8.7	1	1	0	0	0	0	0	0	2	1.80	1.00	1.80	72	72		
1027	7 Leisure Dini		30	8.7	1	1	0	0	0	0	0	0	2	1.80	2.50	4.50	135	135		
1028	30 Drafting		40	8.7	1	1	0	0	0	0	0	0	2	1.80	1.00	1.80	72	72		
1029	7 Leisure Dini		42	8.7	1	1	0	0	0	0	0	0	2	1.80	2.50	4.50	189	189		
1030	30 Drafting		24	8.7	1	1	0	0	0	0	0	0	2	1.80	1.00	1.80	43	43		
1031	34 Accounting		84	8.7	1	1	0	0	0	0	0	0	2	1.69	0.80	1.35	114	114		

MEDOFFIC.LTG (contd)

SPACE		SPACE		NO.		NO.		CONTROL		CONTROL		PTS.				TOTAL	
NO.	TYPE DESCRIPTION	DIMENSIONS	AREA	CLG	HT	SPACES	TASKS	TYPE	NO.	TYPE	NO.	INST.	REQD.	AF	UPD	Pb	LPB
1032	2 Corridor		288	8.7	1	1	0		0	0	0	0	2	1.00	0.80	0.80	230
1033	11 Active Traff		160	8.7	1	1	0		0	0	0	0	2	1.42	0.60	0.85	136
1034	34 Accounting		45	8.7	1	1	0		0	0	0	0	2	1.80	0.80	1.44	65
1035	2 Corridor		216	8.7	1	1	0		0	0	0	0	2	1.00	0.80	0.80	173
1036	3 Classroom/Le		984	8.7	1	1	0		0	0	0	0	2	1.09	2.00	2.18	2146
1037	44 Inactive Sto		20	8.7	1	1	0		0	0	0	0	2	1.80	0.30	0.54	11
1038	11 Active Traff		18	8.7	1	1	0		0	0	0	0	2	1.80	0.60	1.08	19
1039	7 Leisure Dini		541	8.7	1	1	0		0	0	0	0	2	1.16	2.50	2.90	1568
1040	45 Bulky Active		64	8.7	1	1	0		0	0	0	0	2	1.80	0.30	0.54	35
1041	35 Conference/M		1062	8.7	1	1	0		0	0	0	0	2	1.08	1.80	1.95	2071
1042	16 Laboratory		1085	8.7	1	1	0		0	0	0	0	2	1.08	2.30	2.49	2699
1043	35 Conference/M		240	8.7	1	1	0		0	0	0	0	2	1.31	1.80	2.35	565
1044	23 Atrium First		280	8.7	1	1	0		0	0	0	0	2	1.00	2.20	2.20	616
1045	18 Stack Area		2804	8.7	1	1	0		0	0	0	0	4	1.02	2.60	2.64	7412
2001	23 Atrium First		280	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	616
2002	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2003	11 Active Traff		136	8.7	2	1	0		0	0	0	0	2	1.48	0.60	0.89	120
2004	23 Atrium First		156	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	343
2005	23 Atrium First		156	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	343
2006	2 Corridor		507	8.7	2	1	0		0	0	0	0	2	1.00	0.80	0.80	406
2007	23 Atrium First		280	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	616
2008	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2009	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2010	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2011	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2012	17 Audio Visual		2512	8.7	2	1	0		0	0	0	0	3	1.02	1.80	1.84	4623
2013	2 Corridor		60	8.7	2	1	0		0	0	0	0	2	1.00	0.80	0.80	48
2014	23 Atrium First		165	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	363
2015	23 Atrium First		180	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	396
2016	35 Conference/M		316	8.7	2	1	0		0	0	0	0	2	1.25	1.80	2.25	710
2017	13 Toilet and W		30	8.7	2	1	0		0	0	0	0	2	1.80	0.80	1.44	43
2018	70 Nurse Statio		186	8.7	2	1	0		0	0	0	0	2	1.37	2.10	2.89	537
2019	2 Corridor		532	8.7	2	1	0		0	0	0	0	2	1.00	0.80	0.80	426
2020	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2021	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2022	23 Atrium First		252	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	554
2023	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2024	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370
2025	23 Atrium First		140	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	308
2026	46 Fine Active		218	8.7	2	1	0		0	0	0	0	2	1.33	1.00	1.33	290
2027	34 Accounting		24	8.7	2	1	0		0	0	0	0	2	1.80	0.80	1.44	35
2028	2 Corridor		66	8.7	2	1	0		0	0	0	0	2	1.00	0.80	0.80	53
2029	23 Atrium First		36	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	79
2030	34 Accounting		30	8.7	2	1	0		0	0	0	0	2	1.80	0.80	1.44	43
2031	23 Atrium First		162	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	356
2032	23 Atrium First		162	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	356
2033	2 Corridor		126	8.7	2	1	0		0	0	0	0	2	1.00	0.80	0.80	101
2034	23 Atrium First		189	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	416
2035	23 Atrium First		150	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	330
2036	13 Toilet and W		144	8.7	2	1	0		0	0	0	0	2	1.46	0.80	1.16	168
2037	13 Toilet and W		177	8.7	2	1	0		0	0	0	0	2	1.39	0.80	1.11	197
2038	44 Inactive Sto		21	8.7	2	1	0		0	0	0	0	2	1.80	0.30	0.54	11
2039	34 Accounting		60	8.7	2	1	0		0	0	0	0	2	1.80	0.80	1.44	86
2040	30 Drafting		1024	8.7	2	1	0		0	0	0	0	2	1.09	1.00	1.09	1113
2041	35 Conference/M		86	8.7	2	1	0		0	0	0	0	2	1.68	1.80	3.02	260
2042	11 Active Traff		144	8.7	2	1	0		0	0	0	0	2	1.46	0.60	0.87	126
2043	34 Accounting		35	8.7	2	1	0		0	0	0	0	2	1.80	0.80	1.44	50
2044	2 Corridor		232	8.7	2	1	0		0	0	0	0	2	1.00	0.80	0.80	186
2045	7 Leisure Dini		30	8.7	2	1	0		0	0	0	0	2	1.80	2.50	4.50	135
2046	30 Drafting		24	8.7	2	1	0		0	0	0	0	2	1.80	1.00	1.80	43
2047	7 Leisure Dini		42	8.7	2	1	0		0	0	0	0	2	1.80	2.50	4.50	189
2048	30 Drafting		24	8.7	2	1	0		0	0	0	0	2	1.80	1.00	1.80	43
2049	34 Accounting		168	8.7	2	1	0		0	0	0	0	2	1.40	0.80	1.12	189
2050	23 Atrium First		168	8.7	2	1	0		0	0	0	0	2	1.00	2.20	2.20	370

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SPACE			SPACE		NO.		NO.		CONTROL		CONTROL		PTS.						TOTAL
NO.	TYPE	DESCRIPTION	DIMENSIONS	AREA	CLG	HT	SPACES	TASKS	TYPE	NO.	TYPE	NO.	INST.	REQD.	AF	UPD	Pb	LPB	LPB
2051	35	Conference/M		224	8.7		2	1	0	0	0	0	0	2	1.32	1.80	2.38	534	1068
2052	23	Atrium First		280	8.7		2	1	0	0	0	0	0	2	1.00	2.20	2.20	616	1232
2053	23	Atrium First		280	8.7		2	1	0	0	0	0	0	2	1.00	2.20	2.20	616	1232
2054	35	Conference/M		280	8.7		2	1	0	0	0	0	0	2	1.27	1.80	2.29	641	1283
2055	23	Atrium First		168	8.7		2	1	0	0	0	0	0	2	1.00	2.20	2.20	370	739
2056	23	Atrium First		168	8.7		2	1	0	0	0	0	0	2	1.00	2.20	2.20	370	739
2057	23	Atrium First		1324	8.7		2	1	0	0	0	0	0	2	1.00	2.20	2.20	2913	5826

EXTERIOR LIGHTING REQUIREMENTS				
AREA CODE	AREA DESCRIPTION	AREA OR LENGTH		ALLOWANCE WATTS
3	Entrance (with canopy) High Traffic	160.00	ft²	1600.00
4	Entrance (with canopy) Light Traffic	80.00	ft²	320.00
1	Exit (with or without canopy)	40.00	ft	1000.00

APPENDIX G

BUILDING TYPE, EXTERIOR AREA, AND SPACE TYPE CODES FOR LTGSTD™ PROGRAM

APPENDIX G

BUILDING TYPE, EXTERIOR AREA, AND SPACE TYPE CODES FOR LTGSTD™ PROGRAM

This appendix shows the building type, exterior area, and space type codes incorporated into the LTGSTD™ program.

Building type codes are based on the list of building occupancies/types in Table 3.4-1 of the Standards. Table G.1 lists the building type codes [with the corresponding unit lighting power allowance (ULPA) values for both 1989 and 1993] for use with the LTGSTD™ program.

The exterior type codes are based on the list of roads, grounds, and other exterior illumination areas in Table 3.4-2 of the Standards. Table G.2 lists the exterior type codes [with their corresponding unit power densities (UPDs)] for use with the LTGSTD™ program.

The space type codes are based on the list of spaces/functions in Table 3.5-1 of the Standards. The UPD values shown for each space type have also been incorporated directly into the program. Table G.3 lists the space type codes for various space functions (with their corresponding UPD values for 1989 and 1993) used with the LTGSTD™ program.

TABLE G.1. Building Type Codes

Type Code	Building Type	Prescriptive Unit Lighting Power Allowance (ULPA), W/ft ² for Gross Lighted Area Ranges						Effective Date
		0 to	2,001 to	10,001 to	25,001 to	50,001 to	>250,000 ft ²	
		2,000 ft ²	10,000 ft ²	25,000 ft ²	50,000 ft ²	250,000 ft ²		
A	Fast Food/Cafeteria	1.50	1.38	1.34	1.32	1.31	1.30	1989
		0.92	0.85	0.82	0.81	0.81	0.80	1993
B	Leisure Dining/Bar	2.20	1.91	1.71	1.56	1.46	1.40	1989
		1.60	1.56	1.52	1.48	1.44	1.40	1993
C	Offices	1.90	1.81	1.72	1.65	1.57	1.50	1989
		1.40	1.34	1.27	1.22	1.16	1.11	1993
D	Retail	3.30	3.08	2.83	2.50	2.28	2.10	1989
		2.70	2.52	2.32	2.05	1.87	1.72	1993
E	Mall Concourse	1.60	1.58	1.52	1.46	1.43	1.40	1989
		0.69	0.68	0.65	0.63	0.61	0.60	1993
F	Service Establishment	2.70	2.37	2.08	1.92	1.80	1.70	1989
		2.81	2.03	1.78	1.65	1.54	1.46	1993
G	Garage	0.30	0.28	0.24	0.22	0.21	0.20	1989
		0.25	0.24	0.23	0.22	0.21	0.20	1993
H	Pre/Elementary School	1.80	1.80	1.72	1.65	1.57	1.50	1989
		1.33	1.33	1.27	1.22	1.16	1.11	1993
I	High School	1.90	1.90	1.88	1.83	1.76	1.70	1989
		1.40	1.40	1.39	1.35	1.30	1.26	1993
J	Technical/Voc. School	2.40	2.33	2.17	2.01	1.84	1.70	1989
		1.77	1.72	1.60	1.49	1.36	1.26	1993
K	Warehouse/Storage	0.80	0.66	0.56	0.48	0.43	0.40	1989
		0.60	0.50	0.42	0.36	0.32	0.30	1993

TABLE G.2. Exterior Area Codes

<u>Area Type Code</u>	<u>Area Type</u>	<u>Unit Power Density</u>
1	Exit (with or without canopy)	25 W/Lin. ft of door opening
2	Entrance (without canopy)	30 W/Lin. ft of door opening
3	Entrance (with canopy) High Traffic	10 W/ft ² of canopied area
4	Entrance (with canopy) Light Traffic	4 W/ft ² canopied area
5	Entrance (with canopy) Loading Area	0.40 W/ft ²
6	Entrance (with canopy) Loading Door	20 W/Lin. ft of door opening
7	Building Exterior Surface Facade	0.25 W/ft ² of surface area to be illuminated
8	Storage and non-manufacturing work area	0.20 W/ft ²
9	Other activity areas for casual use	0.10 W/ft ²
10	Private driveway/walkways	0.10 W/ft ²
11	Public driveways/walkways	0.15 W/ft ²
12	Private parking lots	0.12 W/ft ²
13	Public parking lots	0.18 W/ft ²

TABLE G.3. Space Type Codes

Space Type Code	Description	Unit Power Density		Space Type Code	Description	Unit Power Density	
		1989	1993			1989	1993
Auditorium 1	Auditorium	1.6	1.4	Offices (Partitions > 4.5 ft below ceiling). Enclosed offices, all open plan offices without partitions or with partitions lower than 4.5 ft below the ceiling.			
Corridor 2	Corridor	0.8	0.8	26	Reading, Typing & Filing	1.8	1.3
Classroom/Lecture Hall 3	Classroom/Lecture Hall	2.0	1.0	27	Drafting	2.6	2.2
				28	Accounting	2.1	1.8
Electrical/Mechanical Equipment Room 4	General	0.7	0.7	Offices (Partitions 3.5-4.5 ft below ceiling). Open plan offices 900 ft ² or larger with partitions 3.5 to 4.5 ft below the ceiling.			
5	Control Room	1.5	1.5	29	Reading, Typing & Filing	1.9	1.5
Food Service 6	Fast Food/Cafeteria	1.3	0.8	30	Drafting	2.9	2.6
7	Leisure Dining	2.5	1.4	31	Accounting	2.4	2.1
8	Bar/Lounge	2.5	1.3	Offices (Partitions < 3.5 ft below ceiling). Open plan offices 900 ft ² or larger with partitions higher than 3.5 ft below the ceiling. Offices less than 900 ft ² shall use types 26, 27, or 28.			
9	Kitchen	1.4	1.4	32	Reading, Typing & Filing	2.2	1.7
Recreation/Lounge 10	Recreation/Lounge	0.7	0.5	33	Drafting	3.4	3.0
Stair 11	Active Traffic	0.6	0.6	34	Accounting	2.7	2.4
12	Emergency Exit	0.4	0.4	Common Activity Areas			
Toilet and Washroom 13	Toilet and Washroom	0.8	0.5	35	Conference/Meeting Room	1.8	1.3
Garage 14	Auto and Pedestrian Circulation	0.3	0.25	36	Computer/Office Equipment	2.1	2.1
15	Parking Area	0.2	0.2	37	Inactive Filing	1.0	1.0
Laboratory 16	Laboratory	2.3	2.2	38	Mail Room	1.8	1.8
Library 17	Audio Visual	1.1	1.1	Shop (Non-Industrial)			
18	Stack Area	1.5	1.5	39	Machinery	2.5	2.5
19	Card Filing & Cataloging	1.6	0.8	40	Electrical/Electronic	2.5	2.5
20	Reading Area	1.9	1.0	41	Painting	1.6	1.6
Lobby (General) 21	Reception and Waiting	1.0	0.55	42	Carpentry	2.3	2.3
22	Elevator Lobbies	0.8	0.4	43	Welding	1.2	1.2
Atrium (Multi-Story) 23	First 3 Floors	0.7	0.4	Storage & Warehouse			
24	Each Additional Floor	0.2	0.15	44	Inactive Storage	0.3	0.2
Locker Room and Shower 25	Locker Room and Shower	0.8	0.6	45	Bulky Active Storage	0.3	0.3
				46	Fine Active Storage	1.0	0.9
				47	Material Handling	1.0	1.0
				Unlisted Space			
				48	Unlisted Space	0.2	0.2

TABLE G.3. (contd)

Space Type Code	Description	Unit Power Density		Space Type Code	Description	Unit Power Density	
		1989	1993			1989	1993
Airport, Bus & Rail Station				Hotel/Conference Center			
49	Baggage Area	1.0	0.75	78	Banquet/Multipurpose Room	2.4	1.4
50	Concourse/Main Thruway	0.9	0.45	79	Bathroom/Powder Room	1.2	0.6
51	Ticket Counter	2.5	1.3	80	Guest Room	1.4	0.7
52	Waiting & Lounge Area	1.2	0.6	81	Public Area	1.2	0.8
Bank				82	Exhibition Hall	2.6	1.3
53	Customer Area	1.1	0.8	83	Conference/Meeting	1.8	1.5
54	Banking Activity Area	2.8	2.2	84	Lobby	1.9	1.3
Barber & Beauty Parlor				85	Reception Desk	2.4	2.4
55	Barber & Beauty Parlor	2.0	1.6	Laundry			
Church, Synagogue, Chapel				86	Washing	0.9	0.6
56	Worship/Congregational	2.5	1.3	87	Ironing & Sorting	1.3	1.3
57	Preaching & Sermon/Choir	2.7	1.8	Museum & Gallery			
Dormitory				88	General Exhibition	1.9	1.2
58	Bedroom	1.1	0.6	89	Inspection/Restoration	3.9	3.0
59	Bedroom with Study	1.4	1.3	90	Inactive Artifacts Storage	0.6	0.25
60	Study Hall	1.8	0.9	91	Active Artifacts Storage	0.7	0.5
Fire & Police Department				Post Office			
61	Fire Engine Room	0.7	0.7	92	Lobby	1.1	0.8
62	Jail Cell	0.8	0.4	93	Sorting & Mailing	2.1	2.1
Hospital/Nursing Home				Service Station/Auto Repair			
63	Corridor	1.3	0.9	94	Service Station	1.0	0.8
64	Dental Suite/Exam/Treatment	1.6	1.4	Theater			
65	Emergency	2.3	2.0	95	Performance Arts	1.5	1.1
66	Laboratory	1.9	1.7	96	Motion Picture	1.0	0.75
67	Lounge/Waiting Room	0.9	0.6	97	Lobby	1.5	1.0
68	Medical Supplies	2.4	2.4	Retail Establishments			
69	Nursery	2.0	1.6	(Merchandising & Circulation Area) Applicable to			
70	Nurse Station	2.1	1.8	all lighting, including accent and display			
71	Occu./Physical Therapy	1.6	1.4	lighting, installed in merchandising and			
72	Patient Room	1.4	0.9	circulation areas.			
73	Pharmacy	1.7	1.5	98	Type A (Mass Merchandising)	5.6	6.0
74	Radiology	2.1	1.8	99	Type B (Service Retail)	3.2	2.9
Surgery & O.B. Suites				100	Type C (Mixed Use Retail)	3.3	2.7
75	General Area	2.1	1.8	101	Type D (Specialty Shop)	3.1	2.5
76	Operating Room	7.0	6.0	102	Type E (Fine Merchandise)	2.8	2.4
77	Recovery	3.0	2.0	103	Type F (Service Establishment)	2.7	2.6
				104	Mall Concourse	1.4	0.6

TABLE G.3. (contd)

Space Type Code	Description	Unit Power Density		Space Type Code	Description	Unit Power Density	
		1989	1993			1989	1993
Retail Support				Handball/Racquetball/Squash			
105	Tailoring	2.1	2.1	118	Club	1.3	1.3
106	Dressing/Fitting Rooms	1.4	1.1	119	Tournament	2.6	2.6
All Sports				Ice Hockey			
107	Seating Area	0.4	0.4	120	Amateur	1.3	1.3
				121	College/Professional	2.6	2.6
Badminton				Skating Rink			
108	Club	0.5	0.5	122	Recreational	0.6	0.6
109	Tournament	0.8	0.8	123	Exhibition/Professional	2.6	2.6
Basketball/Volleyball				Swimming			
110	Intramural	0.8	0.8	124	Recreational	0.9	0.9
111	College	1.3	1.3	125	Exhibition	1.5	1.5
112	Professional	1.9	1.9	126	Underwater	1.0	1.0
Bowling				Tennis			
113	Approach Area	0.5	0.5	127	Recreational (Class III)	1.3	1.3
114	Lanes	1.1	1.1	128	Club/College (Class II)	1.9	1.9
				129	Professional (Class I)	2.6	2.6
Boxing/Wrestling (Platform)				Table Tennis			
115	Amateur	2.4	2.4	130	Club	1.0	1.0
116	Professional	4.8	4.8	131	Tournament	1.6	1.6
Gymnasium							
117	General Exercise & Recreation	1.0	1.0				

APPENDIX H

FORM FOR DOCUMENTING PROGRAM PROBLEMS AND BUGS

APPENDIX H

FORM FOR DOCUMENTING PROGRAM PROBLEMS AND BUGS

The form on the following page is for your use in reporting any problems or bugs you encounter while using these programs. Please document specific problems/bugs under Item 5 on the form. Any suggestions you have for improving either the users guide or the programs will also be appreciated.

PROGRAM PROBLEMS AND BUGS

Name _____
Company _____
Address _____
City _____ State _____ Zip _____
Telephone _____

1. Which program are you using?

___ ENVSTD ___ LTGSTD Version _____

2. Please evaluate the users guide:

	Excellent				Poor
Technical Accuracy	5	4	3	2	1
Organization	5	4	3	2	1
Procedures	5	4	3	2	1
Figures	5	4	3	2	1
Examples	5	4	3	2	1

3. Rate your own knowledge of personal computers:

___ First-time computer user ___ Intermediate user
___ Advanced user ___ Programmer

4. What errors did you find in the users guide?

<u>Error</u>	<u>Page No.</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

5. What problems/bugs did you find in the program? Please list the keystrokes you used, if possible. _____

6. What other comments would you like to make about the programs or the users guide? _____

Thank you for taking the time to complete this form. Please return it to:

Interim Commercial Building Standards Software
D. B. Crawley, Program Manager
Pacific Northwest Laboratory
P.O. Box 999
Richland, Washington 99352