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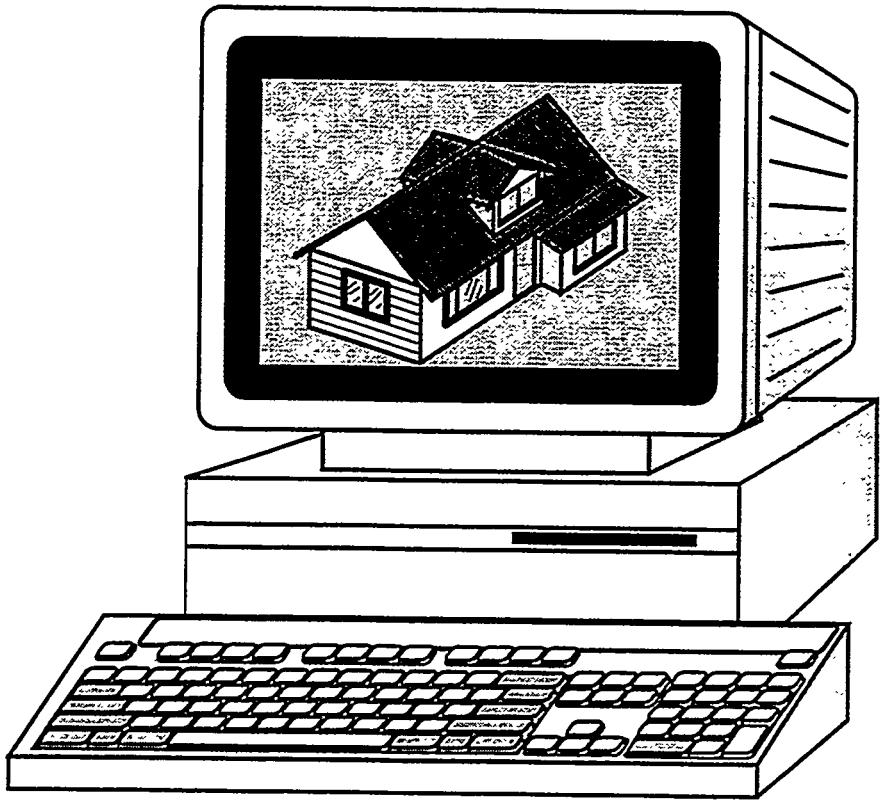

National Energy Audit Manual

National Energy AudiT (NEAT) Users Manual

John Krigger
Nate Adams
Saturn Resource Management
Helena, Montana

Mike Gettings
Energy Division
Oak Ridge National Laboratory
Energy Division
Oak Ridge, Tennessee

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Welcome to the U.S. Department of Energy's (DOE's) energy auditing tool, called "NEAT." NEAT, an acronym for National Energy AudiT, is a program for personal computers that was designed for use by local agencies in the Weatherization Assistance Program. It is an approved alternative audit that meets all auditing requirements set forth by the program as well as those anticipated from new regulations pertaining to waiver of the 40 percent materials requirement.

NEAT is easy to use. It applies engineering and economic calculations to evaluate energy conservation measures for single-family, detached houses or small multifamily buildings. You can use it to rank measures for each individual house, or to establish a priority list of conservation measures for nearly identical housing types.

NEAT was written for the Weatherization Assistance Program by Oak Ridge National Laboratory. Many building energy consumption algorithms are taken from Lawrence Berkeley Laboratory's Computerized Instrumented Residential Audit (CIRA), published in 1982 for the Department of Energy. Equipment retrofit conservation measures are based on published reports on various heating retrofits. Heating and cooling system replacement conservation measures are based on the energy ratings of new heating and cooling equipment.

The Weatherization Program anticipates that this computer-based energy audit will offer substantial performance improvements to many states who choose to incorporate it into their programs.

When conservation measures are evaluated locally according to climate, fuel cost, measure cost, and existing house conditions, the Program will be closer to its goal of assuring the maximum return for every federal dollar spent.

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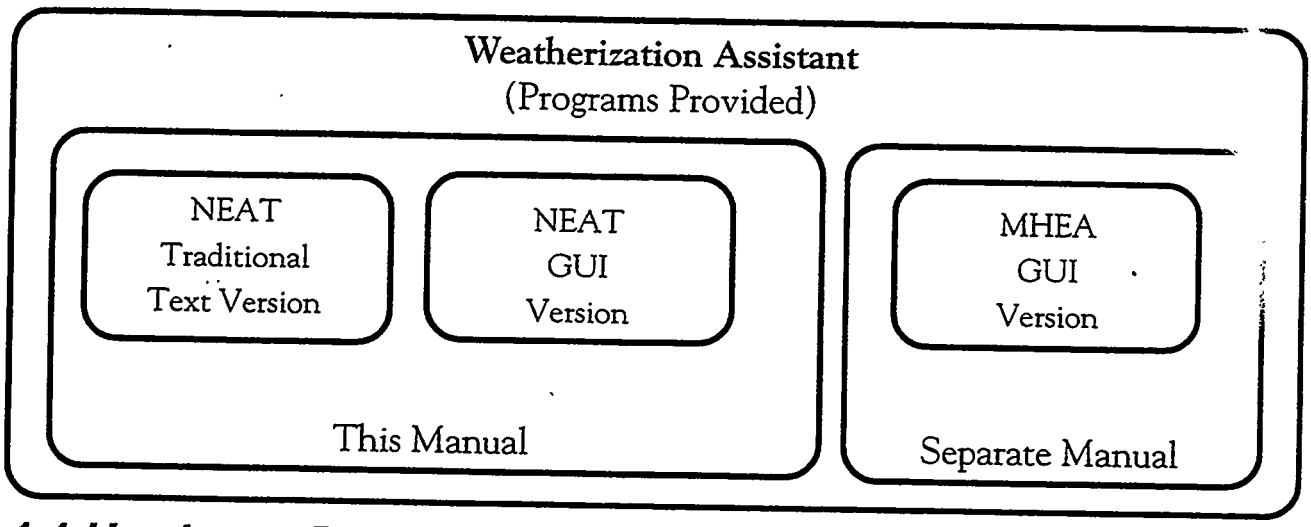
Chapter 1

NEAT, an acronym for National Energy AudiT, is a program for personal computers that was designed for use by local agencies in the Weatherization Assistance Program. It can assist these agencies select energy conservation measures for primarily single-family site-built homes that meet government criteria for cost-effectiveness.

This manual has been written to describe the operation of NEAT Version 6.1. This version of NEAT is being distributed with the Manufactured Home Energy Audit (MHEA) in a package of programs referred to as the "Weatherization Assistant." MHEA performs a similar task to that of NEAT except for manufactured housing.

Installation of the Weatherization Assistant, described in Chapter 2 of this manual, *Installing and Starting NEAT*, will provide you with both of these programs, NEAT and MHEA, having graphical user interfaces (GUI). The remainder of this manual describes the operation of NEAT only. A separate companion manual, also included in the Weatherization Assistant package, describes the MHEA program.

The GUI interface helps speed up data entry by use of a mouse. This distribution of the Weatherization Assistant also includes NEAT with a traditional text interface, used in prior versions of the program. Throughout this manual, these two versions of NEAT will be referred to as the "GUI version" and the "text version."



1.1 Hardware Requirements

NEAT is written in the programming language "C." NEAT requires no additional computer software other than a DOS, Windows, or OS/2 operating system, one of which normally comes with the purchase of a computer.

NEAT runs on any IBM-compatible computer having 470 kilo-bytes (kB) of free random-access memory (RAM). Installation of both NEAT and MHEA requires approximately 9 Mega-bytes (MB) of available hard disk space. All files necessary to run both NEAT and MHEA are stored on a single high density diskette, with a second disk provided to hold additional weather files for different cities throughout the United States. (These files can be accessed from the Setup Menu to select the city nearest the audited residence.)

A math co-processor is not essential, but will significantly speed up NEAT. NEAT uses printer commands already existing on your computer to print results. No re-configuring of you printer is necessary. Output files produced by the program are in a format readable by any word processor or text editor and can be viewed in DOS.

1.2 NEAT-Assisted Energy Audit

NEAT is a method for selecting energy conservation measures for houses. A complete weatherization program includes many steps in addition to selecting these measures. These steps, and some of their relationships to NEAT, may include:

1. Selecting eligible houses and determining the expenditure limit for each.
2. Visiting each house to collect information. Inspecting and measuring various components. Interviewing clients. Noting health and safety problems. Making sketches. And, possibly, performing general repairs to the house. (NEAT has certain data requirements, but local agencies' programs may collect additional information.)
3. Conducting air leakage repairs. NEAT can use blower door measurements, but these measurements are not required. NEAT will calculate the weatherization energy savings and Savings-to-Investment Ratio (SIR) for infiltration reduction work that has been performed, if data from blower door tests and cost of the work are provided.
4. Installing cost-effective low-cost and no-cost conservation measures (such as replacing furnace filters, servicing evaporative coolers, or installing energy-saving showerheads). These measures, which must be approved by the DOE, often can be installed as quickly as they can be analyzed and are not evaluated within NEAT.
5. Inspecting and diagnosing heating and cooling equipment. Combustion tests measure the steady-state efficiency of heating systems. If such tests are available, NEAT will use them to more accurately estimate savings from equipment replacement or tune-up. If testing is not available, NEAT's default values will estimate efficiency.

6. Choosing measures based on the building description data. NEAT will generate a report of cost-effective energy conservation measures for both the building envelope and heating/cooling equipment.
7. Obtaining energy consumption data from the customers' utilities. NEAT can use these data to adjust savings estimates for various energy conservation measures.
8. Installing measures following state-of-the-art procedures.
9. Performing an on-site quality assurance inspection of installed energy conservation measures.
10. Educating customers about what they can do to minimize energy consumption.

1.3 What NEAT Does

NEAT uses engineering calculations to compute the savings of individual energy conservation measures. NEAT requires a description of each building and its energy-related information. You may take data input forms to the building site and record information by hand, or you may enter information directly into a portable computer.

You enter data onto computer screens that store information about the characteristics of the house and its mechanical systems. Screens contain entry blanks or tables for entering data regarding each general component type, such as walls or foundation spaces. The GUI version screens (normally referred to as forms) also contain buttons or boxes which are selected using your computer's mouse.

NEAT uses this data to rank individual energy conservation measures and also evaluates the interaction between conservation measures. For example, since insulation reduces the amount of energy used for heating, it also reduces the energy savings from a furnace replacement.

NEAT follows eight steps to select the most cost-effective energy conservation measures for a particular single-family house:

1. NEAT guides the auditor through the process of entering data from the house.
2. NEAT computes heat loss, heat gain, and energy required to keep the house at a specific thermostatic set point.
3. NEAT reviews possible conservation measures and checks their applicability to the house described by the auditor.
4. NEAT calculates savings for each applicable conservation measure and computes the discounted savings-to-investment-ratio (SIR). The SIR tells you how many times a conservation measure will repay the initial investment during its lifetime.
5. NEAT ranks the energy conservation measures in order of their SIR.
6. Beginning with the highest SIR, NEAT applies each conservation measure

to the house and then recomputes a new SIR for the remaining measures, taking into account savings gained by preceding measures.

7. NEAT again ranks the conservation measures and prepares an essential materials list.
8. NEAT adjusts measure savings based on actual consumption data from the utility company, if the user desires.

NEAT calculates heat loss and gain on a monthly basis, using ten-year average weather data for the selected city. NEAT then evaluates all conservation measures by how much they reduce the flow of heat through the envelope and by how much they reduce the house's "balance point" (the outdoor temperature above which no heating is needed or below which no cooling is needed).

NEAT estimates heating and cooling efficiency based on information you enter. NEAT also accepts values determined from combustion efficiency measurements.

The amount of solar energy absorbed by a house varies according to area and orientation of its walls, windows, and doors. To help NEAT consider this effect, you need to enter the nearest cardinal direction that exterior walls face, as well as in which wall windows and doors are located.

NEAT also accounts for the typical amount of heat generated inside a house by people and their refrigerator, water heater, other appliances and lights.

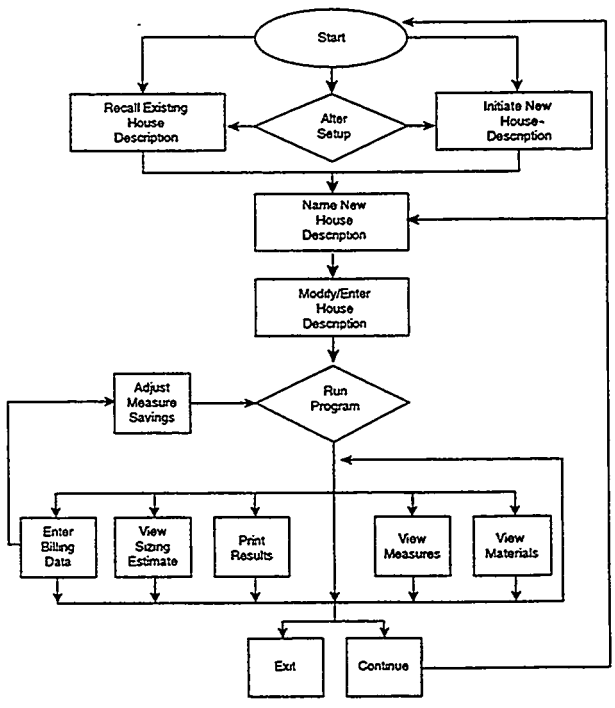
Since conservation measures typically remain after occupants move, NEAT assumes a house is maintained at average conditions, regardless of specific occupants. This follows the intent of government and utility programs that finance energy conservation savings to be realized for up to 20 years.

NEAT reports the cost-effectiveness of conservation measures—both individually and cumulatively—to fit varying budgets and guidelines of different weatherization programs.

If you follow NEAT, money spent on residential energy conservation will be an economical investment according to the Program rules.

1.4 NEAT Flow Chart

The user-options and program flow experienced when running NEAT are illustrated in the following flow chart.



Chapter 2

NEAT is being distributed as part of a package of energy auditing tools collectively known as the "Weatherization Assistant." The following instructions will install all of these tools onto your computer. They assume you have an IBM-compatible computer with at least 9 MB of available hard disk space. Installation only adds a new directory tree to your hard drive and does not effect any system files.

Programs in the Weatherization Assistant will execute on a variety of platforms, including DOS (version 4.0 or higher), Windows 3.1 or 3.11, Windows 95, and OS/2. The following instructions will cover all but OS/2. See the "install.txt" file on the distribution disk for guidance on installation with this platform.

Remember:

- Keyboard characters this manual wants you to type are printed in bold. Example: **INSTALL.**
- Command keys you are to press, such as **Enter**, have brackets [ ] around them. Example: **[Enter]**.

2.1 Program Installation - DOS / Windows 3.1 or 3.11

After turning on your computer, you will either get a DOS prompt (C:\>) or be presented with the Windows desktop showing icons representing various programs on your computer. If you see the latter, click on the File menu item then the Exit Windows selection. Click on the **Okay** button in the box which appears. This will end your Windows session and give the DOS prompt. The DOS prompt is a computer symbol that usually contains the name of the disk drive and the directory on your computer being accessed. If you are not familiar with DOS, see Appendix A, *Notes on DOS*.

Put the Weatherization Assistant program disk in the computer's A drive (or B drive) and type **A:** (or **B:**), then press **[Enter]** (designated as **[Return]** on some computers). Type **INSTALL** <PATH>, where <PATH> tells the computer where you want the programs to be copied on your computer. For example, if you want the programs of the Weatherization Assistant to be copied to the C:\WA directory, type **INSTALL C:\WA**. The programs have now been copied to your hard drive. You need to type **C:** and press **[Enter]** here to access the hard drive. If you copied the programs to a drive other than the C drive, substitute the letter of this drive for C.

You are now ready to run NEAT. Eject the program disk from you A (or B) drive and store it.

2.2 Installing a Windows Icon

After completing the installation procedure of the previous section, the Weatherization Assistant can be started from the DOS prompt. However, you may wish to install an icon onto your Windows desktop to allow starting the program from within Windows. This step is not required to use the programs from DOS.

To add a Weatherization Assistant program icon to your desktop, follow the steps outlined below. Further detail can be obtained from your Windows manual under "Creating a Program Item," or similar section.

From Windows, select the program group into which you want to install the Weatherization Assistant icon. For example, double click on the Applications program group. Choose the File/New item from the Windows Program Manager main menu. Click on **OK** after insuring Program Item has been selected. Type **Weatherization Assistant** as the Description, **WA** as the Command Line, and <PATH> as the Working Directory. <PATH> is the location on your hard drive to which you copied the program. In the example of Section 2.1, this was **C:\WA**. Click on the Change Icon button. A message similar to "No icons available" will be displayed. Ignore it and click on **OK**.

The Change Icon window will appear. Type <PATH>**\WA.ICO** for the File Name at the top of the window, where <PATH> is the location of the Weatherization Assistant on your computer. For the example being used, the File Name entry would be **C:\WA\WA.ICO**. This will add the Weatherization Assistant icon to the program group you chose. Clicking on the icon will start the program.

2.3 Program Installation - Windows 95

The procedure used to install the Weatherization Assistant onto a computer using Windows 95 follows the standard process for that platform. A summary is given below. More details can be found in your Windows 95 manual.

Turning on your computer places you in the Windows 95 desktop. From here, double click on the following icons: My Computer, Control Panel, then Add/Remove Programs. Click on the Install button. Place the Weatherization Assistant program disk into drive A of your computer. (Your drive A must be a high density drive, else installation will not work according to these steps. See your Windows manual for additional assistance.) Click on **Next**. Windows should find the "A:\INSTALL.BAT" file and place this text in the input window. Press the **[End]** key on your keyboard, then a space, then the path indicating where you want Windows to copy the program.

For example, if you wish to copy the Weatherization Assistant into the C:\WA directory on your computer, add this path such that the input window reads **A:\INSTALL.BAT C:\WA**. Press **[Enter]** or click on the Finish button to begin installation.

A DOS window will open and the files being copied to your hard drive will be listed. When the copying stops and the window title displays "Finished", click on the [X] button in the upper right corner of the DOS box to close the window. Close the Control Panel in a similar manner. Installation is complete.

2.4 Creating Backup Disks

It is often a good idea to create backup copies of your distribution disks. If you ever need to install NEAT again, either on the same or different computer, and the original distribution disks fail (as disks will), you have a backup from which to work. Put the distribution disk in the A drive. Type **DISKCOPY A: A:**, then press **[Enter]**. When instructed to do so, remove the distribution disk ("source") and insert a blank, formatted, high density backup disk ("target"). Then press **[Enter]** again. Depending on the memory your computer has, you may need to repeat this cycle several times, following the instructions provided on your computer's display. If the distribution disk fits only into your computer's B drive, substitute **B** for **A** in the above procedure.

2.5 Starting NEAT

How you start the Weatherization Assistant depends on what platform you have installed the program on. In DOS, turn on your computer and wait for the DOS prompt (C:\>). Use the DOS change directory command (CD) to tell your computer to change the directory to the location where you installed the program. For instance, if you installed Weatherization Assistant into the "WA" directory, type **CD\WA** and press **[Enter]**. The computer will display the DOS prompt (C:\WA>). Typing **WA** will start the program. From the introductory screen which appears, click on either MHEA or NEAT to start the Manufactured Home Energy Audit or the GUI version of the National Energy Audit. NEAT also has an introductory screen. Click the mouse once at any location to continue, allowing access to the Main Menu.

You may also start NEAT without passing through the Weatherization Assistant from the DOS prompt by typing **NEAT** for the GUI version or **NEATTXT** for the text version. To run MHEA without passing through the Weatherization Assistant introductory screen, type **MHEA** at the DOS prompt.

If you installed the Weatherization Assistant onto a Windows 3.1 or 3.11 platform, there are several ways you can start NEAT. Open the Main program group under

Windows Program Manager. Double click on the MS-DOS Prompt icon to open a DOS window. Then, follow the steps given above for DOS, starting with the CD command.

If you have installed the Weatherization Assistant icon onto your Windows desktop (see Section 2.2, *Installing a Windows Icon*), you can start NEAT by opening (double clicking) the program group on your desktop where you installed the icon (the Applications program group in the example of Section 2.2). Double click on the Weatherization Assistant icon (a computer and display with the outline of a house on it).

Then select either the NEAT or MHEA buttons to start these programs. Progress past NEAT's introductory screen by clicking the mouse at any location.

To start NEAT from Windows 95, double click on the My Computer icon, then on the icon for the drive where you installed the Weatherization Assistant (C: in the example used). Locate the folder (directory) into which the program was installed (WA in the example). Double click on this folder to open it. Double clicking on the MS-DOS prompt titled WA will start the Weatherization Assistant. Select either the NEAT or MHEA buttons to start these programs. From NEAT's introductory screen, click the mouse once to continue.

2.6 Installing the Weather Files

Although the Weatherization Assistant programs have now been installed onto your computer, they will only run for one weather city. You must now select which cities you wish to have quick access to as you run the programs. The procedure of installing additional weather cities can be performed from either NEAT or MHEA, but must be performed before either program can use additional weather, since both use the same weather data. The procedures are similar in both programs, but only the procedure for NEAT will be described here. (See the MHEA User's Manual for the analogous procedure in MHEA.) Weather cities can be installed any time you wish to add more weather cities to your hard drive.

Start NEAT using the appropriate process described in Section 2.5, *Starting NEAT*. Select (click on) the Install item under the main menu (see Chapter 4, *Navigating the GUI Version* for details on selecting items, buttons, etc.). Under the Setup menu, select Weather Data Files, then Install. Insert the Weather Data disk in the appropriate drive of your computer. You will be presented with a screen asking which drive the contains the weather data disk: A: or B:. Select the appropriate response. A warning screen appears confirming your response and asking you to make sure the weather disk has been put in the indicated drive. Click on **Continue** to proceed or **Escape** to abort the procedure.

You will be presented with a scrollable pick list containing the names of all the cities for which NEAT has weather data. They are listed in alphabetical order of their state's abbreviation. See Section 4.5, *Using Vertical Scroll Bars* for details on viewing the entire list. Click on as many of the cities as you wish to have installed on your hard drive. A selection is indicated by the presence of a _ in the column to the left of the names. A city selected may be un-selected by clicking on it a second time. Once you have chosen all the cities desired, click on the **Okay** button to install the files or **Cancel** to abort the selection. Up to a minute may be required to "unpack" the weather files and copy those you selected to the hard drive. A window appears indicating the process is continuing. When it disappears, the process is complete. Click the mouse twice to close submenus, then click on the Quit main menu item to exit NEAT.

NOTES:

Chapter 3

The GUI Version of NEAT makes use of a graphical user interface. Using this software is much like using any other windowing graphical interface. Many of the data input forms have been optimized for mouse usage, so it's best if you have a mouse, track ball, or some other type of cursor control device. If you do not have a mouse, you can still make use of the form navigation keystrokes to make your way around the forms and check boxes or you may use the text version of NEAT.

3.1 Entering Data in Fields

The GUI Version of NEAT uses screen forms to input data to NEAT. The forms contain either fields (boxes with a blinking cursor), or check box groups that allow you to make selections. There are several different ways you can select fields when you are in a form. Experiment and see what method is most comfortable for you.

1. You can point and click the left mouse button on the field you want to edit or the check box you want to select.
2. You can use the **[Enter]**, **[Up Arrow]**, and **[Down Arrow]** keys to cycle through the field entries and check boxes.
3. The **[Tab]** and **[Shift-Tab]** keys work the same as the up and down arrows.
4. You can type the **[Alt] 'hot key'** shown on the label. The "hot key" is the key corresponding to the letter or number underlined in the label to the field. See Section 3.4, *Hot Keys*.

Once you are in a field, there are a number of editing features you can use. Here are the editing features for field entries:

- The **[Left Arrow]** and **[Right Arrow]** keys move the cursor one character within a field.
- The **[Home]** key moves the cursor to the beginning of the field and the **[End]** key to the end of the field.
- The **[Backspace]** key deletes the character before the cursor while the **[Delete]** key removes the character after or over the cursor.
- The **[Enter]** key accepts an entry and moves to the next field.
- The **[PgUp]** and **[PgDn]** keys move you to the next or previous record (screen). For example, if you have five walls defined and you are editing the third wall, the **[PgDn]** key will take you to the screen for the second wall.

- The cursor is in the OVERWRITE mode by default and appears as an underline where you are editing. You can switch to the INSERT mode by pressing the **[Ins]** key. This changes the cursor to a vertical bar just to the left of the character where you will insert. The OVERWRITE or INSERT mode is consistent through all forms.
- If there is an entry already in the field, the first keystroke will erase the old entry and start the new entry. If you want to edit the existing entry, use the **[Left Arrow]**, **[Right Arrow]**, **[Home]**, or **[End]** key first before you type the first character. The exception to this rule is when NEAT detects an error in your input and places the cursor back in the field. In that case, your keystrokes edit the existing entry rather than replace the existing entry.
- If one exists, the default value for the field you are in will be displayed at the bottom right of the screen following the word "Default." A default value will be automatically transferred into the field if you exit the field while empty. The backspace key may be used to erase an existing entry in a field.
- Pressing the **[F1]** key while in a field or the right mouse button while pointing to a field (or any other object) brings up context sensitive help material about that data entry. See Section 4.9, *Getting Help*.

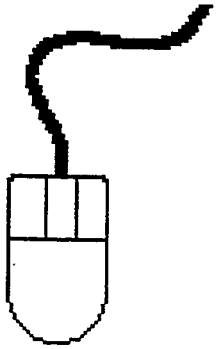
3.2 Ghosted Fields

Some of the fields you will see in the forms are the same color as the form background. These "ghosted" fields are either (1) not applicable due to other selections you have made on the form, (2) contain values computed from other fields, or (3) have been chosen elsewhere and only displayed for your information. In the **Defaults** item under **Setup**, only those fields which allow default values to be set are not ghosted. Ghosted fields in NEAT can not be edited and do not invert their color when you point at them with the mouse.

3.3 Hot Keys

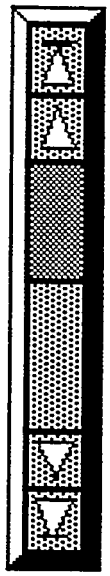
"Hot Keys" are keys you can use to select items in a menu or in a form using the keyboard. The key you need to press is underlined on the menu or the object in the form. Hot keys in NEAT are activated by holding down the **[Alt]** key while pressing the key indicated by the underlined character. Since many items needing input to NEAT are text entry fields, there may be times when it will be faster to move from one text entry field to another using the hot key rather than removing your hands from the keyboard to use the mouse.

3.4 Using the Mouse in NEAT



You should find that using the mouse in NEAT is quite simple and intuitive. Just point at an object and click the left mouse button to select a field, button, or menu item. If you are selecting an object from a scrolling list of objects you can either (1) double click the left mouse button while pointing at your selection or (2) single click on the selection and then click on the Okay button.

3.5 Using Vertical Scroll Bars



The vertical scroll bar is used to control your view of a long file or list of items. There are three main areas in the scroll bar that you should be familiar with. First, are the top and bottom buttons on the extreme ends of the scroll bar. These look like arrows pointing to a line and they let you get to the top or bottom of the file or list quickly. The next buttons (toward the center) are the line up and line down buttons. These let you scroll through one line at a time. Finally, the box in the center shows you the size and position of the displayed list relative to the whole list. It moves when you use the other buttons, but you can also use it directly. Just point to it with the mouse, hold down the left button and position the box by dragging the mouse. When you release the mouse button, the display is updated to reflect the new position.

3.6 Menus and Forms

The operation of the menus and forms is intended to be as intuitive as possib If you are entering data into a field you can make use of the field entry fea res described in this chapter. To get more help on individual forms or menu items ust point to the item and press the right mouse button to get context sensitive help see Section 3.9, *Getting Help*). When you are finished entering data into a form there are two ways to leave the form. First, you can click on the **Okay** button to save your data and exit the form, or you can click on the **Cancel** button to ignore the data you have entered or the erasures you have made and leave the form.

3.7 List Control

A number of forms in NEAT access a list of building components (e.g. walls, windows, etc.). In these forms, there is a set of list control buttons and a scroll bar to control which record in the list you are editing. Here is a description of the list controls.

Scroll Bar - Use the scroll bar to quickly change your position in the list. You can step through the list one record at a time using the left and right arrows (right is forward, left is backward) at the ends of the bar. The **[PgUp]** and **[PgDn]** keys work the same as these left and right arrow buttons for those of you without a mouse. You can go to the top or bottom of the list with the extreme left or extreme right buttons (arrows pointing to vertical lines). These buttons will take you to the first record and the last defined record of the list. For example, if you have entered data for only five walls of the maximum allowable eight, these buttons will position you within the form for the first and fifth wall.

The center of the scroll bar shows you the relative position in the list. You can move the center of the scroll bar with the mouse to change records as well. Point to it with the mouse, hold down the left button and position the box by dragging the mouse. A field at the bottom left of the scroll bar always shows you your absolute position in the list relative to the maximum allowable records possible for the specific component type. The field contains two numbers in the form XX/NN, where XX is the current record number and NN is the maximum allowable records.

Delete Button - Use this button to clear all the entries and un-check all the boxes for a record.

Goto Button - This button will generate a list of records you have defined. Select the record you want to go to and press the **Okay** button. You can also just double click on the entry you want.

3.8 Copy and Paste

The **Copy** and **Paste** buttons provide a convenient way to repeat common data entries. When you press the **Copy** button, a complete copy of all fields and check box selections in the current form is written to a buffer file on your computer. You can then position the current form to any record of the same component type and press the **Paste** button to fill in all of the fields and check box selections for that form.

WARNING, The Paste operation OVERWRITES any data that may currently exist on the form. If you have checked the **Overwrite Warnings** box in the **Setup/ Preferences** form, NEAT will give you a warning before copying the data. To remove the warning message, check **No** for **Overwrite Warnings** in the **Preferences** form.

There is a buffer file for each component type, i.e. one for walls, another for windows, etc. Also, the files are not erased when you exit NEAT. This means that you can copy elements from one building to another. Just use the **Copy** button to copy the elements you want from the first building. Then close that building file,

open the second building file and use the **Paste** buttons.

In the heating system form, pressing the **Copy** button copies all of the data on the main form AND the heating system details sub-form. Conversely, the **Paste** button fills in ALL of the fields on the main heating system form AND the sub form.

3.9 Getting Help

You can get help by pressing the right mouse button or the **[F1]** key anywhere in NEAT. Normally, if you press **[F1]** or the right mouse button when you are pointing at an object (menu items, data entry fields, and buttons included), you will see help material specific to that object. You can also look through the help material by topic using the index or the table of contents. When you see the list of topics, just double click on the entry to move to that topic.

The title of the help material is always shown at the top of the help box that pops up on the screen. Every help screen contains a **Contents** button on the bottom left corner. Pressing this button will show you the complete table of contents for all of the available help material. The buttons on the bottom right of the help form le- you move to the next or previous help topic in a category of help topics. The righ.t topic button (**Next**) moves to the next topic and the left topic button (**Prev**) mov es to the previous topic. If you reach the end (or beginning) of the category, one of ·ne buttons becomes ghosted making it unavailable. Topics are grouped by the level of indentation you see when you view the table of contents. On the right hand sic. : of the help form near the bottom are buttons (**UP** and **DN**) for paging through ong help material entries. If the buttons are ghosted it means there is only one pa e of help.

Hypertext items are the highlighted help text you see in a different color. : you move the mouse cursor to the highlighted word(s) and press the left mouse ke· ·ou will see more information on that topic or word. If you selected one of the hyperte ·'ed items while in the help form, the **Backup** button becomes available (un-gho:·ed). Pressing the **Backup** button moves you back to the previous help material. You can explore many levels of hypertext and still get back to your original starting place by repeatedly pressing the **Backup** button. If the **Backup** button appears ghosted it means you are back to where you entered the help utility.

You can leave the help form and return to NEAT at any time by pressing the **Okay** button at the bottom of the form.

Chapter 4

4.1 Data Input Screens

Building description data are entered on individual computer screens, similar to the pages of a book. Once the minimum information has been entered (see Section 4.2, *Keystrokes and Cursor Movement*), you may page through the screens in any direction you choose.

There are two types of screens: 1. "Tabular" screens with rows and columns and 2. "Form" screens with spaces for words or numbers.

Entries consist of text, numbers, or menu choices (letters or numbers). If an entry must be provided, you will be so informed and will not be allowed to proceed until an appropriate value is entered.

Menu boxes automatically appear beside selected entry fields, allowing you to select a number or letter to represent your answer.

Essential entries include construction characteristics, insulation levels, and areas. Nonessential entries (comments, equipment manufacturers, and models) are for the user's convenience and are not used in computing and selecting conservation measures. Comments will be printed with the recommendations or may be viewed prior to exiting NEAT. If these nonessential entries are skipped, the item will either be left blank set to zero, or set to a default value.

Remember:

- Keyboard characters this manual wants you to type are printed in bold. Example: **INSTALL.**
- Command keys you are to press, such as **Enter**, have brackets [ ] around them. Example: **[Enter]**.

4.2 Keystrokes and Cursor Movement

After entering the General House Data screen and at least one line in the Walls screen, you can move freely from screen to screen. While it is not necessary to enter all individual components (such as all windows on the window screen) to freely move around, it is necessary to complete or eliminate the description (line) of any component whose description has been started, i.e., there can be no incomplete component descriptions. When editing an existing building description, these requirements have

already been satisfied and the user can pass at will from screen to screen. When each screen is first displayed, there is a dialog box which gives you three options:

- Press **[PgUp]** to view the previous screen.
- Press **[Enter]** to enter the current screen to begin adding or editing information.
- Press **[PgDn]** to leave entries on the current screen unchanged and proceed to the next screen.

After you press **[Enter]** to enter the current screen, the cursor will rest on the first field of that screen. To enter data, simply type the appropriate information in each field and press **[Enter]**. Some entries require you to choose a number or letter from menu selections (see Section 4.3, *Dialog Boxes and Menu Boxes*). Press the number or letter that matches your choice, and NEAT will enter your selection.

On tabular screens for such single character responses, NEAT will automatically jump to the next column of data only if the row has not been entirely filled in, i.e. you are inputing a new row of data. However, if the current line has already been totally filled in, such that you are editing existing data, NEAT will remain in that field waiting for you to direct its movement. This allows for faster changes down columns when modifying previously entered data or if a single row is entered, then copied multiple times, and modified by columns.

The bottom row of each building description input screen contains a green instruction bar. They indicate the applicable control keys for that screen. Note, however, not all will be available at all times for a particular screen. Some are only applicable when inputing multiple character entries (such as **[Left Arrow]** and **[Right Arrow]**), while others (such as the **[PgUp]**,**[PgDn]**, and **[F10]** keys) will only operate when complete data rows exist.

Here are NEAT's common keystrokes:

- The **[Enter]** (or **[Return]**) key performs several different functions in NEAT's building description. It saves the number or text you have entered in the current field, and then moves the cursor right, to the next field. Pressing **[Enter]** will also place NEAT's default value (located in the top right corner of the screen) in the field if no entry has been made previously. Also, **[Enter]** skips the cursor over a previous entry as you edit or review an existing NEAT building description.
- **[Shift][Tab]** moves the cursor left, to the previous field. **[Enter]** or **[Tab]** moves the cursor right, to the next field.
- The **[Up Arrow]** key allows you to move up the screen. The **[Down Arrow]** key allows you to move down the screen. However, these keys will not allow you to leave a partially filled row in a tabular screen. The row must either be completed or eliminated using the **[F2]** key (see **[F2]** below).

- The [Left Arrow] and [Right Arrow] keys move the cursor a single space in any field which requires multiple characters.
- The [Backspace] key will erase the character to the left of the cursor.
- The [Escape] (or [Esc]) key erases the entire field where the cursor rests.
- The [Insert] key does not function in NEAT. Characters are always replaced, never inserted. If you wish to change only one character of an answer, simply type the new character over the incorrect one. To edit a field, position the cursor where you want it and simply type the new entry over the old.
- The [F1] key, pressed while accessing any data field in the building description input, will display text describing in more detail the data required by the field. The [Esc] key must be pressed to exit the display and continue entering data. If [F1] is pressed any time the green **PgUp/Enter/PgDn** instruction box is displayed, a help screen describing the function of all control keys will be displayed.
- The [F2] key deletes an entire line (including partially filled in lines) on a tabular screen, if pressed anywhere on the line.
- On tabular screens, except the finished attic screen, the [F3] key copies the line in which the cursor currently lies. The other rows of data are moved downward and the copied line is placed below the line from which it was copied. The option will not work if the maximum number of components have already been described for that particular component type. For windows and doors, the respective codes are automatically adjusted to remain in order while including the added (or deleted) component. For other screens, the user must personally modify component codes for rows added using the [F3] key. Duplicate codes are not allowed and must be corrected before exiting the screen. (See Section 5.3 *Component Codes*.)
- The [PgUp] and [PgDn] keys move you from the current screen (page) to the preceding or succeeding screen. They may be used anywhere within a tabular screen if no rows are left partially filled in, or within a form screen when all but optional data has been supplied.
- The [F10] key takes you from wherever you are in the building description entry process to the **Report Menu**, saving the building description as it currently exists. NEAT executes the analysis of the existing description. The [F10] key is operable only when the minimum building description data has been entered (General House Data and one wall) and when no uncompleted rows exist on tabular input screens. From the **Report Menu**, you can then simply choose **Exit Program** to leave NEAT. Note, the

building description may be very incomplete and produce no usable results, but it can be recalled and added to whenever you desire.

If irreparable problems arise:

- [Ctrl] C will exit NEAT and bring you back to DOS.
- [Ctrl] [Alt] [Del] will exit NEAT and re-boot the computer.
- If all else fails, turn the computer off, then back on again.

Each of the above tactics will result in the loss of all the information you have entered or changed, unless initiated after arriving at the Report Menu.

Here are guidelines to help you enter figures:

- Fractions are not accepted.
- There is generally no need for decimal figures beyond the tenth place (for example, 12.1, not 12.1474).
- NEAT is designed to compute numbers that have an accuracy of two or three significant figures. This means that you might round 1230 to 1200, but you shouldn't round 1230 to 1000. 14321 may be rounded to 14300, but not to 10000. 843.88 can be rounded to 843 or 840, but not to 800. (Significant figures are shown in bold.)

4.3 Dialog Boxes and Menu Boxes

Dialog boxes are questions or instructions displayed on the computer screen. They may ask a "yes" or "no" question or offer other options. Dialog boxes often show the default value for the field where the cursor is located.

If you enter a number markedly different from normal values, a dialog box will appear and ask for confirmation. If the number should be accepted, press [Enter]. In some cases, NEAT will not accept numbers outside an allowable range of values. For example, combustion furnaces cannot have efficiencies greater than 100 percent. If you try to enter 110 percent, a dialog box will inform you that NEAT is rejecting your entry.

Menu boxes offer you various options. Simply type the number or letter of your menu selection. If you have a color monitor, the color of the box indicates its general purpose: green - execution options; light blue - default values; reverse video - menu boxes; and red - warnings.

NOTES:

Chapter 5

5.1 Building Descriptions

The term "building description" will be used within this manual to designate all the data supplied to NEAT in describing a particular building. The building description is tailored to single-family, site-built, detached houses, although NEAT may also be used with small, multi-family buildings.

A building is described to NEAT by entering building characteristics into the computer on separate screens (see Appendix D, *NEAT Input Forms*). In the text version of NEAT, these screens resemble the pages of a book, which may be "turned" using the **[PgUp]** and **[PgDn]** keys on your computer. In the GUI version, they may be accessed in any order through the **Input** menu. Each screen permits entry of information about one of the following building components:

General House Data; Exterior Walls; Windows; Doors; Unfinished Attics; Finished Attics; Foundation Spaces; Lighting; Air Conditioners; Heating Systems; Primary Furnaces-Boilers; Space Heaters/Other Systems; and Itemized Additional Costs and User-Defined Measures.

Auditors enter data into entry blanks, called fields, on each screen. In addition to entry blanks, the GUI version also accepts input through the use of dialogue and check boxes, and buttons. See Chapters 3, *Navigating the GUI Version* and 4, *Data Entry in the Text Version*, for more details.

For NEAT to process an audit, you must enter all essential data on the General House Data screen (see Section 7.1, *General House Data*), and define at least one wall on the Exterior Walls screen (see Section 7.2, *Exterior Walls*).

5.2 Building Identifiers

The building identifier, referred to as the "File Name" in the GUI version, is an important data item. It is supplied by the user prior to entering building description data. It uniquely identifies the building description to NEAT and the user. Future reference to a particular building description will be made using this identifier.

Each time you enter a new building description or save an altered description, you will choose an eight-or-fewer-character building identifier. Enter the name of the occupant, the landlord, the address, your agency's job number, or any abbreviated combination. Allowable characters include all letters and numerals (A-Z, 0-9), and several special characters, including underscore (_), and the dollar sign ($). See your

DOS manual for additional characters. NEAT does not differentiate between upper and lower case letters for the building identifier.

Common building descriptions could be saved using building identifiers such as "RANCH," "2STORY," "SPLIT," etc.

You must be careful to distinguish the building identifier of a previously entered building description you may ask NEAT to restore (open) and the identifier you supply to identify the building description following any changes you may wish to make. The two may be the same, but if so, the modified building description will replace the description of the house which was restored (see Sections 6.1 and 6.2, *Main Menu*). Both GUI and text versions provide messages warning you of this potential loss of data.

5.3 Component Codes

Component codes are abbreviated names, which identify specific house components (for example, a north facing wall segment or a window on the east wall). There are two types of codes: 1. User-entered and 2. NEAT-generated. Both types contain up to four letters or numbers which are not case-sensitive. They will automatically be displayed and understood by the program as being all capital letters, regardless of how they were entered.

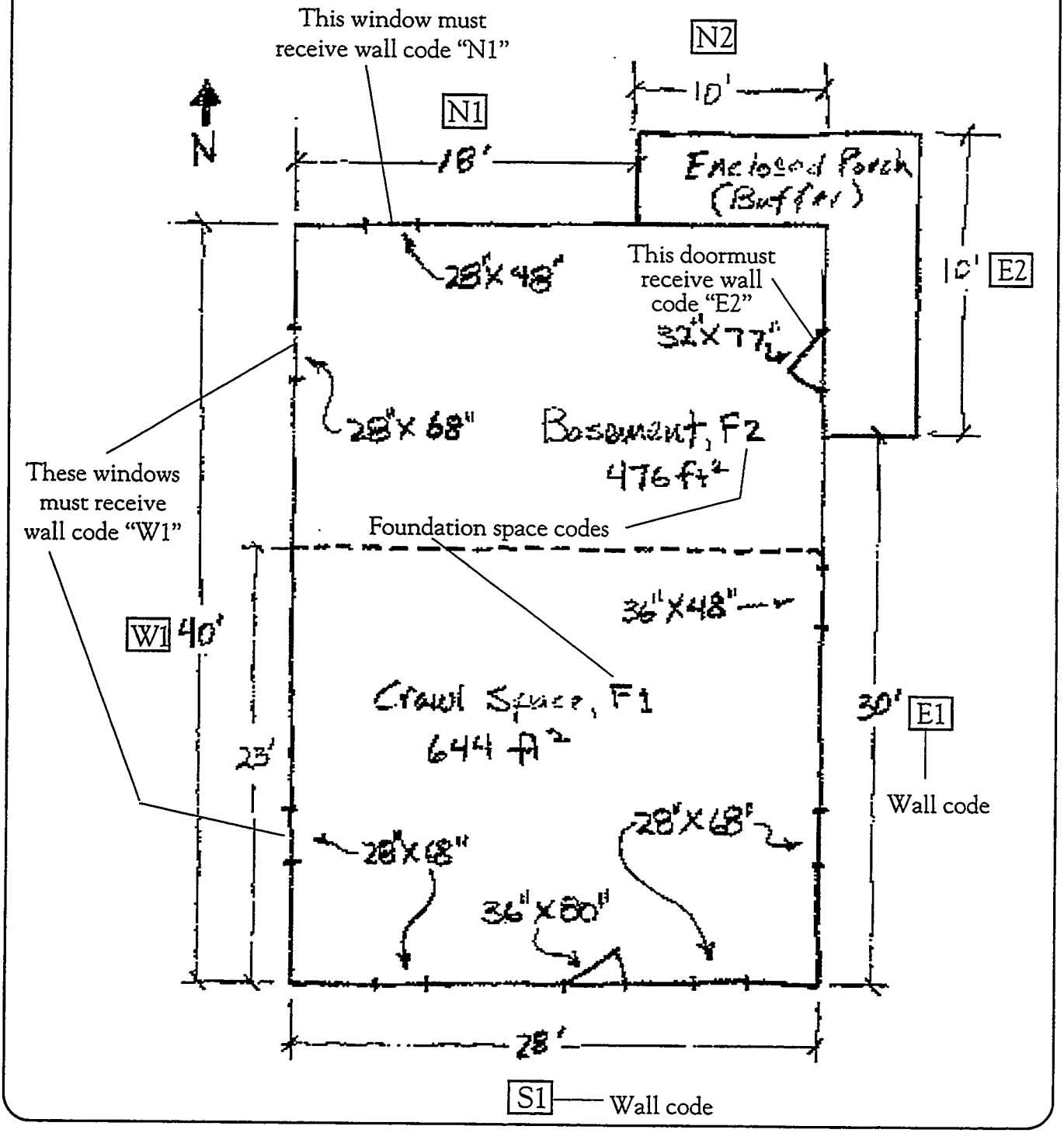
The user-entered codes are specified by the auditor or NEAT user to help remind them of the particular building components they refer to. They must be unique. Whenever an input screen is exited (by clicking on the **Okay** button in the GUI version or using a **[PgUp]**,**[PgDn]**, or **[F10]** key in the text version) the user-defined Codes will be checked to insure uniqueness. If not, a warning box will be displayed asking you to correct the situation. For example, if the **Copy/Paste** or **[F3]** functions had been used to copy an Unfinished Attic segment, you would need to change the Code on the duplicated segment so that it no longer was the same as the Code of the original segment from which it had been copied.

Codes link the floor plan (drawn as an aid to auditing and data entry) to the entry of different data fields (walls, attics, foundation spaces, and air conditioners). User-entered wall codes separate walls into sections that face different directions, have different construction characteristics, and/or contain different insulation levels.

Entries for Exterior Walls, Windows, and Doors are related by the wall code. Wall codes are used in the window and door input screens, for example, to allow NEAT to subtract window and door areas from the area of the wall that encloses them.

From the accompanying floor plan sketch, it is apparent that the north wall has a segment exposed to the outside, and a segment buffered by an enclosed porch. These segments are distinguished by wall codes "N1" and "N2," respectively. Thus, the 28"X48"

Sketch of Morris residence floor plan, showing Wall and Foundation Space Codes.



window receives the N1 wall code and the 32"X77" door receives the N2 wall code. The codes are also used in the report to designate which component a particular measure is to be applied to.

The NEAT-generated codes (for windows, doors, and finished attics) are automatically created by NEAT, but serve a similar purpose as the user-entered codes. They identify specific components in the reports. The codes for the finished attic components are abbreviations of the particular finished attic component types: "ocj"-outer ceiling joist, "cbm"-collar beam, "knw"-kneewall, and "rrt"-roof rafter. See Section 5.6, *Finished Attic Areas*, for a description of these types.

5.4 Measure Numbers

Measure numbers group together building components which are to receive the same energy conservation measure, that is, for which a single SIR will be determined. For component types that require measure numbers, assign numbers beginning with 1, followed by 2, etc. Don't try to assign a measure number of 3 unless energy conservation measures 1 and 2 already exist for a particular component type. NEAT will not permit it.

Measure Numbers for component types where specific records have been deleted or existing Measure Numbers changed will be automatically adjusted to prevent any disruption of consecutive values. In the GUI version, this is done when the building description is saved using the File/Save menu item. For the text version, adjustment of Measure Numbers is done whenever a screen is exited.

Thus, for example, if only one wall with Measure Number 2 exists and it is either deleted (using the **Erase** button or **[F2]** key) or changed to a value of 1, all Measure Numbers of walls greater than 2 will be lowered by one.

Measure numbers on the Exterior Walls screen group walls to be considered together in receiving wall insulation. Those on the Unfinished Attic and Finished Attic screens group components for the attic insulation measures. Those on the Foundation Spaces screen group components for floor insulation.

Consider building components of the same type, for example, attics. Those attic components having the same measure number will receive a savings-to-investment ratio (SIR) and separate ranking from other attic components having a different measure number. For example, there may be an attic section which has room for four inches of fiberglass insulation, and another section which has room for twelve inches of insulation. If you desire separate SIRs for each, assign measure number "1" to the first attic section, and measure number "2" to the second.

The accompanying illustration further demonstrates application of measure numbers. A screen from the text version of NEAT is used to show more directly the relationship between the Measure Numbers and the description of the wall segments. The north wall has two sections (wall codes N1 and N2). They are both uninsulated. However, the heat loss through them will be significantly different because N1 is exposed, while

Exterior Walls Screen (note the selection of measure numbers):

Exterior Walls

Wall Code	Wall Dir	Wall Exp	Ext Type	Wall Type	Wall Area (sqft)	Exst Ins Type	Exst Ins R	Add Ins Type	Add Ins Added Cost	Comments	Meas No
S1	S	E	1	2	340	0		1		1st, 2nd, & Dormer	1
W1	W	E	1	2	340	0		1			1
N2	N	B	1	2	80	0		1		Buffered 1st	2
N1	N	E	1	2	260	0		1		1st, 2nd, & Dormer	1
E1	E	E	1	2	260	0		1			1
E2	E	B	1	2	80	0		1		Buffered 1st	2

N2 is buffered by an enclosed patio. Thus, N1 is assigned "Meas. No. 1", and N2 is assigned "Meas. No. 2."

You are not required to assign different measure numbers to each component. If a single measure number is assigned to all components of the same type, a single SIR will be assigned to insulating those components and the same insulation level will be recommended for them. However, any member of the group for which the measure is not applicable (such as a wall which is already insulated) will automatically be dropped from the group.

Typically, walls with different exposures (buffered versus exposed) or significantly different construction should be given separate measure numbers as should attics with differing current or possible insulation levels.

Chapter 6

The Main menus in both the GUI and text versions of NEAT provide access to most tasks available in the program. Together with the File submenu in the GUI version, they also control the initiation, retrieval, copying, and saving of building descriptions. This chapter will provide summaries of NEAT's basic tasks as well as discuss in detail the operations associated with managing building descriptions.

6.1 Main / File Menus - GUI Version

After entering NEAT, you will see the "Welcome" screen for NEAT, identifying the program and its credits. Press any key to continue with the program. The menu bar at the top of your computer's screen provides you with the following options: File, Input, Run, View, Quit, Setup, Help. (Refer to your "Windows" manual for basic techniques of working with menu bars, dialogue and check boxes, and buttons.)

- Selecting the **File** main menu item produces a drop-down menu with nine additional choices: New, Open, Save/Copy, Close, Delete Input Files, Delete Report Files, Energy Use Ratio Calculator, NEAT Text Version, and DOS Shell.

Select **New** to name a new building description. You will be given the opportunity to enter a brief House Description (36 characters or less) and a File Name (Building Identifier). See Section 5.2, *Building Identifiers* for character restrictions on the File Name. All data entry forms will be blank for this new building. Following your entry, click the mouse on **Okay** to record your entries or **Cancel** to cancel your entries and return to the main menu.

Select **Open** to restore an existing NEAT building description. The lower portion of the next screen will list the File Names and Descriptions of all the existing building descriptions. Click the mouse on the line of the building you wish to restore. Its Name and Description will be copied to the first line of the screen, indicating your choice. Click the mouse on **Okay** to accept your choice or **Cancel** to cancel it and return to the main menu.

Select **Save/Copy** to save any changes you have made in a building description previously opened using the **New** or **Open** menu items. The File Name data entry field of the next screen will contain the File Name (Building Identifier) you supplied when first creating or restoring the building description. Click the mouse on **Okay** to save your changes using this File Name. If you wish to save the changes under a different File Name, enter the new File Name in the field. If you wish to insure that

this new File Name has not been used before, click the mouse on the **No** box opposite "Overwrite OK."

Select **Close** to terminate data entry for the current building description. NEAT will give you a warning message if this step will cause you to loose some recent inputs. If you proceed, changes made since last using the **Save/Copy** menu item will be lost.

Select **Delete Input/Report Files** to delete building descriptions you have entered previously or the reports created by running NEAT for these building descriptions. Click the mouse on the line of the building you wish to delete. A check will be placed in the column to the left of the File Name (Building Identifier) indicating that this building has been chosen for deletion. Click on **Okay** to proceed with the deletions of all check building files, or **Cancel** to cancel the operation.

The **Energy Use Ratio Calculator** menu item will compute for you a measure of a home's energy efficiency to assist you in deciding the level of effort which may be necessary to weatherize the home. See Chapter 9, *NEAT Auxiliary Functions*, for details.

Choosing **NEAT Text Version** will allow you to enter data using the traditional text version of NEAT. Selecting **DOS Shell** places you at the DOS prompt, permitting you to enter DOS commands while still in NEAT. Typing **exit** then **[Enter]** from this DOS shell will return you to NEAT.

- Select **Input** to enter building description data for the new or existing building chosen using the **New** or **Open** items from the **File** menu item. See Chapter 4, *NEAT Data Input* for additional information. After providing this input, you should save these changes using the **File/Save** menu item.

- After entering new building description data or revising the data from a previously described building, select **Run** to have NEAT perform the calculations necessary to provide recommendations for the home's weatherization. If you have altered a building description and not yet saved the changes using the **File/Save** menu item, NEAT will prompt you to do this before continuing with your choice to **Run** the program.

- Select **View** to view a summary of the current building description (**Building Description**), examine the results of comparing NEAT energy consumption predictions with billing data (**Utility Bills**), look at the recommendations resulting from having selected **Run** for the current building description (**Recommended Measure List**), view the energy consumption and equipment sizing recommendations from NEAT

(Energy Consumption/Sizing), or view your extended list of Actual Work Performed (see Section Chapter 9, *NEAT Auxiliary Functions*),

- Select **Quit** to exit NEAT and return to the operating system.

- Select **Setup** to set up NEAT to reflect your preferences and local conditions. See Chapter 10, *Customizing a NEAT Audit*, for more details.

- Select **Help** to locate text explaining data entry fields or features included in NEAT. Help on a specific data entry field may also be obtained by pressing the [F1] key or the left mouse button when accessing that item of data.

6.2 Main Menu - Text Version

The main menu of the text version of NEAT displays the following initial options:

1. ENTER NEW BUILDING DESCRIPTION
2. RESTORE BUILDING DESCRIPTION FOR EDITING
3. SET-UP
4. AUXILIARY FUNCTIONS
5. EXIT PROGRAM

- Press 1 to enter data for a new building. The next data entry screen asks only for a building identifier. It will be assigned to the building description about to be entered. Enter an alpha-numeric name of 8 or less characters (see Section 5.2, *Building Identifier*). If the name has not been used previously, the next data entry screen, **General House Data**, will appear. If the identifier has been used previously, you will receive a warning indicating that a building description with this identifier already exists. You will be asked if you wish to continue, thus replacing the previous building description with the one you are about to enter. Enter 'Y' if you no longer want the existing building description and want the description you are about to enter to take its place. Entering 'N' will allow you to re-enter a building identifier, presumably different from your first entry. Once you have either entered a unique building identifier or indicated the desire to replace an existing description, you will be presented with the **General House Data** screen. You are now ready to enter the building characteristics. Follow the instructions under Chapter 4, *Data Entry in the Text Version*, as summarized in Section 5.1, *Building Descriptions*.

- Press 2 to edit an existing NEAT building description. This takes you to another screen which lets you restore any previous NEAT building description. On the line provided, type the eight-or-fewer-character building identifier of the building

description you wish to restore. Pressing **[End]**, rather than entering a building identifier, will return you to the main menu without restoring a building description.

You can choose from a listing of building identifiers already used by pressing **[PgDn]**, instead of entering a building identifier. Then press **[Enter]** to list the building identifiers in the default directory path displayed on the screen. *{You may alter the path displayed to list building descriptions stored in other locations on your computer. You will be warned if the chosen path does not exist or if no building descriptions exist at the location.}* (See Section 10.9 *Altering Key Parameters* for instructions on changing the default path.) You will then be presented the **Restored Building Selection** screen which lists building identifiers for building descriptions you may restore. Use the **[Up and Down]** arrow keys, the **[Tab]** key, and the **[Enter]** key to move among the building identifiers. When you find the identifier of the building to be restored, type an asterisk (*) on the line beside it. Press **[End]** to record your selection.

Following your selection of the building identifier of the building description to be restored, you will be presented with the screen asking for a building identifier to name the description you are about to create by making modifications to the description just restored. This is the same screen displayed had you chosen option 1, *Enter New Building Description* from the main menu, with one exception. The building identifier of the description just restored is displayed in the upper right hand corner of the screen. This is a default value for your entry. If the entry field on this screen is blank and you press **[Enter]**, this default name will be selected and you will be replacing the description restored with the one you are about to create. If you do not wish to replace the restored description, enter a new, unique building identifier at this time. See the discussion of selection 1, *Enter New Building Description* above for additional instructions on this entry screen.

Assume you want to edit an existing NEAT building description and save the changes under the same identifier, choose 2, *Restore Building Description for Editing*, and enter its eight-or-fewer-character building identifier in the space provided. Then, enter the same identifier on the succeeding screen, or press **[Enter]** to accept the default. Any changes you make on subsequent screens will be saved with the same building identifier.

If you want to use an existing NEAT building description as a pattern for a new description, enter the existing building identifier when asked during the restoring process. Then, enter a new building identifier on the next screen. For example, if you audited the Morris residence and the Anderson's house is very similar, you could use the Morris audit as a pattern, to save you from reentering much of the same data.

First, choose selection 2, *Restore Building Description for Editing*. Type **Morris** and press [Enter]. Then, enter the building identifier **Anderson** in the field provided on the next screen. Make the necessary changes to distinguish the Anderson house from the Morris house. You now have a new building description called ANDERSON, while the original MORRIS building description remains unchanged.

NEAT saves building descriptions and results after all changes are completed and NEAT is processing the data. For those familiar with the DOS convention for naming files, the building identifier is used as a filename for information automatically saved with each audit executed. The extension .BLD is added to the filename containing all of the NEAT input screens. The extension .REP is added to the filename containing the NEAT output reports. Thus, in the example above, four files would result: MORRIS.BLD, MORRIS.REP, ANDERSON.BLD, and ANDERSON.REP.

- Press 3 to set up NEAT to reflect you local conditions. You can select a city in your geographic region with similar weather. It may be appropriate to enter values for local material and labor costs. Refer to the instructions in Chapter 8, *Customizing a NEAT Audit*.

- Press 4 to use NEAT's auxiliary functions. You can enter both pre- and post-retrofit billing data for heating and cooling fuels or have NEAT determine an energy use index, which can guide your decision to perform work on the house. You can also create a list of work actually performed in weatherizing a house as well as the actual costs incurred. See Chapter 9, *NEAT Auxiliary Functions* for details.

- Press 5 to exit NEAT and return to the DOS prompt.

6.3 Audit Report

The NEAT audit report lists energy conservation measures ranked by their SIR, and a list of primary materials needed to perform these measures. You can view these two lists by making the appropriate selection from the Report Menu, which appears after you enter the building description (see Chapter 8, *NEAT Results*). The Report Menu also provides an option for adjusting measure savings to reflect actual energy consumption. Estimates of equipment sizing can also be viewed from the Report Menu (see Section 8.4, *Equipment Sizing*).

6.4 Storing NEAT Results

NEAT automatically saves building descriptions and recommended energy

conservation measures in two separate "files." Both bear the name of the building identifier you chose for the house. The NEAT version number and release data, as well as the date and time you executed NEAT for the house, are printed at the top of each of these files.

It is a good idea to keep recent NEAT building description files on the hard disk. Store your older NEAT files separately on a floppy disk or in another directory on the hard disk. Then, delete them from the primary NEAT data directory. Otherwise this directory becomes cluttered and clumsy to work with. (See Appendix A, *Notes on DOS*.)

6.5 Setup

The Setup Menu offers additional menu selections which customize NEAT to reflect your specific local climate, fuel cost, material and labor costs, and other parameters. Chapter 10, *Customizing a NEAT Audit*, describes how to access and change these parameters.

NOTES:

Chapter 7

The building description contains all of the information needed to describe a particular building to NEAT. Entry of this data is divided into component types, such as walls, windows, attics, etc. Similarly, this chapter is divided into subsections, one for each component type, each describing the data required to characterize a member of that component type. Whether you are using the GUI or text version of NEAT, each component type will have its own screen specifically designed for entry of data related to that component type.

Copies of the screens which you will see when entering data into NEAT are included in the Appendices. Appendix D contains screens which will be seen in the text version of NEAT. They can also be used by the auditor in collecting data while in the field. Appendix E contains the forms seen during input of the building description in the GUI version of NEAT. Choose the screens which best meet your needs or which apply to the version of NEAT you have chosen to use.

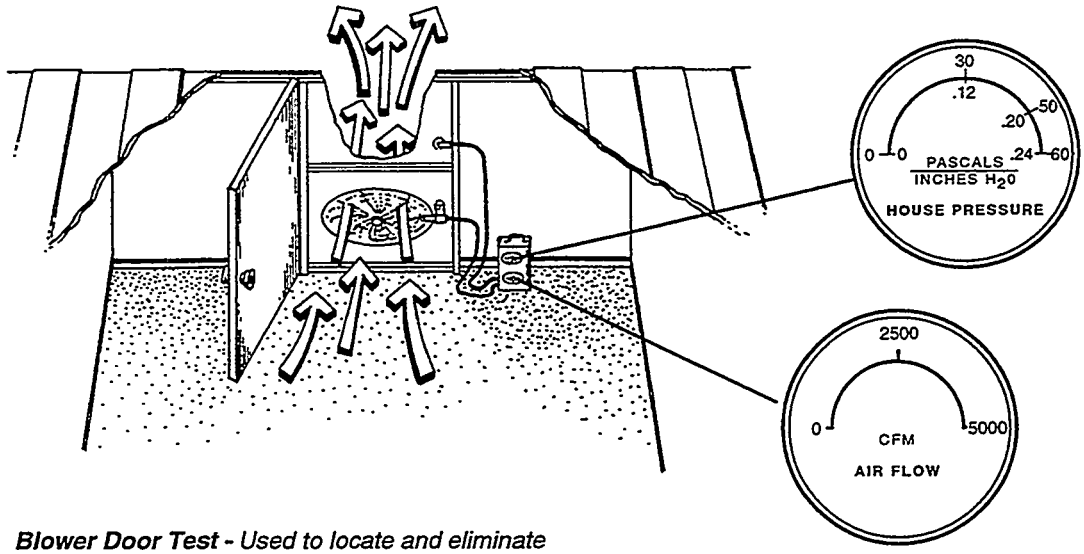
Throughout this chapter, references will be made to specific choices you are asked to make regarding the building description. For example, you are asked to indicate whether an attic is "1 - Unfloored," "2 - Floored," or "3 - Cathedral." In the text version of NEAT you make your response by entering the number or letter preceding the brief description of the choice, ("1", "2", or "3" in the example). In the GUI version, you click the mouse on the box next to the description. There is no single character associated with the description. Thus, if you are using the GUI version of NEAT, you may disregard the appearance of these single character designations used within this chapter.

Entries are mandatory unless followed by the word "optional" in the descriptions which follow. The "Range of values" listed for numerical entries indicate the range of responses within which the program will not question the value. Outside this range, the program will ask you to confirm the value by pressing the [Enter] key again. "Acceptable values" give ranges outside of which a value will not be accepted.

7.1 General House Data

The following are descriptions of entries for the General House Data screen:

House Descriptor, Auditor, and Date of NEAT audit - These are comment fields for general reference information. The entries are not used by NEAT except to be displayed at the top of the output reports. (Optional.)



Blower Door Test *- Used to locate and eliminate envelope leakage.*

Number of Conditioned Stories - Include a finished attic if the space is heated or cooled. Include a basement if it is heated or cooled and the majority of its wall area is above-grade. You may enter a decimal like 1.5 for split level or half-story upstairs. (Default- 1.0.)

Conditioned Living Space Floor Area - Enter the number of square feet of floor area that is heated or cooled. (Default- 1200.)

Average Number of Occupants - On the average during the year, enter the greatest number of people who occupy the house at any given time (e.g. during dinner). (Default - 2.)

Blower Door Data - Blower doors measure air leakage and help locate air leaks. NEAT can use blower door measurements to calculate savings from air leakage reduction measures. If you choose, NEAT will calculate the Savings-to-Investment Ratio (SIR) of all air leakage measures based on blower door readings before and after air sealing. You must enter the cost of this work, as well as pre- and post- blower door readings. (Note: NEAT does not direct blower door-guided air sealing work because air leakage reductions from specific measures are difficult to accurately predict with calculations.)

Pre-Retrofit Blower Door Data - These entries are for blower door measurements of air leakage before sealing. Pre-retrofit entries are optional and, if provided, used only to estimate savings from air sealing. Pre-retrofit entries will not affect savings computed for other measures. These computations use the post-retrofit blower door data. Therefore, if no sealing is performed, report any blower door readings as post-retrofit data. (Range of values: 500 to 8000 cfm for air leakage rates and 10 to 100 Pascals (Pa) for blower door pressure differentials.) (Pressure differential default- 50 Pa.) (Optional.)

Post-Retrofit Blower Door Data - These entries are for blower door measurements after air sealing. NEAT uses a post-retrofit default value of 2500 cfm at 50 Pa if the actual measurement is not provided. A default value is necessary to provide NEAT with an estimate of energy consumption resulting from air leakage. If the only air leakage information available is in air changes-per-hour (ACH) at natural conditions, an approximate conversion to CFM at 50 Pascals (CFM_{50}) may be obtained as follows: CFM_{50} = ACH x House volume ÷ 3. (Range of values: 500 to 8000 cfm for air leakage rates, and 0 to 100 Pa for blower door pressure differentials.) (Air leakage rate default-2500 cfm; pressure differential default-50 Pa.)

Cost of Air Leakage Rate Reduction - Enter a dollar amount indicating the cost to reduce air leakage from the pre-retrofit to the post-retrofit level. (Range of values: 0.0 to 1000.) If a cost is entered together with the above entries of pre- and post-retrofit blower-door data, a SIR, in addition to the energy savings for the air-leakage reduction, will be computed and reported. (See Section 8.2, *Recommended Measure List.*) (Optional.)

7.2 Exterior Walls

In order for NEAT to execute and save data, you must enter data for at least one wall. This could represent an apartment with only one outside wall, with no heat transfer assumed through the other walls.

There would normally be at least one wall described for exposed surfaces facing in each cardinal direction, because solar heat gain through windows on a wall varies according to its direction. In order to describe all walls most efficiently, combine multi-storied walls that have the same orientation and construction. Other than cardinal direction, the most important difference is whether the wall is already insulated or can be insulated.

Exterior wall data are presented in the following order:

Wall Code - User entered wall codes identify wall sections that face different directions or are constructed differently. For example, the west-facing wall might be coded W1, WW, or any other designation (up to four characters). The wall code allows NEAT to subtract the correct window and door areas—entered in the following two screens—from the corresponding wall area. The wall codes are also helpful when labeling your drawing of the house's floor plan and identifying which walls should receive recommended insulation. (See Section 5.3, *Component Codes*).

Wall Direction - Enter the closest cardinal compass direction the component faces, either north (N), south (S), east (E), or west (W).

Wall Exposure - NEAT gives you three choices: "Exposed" to outside air; "Buffered" by unconditioned space (for example, a garage or porch); or adjacent to an

"Unconditioned Attic."

Exterior Type - Select the type of siding on the exterior wall, not the framing material or load-bearing structure. The six choices are: 1- Wood, Masonite; 2- Aluminum, Steel, Vinyl; 3- Stucco; 4- Brick; Stone; 5- None; 6- Other. NEAT assumes a layer of wood sheathing under the siding.

Wall Type - NEAT asks for the type of load-bearing structure. The five choices are: 1- Balloon frame; 2- Platform frame; 3- Masonry, Stone; 4- Concrete block; 5- Other. Only frame walls are considered capable of being insulated by all types of Added Insulation, except User-Defined Wall Insulation Type 2. (See *Added Insulation Type*, below).

Wall Area - Enter the total area of each wall segment, including the windows and doors in that wall area. This entry must be in units of square feet greater than zero.

Existing Insulation Type and R-Value - Enter the type of insulation found (inspect an electrical outlet, a drilled hole, or some other penetration). The six choices are: 0- None; 1- Blown cellulose; 2- Blown fiberglass; 3- Rock wool; 4- Batt fiberglass; 5- Rigid board styrofoam; 6- Other. The default R-values displayed in the R-value column assume a $3^1/_2$ inch cavity and a standard R-value/inch for the insulation type indicated by the user. If both cavity insulation and exterior sheathing insulation are present, their R-values should be added to provide input for this field. Walls with existing insulation are not considered for further insulation unless the Existing Insulation Type is 5-Rigid board styrofoam.

Added Insulation Type - NEAT currently allows entries of: 0- None; 1- Blown cellulose; 2,3 - two types you have defined in Key Parameters. The names you entered in Key Parameters for these additional types will be displayed here. The text version of NEAT displays them in reverse video to remind you that they are user-defined. The R-values added to the wall cavity for these two types are also entered in Key Parameters. The User-Defined Type 2 Wall Insulation material is allowed to be installed on any Wall Type, whereas the other wall insulation types will be attempted on only frame walls.

Added Insulation Added Cost - Enter added costs not normally associated with installation of wall insulation. For instance, enter additional labor costs for removing and repairing an unusual siding type. (Default - 0).

Comments - Make any comments regarding exterior walls that you want to appear on the NEAT audit report. (Optional).

Measure Number - This entry field helps to distinguish between wall segments that have different characteristics. For example, there might be insulated and uninsulated walls, walls you can and cannot insulate or whose costs to insulate differ, or walls that are buffered and not buffered. Each of these could have different measure numbers.

Note, however, that any wall which has been designated as already insulated or unable to be insulated will be automatically dropped from a group of walls with the same measure number when the wall insulation measure is considered. Give the same measure number to all wall segments to be grouped together in determining their particular SIR. (See Sections 5.3 and 5.4, *Component Codes* and *Measure Numbers*).

7.3 Windows

The window screen contains information needed to describe different window types.

In the text version, each line may be used to describe a single type with given dimensions, while in the GUI version, each screen describes a given type. Windows of the same type and size on the same wall segment may be entered on a single record. In the Number of Windows (No Wndws) field, indicate how many windows have this description.

A total of sixteen window descriptions may be entered. In the text version, this requires two computer screens of entries. The second screen contains the abbreviation "Cont." in the heading to remind you that it is the second screen. This second screen will not appear unless you use more than eight window entry lines. After you reach the end of the first screen, you can go to the second screen by pressing enter at the end of the last line. When you enter data on the second screen, that screen becomes a permanent part of your current building description which you can access by paging down or using the down arrow from the last line of the first screen.

If the sixteen total window lines are not enough to describe all the windows, you can combine windows of the same height on the same wall by adding their widths in lines and then recording them as one window on one line. You can also combine two or more windows by adding their widths together and then averaging their heights (add the heights together and divide by the number of windows). In both cases, you would enter the combined width with the average height.

Care must be taken in adding or averaging window dimensions.

Window treatments may be priced either by dimension or unit. As a result, if unrealistically large pseudo-windows have been described to NEAT by adding dimensions of individual windows, and window treatment measures have been priced by unit, erroneous SIRs will be reported for these window treatment measures.

Window data are presented in the following order:

Wall Code - Enter the wall code for the exterior wall in which the window is contained. The acceptable Wall Codes, as determined by your input for theExterior Walls, will be displayed in a menu box which will open the Select Wall button is clicked or the Wall Code field is accessed. This entry allows NEAT to subtract window area from the appropriate gross wall area. (See Section 5.3, *Component Codes*).

Number of Windows - Enter the number of identical windows described by this row of data. If dimensions entered are those derived by combining individual windows into one pseudo-window of equivalent area, enter "1" as the number of windows. (Default- 1.)

Frame Type - Select correct window frame and sash construction materials. The three choices are: 1- Wood (describe vinyl frame windows as wood frame); 2- Metal; 3- Improved metal (metal frame with a thermal break).

Glazing Type - Select window glazing types, depending on materials and layers of glass. The five choices are: 1- Single; 2- Single with wood storm; 3- Single with metal storm; 4- Double pane; 5- Single with bad storm (offering little or no additional protection from air leakage).

Shaded (%) - Enter approximate percentage of window area frequently shaded by eaves (typically 20 percent), porches (typically 100 percent), or other exterior barriers. Do not enter the % sign. (Default- 20.)

Window Width and Height - Enter width and height of a storm window if such were to be installed. NEAT will use these dimensions to estimate the glazing area of the window. NEAT will also subtract this area from the wall area entered on the previous screen. The auditor can refer to these dimensions if storm windows prove to be cost-effective.

Cost - Enter the cost of a retrofit storm window if significantly different from the cost entered in the material cost section of Setup. (Optional.)

The default cost can be altered in the Setup Menu (see Chapter 9, *Customizing a NEAT Audit*). If you have combined windows into a single record, multiply the unit cost by the number of windows combined in the record, and enter it in the "unit cost" column. (Optional.)

Comments - Enter comments about windows that you want to appear on the NEAT report. (Optional.)

Window Code - NEAT supplies a code for each window entry. This category allows you to identify the specific window in the NEAT report (see Sections 5.3 and 5.4, *Component Codes* and *Measure Numbers*).

7.4 Doors

Storm doors or replacement doors are not evaluated within NEAT because they are normally not cost-effective measures, based solely on heat conduction savings. Storm doors or replacement doors may, however, be considered as repair items related to weatherization or as part of the air-leakage reduction work. If installed, their cost could be entered as an air leakage or repair cost on the General House Data screen.

NEAT subtracts door area from the wall area and figures heat loss from the wall and door separately. If the door area is very small compared with the total wall area, you may consider neglecting it. If wall insulation becomes a recommended measure, however, the area of any doors not described here will be included in cost calculations for wall insulation.

Door data are presented in the following order:

Wall Code - Enter the wall code for the exterior wall section in which the door is contained. Choose from those listed in the menu box displayed for this field. In the GUI version, click on the Select Wall box to display the list of acceptable wall codes. This wall code entry allows NEAT to subtract the door area from the appropriate gross wall area (see Section 5.3, *Component Codes*).

Number of Doors - Enter the number of identical doors described by the current line. (Default- 1.)

Door Type - Select one of the four door types: 1- Wood, hollow-core; 2- Wood, solid-core; 3- Steel, insulated; 4- Other (doors with average characteristics). A door with glazing may be described either as a combination of window and door or as the component type with the greatest fraction of area. Normally door areas are small compared with the total window and wall area, making the decision less critical.

Area - Enter the area, in square feet, of the door. (Default- 20.) NEAT will compute the total door area, as the door area entered times the number of doors indicated for the door type described..

Condition - Enter one of three choices for the storm door condition: 1- Adequate, 2- Deteriorated, 3- None.

Door Width and Height - Use these two columns to record width and height in inches, of door openings, if door replacement or storm door installation is needed as a repair item. Otherwise, the fields may be left blank.

The dimensions are for reference and are not used in NEAT calculations.

Comments - Enter comments about doors that you wish to appear on the NEAT audit report. (Optional.)

Door Code - NEAT supplies a door code for each entry, just as it does for windows (see Sections 5.3 and 5.4, *Component Codes* and *Measure Numbers)*.

7.5 Unfinished Attics

Data regarding unfinished attics are presented in the following order:

Attic Code - Enter a code to identify each attic or attic section.

Attic Type - Enter one of three choices: 1- Unfloored; 2- Floored; 3- Cathedral. If the attic has a floor, an estimate of the additional cost of insulating due to this obstruction may be entered in the column marked Additional Installation Cost.

Joist Spacing - Enter the joist spacing in inches. This number is for reference and is not used in the calculations. (Optional.) (Default- 24.)

Floor Area - Enter the area of the ceiling or attic floor that borders a conditioned space. This value must be greater than 0.

Existing Insulation Type - Enter one of six choices: 0- None; 1- Blown cellulose; 2- Blown fiberglass; 3- Blown rockwool; 4- Fiberglass batt; 5- Other.

Existing Insulation Depth - Enter the depth of existing insulation, in inches. NEAT will skip/ghost this field if you have entered "0" for existing insulation type.

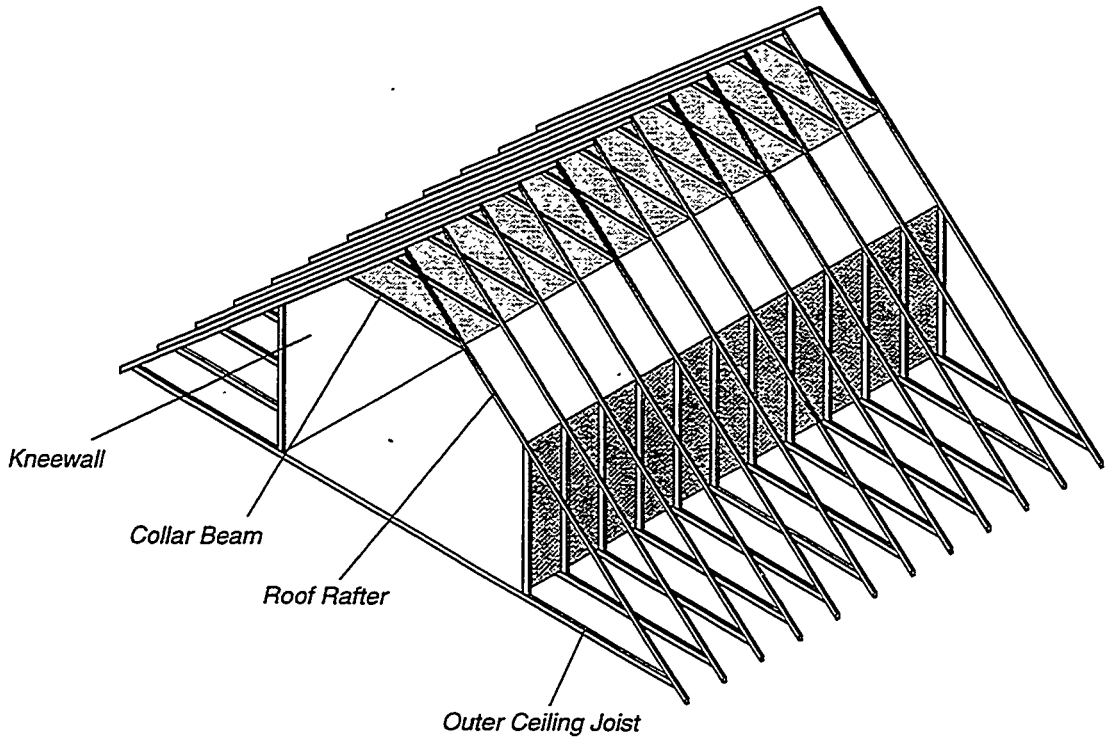
Added Insulation Type - Select one of five choices: 0- None (attic cannot be insulated); 1- Blown cellulose; 2- Blown fiberglass; 3,4 - two types you have defined in Key Parameters. The names you entered in Key Parameters for these additional types will be displayed here. The text version of NEAT displays them in reverse video to remind you that they are user-defined. NEAT will consider the same insulation levels for these user-defined types as for blown cellulose or fiberglass.

Insulation Maximum Depth - Enter, in inches, the maximum depth of insulation which can exist in the attic (including any existing insulation). It is expected that insulation depth will be restricted at the eaves and virtually unrestricted toward the interior of the attic. For floored attics, this depth will usually be the height of the attic floor joists ($3^1/_2$" or $5^1/_2$"). If the space is greater than 15 inches, NEAT assumes unlimited insulation may be added. If a maximum depth restriction has been indicated for a particular attic segment, NEAT will evaluate not only adding the standard levels (R-11, R-19, R-30, and R-38) but also the level of insulation to fill the attic cavity. Insulation costs use interpolations between costs of installing the standard levels, as given by the User in Setup. (Default- Unlimited space.) NEAT will skip/ghost this field if you have entered "0" for added insulation type.

Additional Insulation Cost - Enter costs which are not included in the typical attic floor insulation procedure. These might include the cost for cutting an opening into the attic or for insulating beneath an attic floor. This additional cost is a single dollar amount added to the overall cost of insulating the attic segment, not an added cost-per-square-foot.

Comments - Enter comments about the attic segment that you want to appear on the NEAT audit report. (Optional.)

Measure Number - Enter a number here, beginning with 1 (see Section 5.4, *Measure Numbers*). This entry field helps to distinguish between attic segments that have different characteristics such as different existing insulation levels or maximum depth of added insulation. Give the same measure number to all attic segments to be grouped together in determining the SIR for attic insulation.



Finished Attic *- The four parts of a finished attic define the envelope of the heated area.*

7.6 Finished Attic Areas

The entries on the Finished Attic screen are similar to those for the Unfinished Attic. Refer to Section 7.5, *Unfinished Attics*, for descriptions of each field. You may enter any combination of the four finished attic components you choose.

In the text version, the **[Up Arrow]** and **[Down Arrow]** keys may be used to travel from any completed row of data to any other completed row of data, skipping any rows having no information. An empty row of data can only be entered from the first available column of data. The components of the finished attic will be automatically assigned the following codes for the purposes of reporting: outer ceiling joist (ocj); collar beam (cbm); kneewall (knw); and roof rafter (rrt).

The following items should be noted:

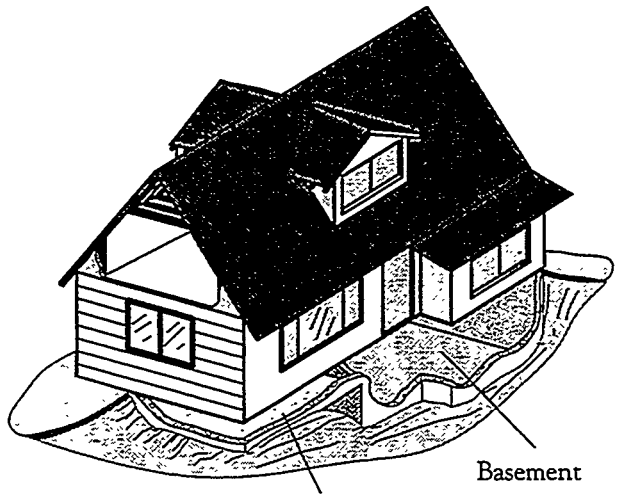
1- No component Type is entered for the kneewall or roof rafter since these components cannot be floored or un-floored.

2- No Meas No is requested for the kneewall. It is automatically ranked separately.

3- The Add Ins Type for the kneewall is assumed to be "4- Fiberglass Batts."

4- It is safer not to group finished attic sections because an insulation depth restriction for one will be applied to all segments grouped together.

5- If "0- None" is selected for the type of either the existing or added insulation, the corresponding depth entry will be skipped/ghosted.



***Foundation Spaces** - Include basement and crawl spaces.*

7.7 Foundation Spaces

Data regarding foundation spaces are presented as follows:

Foundation Space Code - Enter a code to identify each foundation space. The code identifies the entire row of data in the text version and the entire screen of data in the GUI version.

Type - Enter one of seven choices for foundation space: 1- Conditioned (means the space has active thermostat control); 2- Non-conditioned (the space is enclosed but with no sources of heat other than conduction through walls and floors); 3- Vented non-conditioned (the area is vented directly outdoors); 4- Unintentionally conditioned (a furnace, water heater, or other heat source may add heat "unintentionally," but there are no heating registers or radiators in the space); 5- Slab, uninsulated; 6- Slab, insulated; 7- Exposed floor (an overhang or house on stilts).

Certain Foundation Space types do not require data in all fields of this component type while other do. For example, the Slab foundation type requires only a Floor Area and Perimeter Length while the Non-Conditioned type requires all fields. If, through editing an existing component entry, the Type is changed from one not requiring certain fields to one which requires these same fields, a warning will appear when you attempt to leave the Foundation Space screen indicating a need to supply the required data. Exiting will not be permitted until the missing entries are supplied.

Floor Area - Enter the area, in square feet, of the floor directly above the foundation space you are describing. For slab-on-grade, enter the area of the slab floor in the living space. Your entry must be greater than zero.

Floor Insulation R-Value - Enter the R-value of the existing insulation in the floor over the basement or crawl space. (Default- Floor uninsulated.)

Perimeter - Enter the length, in feet, of the floor perimeter bordering the outdoors.

Do not include the perimeter that borders another foundation space. (Default- uses the perimeter of a square with the area given in the Floor Area field.)

% Exposed - Estimate the percentage of floor perimeter for which the band joist is uninsulated and exposed to outdoor air. (Do not enter the % symbol.) (Default- 100.)

Total Wall Height - Enter the height, in feet, of the basement wall or crawl space wall. Estimate an average if height is not uniform. Your entry must be greater than zero. If the wall height is less than two feet, no floor or foundation wall insulation measure will be considered.

% Wall Height Exposed - Estimate the percent of the basement wall or crawl space wall exposed to the outside air. You may again need to average. (Do not enter the % symbol.) (Default- 100.)

Wall Insulation R-Value - Enter the R-value of insulation currently on basement or crawl space wall. (Optional.)

Insulation Mode - Indicate how you wish NEAT to consider insulating the foundation space. The choice are: 0- None (do not consider any insulation); 1- Floor or wall (choose which ever insulation mode is most cost-effective); 2- Floor only; 3- Wall only. Whichever selection is chosen, NEAT will still not recommend any measure which does not meet the minimum SIR test. Some Foundation Space Types preclude consideration of certain insulation modes (e.g. wall insulation for an exposed floor or a vented crawl space). These are automatically excluded.

Additional Installation Cost - Enter added costs not normally associated with a typical installation of insulation in the foundation space. If either Insulation Modes 2 (Floor only) or 3 (Wall only) has been chosen, the cost will be added to the standard cost of the indicated insulation mode. If Insulation Mode 1 (Floor or Wall) has been selected, entry of a positive value will indicate an added cost to floor insulation, while a negative entry will force the positive magnitude of the entry to be added to the cost of insulating foundation wall insulation. There is no way to specify added costs to both floor and foundation wall insulation modes at the same time. Note: the added costs are lumped dollar amounts for insulating the entire component, not a dollar amount per square foot of insulation.

As an example, if insulating either walls or floor is possible, yet insulating the floor above the non-conditioned basement could lead to frozen pipes, select Insulation Mode 1 and enter the added cost of protecting the pipes as a positive value in this field. Note that NEAT assumes subspaces with wall height of less than two feet cannot be insulated.

Comments - Enter comments regarding the foundation space that you want to appear on the NEAT audit report. (Optional.)

Measure Number - Supply a number, beginning with 1 (see Section 5.4, *Measure Numbers*). This entry field helps to distinguish between foundation segments that may

be insulated differently. Give the same measure number to all foundation segments to be grouped together in determining the SIR for floor and foundation wall insulation measures.

7.8 Lighting

Data describing the existing lighting in the house is entered on the Lighting form. If your program does not consider replacing existing incandescent lamps with compact fluorescent ones, you can ignore this form. The form is used only to describe the lighting fixtures you intend to consider for this replacement measure.

Entries on this screen are a follows:

Room - Enter the room in which the lights being described are located, e.g. "Dining" "Bedrm-1" or "Kitchen". The entry is for the auditor's use in locating the lamps for possible later retrofit. No default is available. (Optional.)

Location (of existing incandescent lamps) - Describe the location of the lighting fixture/s within the room using one of the following selections: C-Ceiling; F-Floor; T-Table; W-Wall. Though required, the entry is not used by NEAT. It is for the auditor's use in locating the lights for later retrofit.

Type (of existing incandescent lamps) - Indicate the type of the existing incandescent lamp: S-Standard or F-Flood (reflective or spot). The entry is required though no default is given. The default for the replacement compact fluorescent's wattage is determined by this entry and the existing lamp wattage. Also, the materials report will indicate that the replacement is to be either standard or flood, depending on your entry here.

Watts (of existing incandescent lamps) - Enter the wattage of the existing incandescent lamp which is to be replaced. Standard incandescent lamp wattages are 25, 40, 50, 60, 75, 90, 100, and 150. The value is required and used in computing the savings resulting from its replacement with a fluorescent lamp. The default for the replacement compact fluorescent's wattage is determined by this entry and the lamp type. (Default - 100.)

Quantity (of existing incandescent lamps) - Enter the number of lamps having the description given by this record and which are candidates for replacement with compact fluorescents. The entry is required with no default.

Hours/Day Used - Enter the average number of hours per day the lamp is normally on. The value must be 24 or less. Your response to this entry has a considerable effect on the savings associated with replacing lamp. You should target this measure to lamps with substantial on-times. The entry is required with no default.

CF Lamp Watts - Enter the wattage of the compact fluorescent which is to replace the existing lamp. Common replacements given below are used as the default for this field. They depend on your entry for existing lamp wattage and type.

Existing Incandescent (Watts)	Replacement Fluorescent (Watts)	Existing Incandescent (Watts)	Replacement Fluorescent (Watts)	Existing Incandescent (Watts)	Replacement Fluorescent (Watts)
Standard					
25	5	60	13	100	26
40	7	75	18	150	38
50	8	90	25		
Flood					
50	11	75	15	100	18

The lighting measure will use the standard replacement wattage closest to your entry.

Added Cost - Enter any added cost, in dollars per lamp, not normally associated with installation of a compact fluorescent and not included in the standard material costs. Replacing a fixture's harp to allow the CFL to fit, or other size modification, are examples. (Default - 0.) (Optional)

Comments - Enter any comments relevant to the lamps described or retrofits to be installed, such as the reason for any added cost recorded or physical restrictions. (Optional).

Lamp Code - NEAT supplies a code for each lighting entry. This code allows you to identify the specific lamp in the NEAT report (see Section 5.3, *Component Codes*).

7.9 Air Conditioners

Data regarding air conditioners are presented in the following order:

Unit Code - Enter a code identifying each air conditioner.

Unit Type - Enter one of two choices: 1- Central air conditioning; 2- Window unit; 3- Heatpump; 4- Evaporative cooler. The Heatpump type must be indicated for one of the cooling systems if the Heatpump Replacement measure is to be considered. (See Section 9.19, *Heatpump Replacement*.) If the Evaporative Cooler Unit Type has been chosen, the fields for Size, SEER, and Year Bought will be automatically skipped/ghosted.

Size - Enter the output capacity of the unit (kBtu/hr). (Capacity is printed on the nameplate, or give your best estimate.)

Area Cooled - Estimate the floor area, in square feet, of those parts of the house cooled by the air conditioner.

SEER or EER - SEER is the acronym for Seasonal Energy Efficiency Ratio, used to rate central air conditioners. EER is the acronym for Energy Efficiency Ratio, used to rate window air conditioners. Both are measures of how efficiently the unit produces the desired cooling. Enter the SEER, if it is given on the nameplate.

An approximate conversion from EER to SEER may be obtained using the following formulas:

- SEER = (1.2 X EER) - 0.7 (if the unit's fan runs only when conditioning is required).
- SEER = (0.9 X EER) + 0.1 (if the fan runs continuously while the unit is in use).

If the appropriate efficiency ratio is not known, press **[Enter]**. NEAT will prompt you to press [Enter] once again to override.

Year Bought - Enter the approximate year the unit was purchased new. Use the full year, e.g. "1986", not "'96". The purchase year is used to estimate the SEER, it it is not provided. This entry is skipped if a value has been provided in the SEER field.

Manufacturer, Model, Comments - Enter pertinent observations regarding the air conditioning. (Optional.)

7.10 Heating Systems

Data regarding heating systems are presented as follows:

System Type - Enter one of ten selections: 1- Gravity furnace; 2- Forced-air furnace; 3- Steam boiler; 4- Hot water boiler; 5- Electric resistance, fixed; 6- Electric resistance, portable; 7- Heat pump; 8- Unvented space heater; 9- Vented space heater; 0- Other. If more than one type of system exists, select as the primary heating system the one that supplies the majority of heat and to which the heating retrofits will apply.

HSPF (Heating Seasonal Performance Factor) - If the heating system Type has been designated as a Heatpump, you will need to provide an estimate of the heating seasonal performance factor of the system. Newer systems are required to display the HSPF rating on the unit. Older systems may list a COP value. An exact conversion from COP to HSPF is not possible since the two parameters depend on different factors. However, a rough conversion may be accomplished by multiplying the COP by 2.4 to obtain an HSPF. (Default - 6.5)

Fuel Type - Enter one of seven selections for the primary heating system: 1- Natural gas; 2- Oil; 3- Electricity; 4- Propane; 5- Wood; 6- Coal; 7- Kerosene.

Location - Enter one of three locations of the primary heating system: 1- Intentionally heated (space that utilizes a thermostat to control its temperature); 2- Unheated (space not heated by a mechanical system); 3- Unintentionally heated (space which is heated by waste heat from furnace, boiler, or other heat producing appliance).

% Heat Supplied - Estimate the percent of heat supplied to the house by the primary heating system. A discussion with household occupants will help you to arrive at this figure. (Do not enter the % symbol.)

Secondary System Fuel Type - Enter the secondary fuel type, if the percentage of heat supplied by the primary heating system is less than 98 percent. Multiple systems using the same fuel may be combined. Select a fuel type from the following list: 1- Natural gas; 2- Oil; 3- Electricity; 4- Propane; 5- Wood; 6- Coal; 7- Kerosene.

Secondary System Efficiency - Select the efficiency rating of the secondary heating system. This may be obtained from furnace efficiency measurements, or the auditor's judgement. This item is accessed only if the percentage of heat supplied by the primary heating systems is less then 98 percent.

Smart Thermostat - Is there an automatic night-setback thermostat present at the time of the NEAT audit? Select: **Y** for yes, or **N** for no.

Uninsulated Duct Length - Enter the length, in feet, of uninsulated supply ducts in unconditioned spaces. (Default-0)

Average Perimeter of Duct - Enter the average perimeter of uninsulated supply ducts in unconditioned spaces. If a value has been entered for the Uninsulated Duct Length, the Average Perimeter of Duct must be greater than 0.0. This latter field will be automatically erased if the value for Uninsulated Duct Length is changed to zero or erased.

Location of Uninsulated Duct - Select the location of the uninsulated duct as either A-Attic or S-Subspace. This item is accessed only if the Uninsulated Duct Length is greater than 0. The Location of Uninsulated Duct field will be automatically erased if the value for Uninsulated Duct Length is changed to zero or erased.

Comments - Enter observations regarding the heating system that you want to appear in the NEAT report. (Optional.)

7.11 Primary Furnace-Boiler, Gas/Propane Fueled; Primary Furnace-Boiler, Oil Fueled; Space Heaters

Depending on the heating system type and fuel type selected in Section 5.9, one of the following screens will appear: 1- Primary furnace-boiler, gas/propane fueled; 2- Primary furnace-boiler, oil fueled; 3- Space heaters/Other systems. (See Appendix C.)

Three parameters concerning the house's primary heating device—input rating, output rating, and steady-state efficiency—are interrelated. If you enter input and output ratings, a default efficiency will be calculated from these parameters. If this value is greater than 100%, the standard NEAT default efficiency will be displayed instead. If you enter only an input rating, NEAT's default values for output capacity and steady-

state efficiency will correspond to the system type and fuel. A measured efficiency is desired over a default or name-plate value because it better reflects actual operating conditions and the potential efficiency increase obtained from replacing the system.

Data regarding primary furnace-boilers or space heaters are presented as follows:

Manufacturer, Model - Enter make and model information from the nameplate. (Optional.)

Input Rating or Input Rating Units- If the heating device is gas- or propane-fueled, enter the input rating of the unit in kBtu/hr. If the heating device is a space heater or an oil-fueled device, select the appropriate Input Rating Units from the menu provided. The choices are: 0- No input; 1- kBtu/hr; 2- gal/hr; 3- lb/hr; 4- ccm (cubic centimeters per minute). Then enter the actual value in the following field. The appropriate value can be measured or taken directly from the nameplate of the furnace, boiler, or space heater. If no input rating is available, choose "0- No input." The next entry, "Value," will be skipped.

Output Capacity - Enter the output of the furnace, boiler, or space heater in kBtu/h.

Steady-State Efficiency - Enter the measured or estimated steady-state efficiency of the primary heating unit. Defaults are based on the system type.

This entry is fairly important. Efforts should be made to obtain the most accurate value possible. NEAT makes recommendations to replace the heating system based on this entry. If you feel that the value provided is not accurate, it is suggested that the Heating System Replacement measure not be implemented in this house, unless for reasons other than energy efficiency.

Pilot Light - Answer two questions for gas- or propane-fueled primary furnace/boilers: 1- Is a pilot light present? 2- Is it on in the summer? Select **Y** for yes; **N** for no.

IID Present - Is there an Intermittent Ignition Device present for gas- or propane-fueled primary furnace/boilers? Select **Y** for yes; **N** for no.

Power Burner Present - Is there a power burner present on gas- or propane-fueled primary furnace-boilers? Select **Y** for yes; **N** for no.

Burner: Retention Head Present - Answer two questions for oil-fueled primary furnace/boilers: 1- Is a retention head present? 2- Is one recommended? Select **Y** for yes; **N** for no. If you answer "yes," NEAT will only recommend a retention head if it proves to be cost-effective. If you answer "no," the measure will not be considered.

Vent Damper Present - Answer two questions: 1- Is a vent damper present? 2- Is the installation of a new vent damper recommended? Select **Y** for yes; **N** for no. If you answer "yes," NEAT will only recommend a vent damper if it proves to be cost-effective. If you answer "no," the measure will not be considered. If a new vent damper is

recommended, enter a suggested diameter for use by the contractor in obtaining the part.

General Condition - Select one of three choices to describe the current condition of the primary heating unit: 1- Poor; 2- Fair; 3- Good. (This response is used to estimate an efficiency increase resulting from a tune-up.)

Tune-up/Replacement Status - Enter one of four choices regarding tune-up or replacement of the primary heating unit: 1- Tune-up/replacement optional (treats system tune-up and replacement like any other measure, ranking them in order of the computed SIR); 2- Tune-up already performed (indicates a tune-up has already been performed and the efficiency entered for the system reflects this tune-up — no tune-up measure will be considered); 3- Tune-up mandatory (system tune-up will be placed at the top of the measures list, despite its computed SIR, and will be implemented, thus affecting savings of all measures following it). 4- Replacement mandatory (system replacement will be placed at the top of the measures list, despite its computed SIR, and will be implemented, thus affecting savings of all measures following it); 5-High efficiency replacement mandatory (furnaces only).

Estimate Replacement Costs - Enter the cost of replacing the primary system. If you don't enter a number, NEAT will compute the cost from data provided in the Setup procedure (see Section 10.4, *Material Costs*).

SS Eff. (Steady-State Efficiency in percent of the replacement space heater) - Enter manufacturer's estimate of the space heater's steady-state efficiency (from the nameplate). For central systems, the replacement efficiency is assumed more consistent and is entered in the Key Parameters section of Setup.

Comments - Enter comments regarding the primary furnace that you want to appear on the NEAT report. (Optional.)

7.12 Itemized Additional Costs and User Defined Measures

Costs not associated with specific energy conservation measures, yet are incurred during weatherization, may be entered on this screen

Such entries use only the first four fields of this screen. If an approximate annual savings is known for some weatherization activity not addressed by the standard NEAT measures, this screen may be used to define a new measure associated with the savings. For user-defined measures, no fields, except materials required, are optional. User-defined measures are treated by NEAT exactly as the standard measures are. (See Appendix B, *Audit Example*, for a sample screen). Data entries are presented in the following order:

Item Description - Enter a brief description of the item associated with the added

cost. This description will be entered in the Recommended Measure column of the reports.

Cost ($) - Enter the dollar cost of the item being described.

Include in SIR - Do you wish this cost to be included in the cumulative SIR on the reports? Select **Y** for yes, or **N** for no. If you choose **Y**, the item will appear on the recommended measure list, following Repair, H&S, and Miscellaneous costs (entered on the General House Data screen). The additional cost will be included in the cumulative SIRs. You must select **Y** for this field if the record is to describe a user-defined measure.

If you choose **N**, the costs are placed at the end of the measure list after a final cumulative SIR has been displayed. The cost is added to the cumulative cost, but not used to compute the cumulative SIR.

Materials Required - Enter a brief description of the major material needed to implement the itemized additional cost or the user-defined measure. The description entered will appear on NEAT's Material Report. (Optional)

Annual Savings (Mbtu) - For user-defined measures, enter an estimate of the annual energy savings associated with the measure in millions of Btu. You may need to use standard conversion factors to arrive at savings in Mbtu. The entry will be used in the computation of the measure's SIR.

Fuel Saved - Select one of seven choice for the type of fuel saved by the user-defined measure: 1 - Natural gas; 2- Oil; 3- Electricity; 4- Propane; 5- Wood; 6- Coal; 7- Kerosene.

Life-time (Years) - Enter the lifetime of the measure/materials associated with the user- defined measure. Industry standards have been established for many materials. DOE requires the maximum to be 20 years.

Chapter 8

In the GUI version of NEAT, you choose to terminate data entry and begin processing this data by first using the **File/Save** menu item to save your changes, then clicking the mouse on the **Run** menu item of the main menu bar. In the text version, press the **F10** key or enter **[PgDn]** then **[Enter]** from the Itemized Additional Cost and User-Defined Measure screen.

During processing, if the house description is complex, NEAT may reach a limit for the number of measures it can consider. If this happens, a message "Measure limit reached" is presented with a "Press any key to continue." The building description has already been saved by this time and, even though this message terminates execution, the building may be recalled and modified until the limit is no longer reached. Reducing the number of separate measure numbers for a given component type or turning off any measures not of interest will help alleviate this problem.

After successfully processing your building description, click on the **View** menu item in the GUI version to view your results and other information resulting from your NEAT session. A drop down menu will appear with the selections listed below. The text version of NEAT will automatically present you with the Report Menu.

GUI **View** Menu	Text Version Report Menu
Building Description	1. View Recommended Measure List
Utility Bills	2. View Material List
Recommended Measures List	3. View Sizing Results
Energy Consumption/Sizing	4. Print Measures and Material Lists
Actual Work Performed	5. Display Comments
	6. Billing Data Adjustments
	7. Continue
	8. Exit Program

8.1 Building Description

Select **Building Description** from the GUI's **View** menu item to see a compressed listing of the building description you have entered during this NEAT session. The format is similar to the data input format used in the text version of NEAT. The

data may be printed by clicking the **Print** button at the bottom right of the screen. The text version of NEAT does not have this feture available from its Report menu. However, this data can also be viewed and printed by following the procedures discussed in Appendix A, *Notes on DOS, View Files*.

8.2 Recommended Measure List

Select **Recommended Measures List** from GUI's **View** menu or press 1 in the text version's Report Menu to view the list of recommended energy conservation measures (see Appendix B, *Audit Example*). The measures will be listed in order of final SIR (after interactions) with infiltration, tune-up, and furnace replacement first if mandatory or already performed. Only measures with SIR greater than the cut-off value selected in Key Parameters of Setup will be displayed. There are two parts to this list. Each part lists the recommended measures followed by the component code or codes to which each measure applies.

The first part of the recommended measure list gives:

- Annual heating and cooling savings for each recommended measure, in millions-of-Btus (MBtus)-per-year and kilowatt-hours-per-year, respectively (no cooling savings are computed if no air-conditioning equipment was described in the building description);
- Savings in dollars-per-year for each; and
- Total energy saved in MBtus.

The second part of the recommended measure list gives:

- Dollar savings per year;
- Dollar cost to install measure;
- Savings-to-Investment Ratio (SIR) for each recommended energy conservation measure (computed over the measure's lifetime);
- Cumulative cost of recommended measures; and
- Cumulative SIR of recommended measures.

Costs entered as Itemized Additional Costs are displayed in the second part of the Recommended Measure list but not the first. These costs are not assigned a savings value or SIR, because no energy savings is associated with them. If, on the Itemized Additional Cost screen, you indicated that a cost should not be included in the SIR, it will be listed at the end of the recommended measure list and its cost added to the cumulative cost, but not the SIR. If, on the other hand, you have requested that a cost be included in the SIR, it will be listed at the top of the measure list and its value added to both the cumulative cost and SIR.

User-defined measures are reported in exactly the same manner as standard NEAT measures.

The results of air leakage calculations will be listed in one of four ways: 1- If you enter pre- and post-retrofit air leakage rates and the cost of infiltration reduction, NEAT will list the cost of reduction, projected savings, and the SIR; 2- If you leave the cost of infiltration reduction blank, NEAT will list the dollar and Btu savings of infiltration reduction in the first part of the report. However, NEAT will not list infiltration reduction on the cumulative part of the report; 3- If you list only the cost of infiltration reduction, NEAT will add it to the cumulative cost without calculating savings of infiltration reduction—the cumulative SIR will reflect the added cost; 4- If you enter no infiltration data, NEAT ignores the infiltration-oriented conservation measure.

In the text version, any key may be pressed to progress through the report screens and return to the Report Menu.

In the GUI version, use the scroll bar to the right of the screen to scroll through the entire report. Note that this report in the GUI version also contains the Material List, annual energy consumption and peak load estimates, as well as any comments you may have entered during the NEAT session. In the text version, these displays are selected by separate menu items on the Report Menu. The GUI version also allows you to print this report by clicking on the **Print** button at the bottom of the screen. Choose the **Okay** button to exit the Report screen.

8.3 Material List

In the text version of NEAT, press 2 to view the material list necessary to accomplish the recommended energy conservation measures. Please note that minor materials, such as fasteners and other hardware, are not listed. This report is part of the Recommended Measures List in the GUI version.

8.4 Equipment Sizing

The output of heating equipment should be matched to the home's calculated heat loss expressed in thousands of Btus per hour (kBtu/h). The sizing formulas used in NEAT were taken with permission from tables published by the Air Conditioning Contractors of America (ACCA) in their Seventh Edition (1986) of *Manual J, Load Calculation for Residential Winter and Summer Air Conditioning*. NEAT calculates the heat loss, but you should verify NEAT's results with the results of the *Manual J* procedure for types of building components common in your area.

The sizing estimate calculated by NEAT is different from a complete Manual J calculation procedure in several ways: (1) the range of building components available in NEAT is not as extensive as the range available in *Manual J*, which could result in

differences; (2) NEAT performs the estimate on the building as a whole, whereas *Manual J* may be applied by zones or even room by room; and (3) generic duct-loss factors are used in NEAT, whereas *Manual J* estimates a specific unique duct loss factor for each zone.

Results of NEAT's sizing calculations appear in the materials list, the sizing report, and the recommended measures file. The materials list will display both the existing heating equipment size as well as an approximate retrofit size (in kBtu/h) if NEAT recommends the heating system be replaced.

The derivation of the retrofit size may be reviewed by selecting Energy Consumption/ Sizing from the GUI's View menu or "3. View Sizing Results" from the Report Menu of the text version. This report will list each building component's contribution to the total design heat loss. You can compare these individual component contributions with standard *Manual J* calculations for an indication of variations between the two sizing procedures.

Results on NEAT's sizing calculations are stored in a file having the building identifier as the filename and "dat" as the extension. The file will be written to the same directory you have requested the report file be placed.

NEAT converts the total building heat loss to a required heating system output by multiplying the former by a duct-loss factor. NEAT does not have sufficient information to accurately predict this factor. The standard *Manual J* technique recommends computing the building heat loss zone-by-zone, assigning a specific heat-loss factor for the duct supplying heat to each zone (refer to *Manual J*). NEAT assumes no duct loss if the heating system is either a space heater or a portable electric resistance heater. Otherwise, it uses a factor of 1.15, assuming that either exposed duct has been insulated by the weatherization of the house or the duct is not in an unconditioned space. Pre-retrofit duct-loss factors of 1.20 are assigned to systems having more than ten feet of un-insulated duct in an unconditioned space.

These duct-loss factors may be inappropriate for hot water or steam boilers which may have lower or higher heat loss through their pipes than forced-air systems have through ducts. You may be able to assign a more accurate duct-loss (or "pipe loss") factor based upon your examination of a home after weatherization. For example, a hydronic heating system with insulated pipes or a forced-air system with insulated ducts may merit a lower "duct-loss" factor. A steam system with uninsulated pipes may merit a higher "duct-loss" factor. You can estimate the heating system output required by multiplying this factor by the building heat loss reported on the Sizing report.

8.5 Print Measures and Materials List

In the text version of NEAT, press 4 to print the recommended measures and materials lists. If you choose to print and the printer is not connected or prepared to print, you

will get one of the following two messages:

1. "Write fault error writing device PRN. Abort, Retry, Ignore, Fail ?"

Correct any problem with the printer or its connecting cables and enter "R" for Retry, or enter "A" for Abort.

2. "Please wait."

If this message remains on the screen for an inordinate length of time (thirty seconds or longer), restart the computer by pressing **[Ctrl] [Alt] [Del]**, or turning the power switch off, then on. (The building description is saved automatically before NEAT displays the Report Menu.) Correct any problem with the printer or connecting cables, restore the building description, page through the input, and request printing from the Report Menu again.

In the GUI version, you print the Measures and Material lists by clicking the **Print** button while viewing the Recommended Measures List.

8.6 Display Comments

Press 5 in the text version's Report menu to review any comments you may have entered during the building description input. Any NEAT generated comments will also be displayed. The comments are stored in the report file saved on your computer. Comments are displayed as part of the Recommended Measures List in the GUI version.

8.7 Utility Bills

Although optional, utility billing data for the homes you weatherize can be a valuable source of information. NEAT allows you to compare its predictions with this billing data. Then, if you desire, it will adjust the measure recommendations to reflect the data. Note, however, that NEAT was designed to make its recommendations based on average weather and occupancy characteristics rather than the specific life styles of the occupants. Thus, it should not be expected to reproduce the billing data with great accuracy. Also, if adjustment is requested, the recommendations will then be specific to the life styles of the occupants during the period in which the billing data were gathered.

Post-weatherization billing data may also be input to NEAT and stored with the other data for a house. Computer software exists which can use both pre- and post-weatherization billing data to derive actual energy savings estimates, possibly useful in program evaluations. Input of both pre- and post-weatherization billing data is not performed from the View/Report menus of NEAT. See Chapter 9, *NEAT Auxiliary Functions*, Section 9.3, *Billing Data Entry* for more details.

The Utility Bills item on the View menu of the GUI version displays all the billing data as you entered it into NEAT. No analogous option exists in the text version apart from printing the data file from the DOS prompt (see Appendix A, *Notes on DOS, View Files*, for details).

The Energy Consumption/Sizing item, also on the View menu of the GUI version, or the 6 - Billing Data Adjustments item in the text version, allow you to see a comparison of the NEAT predicted consumptions and the billed consumptions. In the GUI version, comparisons for both heating and cooling are given on the same scrollable screen, while in the text version, you must make the appropriate selection (1 for heating or 2 for cooling) from the sub-menu, Billing Data Comparison Menu. Displays are available only if the corresponding heating and/or cooling billing data have been previously entered.

The predicted values are based on assumptions used in estimating measure savings and the building description you have entered and correspond to the same time intervals for which the billing data were taken, allowing a one-to-one comparison. They will be displayed side-by-side with actual values taken from the billing data. If you have entered the values, NEAT will use the pre-retrofit air leakage data from the General House Data screen in computing the predicted consumptions. Otherwise, NEAT will use the post-retrofit air leakage data.

Also displayed side-by side will be the heating or cooling degree-days assumed by NEAT in its computations as well as those you entered with the billing data (if available). Both will be based on the base temperature you indicated during entry of the billing data. Comparison of predicted and actual consumptions and degree-day totals should assist you in determining whether to use NEAT adjusted measure savings based on the billing data entered. Percent differences of the totals of these two quantities are displayed to further aid in the decision.

After viewing these comparisons, click on the **Okay** button in the GUI version or press any key to return to the Billing Data Comparison Menu in the text version. If you have entered pre-weatherization billing data and chose at that time to make adjustments based on the data (see Chapter 9, *NEAT Auxiliary Functions*, Section 9.3, *Billing Data Entry*), the GUI's Recommended Measures List menu item will contain results both with and without this adjustment.

In the text version, you must first indicate your preference to adjust the measure recommendations by selecting 3 - Adjust Measure Savings from the Billing Data Comparison Menu, then 4 - Return to Report Menu, from which you may select View Recommended Measure List / Material List to see the results of the adjustment.

Note, if the adjusted NEAT recommendations will no longer correspond to average conditions but, instead, the conditions that existed during the time the billing data was collected. NEAT saves the reports generated both before and after adjustments.

8.8 Actual Work Performed (GUI Version)

NEAT's Actual Work Performed feature allows you to record work that was actually performed during weatherization of a house, as opposed to that which was recommended by NEAT. See Chapter 9, *NEAT Auxiliary Functions*, Section 9.4, *Actual Work Performed*, for more details. This feature is accessed from the Main Menu in the text version of NEAT.

8.9 Continue / Termination (Text Version)

Pressing 8 (Exit Program) from the Report Menu will exit NEAT and return you to the operating system (DOS) prompt. Press 7 (Continue) if you wish to continue executing NEAT. The Termination Menu will appear with the following four options:

TERMINATION MENU
1. Exit to Operating System
2. Restart with Modified Building Description ( )
3. Restart with Original Building Description ( )
4. Return to Main Menu

Press 1 to exit NEAT and return to the operating system. Press 2 to restart NEAT having already restored the same building description you just entered. The building identifier you gave this description will be printed in parentheses to the right of the option listing in the menu to help remind you. Press 3 to restart NEAT with an originally restored building description without modifications. This selection is available only if the current session of NEAT was initiated by restoring a previously entered building description. If this is the case, the building identifier of this originally restored description will be displayed in parentheses following this menu option. If this NEAT session began with entering a totally new building description the parenthesis will be empty and choosing this option will take you back to the Main Menu. Note, if you initiated NEAT by restoring a previously entered building description, then chose to give the modified description the same building identifier as the restored description, this option will be unable to restore the original description, the building identifiers displayed in the menu options 2 and 3 will be the same and both will refer to the modified building description. Press 4 to return to the Main Menu with no building description restored.

NOTES:

Chapter 9

NEAT's Auxiliary Functions permit you to perform additional tasks not directly associated with the selection of energy conservation measures. You may have NEAT compute an estimate of a home's energy efficiency or the minimum cost-effective hourly CFM_{50} infiltration reduction. Both of these values can assist you in deciding the level of effort which may be necessary to weatherize the home. You may enter pre- and/or post-retrofit billing data for either the heating or cooling fuels. Or, create a list of work actually performed in the weatherization of a home as well as actual costs incurred or use this same framework to create a more customized work order.

In the text version of NEAT these auxiliary functions are accessed by pressing 4 (Auxiliary Functions) from the Main Menu. Following a request for the building identifier of the building to which the data will apply (see Section 6.2 *Main Menu*, Option 2), you will be presented with the Auxiliary Functions Menu having the following options:

AUXILIARY FUNCTIONS MENU (Text Version)
1. Energy Use Ratio / Minimum Infiltration Reduction
2. Pre-Weatherization Billing Data
3. Post-Weatherization Billing Data
4. Process Actual Work Performed
5. Print Actual Work Performed
6. Return to Main Menu

These functions are accessed from several locations in the GUI version of NEAT. They will be discussed within the topics below. The functions apply to whatever building description is currently open when the function is accessed, identified by the building identifier shown at the bottom of the screen following the words "Working BLD File."

9.1 Energy Use Ratio

The energy use ratio for a house gives you a measure of how energy efficient (or energy consuming) the house is. It can be determined if you know the annual energy use of the home (taken from utility bills) and the home's living space floor area. To access the input screen for this feature,in the GUI version of NEAT, click on the Energy Use Ratio Calculator menu item under the File menu or select 1 - Energy Use Ratio / Minimum Infiltration Reduction in the text version. If a building

description has been previously selected, this home's Living Space Floor Area will appear as the default value (text version) or just to the right of this value's input field (GUI version).

Next, enter the annual energy use for the home. This can be obtained from utility bills, though conversion to Mbtu will likely be necessary. To convert therms to Mbtu, divide the therms by 10. To convert kWh of electricity to Mbtu, divide by 293. It is your choice whether you use the sum of the heating and cooling fuels or only the heating. Traditionally, the energy use ratio is calculated with only the heating fuel's use.

In the GUI version of NEAT, if a house already having utility data has been opened, the total energy use entered there will be displayed to the right of this data item's entry field. Be careful, though. To use the energy use ratio properly, the annual energy use should be entered. The utility billing information entered previously may not span an entire year. You also may change the weather for which the ratio will be calculated. The currently selected weather is displayed. You must also select whether to include the cooling component of the weather within the calculation. It is strongly recommended that if you have included the cooling energy use in the total annual energy use entered in the previous field, you also include the cooling component of the weather in the calculation. The weather parameters used in the calculation (heating and cooling degree days, base 65°F) are displayed. Finally, click on the Calculate Energy Use Ratio button to complete the calculation and display the result.

In the text version of NEAT, previously entered billing data is not referenced in order to supply you with a default value for the annual energy use. You also cannot change the currently accessed weather. This must be done prior to entering this feature, using the Setup facility under the Main Menu (see Chapter 10, *Customizing a NEAT Audit)*. The text version automatically calculates two values of the energy use ratio, one using only the heating component of the weather and the other using both heating and cooling components. Once the Living Space Floor Area and Annual Energy Use have been entered, the results of the calculation appear with no further response from you.

The calculation of the energy use ratio has no effect on NEAT's measure recommendations for a house. To be of value to you, it must be compared to values obtained from other houses, giving you a comparative feel for the energy efficiency of one house compared to another. Note, however, values of the energy use ratio may be affected as much by the life styles of the occupants as by the construction characteristics of the house.

Exit the GUI version of this feature by clicking on the Okay button at the bottom of the screen. In the text version, supply one additional data item, the average hourly cost for infiltration work (see the section below, 9.3 *Minimum Infiltration Reduction*).

9.2 Minimum Infiltration Reduction (Text Version)

The text version of NEAT can also supply you with an estimate of the minimum hourly infiltration reduction that you should accomplish to remain cost-effective in your blower-door directed infiltration retrofit work. If blower-door readings of a home's leakiness are taken after each hour's infiltration reduction efforts, an hour's work should reduce the leakiness by this minimum amount to remain cost-effective. The value should be used as a guide and not necessarily as an absolute cutoff. It is based on a number of assumptions, not all of which may be totally accurate. It assumes that all leaks are to the outdoors and that they are repaired in decreasing order of their severity. If an hour's efforts do not produce the indicated reduction, yet a home is still relatively leaky, a significant source of infiltration may simply yet to be identified. Further examination may still be warranted.

In the field provided, enter the average cost (including both labor and materials) of one hour of infiltration work. This will be an estimate, since each hour seldom requires the same materials. The minimum cost-effective hourly reductions are then displayed in CFM_{50}, that is, the cubic feet per minute of leakage air at a 50 Pascal pressure differential. Three values are computed, one for each of three sources of the home's heat. "Non-electric" applies to all fossil fuel sources of heat, e.g. oil, gas, coal, etc. If there are multiple sources, choose the one which supplies the majority of heat.

These estimates should not be used in climates which have negligible heating requirements. In such climates savings due to infiltration reduction are more strongly affected by factors such as moisture and internal heat sources, not addressed in this calculation.

9.3 Billing Data Entry

Pre-retrofit billing data can be used by NEAT to adjust its predictions of measure savings to reflect this actual consumption (see Section 6.6 *Billing Data Adjustments*) or to estimate a building's energy use index to gauge the existing efficiency of a house (see Section 8.1 *Energy Use Ratio*). Post-retrofit data can be used with the pre-retrofit billing data to estimate an actual metered energy savings resulting from the weatherization work.

If you wish to enter billing data, ask the client for up to 12 months of utility bills. If the client has discarded these bills, he or she may request consumption records from the local utility. Or, the client may sign a release which grants you authority to directly obtain the data.

NEAT cannot separate heating and cooling consumptions from a single billing history when the same fuel is used for both conditioning components. Thus, an electrically heated house with air-conditioning or a house with a heatpump cannot use NEAT's billing data features unless you can successfully divide the electric bills into their heating and cooling components before entering the data into NEAT.

NEAT's billing data features work best with metered fuels, such as natural gas and electric. In fact, the billing data entry screens were designed for these two fuels. Use with other fuels will likely require units conversions. Bulk fuels, such as propane or fuel oil, which are delivered in bulk and stored in tanks at the house, are less appropriate. Unless deliveries are relatively frequent and approximately the same amount of fuel remains in the tank at the time of each delivery, use of billing data for these fuels can lead to substantial inaccuracy. The following discussions will assume electric or natural gas heat.

To enter billing data into NEAT, choose the Utility Bills item under the Input main menu item of the GUI version. From the submenu, select the type of billing data you wish to enter: pre- or post-weatherization heating or cooling.

In the text version of NEAT, selection of either Auxiliary Functions options 1 or 2 present you with similar Pre- and Post-Retrofit Billing Data menu screens, simulated below.

PRE-(POST-) RETROFIT BILLING DATA MENU
1. Enter gas or propane heating bills (therms)
2. Enter electric heating bills (kWh)
3. Enter electric cooling bills (kWh)
4. Return to Previous Menu

Select the appropriate option depending on the fuel source and season for which data is to be entered. NEAT requires cooling data in kilowatt-hours of electricity and heating data in either therms or kilowatt-hours. The utility may document natural gas consumption in therms, mcf (thousand cubic feet), or ccf (hundred cubic feet).

Mcf and ccf can be converted to therms by multiplying by a value obtained from the local gas utility. Because heat content of natural gas varies according to composition, ask the utility for the number of therms contained in a mcf or ccf delivered to homes in the area. This value (in therms-per-ccf) should be entered in the Key Parameters (see

Section 9.9, *Altering Key Parameters*). Most natural gas contains approximately ten therms per mcf and one therm per ccf of natural gas.

The Billing Data screen is the only screen in the text version of NEAT on which data can be entered in any order. However, when finished, the billing periods must be consecutive from earliest to most recent as you progress down the screen. For example, if billing periods are consecutive months, the months may be entered consecutively down the first column, using the [Down Arrow] after entering the number corresponding to each month. Thus, the user might begin on the first row and column, and enter: 1 [Down Arrow] 2 [Down Arrow] 3 [Down Arrow], etc. The same principle applies to the other columns of data on this screen. In the GUI version, text can also be entered in any order if the mouse is used to point and click on the next field you wish to add data. Here also, billing periods must be consecutive from earliest to most recent.

Fuel Bill Data Entry Screen

Enter date meter read (month/day) and number of days in first period.	Enter the corresponding fuel consumption for each period. (Therms)	Enter the number of HDD's in each period. (Optional)
/___/___/ ____	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____
/___/___/	_____	_____

Enter the base temperature for the HDD values entered _____
Enter base load (units/month) _____

Natural Gas Data Entry Screen *- The user may enter up to 12 months of natural gas billing data from the Report Menu.*

If any row of data does not contain an acceptable date and consumption, the program will ignore it and all subsequent rows. Although the billing periods may lie in two consecutive calender years, the total duration for which data are entered cannot be greater than one year.

The Fuel Bill Data Entry screens provide an option for entering heating degree days (HDDs) and cooling degree days (CDDs) for natural gas and electricity billing data, respectively. The degree-day information will not affect any adjustments to the measure savings. It simply allows you to compare degree-days used by NEAT with those from the actual billing periods. Heating and cooling degree days are available from local utilities, state energy offices or the U.S. Department of Commerce National Weather Service, Asheville, NC.

If degree-day information has been entered, NEAT requires base temperatures for these HDD or CDD values. Assume a base temperature of 65°F for HDDs and 78°F for CDDs, unless a different base temperature is listed on the utility bill.

The text version of NEAT estimates the heating base load for natural gas data in units of therms-per-month and the cooling base load for electric data in units of kwh-per-month. This estimated value will be displayed as a default value. If you are editing billing data entered previously, the base load from that data will be displayed in the entry field. Choose either the estimated or the recalled value, or enter a new self-determined base load, in the same manner as you would for other numeric fields.

The GUI version of NEAT does not attempt to estimate a base load for you. You must provide a self-determined value if a recalled value is not displayed.

The heating base load is natural gas consumed separate from the household's heating system. The cooling base load is electricity consumed separate from the household's air conditioning.

To determine heating base load yourself, select a month when the furnace did not operate, most likely during summer. This month should be one of normal household occupancy—no long term visitors or household vacations. Determine natural gas consumption in therms.

To determine cooling base load, select a month with no electric heating or air conditioning consumption, most likely during fall or spring. The number of kilowatt-hours consumed is the base load.

The billing data entry screens in the GUI version contain two additional items: Billing Units and Use in Model Correction.

The Billing Units check boxes are accessible only for entry of heating bills. Checking either **kWh** or **Therms** tells NEAT the units of the billing data you entered. In the text version, this was determined by your choice on the Billing Data Menu screen.

The Use in Model Correction checkbox in the GUI version tells NEAT whether to adjust the measure savings to reflect the billing data you entered. If you answer Yes, NEAT will compute and report both the unadjusted and the adjusted results. Otherwise only the unadjusted results will be available. NEAT will make these adjustments based only on the pre-weatherization billing data and only for the combined heating and cooling bills, if both are entered. Thus, a decision to adjust or not to adjust made on any one of the billing data entry screens is sufficient. In the text version of NEAT, this decision to computed adjusted savings is made from the Billing Data Comparison Menu under the Report Menu (see Section 8.7, *Utility Bills*).

9.4 Actual Work Performed

NEAT's Actual Work Performed feature allows you to record work that was actually performed during weatherization of a house, as opposed to that which was recommended by NEAT. Many circumstances can prevent or add to the measures recommended by NEAT. Insulation contractors may find that a wall segment was, in fact, already insulated, even though it was thought uninsulated at the time of the audit. Occupant preferences may change the work actually performed. In addition to a change in the measures actually installed, prices or quantities may differ from those originally estimated. This feature gives you the opportunity to record the actual work performed while keeping a record of the NEAT recommendations as well.

Any program evaluation involving performance of the retrofits needs to be based on measures actually installed. In conjunction with the pre- and post-retrofit billing data which may be recorded in NEAT, estimates of actual measure savings become possible.

An alternative use of this feature may be to create a more detailed work order prior to weatherization of the house. Many of the same circumstances which could cause the actual measures list to differ from the NEAT recommended list, if known prior to weatherization, could be considered in making a more accurate work order. The Actual Work Performed feature allows addition of multiple materials for any weatherization activity permitting greater detail. A total of 27 items are allowed.

To access this feature, click on the Actual Work Performed menu item under the Input main menu selection in the GUI version or press 3 (Process Actual Work Performed) from the Auxiliary Functions Menu in the text version. Access is permitted only if a report file exists for the building description currently opened (selected upon entering the Auxiliary Functions Menu from the Main Menu in the text version). If you have not previously created a list of actual work performed for the house, NEAT will create one for you from the existing Recommended Measure and

Material lists. If you have already previously created an Actual Work Performed list for the house, NEAT will give you the option of editing it or recreating it from the original measure and material reports. Note, if you choose to recreate the list from the reports, the previous actual work performed list will be lost.

Appendix B, *Audit Example*, contains an example of an Actual Work Performed list. The information contained in this form includes: Measure Installed, the measures Savings ($/yr), the Cost of implementing the measure ($), the Materials Installed in implementing the measure, the Quantity of each material, and the Units associated with the quantity. You may have any number of materials associated with a given measure. There are no restrictions on completing rows of data. You may leave any fields you wish blank.

Cursor movement is controlled in much the same way as on the building description input screens. However, in the GUI version you may use the **Copy Line** and **Past Line** buttons to copy entire lines of data. Position the cursor somewhere in the line you wish to copy. Click on the **Copy Line** button then on the **Okay** button which appears. Position your cursor in the line below where you wish the copied line to be inserted. Click on the **Paste Line** button. The line will be inserted above the line on which your cursor lies. Copy and paste a blank line from the bottom of the list to insert a blank line within the list. Use the **Delete Line** button to delete the entire line on which your cursor lies.

In the text version, you may use the **[F2]** and **[F3]** keys to delete and copy lines (see Section 5.1, *Keystrokes and Cursor Movement*). Here, lines may only be copied to the line immediately below where the cursor lies when the **[F3]** key is pressed, the other lines being forced down one row each. Inserting a blank line is not as easy as it is in the GUI version. You must use the **[F3]** key to copy a line at the position where you want the blank line, then erase the duplicate line's fields using the **[Esc]** key.

To print the Actual Work Performed listing, go to this menu item under the View main menu selection of the GUI version and click on the **Print** botton. In the text version, choose 5 - Print Actual Work Performed from the Auxiliary Functions menu.

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NEAT computes energy savings and selects conservation measures using assumptions in addition to the building description, such as fuel and material costs. These and other parameters can be customized to produce audit results tailored to your location. By changing the parameters, you can reflect specific local conditions. You can have these changes affect only the current NEAT run or all future runs as well. Or, you can create up to 10 sets of parameters to choose from at any time. The GUI version also allows you to choose additional personal preferences and defaults to further customize your program.

10.1 Preferences (GUI Version)

Select Preferences under the Setup main menu item in the GUI version to alter how the program responds to some of your requests. You may change what editor is used to display results selected from the View menu item. In the Preferred Editor field, enter the full path name of the editor you choose (e.g. C:\WP51\WP) or just the editor name (e.g. WP) if you have the word processor's directory in your DOS path. If left blank, you will view your results with the default editor provided with NEAT.

Click on the **Yes** Overwrite Warnings check box on this same screen to have NEAT warn you any time an operation you request would overwrite existing NEAT data on your computer. The **Yes** condition is the default and suggested for most users. Checking **No** will eliminate these warnings giving you no indication of losing potentially valuable data.

A **Yes** response to the Field Validation check boxes tells NEAT to test the value of each numeric field when it is exited to see if it lies within both acceptable and reasonable ranges. If the value lies outside the acceptable range displayed in the warning, you will be instructed to re-enter a value which does lie inside the range. If the value you entered lies outside a reasonable range, you will again be warned of the reasonable range and given an opportunity to either **Correct** the value or **Ignore** the warning and retain the value entered. If the **No** Field Validation check box has been chosen, NEAT will still check the entire form for valid entries when you have finished the form and selected **Okay** to exit the form.

Click the **Yes** button beside Update Startup File on Exit to have the GUI version of NEAT start each time with the last referenced building description automatically

opened. Otherwise the same file will be recalled each time you start NEAT. The current startup file is listed under the Parameters/File Locations menu item under Setup.

Click on the **Okay** check box at the bottom the screen to accept the responses you made on this screen or **Cancel** to ignore the changes and return to conditions prior to entering the screen.

10.2 Changing Parameters

To change parameters, select the Parameters menu item under Setup on the main menu bar in the GUI version of NEAT. In the text version choose 3 - Setup from the main menu. You will be presented with the following selections:

GUI **Parameters** Menu	Text Version Setup Menu
File Locations	1 - Alter Material Costs
Material Costs	2 - Alter Fuel Costs
Fuel Costs	3 - Alter Fuel Escalation Rates
Fuel Escalation Rates	4 - Select Candidate Measures
Candidate Measures	5 - Change Weather Data
Key Parameters	6 - Alter Key Parameters
User-Defined Types	7 - Change/Create Setup File
Choose Parameter File	8 - Return to Main Menu
Save As	
Reset Parameters	

Each of these selections will be discussed individually in the sections which follow. In the GUI version, after making changes in many of the forms, NEAT will ask if you wish to update the key parameters on your disk. If you click on the **Yes** button, NEAT will save the changes you made for future runs which use the current parameter file (see Section 10.11, *Multiple Parameter Files*). If the **No** check box is selected, the changes will apply to runs made during present NEAT session only.

In the text version of NEAT, this same choice is made when ever a Setup option is selected by typing a **Y** or **N** to the question, "Do you wish to permanently alter these parameters?" As in the GUI mode, if you answer **Y**, the changes will be saved for all future NEAT runs using the current parameter file, whose description is given at the top of the Setup screen under the "Setup Menu" title line.

Key actions in both the GUI and text versions are consistent with those found in building description entry screens (see Chapters 3, *Navigating the GUI Version* and 4,

Data Entry in the Text Version). However, for numeric fields in the text version, pressing the first acceptable number key will automatically erase the entire field, preparatory for entering an entirely new value.

10.3 File Locations

Use this form to change the default paths NEAT uses for your input, output, and weather files. NEAT will save a building description file (BLD) to whatever directory is displayed in the Data Path field. After running NEAT for a specific building description, results are saved to the directory in the Output Path field. If you choose to change the weather NEAT uses, the program will look in the directory displayed in the Weather Data Path for available weather files to select from. Unless you specify a specific drive or the root directory on a drive, the path names are assumed to lie under NEAT's main execution directory (see also, Appendix A, *Notes on DOS*).

In the text version of NEAT, these same fields are located on the second page of the 6 - Alter Key Parameters option under the Setup menu.

In the GUI version, this screen also allows you to change the parameter description for the currently accessed parameter file (see Section 10.11, *Multiple Parameter Files*). Note that the field is longer than the window in which it is viewed. Thus, you may need to force the cursor off either end to access all of the name.

10.4 Material Costs

You can tell NEAT what values to use for the life span of each energy-saving conservation measure and labor and material costs of installation. These figures are displayed on the Material Costs screens.

NEAT assesses costs to energy-saving conservation measures by the square foot, linear foot, or per item. Costs listed in the **Materials Cost** and **Labor Cost** columns are costs for the unit of measure listed on that line. For example, if the "Cost Matrl" for "Celluls, Blwn - R-11" is ".0732" and the Unit is "sq. ft.," that means blowing in cellulose will cost $0.0732 per square foot for materials. Labor costs are listed separately in another column.

The column marked "Cost/Item" is designed specifically for window treatments, where the "Unit" is either "Lnft/E" or "Sqft/E." Because these materials may be priced either by dimension (per linear foot or square foot) or by application (per window), NEAT permits you to enter cost information either way.

If the window treatment is priced by dimension, use the "Cost ($/Unit) - Matrl/ Labor" columns to record the material and/or labor cost associated with installation.

The unit will be either "Lnft" or "Sqft," whichever is listed to the left of the "/" in the "Unit" column.

If, however, the treatments are priced per application, i.e., a fixed price per window treated, enter this cost in the "Cost/Item" column. If costs are entered for both of these approaches for the same material, the total cost will be the sum—probably not the result intended unless there is a flat price per window plus a cost per dimension.

The "Cost/Item" column is not appropriate for other measures.

10.5 Fuel Costs

The Fuel Cost screen contains dollar costs of the listed fuels in common units (mcf of natural gas, kwh of electricity, gallons of #2 oil, gallons of propane, cords of wood, tons of coal, gallons of kerosene). Assemble a list of fuel costs in your area and enter these values into this screen.

Check the costs of fuels in your area at least once a year and update the costs, if necessary. Fuel costs should be typical—avoid high or low short-term values.

10.6 Fuel Escalation Rates

Each year, the Department of Commerce prepares and publishes for the Department of Energy fuel escalation rates to be used by the Weatherization Assistance Program. The Program rules require agencies to update the fuel escalation rates at least every five years. Each release of NEAT will contain the most recent values published. Thus, unless your version of NEAT was released more than five years ago, you should not have to make any changes in these values.

In the text version of NEAT, alterations made in this screen are permanent. You are given no other choice during Setup. If you wish to save a copy of the outdated values, make a copy of the existing parameter file before making the changes (see Section 10.11, *Multiple Parameter Files*).

10.7 Selecting Candidate Conservation Measures

This screen allows you to turn off certain conservation measures permanently, or just for one particular audit. For instance, if the weather in your location suggests that evaporative coolers are cost-effective, but they are not accessible or practical to install, this measure may be turned off. Or, you may lack confidence that occupants will not override the automatic setback thermostat, giving cause for eliminating this measure.

The infiltration reduction measure performs as described in Section 8.2, *Recommended Measure List*, and cannot be turned on and off from Setup.

In the GUI version of NEAT, click on the check boxes preceding each measure name to change its status. The presence of a "✔" in the check box indicates the measure is to be considered.

In the text version, press **Y** if you wish to consider a conservation measure. Press **N** if you wish to turn off the measure.

10.8 Changing Weather Data

To change the weather NEAT uses when it runs, choose the Weather Data Files menu item under the Setup main menu selection of the GUI version. You will be presented with three options: Install, Remove, and Choose. Click on the Choose menu item. You will be informed what weather file is currently being used. Click on **Okay** and a pick list of cities will be displayed. Point and click your mouse on the weather city you wish to use. Use the scroll bars to the right of the list if necessary to show the city your looking for. The city name will be transferred to the selection field at the top of the window. Click on **Okay** to confirm your selection or **Cancel** to abort your selection.

In the text version of NEAT, select **5** - Change Weather Data from the Setup menu. The screen displays three choices. Press **[End]** to retain the current weather file and return to the Setup menu. Or, press **[Enter]** to accept NEAT's default location for weather files, created when the program was installed. Users experienced with DOS may have moved their weather files to a different directory. If so, NEAT must be told of their location, or "path." If applicable, enter this path, including a terminating backslash, "\", on the line provided, then press **[Enter]**.

If you have not chosen to return to the main menu, the available cities will appear in alphabetical order on the screen. Choose a city near the location of the house being audited. Use the **[Up]** and **[Down Arrow]** keys, the **[Tab]** key and the **[Enter]** key to move among the cities. When you find the city you want, put an asterisk (*) on the line beside it. Press **[End]** to record your selection and return to the Setup menu.

In order for cities to be displayed in either the GUI or text versions weather station pick lists, they must have already been installed. See Chapter 2, *Installing NEAT* for details on use of the Install and Remove menu items in the Weather Data Files menu of the GUI version to install weather stations.

10.9 Altering Key Parameters

Key parameters are accessible to give you more flexibility in applying NEAT. If you have more accurate numbers than NEAT's default values, enter them to replace existing values. For example, if your energy conservation program installs furnaces that are 82

percent efficient, you should change the furnace replacement from 85 percent to 82 percent. Caution should be exercised in altering parameters. NEAT attempts to find energy conservation retrofits for houses with "average" occupants. Again, no effort should be made to adjust parameters to coincide with life-styles of individual occupants.

The following parameters are accessible:

- Real discount rates, supplied by the DOE, will need to be changed periodically.
- Minimum acceptable SIR.
- Heating and cooling setpoints for day and nighttime.
- Night setback accomplished by smart thermostats.
- Average annual outside film coefficient (Btu/hr-sqft-F).
- The base value of free heat from internals (Btu/hr) accounts for appliances and lights. NEAT adds to this base amount heat generated from two adults (276 Btu/hr per adult) and one child (224 Btu/hr) for every 400 square feet of floor area over 1000 square feet.
- Cooling sensible heat ratio.
- Three R-values are included as choices denoted as "**other**" in the building description menus. You can change these R-values to reflect unique building characteristics that may not be included in existing options provided by the menu box. For example, if you commonly encounter vermiculite as the "other" insulation choice, enter an R-value of 2.3 R per inch.
- R-value added by foundation wall insulation measure.
- Furnace/boiler replacement seasonal efficiencies (%).
- High efficiency furnace replacement steady-state efficiency (%).
- Heat content for natural gas (therms/ccf).
- Window A/C replacement SEER
- Central A/C replacement SEER
- Heatpump replacement SEER (cooling)
- Heatpump replacement HSPF (heating seasonal performance factor)
- Impute cooling savings without air conditioning (**Y/N**).
- SEER used to optionally impute cooling savings.

The last two items above control NEAT's optional feature of computing cooling savings for measures in a home without air conditioning. A home without air conditioning cannot actually save cooling energy, since no energy is expended for cooling in the first place. However, most measures which would save cooling energy in a home with air conditioning can make living conditions more comfortable during the summer in homes without air conditioning. Thus, you may "impute" a savings in these homes in order to install measures to increase the comfort. The homes may install air conditioning in the future, thus eventually allowing this imputed savings

to occur. This feature would be more commonly used in the far south where cooling is the dominant factor.

Enter Y to permit this feature. The SEER key parameter should be the seasonal energy efficiency ratio (SEER) of an air conditioning unit that would most likely be installed in the home sometime in the future. Entry fields for this feature are on the second page of Key Parameters in the text version of the program.

The second page of Key Parameters in the text version of NEAT also allows entry of User Defined Types of insulation and the Paths for building description, report, and weather files. See Sections 10.10, *User Defined Types* and 10.3, *File Locations* for additional information.

10.10 User-Defined Types

The NEAT building description forms contain two wall and two attic insulation material types which you may define to meet your needs. Select the User Defined Types menu item under the GUI version's Setup/Parameters menu selection. In the text version, these fields appear on the second page of Key Parameters under the Setup menu.

In the fields labeled "Ceiling/Wall Insulation, User Defined Type _," enter the name of an insulating material you wish to use, not already provided by NEAT (e.g. Rockwool or Blwn Fbrgls). Once entered, these names will appear in place of the "User-Defined" name in the Material Cost section of Setup, in the building description forms for walls and attics, and in any reports which recommend a measure using these materials.

Below each of these material names are numeric fields giving the R-values per inch of the ceiling insulation types you are defining and the total R-value added to a wall for the wall insulation types. The R-values have dimensions hr-ft^2-°F/Btu. Typical values corresponding to various insulation types may be found in building manufacturers' data sheets or in ASHRAE's (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) Handbook of Fundamentals. Entries in these fields permit your defined insulation types to have the physical characteristics you desire.

10.11 Multiple Parameter Files

All of the parameters you provide during setup (except the weather station) and have chosen to save for future runs (see Section 10.2, *Changing Parameters*), are saved on your computer in what is called a parameter file. NEAT allows you to have as many as ten sets of parameters, thus ten parameter files. These files are identified by a name (GUI version only) and a description. Both versions of NEAT recognize

the same parameter files, so a file created by one version may be used also by the other.

For instance, if you have agencies which provide services in two locations with significantly differing material and fuel costs, you may wish to create a parameter file for each of these locations. You can then easily switch between the two using the multiple parameter file feature. The descriptions of the two parameter files would most likely identify the location to which they pertained or the agencies which provided the services at the location.

NEAT is distributed with a standard average set of parameters (material, labor, fuel costs, candidate measures, etc.). To create a second set of parameters tailored to your location, click on the Save As menu item under Setup/Parameters in the GUI version. In the File Name field, type a file name for the new parameter file you are about to create. This name is not the same as a building description file name used as the building identifier, but it has the same restrictions of length and permissible characters (see Section 5.2, *Building Identifiers*). If you wish to insure that no other parameter file has this same name, click on the **[No]** Overwrite OK? button and NEAT will not permit overwriting and existing parameter file. Clicking on **Okay** will copy the currently accessed parameter file to a second having the name you provided and automatically make it the accessed file. Click on **Cancel** to abort the operation. You may change the description of this parameter file by entering a new Description of Parameters File on the File Locations screen (see Section 10.3, *File Locations*).

Once you have multiple parameter files, use the Choose Parameter File menu item on the Setup/Parameters menu of the GUI version to select the current file to be used by NEAT. The parameter file description will be displayed together with an **Okay** button. Click on the **Okay** button to continue. You will be presented with a parameter file pick list. Click on the line containing the parameter file name and description you wish to select. It will be transferred to the top line on the form, confirming your choice. Click on the **Okay** button to complete the selection or **Cancel** to abort.

To create a new parameter file in the text version of NEAT, select **7** - Change/ Create Parameter File from the Setup menu. A list of existing parameter file descriptions will be displayed. Use the **[Up Arrow]** and **[Down Arrow]** keys to locate the cursor on the field to the left of the description you wish to use as a starting point for the new parameter set. If you have just installed NEAT, you will only have one choice, the standard parameter file. Pressing the **[F3]** key will copy this parameter file to another, having the same description as the first. You will see another parameter description appear, identical to the one you copied. Enter a asterisk,

[*], to select this parameter file such that the changes you make from the Setup menu will apply to this new file. The cursor will move to the right into the parameter description field. Press [Esc] to erase the parameter description of the file from which this new file was copied and type in a new description. Press [End] to exit the screen.

This same screen in the text version is used to change the current parameter file, if you have defined more than one. Select 7 - Change/Create Parameter File from the Setup menu. Use the [Up Arrow] and [Down Arrow] keys to locate the cursor on the field to the left of the description you want to make current. Enter a asterisk, [*], to select this parameter file. Enter [End] to complete the selection of [Esc] to abort. Be careful, the [Esc] key entered while in the parameter file description field on the right will simply erase the description, not abort the selection of the current parameter file.

Once you have created a new parameter file, whether with the GUI or text version of NEAT, you now make changes to it as you would any other parameter set following the procedures in this chapter. Make sure to request that your changes be saved permanently to disk, or they will not change the parameter file (see Section 10.2, *Changing Parameters*).

Note that changes in the weather city selected are not saved in a parameter file. They are saved separately. NEAT will run with the same weather until you use the Change Weather setup option to select a different city (see Section 10.8, *Changing Weather Data*).

10.12 Reset Parameters

The Reset Parameters menu item resets all of the parameters of the currently accessed parameter file to those which existed when NEAT was first installed, that is, those of the original standard parameter file. Note, it will overwrite any of the settings which existed in the current parameter file prior to choosing to reset them.

10.13 Defaults (GUI Version only)

Many of the building description fields which require input have default values which will be automatically inserted into the field if it is accessed (clicked on) and left without making an entry. The Defaults menu item under the GUI's Setup main menu allows you to change these default values. Click on the Defaults menu item and you will see a submenu which is similar to the menu under the Input main menu. It will contain categories for each of the building component types, e.g., Walls, Windows, Doors, Unfinished Attics, etc. Clicking the mouse on any of these items displays a screen which is the same as the screen under the Input menu for the analogous component type, except that many of the fields are ghosted. The fields

which are not ghosted have displayed within them the default value for that corresponding field on the building description input forms. If you change the value, the default value experienced on the input form will change accordingly.

NEAT's text version uses default values, but they cannot be changed.

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The list of energy conservation measures considered by NEAT may be accessed through the Setup Menu, Select Candidate Measures option (see Section 8.5, *Selecting Candidate Conservation Measures*).

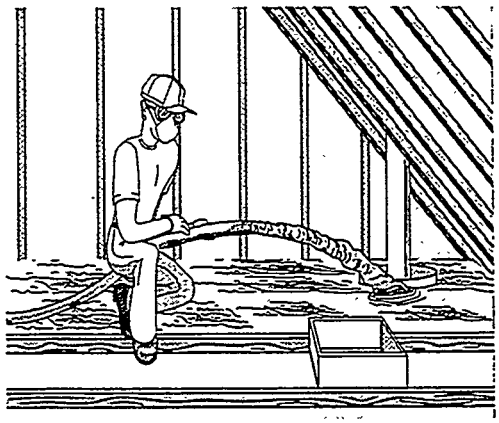
NEAT currently examines 21 energy conservation measures:

1. Attic insulation (R-11, 19, 30, 38)
2. Wall insulation
3. Sill insulation
4. Floor insulation (R-11, 19, 30)
5. Foundation wall insulation
6. Duct insulation
7. Storm windows
8. Low-E windows
9. Thermal vent dampers
10. Electric vent dampers
11. Intermittent ignition devices (IID)
12. Electric vent dampers and IIDs combined
13. Flame retention head oil burners (FRHOB)
14. Furnace tune-ups
15. Mid-efficiency furnace replacement
16. High efficiency furnace replacement
17. Space heater replacement
18. Smart thermostats (setback thermostat)
19. Window air conditioner replacement
20. Heat pump relacement
21. Air conditioner tuneup
22. Evaporative coolers
23. Awnings
24. Sun screens
25. Window films
26. Lighting

The first eight conservation measures are designed to reduce heat loss through walls, floors, ceilings, and windows. Attic insulation and Low-E windows also have the advantage of significantly reducing heat gain during the cooling season.

Conservation measures 9 through 18 improve heating system efficiency by decreasing heating energy consumed by the house. They do not affect heat loss through the envelope, however.

Conservation measures 19 through 25 either reduce heat gain or improve cooling efficiency during the cooling season. Evaporative coolers and new air conditioners can reduce cooling costs markedly, if properly installed. Window shading reduces solar gain—a major element of total heat gain. Shading the windows may affect the heating load, because shade blocks some solar heat from the house during the heating season. Conservation measure 26, lighting, reduces the electric costs of the house, while having only minor effects on the heating and cooling costs.



Installing Attic Insulation

11.1 Attic Insulation

NEAT analyzes the addition of R-11, R-19, R-30, or R-38 blown insulation to the attic as separate measures. For example, if NEAT recommends addition of R-11 insulation to an attic already having R-19 insulation, a total of R-30 is being seen as cost-effective for the house. The maximum possible depth of insulation is the maximum number of inches of existing and added insulation which could exist in the attic, not including possible compression at the eaves.

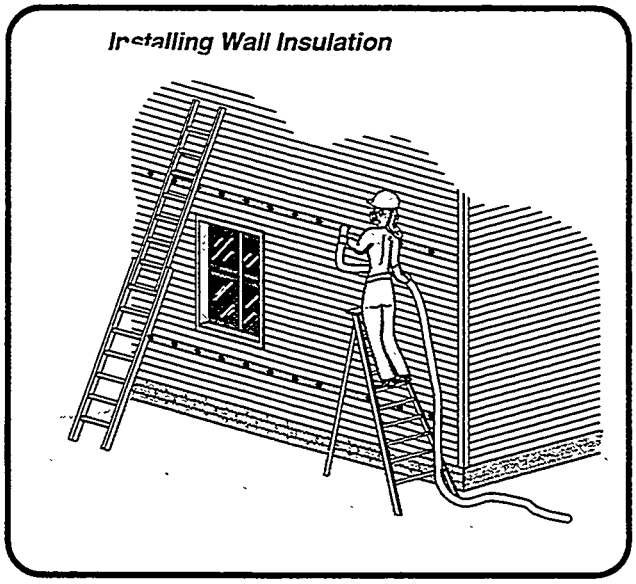
If you specify no maximum depth restriction (see Section 7.5, *Unfinished Attics*) for an attic segment, NEAT will determine the correct standard R-value of insulation to be added for your region. If a depth restriction has been specified, NEAT will evaluate not only adding the standard levels (R-11, R-19, R-30, and R-38) up to the maximum depth, but also the level of insulation necessary to exactly fill the attic cavity. Installation costs use interpolations between costs of installing the standard levels, as given by the User in Setup.

NEAT assumes that heat flow has a choice of two paths: one through the ceiling joist and any insulation resting on top of it, and the other through the ceiling panel and insulation in the joist spaces. NEAT assumes that joists occupy 15 percent of the attic area and spaces between them occupy the other 85 percent.

11.2 Wall Insulation

The wall insulation portion of NEAT assumes the same 15 percent framing and 85 percent cavity area as the attic.

NEAT reduces the free solar heat transmission through insulated walls. If a wall is located next to a sheltered but unheated area, NEAT reduces the predicted savings from wall insulation by one-third, since this buffered area serves to reduce the heat loss.

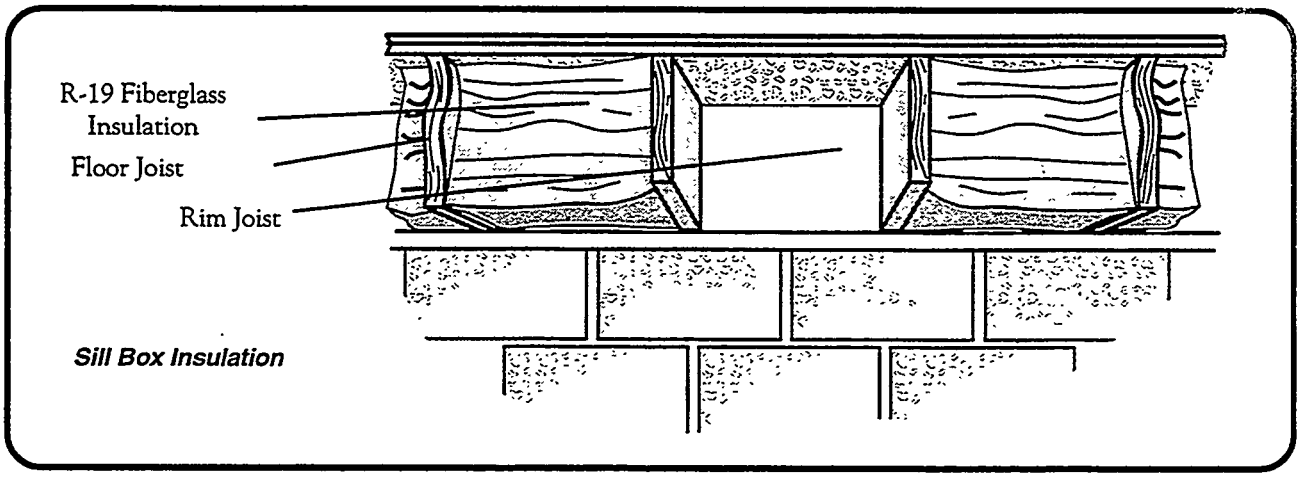


11.3 Sill Insulation

The sill box area on many houses is uninsulated. Insulating this sill box is often cost-effective. Seal the big air leaks in the sill box area before insulating.

NEAT will compute the change in the overall conductance of the foundation space that results from installing sill box insulation. NEAT may recommend installation of R-19 fiberglass insulation to areas of the band joist that are uninsulated and exposed to the outdoors.

Sill and floor insulation measures are considered mutually exclusive, i.e. NEAT will not recommend both measures—only the most cost-effective one.

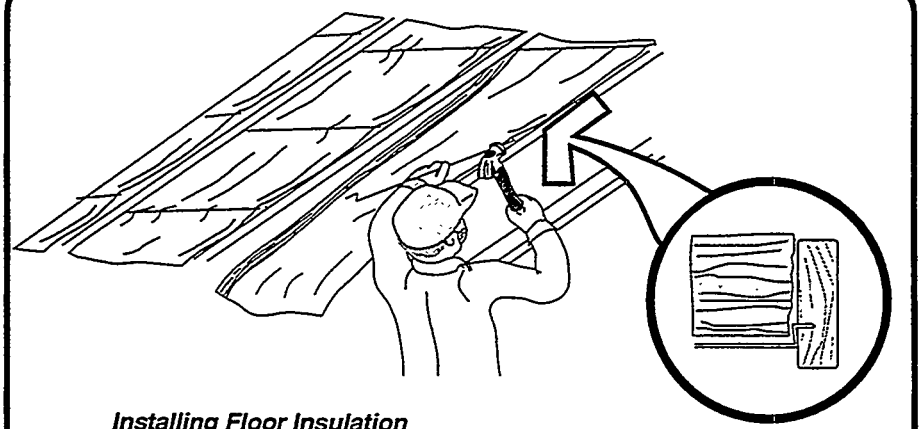


11.4 Floor Insulation

NEAT considers adding R-11, R-19, or R-30 fiberglass batt insulation to the floor between the living space and the foundation space. If the foundation space is unintentionally heated, you might consider reducing lost heat by insulating the water heater

and air ducts, or by sealing duct leaks, if conditions call for these low-cost measures.

You may enter the cost of duct repair, pipe insulation, and/or electric heat tape to protect pipes in the field provided on the Foundation Space data input screen if you want these costs to affect the SIR of installing floor insulation. (See Section 7.7, *Foundation Spaces*.)



Installing Floor Insulation

See Section 11.5, *Foundation Wall Insulation*, for information regarding selecting between the floor insulation and foundation wall insulation measures.

11.5 Foundation Wall Insulation

The foundation wall insulation measure assumes a uniform addition of insulation to both above- and below-grade foundation space walls. The R-value of insulation added is supplied in Key Parameters and the cost per square foot is set in the Material Costs section of Setup. No insulation will be added to foundation walls of a subspace having average height less than two feet.

The foundation wall insulation and the floor insulation measures are mutually exclusive, i.e., only one of the measures can be recommended for a given subspace. Which, if either, is determined by your choice of the Insulation Mode on the Foundation Spaces input form (see Section 7.7, *Foundation Spaces*). You may have NEAT consider only one of the two modes of insulating the space, both of them (recommending the most cost-effective), or neither. Note, however, just asking for consideration of only one of the two modes does not guarentee it will be recommended. It still must have an SIR above the minimum allowable.

11.6 Duct Insulation

Insulating uninsulated duct which exists in unconditioned (or unintentionally heated) spaces will most often be cost-effective. The duct insulation measure in NEAT examines heat lost from the furnace supply duct during winter as well as heat gained by the duct during summer (if central air conditioning is present). These heat exchanges are assumed to occur between the duct and either a foundation space or

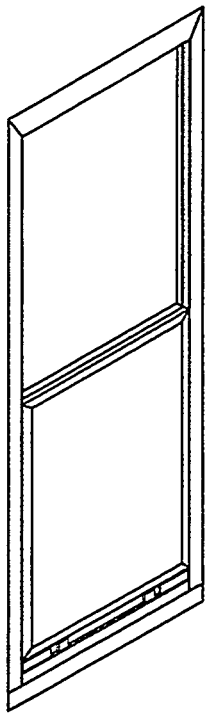
the attic, depending on your input for the location of uninsulated duct on the heating system form (see Section 7.7, *Foundation Spaces*).

11.7 Storm Windows

NEAT assumes excessive leakage through a window has already been discovered and repaired during the infiltration reduction phase of the audit. This may have involved installation of a storm window or of an entirely new window.

NEAT predicts that a storm window will add 0.59 R to a single-pane window. However, when the prime windows leak, storm windows—especially interior storms which tend to be tighter—may produce an additional benefit of reducing air leakage. The change in air leakage through the window system with and without a storm window is difficult to estimate and is not included in NEAT's savings-to-investment analysis.

The cost of storm windows varies widely due to quality, quantity purchased, shipping, and labor costs. In the building description input (see Section 7.3, *Windows*), the user is given the opportunity to enter the cost for an individual storm window—if a more accurate cost than that entered during "Setup" on the material cost screen can be given.

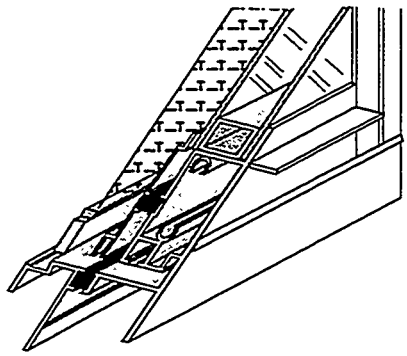


Storm Window

11.8 Low-E Window

NEAT considers double-pane windows with a metalized coating on one of the interior glass surfaces. These low-E windows save energy during the winter by reflecting heat rays originating in the house back indoors. During the summer, low-E windows reflect solar heat outdoors. Low-E windows also have a higher R-value than single- or standard double-pane windows.

Low-E Double-Pane Window

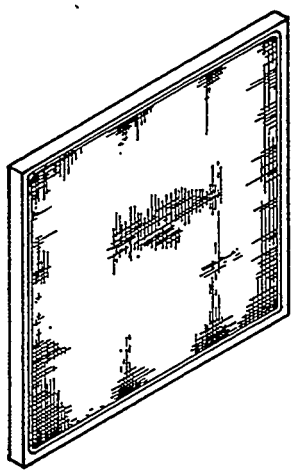


11.9 Window Shading

NEAT may suggest one of three types of window shading: 1- Awnings; 2- Sun screens; and 3- Window films.

Awnings are an effective conservation measure because they stop solar heat before it contacts the house. However, awnings are expensive, they require more planning, and they restrict views through windows more than other conservation measures.

There are two kinds of sun screens. NEAT assumes that fabric sun screens block about 66 percent of solar heat and that aluminum louvered sun screens block about 89 percent of solar heat. Fabric sun screens are cheaper and easier to assemble than louvered sun screens.



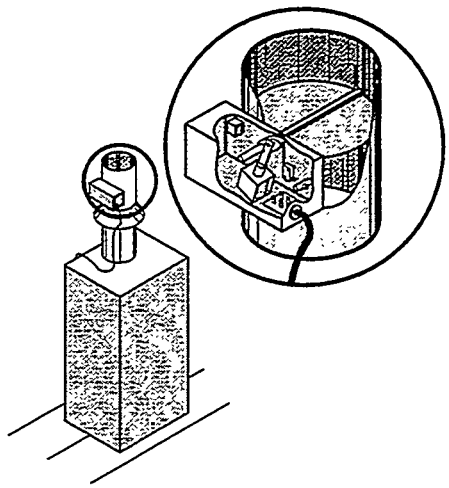
***Sun Screen** - Consists of a sun-blocking fabric stretched on an aluminum frame.*

NEAT assumes that window films block 74 percent of solar heat. The more reflective, hence more effective, films are highly metalized and appear mirror-like from outdoors. Special all-season metallized films, sometimes called low-E films, also reflect heat energy from inside the house during the heating season. These films are more cost-effective in all but the hottest, sunniest climates than films that merely reflect solar heat.

NEAT assumes that these window treatments, if installed, will cover the entire glazed portion of the window.

11.10 Vent Damper

A vent damper reduces heat loss from a heating system by closing the chimney when the burner is not operating. The vent damper prevents most of the residual heat from escaping the heat exchanger, allowing the pump or fan to deliver the leftover heat to the house instead of losing it up the chimney.



Electric Vent Damper

Electric vent dampers are recommended by NEAT for installation with central gas heating systems that currently have intermittent ignition devices (IID) or will have an IID installed during retrofit.

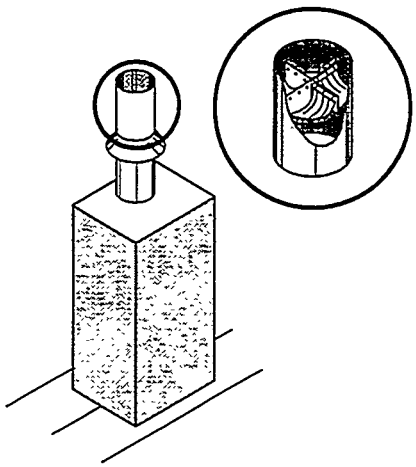
Electric vent dampers use a solenoid or a small electric motor. A solenoid is a magnetically-operated lever that opens the damper when the

burner fires and closes it when the burner goes off.

Vent dampers for use with oil systems or with gas systems with IIDs may have dampers that close almost completely.

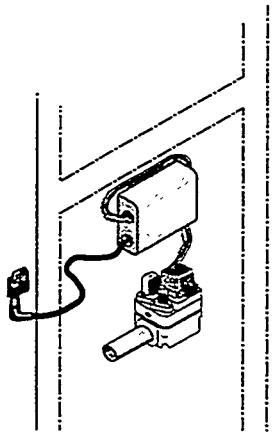
Electric vent dampers for gas systems with pilot lights do not close completely. To vent the pilot light, these dampers leave about 10 percent of the chimney's cross-sectional area open.

NEAT recommends thermal vent dampers for heaters with and without pilot lights. These dampers open a bimetallic damper when they sense heat. Thermal vent dampers close when the burner is off and the chimney cools. Thermal vent dampers may be dangerous in heaters with marginal draft and may not be permitted by some local codes.



Thermal Vent Damper

Some locations may have regulations barring installation of vent dampers. Should a damper fail in the closed position, serious health problems may be incurred by the occupants.



Intermittent Ignition Device

11.11 Intermittent Ignition Device

An intermittent ignition device (IID) saves energy by eliminating the need for a standing pilot light. The IID consists of a special gas valve, an electric igniter, and a pilot light that remains on only while the main burner is lit. NEAT assumes that an electric vent damper will be installed only with an IID, or that an IID will be present before an electric vent damper is recommended.

NEAT uses formulas to estimate savings for two possible conditions: 1- Pilot light on during the summer; 2- Pilot off during the summer.

Indicate on the heating screen (see Section 5.9, *Heating Systems*) which of these conditions exists. Rather than computing savings based on a percentage of annual consumption, NEAT links savings to the location's heating degree days. For most climates, this results in annual savings from 4 to 6 percent of gas consumed by the heater.

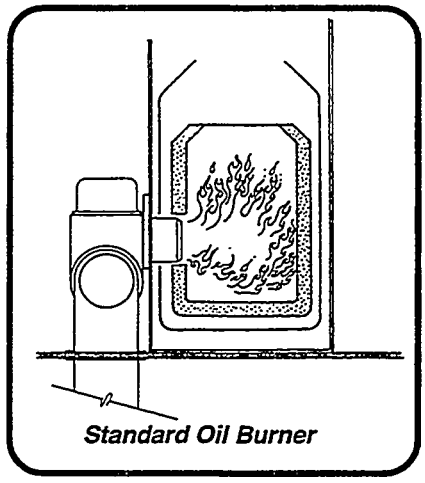
11.12 Furnace Tune-Up

Heating systems may function far below their potential efficiency or may be unsafe due to the following common problems:

- Dirt, soot, or other materials interfering with the burner flame;
- Dirt, soot, or corrosion on heat exchanger surfaces;
- Electric controls malfunctioning or out of adjustment;
- Air hotter than necessary to heat the house;
- Incomplete combustion;
- Faulty draft;
- Incorrect fuel input;
- Blockages or leaks in heating distribution system; or
- Faulty thermostatic setting, anticipator adjustment, or location.

Heating technicians performing tune-ups should have specific training on increasing the efficiency of heating systems. Technicians should have test equipment to measure efficiency, air temperature, carbon monoxide, draft, and all other parameters relevant to the seasonal efficiency of each heating system.

NEAT assumes a tune-up performed by a qualified technician will save from 0 to 14.5 percent of the fuel used for heating, depending on condition of the furnace and its fuel type.

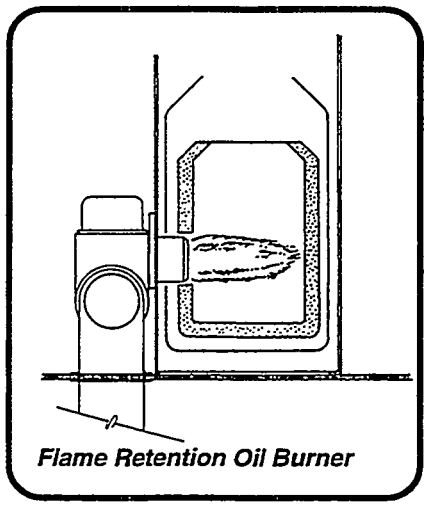


Standard Oil Burner

11.13 Flame Retention Head Oil Burner

A flame retention head oil burner (FRHOB) is a burner that provides higher combustion efficiency by mixing the mist of oil and air more vigorously than conventional burners. Furnaces and boilers with FRHOBs have steady-state efficiencies of 80 percent or more. Replacing an existing oil burner with a FRHOB is usually cost-effective if existing steady-state efficiency is less than 75 percent.

When a conventional oil burner is replaced with an FRHOB, the burner nozzle is usually reduced a size to account for the oversizing of the original burner, the higher efficiency of the FRHOB, and improvements to the envelope of the house. NEAT does not account for any additional savings that may result from this down-rating of capacity.



Flame Retention Oil Burner

The combustion chamber of the existing heating unit may be re-lined with a ceramic liner—installed like a plaster cast—when the burner is replaced. If installation of a flame retention burner in your state's program includes this procedure, the price of the FRHOB should include its cost.

11.14 Furnace/Boiler Replacement

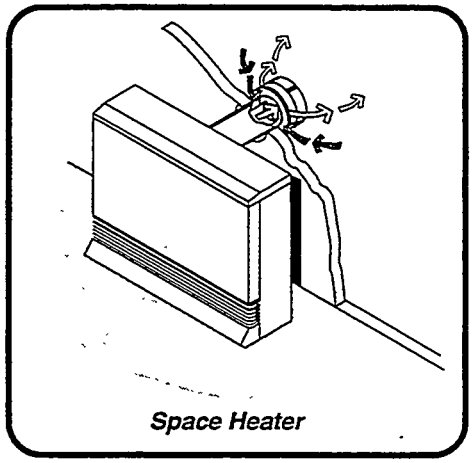
Replacing the heating system makes economic sense when the steady-state efficiency of the existing system is low and can't be significantly improved.

Low-efficiency heating units allow up to twice the amount of air needed for combustion to pass through the heat exchanger. This excess air takes heat with it up the chimney while the burner is both on and off. Mid-efficiency gas heaters allow the minimum air required for complete combustion. They also close the chimney when the burner is off. The naturally-drafting chimney and draft diverter are eliminated in favor of a fan that draws combustion air in and propels combustion products out of the heater. Mid-efficiency gas heaters use an intermittent ignition device that eliminates the standing pilot, which uses 4 to 6 percent of the energy consumed by a conventional unit. With these improvements, mid-efficiency gas heaters achieve seasonal efficiencies of 80 percent or more.

Mid-efficiency oil heaters use a flame retention head oil burner. They also eliminate the natural draft chimney and the barometric draft control by using an induced draft fan and a smaller flue pipe. These improved oil heaters achieve seasonal efficiencies of around 85 percent.

The most efficient gas heaters cause water vapor formed in the combustion process to condense into liquid water. These condensing heaters reclaim the heat in the water vapor and achieve seasonal efficiencies of more than 90 percent. These heaters liberate latent heat using a corrosion-resistant heat exchanger that is not damaged by corrosive water condensing out of combustion gases.

NEAT provides for two separate furnace replacement measures: 1- An improved-efficiency heating unit (80+ percent); or 2- A high-efficiency unit for gas heating units only (90+ percent). To enter heating unit efficiencies, see Chapter 10, *Customizing a NEAT Audit.*

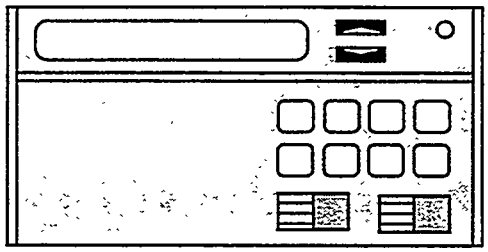


Space Heater

11.15 Space Heater

If the original system is a very inefficient gas, propane, or oil space heater, NEAT may suggest replacing the existing space heater with a new higher-efficiency space heater of the same fuel type. Space heaters fueled by

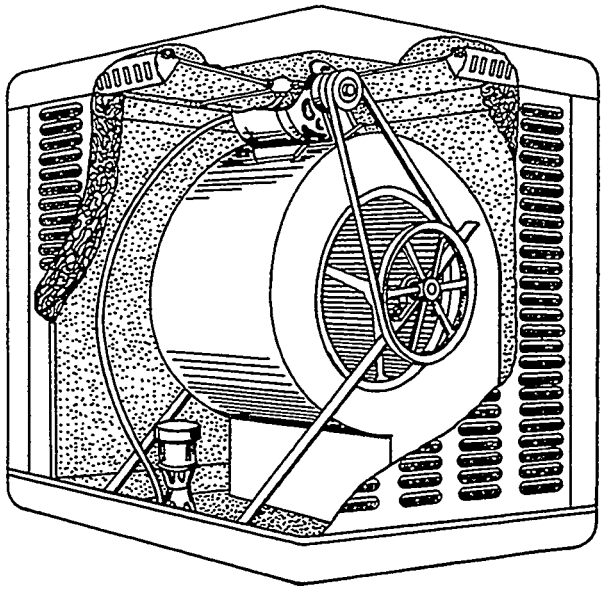
electricity, wood, or coal are not considered by NEAT. Because the efficiencies of replacement space heaters vary greatly, the user is given the opportunity to input replacement efficiency on the space heater input screen or to accept NEAT's default values.



Automatic Setback Thermostat

11.16 Setback Thermostat

Automatic setback thermostats are cost-effective for people who have regular schedules. Automatic thermostats are effective energy savers in all climates. If the house has central cooling, be sure to install a combination heating/cooling automatic thermostat. Define the number of degrees Fahrenheit of nightly setback when you set the key parameters (see Chapter 10, *Customizing a NEAT Audit*).



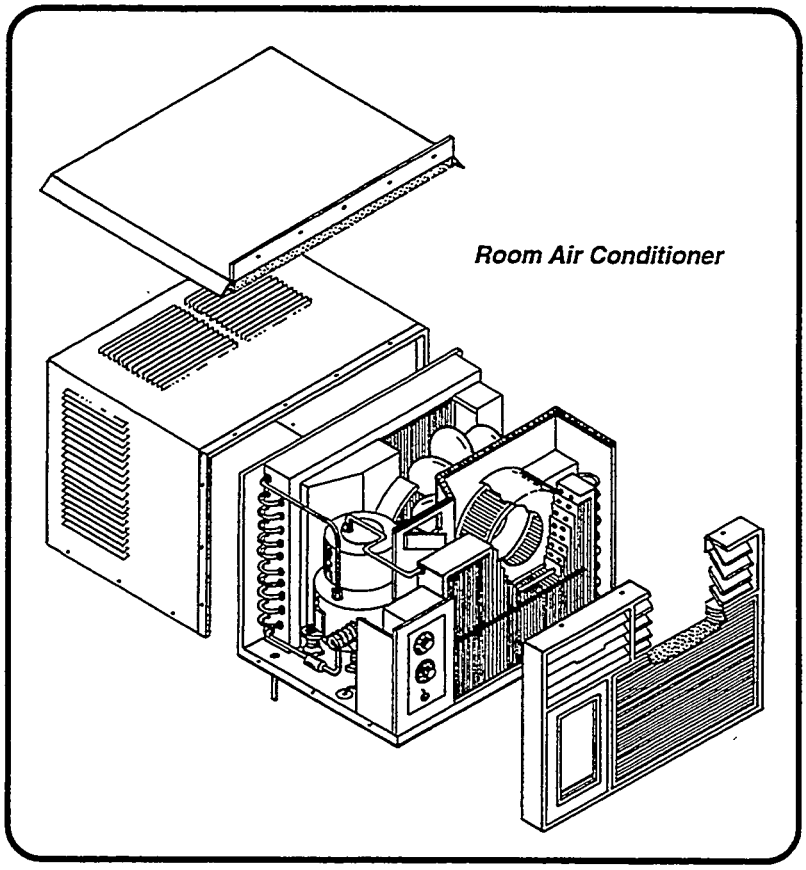
Evaporative Cooler

11.17 Evaporative Cooler

In the warm, dry climates of the western United States, evaporative coolers (also called swamp coolers) are a popular and energy-efficient cooling device. The lower the summertime relative humidity, the more the evaporative cooler will drop the indoor temperature. Evaporative coolers use one-quarter to one-sixth of the energy of air conditioners and they cost about one-half as much to install. Unlike central air conditioners, evaporative coolers provide a steady stream of fresh, humid air to the house.

Because NEAT will recommend evaporative coolers in many climates due to their low cost and high efficiency, it is important to determine whether this measure is suitable for your own location. Be sure to turn it off permanently in the Setup section (see Chapter 10, *Customizing a NEAT Audit*) if it is not to be considered, since its high cost-

effectiveness will usually place this measure at the top of the recommended measures list, making other cooling measures less cost-effective.


Room Air Conditioner

11.18 Air Conditioner Replacement

Air conditioners move heat from indoors to outdoors with a cooling coil (the evaporator), a heating coil (the condenser), and a compressor, which moves a heat-transfer fluid (the refrigerant) between the two coils.

The federal government requires all air conditioners to carry a yellow energy label listing its annual cost of operation and a measure if its efficiency, EER for room air conditioners and SEER for central systems. A room air conditioner with an EER of 12 will use half s much electricity for cooling as one with an EER of 6.

All room air conditioners manufactured after January 1, 1990 must have an EER of at least 8 or 9 depending on size, but the most efficient units have an EER of around 12. However, you can still buy room air conditioners with EERs as low as 5.3. Central air conditioners manufactured after this date must have an SEER of about 10 or greater, varying slightly by the type of unit.

NEAT will consider replacement by either a room or central air conditioning system, depending on the type of the existing system.

Enter the cost of replacing individual air conditioners having each of the three capacities listed for both room and central systems in the Material Cost section of the Setup. For room air conditioners, NEAT will interpolate to arrive at a cost of replacing the size of unit specified in the building description. For central systems, the program will use the capacity of the nearest _ ton increment from 1_ to 4_ tons, using interpolation or extrapolation of costs for those three standard sizes not specifically listed.

Since NEAT accepts only Seasonal Energy Efficiency Ratio (SEER) values, you may need to convert EER to SEER values. (See Section 7.9, *Air Conditioners*, for converting EER to SEER.) Replacement SEERs may be altered in the Key Parameters of the Setup Menu (see Chapter 10, *Customizing a NEAT Audit*).

11.19 Heatpump Replacement

Heat pumps operate like air conditioners except that the heating and cooling coils can switch functions to supply heat as well as cooling.

Federal government regulations require all heat pumps manufactured after January 1, 1990 to have minimum SEERs of between 9.7 and 10 and heating seasonal performance factors (HSPF) of between 6.6 and 6.8, depending on type.

The heat pump replacement measure will only be evaluated if you have designated an A/C component as Type "Heatpump" and the Primary Heating System is also of type "Heatpump". No more than one cooling system should be designated as a "Heatpump" whenever the measure is to be evaluated.

The efficiencies of the replacement system are set by the user in Key Parameters of Setup. The material costs are determined from the user-supplied costs for three sizes of heatpumps supplied in the Material Cost screens of Setup, in a manner analogous to the central air-conditioning measure described above. The Material List will display the Size (KBtu) from the Air Conditioners screen for the size of the system to be installed as the replacement system, not the tonnage.

Due to the relatively high cost of replacing a heat pump, this measure is not commonly recommended.

11.20 Air Conditioning Tune-up

Significant efficiency increases for an air-conditioner may be possible through proper maintenance and periodic tune-ups. The following steps are suggested in performing the tune-up of an existing air conditioner:

- Replace or clean existing air filters,
- Check and clean condensate trough and drain;
- Clean evaporator (indoor) and condenser (outside) coils,
- Straighten bent or flattened coil fins if necessary,
- Insure unobstructed air flow to the condenser coil,
- Check for proper refrigerant charge,
- Remove dust and dirt from fan blades,
- Examine and oil motor and fan bearings,
- Inspect and/or tighten electrical connections and contacts,
- Check for blockages or leaks in the supply and return ducts.

Properly trained HVAC technicians should perform the tune-up insuring the use of proper equipment, especially in checking the refrigerant charge and the electrical wiring, and straightening the coil fins.

NEAT assumes that a thorough air conditioner tune-up will increase the system's SEER from 0 to 36 percent, depending on its existing condition.

11.21 Lighting

Replacing existing incandescent interior lighting with compact fluorescent lights is a relatively straight forward way to reduce the electric consumption of a home. The development of the compact fluorescent bulb has made this retrofit an extremely simple one to accomplish because most compact fluorescent lights are fitted with screw-in bases identical to the incandescent bulbs which allow a quick and easy one-for-one replacement. Compact fluorescent lights should be chosen carefully because physical size and weight can prevent some bulbs from being used in certain fixtures. There is a variety of bulbs available making it possible to find a compact fluorescent replacement for just about any fixture type that currently exists.

One of the main advantages of the compact fluorescent is its extended life, approximately 10,000 hours versus a normal incandescent's life of approximately 750 to 1000 hours. This equates to approximately thirteen incandescents to equal the same life as one compact fluorescent. The considerably longer life of compact fluorescent bulbs coupled with their energy savings helps to offset the substantially higher initial cost of the compact fluorescent versus the normal incandescent bulb.

NEAT computes the savings of using the lower wattage compact fluorescent bulb to replace an existing incandescent bulb. The watt reduction is determined from the user's input of existing and replacement bulb consumption, though default values for replacement wattage give the standard replacement for the existing bulb.

Neat also accounts for the longer life of the fluorescent bulb over that of the incandescent.

You must enter the cost for various wattage compact fluoresent bulbs in the Material Cost section of Setup.

NOTES:

Appendix A

Computers store information on two different types of disks. "Hard" disks have large storage capacities and are located inside the computer. "Floppy"disks are 3.5 or 5.25 inches square and have a much smaller storage capacity than hard disks. Floppies are used to store information you don't use every day or to transport information between computers.

Disk drives are the mechanical devices that read the disks. Disk drives have names - the first floppy disk drive is A; the second floppy disk drive (if you have one) is B; and the hard disk drive is C. To tell the computer which disk drive to use, type the letter of the drive, followed by a colon (:), and press **[Enter]**. For example, type **A:** **[Enter]** to access the "A" drive.

Information is stored in separate files, each containing material the computer operator has found to be related. Each file has a name, normally assigned by the operator or computer program developer. Filenames consist of an eight-or-fewer-character name followed by a period, then an optional three-character "extension." For example, the file **wx.inp**, which contains NEAT's weather information, has the name **wx** with the extension **inp**.

Filenames may not contain the following characters: +, =, /, \, |, *, <, >, ", ?, :, ;, ,(comma), .(except in the space preceding the extension), and spaces. See your DOS manual for more details.

Several files are of particular interest to the NEAT user. The (**<BI>.bld**) file, contains building descriptions entered by the user. (**<BI>** stands for the building identifier you supply during data entry.) The (**<BI>.rep**) file, contains recommended energy conservation measures and associated materials list. The (**<BI>.dat**) file contains the results of any billing data comparisons you may have requested and a detailed listing of the sizing calculations, giving each component's contribution to the total peak output required. Using commands described below, the information in these files can be reviewed by the user.

Files with the extension "par", contain the settings you input during Setup.

Disk Operating System

Disk Operating System (DOS) is the set of computer instructions that runs the computer and allows you to perform tasks related to NEAT. DOS allows you to create, copy, and delete files, or to make and remove directories.

Appendix A - Notes on DOS

DOS commands are executed before or after the NEAT program. Type a DOS command at the DOS prompt. The DOS prompt looks like this: C:\> (the short flashing line or rectangle at the end of the prompt is the cursor). As you type commands, whatever key you press on the keyboard appears at the cursor and the cursor moves to the next space.

Directories and Sub-Directories

Much as a file folder organizes papers related to a common topic, files on a computer are grouped into named collections called directories or sub-directories. When you installed NEAT, you were asked to select a location to which the program's files would be copied. This location, or "path," included the name of the drive (C:) and the name of a "subdirectory." In the example, the subdirectory "WA" was chosen, representing the "Weatherization Assistant."

You may create additional directories or sub-directories, as you need them, by typing MD ("make directory"). Then, type the new name and press [Enter]. For example, if you want to create a sub-directory called "JANE,"

- Type MD JANE
- Press [Enter]

Sub-directories may be "cascaded." That is, if you are in one sub-directory, you may create another sub-directory which further subdivides the one you are in.

You can also remove subdirectories. You can remove the sub-directory JANE by typing RD JANE ("remove directory"). You must delete all the named files from a directory or a sub-directory before removing the directory itself.

The CD ("change directory") command allows you to access the files in a given directory. In order to access files in sub-directory "JANE" (which happens to subdivide the directory you are currently accessing), type CD JANE. A backslash ("\") denotes the root directory, or the directory under which all other sub-directories must lie. It is the directory you will be accessing when you first turn on your computer.

The DIR ("directory") command displays a list of files in the directory currently accessed. If the list is too long to fit on one screen, typing DIR/P will cause the listing to pause when the screen is full, until another key is pressed. Thus, to view the contents of the WA sub-directory (created when you installed NEAT onto your hard disk drive):

- Type CD\WA
- Press [Enter]
- Type DIR/P
- Press [Enter]

The screen will display a list of WA's files and/or sub-directories.

The asterisk "*" is called the "wildcard" character because it represents any combination of characters, except the period between the file's name and extension. You can use this character to ask the computer to list only certain files. Thus, if you are interested in listing only the building description files (files with the "bld" extension), type **DIR *.bld**. This gives you a way of determining which building identifiers you have already used with NEAT.

Copying Files

You'll need to know other DOS commands to stay well-organized. If you use a hard disk, you won't want to store the results of every NEAT audit there forever, since that would exhaust valuable disk space. Instead, you may wish to copy older files to floppy disks and then delete them from the hard disk.

To access the file to be copied, use **C:**, **A:**, or **B:** and **CD** followed by the name of the sub-directory where the file is located. Then, type **COPY**, followed by the file to be copied and the location where you want the copy placed.

For example:

- Type **C:**
- Type **CD\WA**
- Type **COPY SMITH.REP A:**

This will instruct the computer to copy the SMITH.REP file (located in the WA sub-directory of the C disk drive) to a floppy disk you have inserted in the A drive. (If you were already accessing the WA sub-directory of the C drive, the first two commands would not be necessary.)

You can rename a file while copying it by adding a new filename to the end of the COPY statement. For example, to copy the SMITH.REP file to the A drive and rename the copy SMITH2.REP:

- Type **COPY SMITH.REP A:SMITH2.REP**
- Press **[Enter]**

In the COPY command, the character "*" is called the "wildcard" because it represents any combination of characters, except the period between the file's name and extension. Thus, to copy all files from the currently-accessed sub-directory to the A drive:

- Type **COPY *.* A:**
- Press **[Enter]**

If you created a sub-directory called AUDSTOR (short for "audit storage") on your floppy disk in the A drive and wanted to copy all NEAT building description files to it, access the drive and sub-directory where the original building description files are located:

- Type COPY *.BLD A:\AUDSTOR
- Press [Enter]

View Files

If you wish to view the contents of a file and not make any revisions:

- Type **TYPE (filename).BLD**
- Press **[Enter]**

For example, to view the JANE.REP report file containing the recommended measures list for the JANE building identifier:

- Type **TYPE JANE.REP | MORE**
- Press **[Enter]**

The "| MORE" switch tells the computer to display only one screen at a time.

If you wish to print a NEAT audit report:

- Type **PRINT (filename).REP**
- Press **[Enter]**

For the above example, the following command will print the contents of the JANE.BLD file: **PRINT JANE.BLD**

After entering this command, the following statement may appear on your screen:

"Name of list device [PRN]:"

If this statement appears, simply press **[Enter]** to initiate printing.

Deleting files

After you have copied the files onto one or more floppy disks, you will want to delete the files from your hard disk. Deleting is easy. Let's say there are several files in the sub-directory named BOB on the hard disk that you want to delete. If the DOS prompt doesn't say C:\> :

- Type **C:**
- Press **[Enter]**
- Type **CD\BOB**
- Press **[Enter]**
- Type **DIR** (to see a list of the files in the BOB sub-directory).
- Type **DEL** (and the file name you wish to delete).
- Press **[Enter]**

Repeat the process for each file you want to delete. Or, use the wildcard character to delete multiple files with a single command. Be careful not to delete files you really want to keep.

Inexperienced computer users should consider experimenting with these commands before performing operations on their permanent files, especially deleting files. Experience can be a valuable resource in understanding the application of DOS commands.

NOTES:

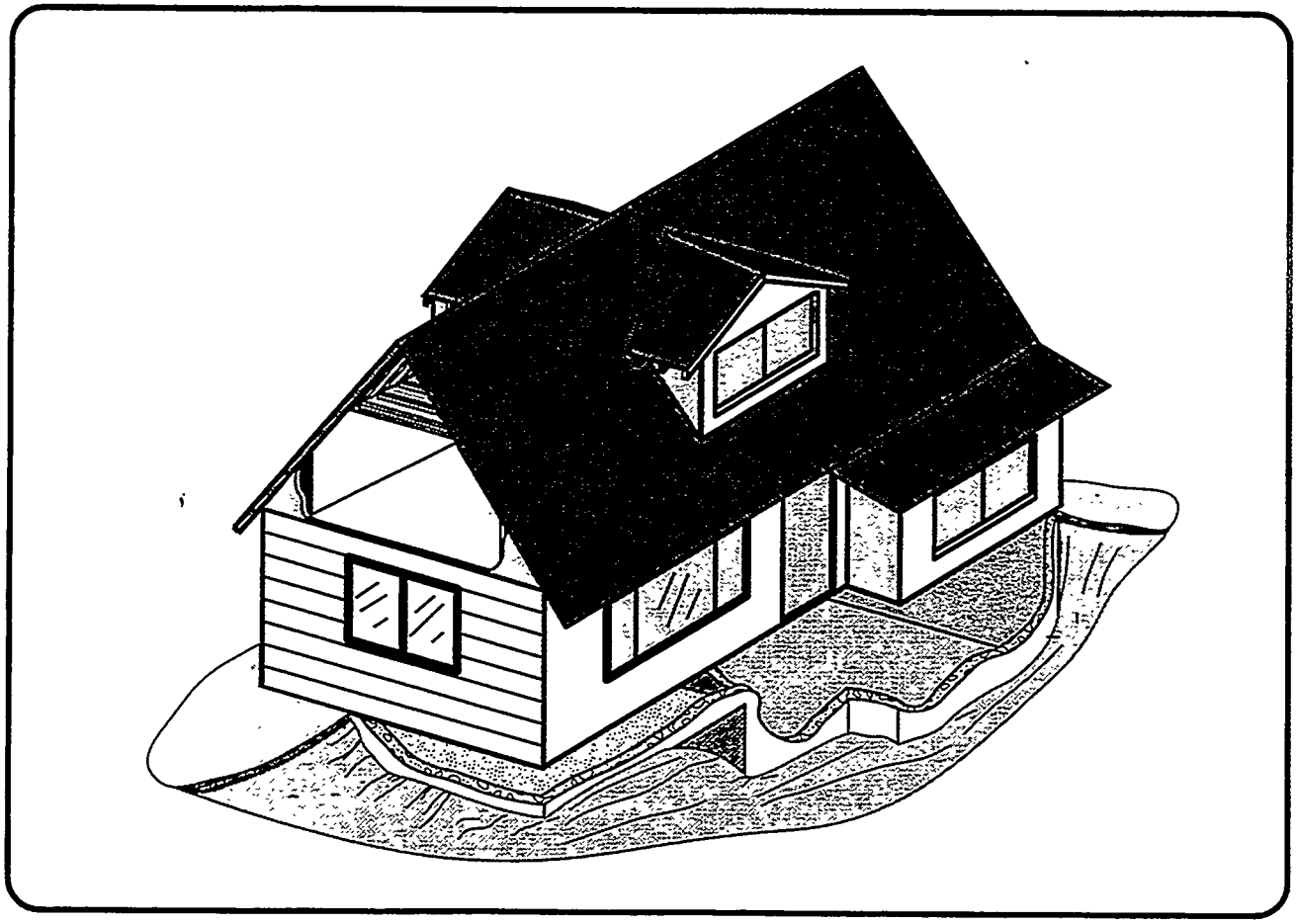
Appendix B

Example House

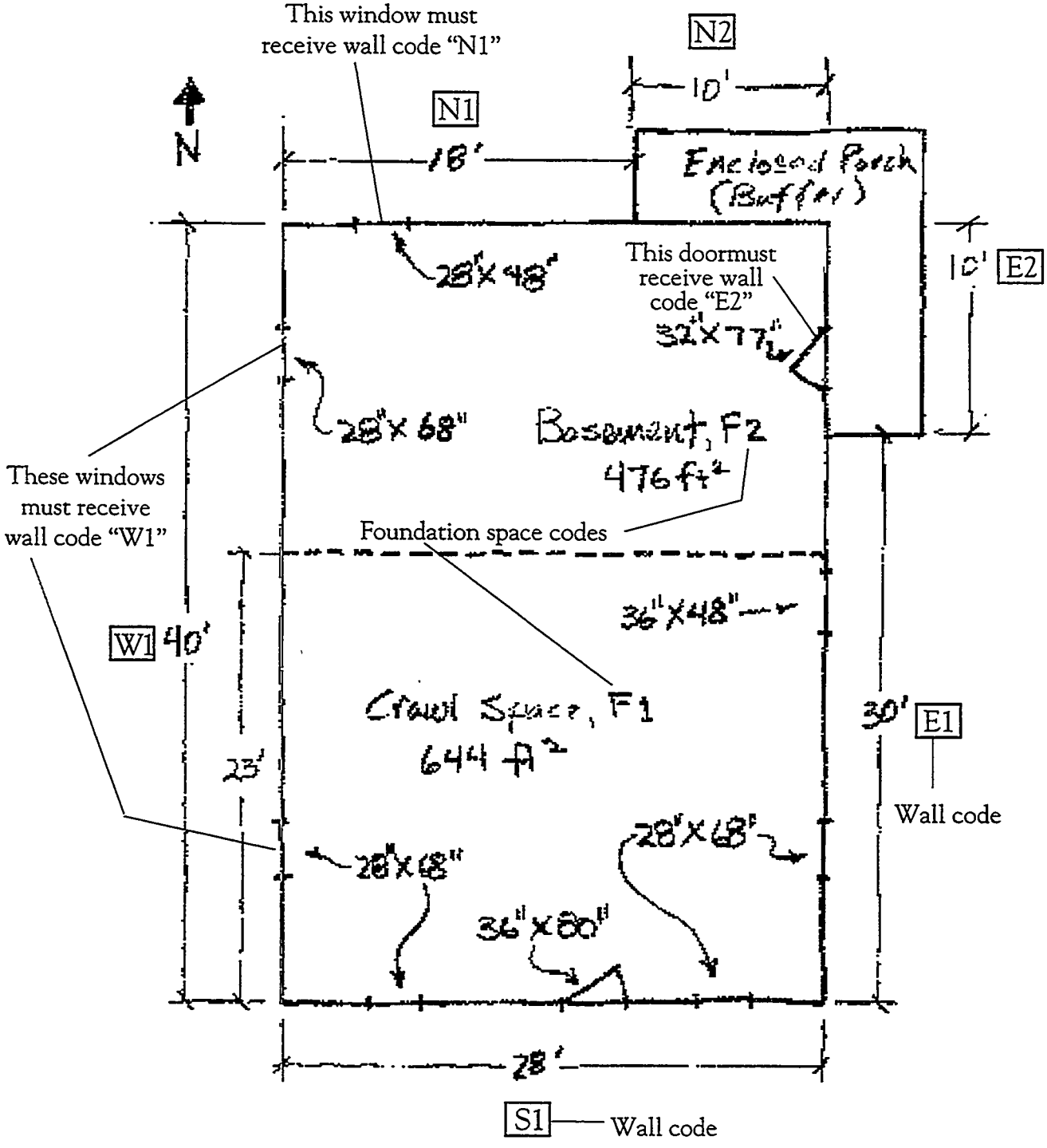
Shown below is a drawing of the Morris residence, located in St. Louis, Missouri. The finished attic and foundation spaces are shown as cutaway sections.

Succeeding pages feature working sketches and completed input screens for a NEAT audit of this house. For conciseness, the text version input screens have been used in this example. Entries into the GUI version forms can be obtained using the keys below each screen. Notice how the sketches show the codes for the doors, walls, and windows as they need to be entered into NEAT.

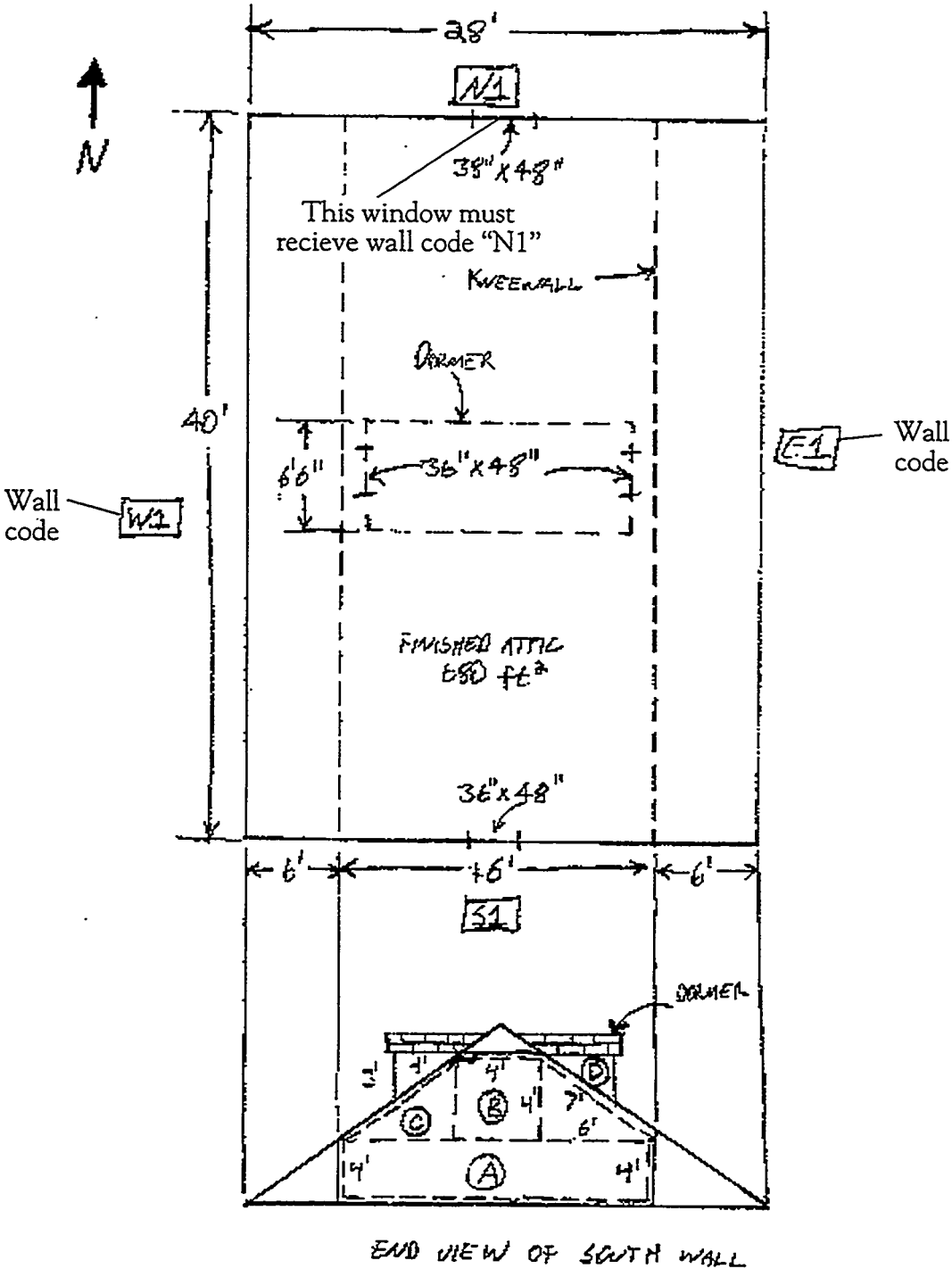
The sketches and screens appear in the order of a typical audit. Please note the Morris house does not require all NEAT screens (it has no space heaters, for example). For a complete set of screens, refer to Appendix C, *NEAT Input Forms*.



1st Floor and Basement Plan
Morris Residence



Finished Attic Plan
Morris Residence



Appendix B - Audit Example

Area Calculations for Exposed and Buffered Walls
(refer to sketches)

E1: 1st FLOOR - $8' \times 30' = 240$
(DORMER) 2nd FLOOR - $3' \times 6'6" = 20$
} 260 ft²

E2: 1st FLOOR - $8' \times 10' =$ 80 ft² (BUFFERED)

W1: 1st FLOOR - $8' \times 40' = 320$
(DORMER) 2nd FLOOR - $3' \times 6'6" = 20$
} 340 ft²

W2: 1st FLOOR - $8' \times 10' =$ 80 ft² (BUFFERED)

Like dormer exterior walls, the end walls of finished attics must also be added to exposed wall areas. To simplify area calculations, the exposed end wall of any finished attic can be divided into rectangles and right triangles like the A, B, and C areas shown by dashed lines in the end view of the south wall, 2nd floor. The individual areas can then be summed (as for S1 below) to get the total exposed wall area (remember, the area of a right triangle is width x height ÷ two).

S1: 1ST FLOOR - $8' \times 28' = 224$

2nd FLOOR - AREA (A) + B + 2 x (C)
$(4' \times 16') + (4' \times 4') + 2 \times \left(\frac{4' \times 6'}{2}\right) = 104$

DORMER - $2 \times (D) = 2 \times \left(\frac{3' \times 4'}{2}\right) = 12$

340 ft²

W1: 1ST FLOOR - $8' \times 18' = 144$

2nd FLOOR - SAME AS FOR S1 2nd FLOOR $= 104$

DORMER - SAME AS FOR S1 DORMER $= 12$

260 ft²

Area Calculations for Finished Attic Components
(refer to 2nd floor sketches and sketch on page 25)

OUTER CEILING JOIST $2 \times (6' \times 40') = 480\ ft^2$

COLLAR BEAM $4' \times 40' = 160\ ft^2$
(DORMER CEILING NOT ADDED)

KNEE WALL $2 \times (4' \times 40') = 320\ ft^2$

ROOF RAFTER $2 \times (7' \times 40') = 560\ ft^2$
(RAFTER AREA REPLACED BY
DORMER NOT SUBTRACTED OUT)

Dormer Shortcut:

When the building was constructed, the builder had to remove some roof rafter area to install a dormer (refer to picture of house). This means that, to make exact calculations, some roof rafter area at a dormer needs to be subtracted from the gross (7' x 40') roof rafter area. Also, because addition of the dormer adds more collar beam area (the dormer ceiling), dormer ceiling areas need to be added to the gross (4' x 40') collar beam area. Doing this can be complex and laborious. This can be avoided because the removed roof rafter area at the dormer and the dormer ceiling are similar in size and energy loss characteristics (close enough when the whole house is considered). The auditor may assume the areas are equal and need not perform the subtraction or addition. Making this assumption, as done in this example (see collar beam and roof rafter area calculations above), provides close approximation and saves the auditor considerable effort.

Appendix B - Audit Example

General House Data

House Descriptor: Morris_____

Auditor: N. Watts_____

Date of Audit: 6-13-93_____

Number of Conditioned Stories 2__
Living Space Floor Area (Sqft) 1800__
Average Number of Occupants 2__

Pre-Retrofit Air Leakage Rate from Blower Door (CFM) 2900_ (Optional)
Pre-Retrofit Blower Door Pressure Differential (Pa) 50__ (Optional)

Post-Retrofit Air Leakage Rate from Blower Door (CFM) 1700_
Post-Retrofit Blower Door Pressure Differential (Pa) 50__

Cost of Air Leakage Rate Reduction ($) 310___ (Optional)

Exterior Walls

Wall Code	Wall Dir	Wall Exp	Ext Type	Wall Type	Wall Area (sqft)	Exst Ins		Add Ins		Comments	Meas No
						Type	R	Type	Added Cost		
S1	S	E	1	2	340	0		1		1st, 2nd, & Dormer	1
W1	W	E	1	2	340	0		1			1
N2	N	B	1	2	80	0		1		Buffered 1st	2
N1	N	E	1	2	260	0		1		1st, 2nd, & Dormer	1
E1	E	E	1	2	260	0		1			1
E2	E	B	1	2	80	0		1		Buffered 1st	2

Windows

	Windows				Retrofit Storm Windows				
Wall Code	No Wndws	Frame Type	Glazg Type	Shaded (%)	Width (in)	Hgth (in)	Cost ($)	Comments	Wndw Code
N1	1	1	1	20	28	48			WD1
N1	1	1	1	20	36	48			WD2
W1	2	1	1	20	28	68			WD3
W1	1	1	1	20	36	48			WD4
E1	2	1	1	20	36	48			WD5
E1	1	1	1	20	28	68			WD6
S1	2	1	1	20	28	68			WD7
S1	1	1	1	20	36	48			WD8

Doors

	Door			Storm Door				
Wall Code	No Drs	Door Type	Area (sqft)	Cond	Width (in)	Hgth (in)	Comments	Door Code
E1	1	2	20	1	32	77		DR1
S1	1	2	20	1	36	80		DR2

Appendix B - Audit Example

Unfinished Attic Areas

Attic Code	Type	Joist Space (in)	Floor Area (sqft)	Exst Ins Type	Exst Ins Dpth (in)	Add Ins Type	Add Ins Max Dpth (in)	Addtnl Instln Cost	Comments	Meas No

Finished Attic Areas

	Type	Area (sqft)	Exst Ins Type	Exst Ins Dpth (in)	Add Ins Type	Add Ins Max Dpth (in)	Addtnl Instln Cost	Comments	Meas No
Outer Ceil Joist	2	480	2	9.5	1	14	0.0		1
Collar Beam	1	160	2	9.5	1	12	0.0		1
Kneewall	XXXX	320	0		-		0.0		-
Roof Rafter	XXXX	560	0		1	3.5	0.0		2

Foundation Spaces

Fndn Code	Type	Floor Area (sqft)	Floor Ins R	Perimeter Lngt (ft)	Perimeter % Exps	Wall Hgth (ft)	Wall % Exps	Wall Ins R	Insulation Mode	Insulation Added Cost	Comments	Meas No
F1	N	644	0.0	74	100.	4	50	0	1			1
F2	C	476	0.0	62	50	8	20	0	1			2

Lighting

	Existing Incandescent Lamps					CF Lamps			
Room	Location	Type	Watts	Qty	Hrs/D Used	Watts	Added Cost	Comments	Lamp Code
kitchen	C	S	60	4	6	13			LT1
dining	C	S	60	5	2	13			LT2
living	T	S	150	3	5	38			LT3
bdrooms	T	S	100	6	6	26			LT4

Air Conditioners
Central/Window

Unit Code	Unit Type	Size (kBtu)	Area Cooled (sqft)	SEER	Year Bght	Manufacturer	Model	Comments
A1	2	14	400	6		Trane	AC3040	

Heating Systems

Primary system:
- Type: 1
- HSPF: (Heatpump heating seasonal performance)
- Fuel type: 1
- Location: 1
- % Heat supplied: 100

Secondary system:
- Fuel type:
- System efficiency (%):

"Smart" thermostat (Y/N): N

Uninsulated duct length in unconditioned space (ft): 120

Average perimeter of duct in unconditioned space (in): 48

Location of uninsulated duct: S

Comments: _____

Primary Furnace-Boiler, Gas/Propane Fueled

Manufacturer Pacific_____ Model PG1234_____

Input Rating (kBtu/h) _____ Output Capacity (kBtu/h) 70_____

Steady State Efficiency (%) 75_

Pilot Light: Present _Y_ (Y/N) On in summer _N_ (Y/N)

IID Present _N_ (Y/N) Power burner present _N_ (Y/N)

Vent Damper: Present _N_ (Y/N) Recommended _N_ (Y/N) Diameter (in) ____

General Condition: _1_ Tuneup/Replacement Status _1_

Estimated Replacement Costs: Labor 900____ Equipment 900____

Comments _____

_____

Itemized Additional Costs and User-Defined Measures

Item Description or User-defined Measure Name	Cost ($)	Incl in SIR	Materials Required	Annual Savings (MBtu)	Fuel Saved	Life-Time (Yrs)
Window replaced	70	Y	24x48 in DH Window			
Door repaired	20	Y				
Flue moved	30	N				
Insulate DHW Htr	40	Y	Water Htr Wrap	2.5	3	10

NEAT - Version 6.1 Oct, 1997 Executed: Tue Nov 04 16:50:58 1997

House Description: Morris
Building Identifier: SAMPLE Climate: ST. LOUIS, MO
Auditor: N. Watts Audit Date: 6-13-93

Recommended Measure	Component	Annual Savings Heating (MBtu)	Heating ($)	Cooling/Elect. (kWh)	Cooling/Elect. ($)	Total (MBtu)
Infiltration Redctn		11.1	58	69	6	11.3
Insulate DHW Htr		0.0	0	0	0	2.5
Wall Ins. R-11 Batt	KNW	15.3	80	79	7	15.5
Fill Ceiling Cavity	RRT	23.5	124	122	10	23.9
Smart Thermostat		6.2	32	0	0	6.2
Sillbox Ins.	F2	0.9	5	-0	-0	0.9
Lighting Retrofits	LT1 ,LT2 ,LT3 ,LT4	0.0	0	2169	185	7.4
Wall Insulation	S1,W1,N1,E1	20.2	106	100	9	20.5
Floor Ins. R-19	F1	10.2	54	-18	-2	10.2
Wall Insulation	N2,E2	2.2	11	-4	-0	2.1

Recommended Measure	Component	Measure Savings ($/yr)	Measure Cost ($)	Measure SIR	Cumulative Cost ($)	Cumulative SIR
Window replaced			70	-	70	-
Door repaired			20	-	90	-
Infiltration Redctn		64	310	1.7	400	1.3
Insulate DHW Htr		63	40	12.8	440	2.3
Wall Ins. R-11 Batt	KNW	87	93	12.4	533	4.1
Fill Ceiling Cavity	RRT	134	151	11.8	683	5.8
Smart Thermostat		32	65	5.4	748	5.8
Sillbox Ins.	F2	5	10	5.2	758	5.8
Lighting Retrofits	LT1 ,LT2 ,LT3 ,LT4	185	279	3.2	1037	5.1
Wall Insulation	S1,W1,N1,E1	115	623	2.4	1661	4.1
Floor Ins. R-19	F1	52	335	2.1	1996	3.7
Wall Insulation	N2,E2	11	94	1.5	2090	3.6
Flue moved			30	-	2120	-

Material List

Material Name	Type	Quantity	
Wall Insulation	Blwn Cellulose	1217	Sqft
Kneewall Ins.	Faced Batt - R-11	320	Sqft
Sill Insulation	Faced Batt - R-19	21	Sqft
Floor Insulation	Faced Batt - R-19	644	Sqft
Smart Thermostat		1	Each
Compact Fluorescent	13 Watt	9	Each
Compact Fluorescent	26 Watt	6	Each
Compact Fluorescent	38 Watt	3	Each
Ceiling Insulation	Celluls,Blwn - 3.5 in.	560	Sqft
24x48 in DH Window			
Water Htr Wrap			

Appendix B - Audit Example

	Pre-retofit Heating	Pre-retofit Cooling	Post-retrofit Heating	Post-retrofit Cooling
Annual load (MBtu/yr)	89	7	33	5
Annual Energy (MBtu/yr)	125	4	47	3
Heat loss (kBtu/hr)	79		35	
Output required (kBtu/hr)	94		41	

Design building heat loss and output required intended only as guides to sizing equipment. See NEAT User's Manual for further details.
NOTE: Read cautions in NEAT User's Manual related to sizing results.

User Comments

S1	1st, 2nd, & Dormer
N2	Buffered 1st
N1	1st, 2nd, & Dormer
E2	Buffered 1st

Pre-Retrofit Heating Bill Data Entry Sc Default Value 19

Enter date meter read (month/day) and number of days in first period.		Enter the corresponding fuel consumption for each period. (therms)	Enter the number of HDD's in each period. (Optional)
/ 1/31/	31	185	1044
/ 2/28/		180	937
/ 3/31/		140	680
/ 4/30/		105	272
/ 5/31/		90	103
/ 6/30/		40	9
/ 7/31/		20	0
/ 8/31/		20	0
/ 9/30/		40	34
/10/31/		115	223
/11/30/		130	599
/12/31/		190	941

Enter the base temperature for the HDD values entered 65.__
Enter base load (therms/month): 19.0__
Accept default/displayed values in customary manner. Home key returns to input.
The default value is a base load in therms/month estimated from billing data.
The value in the input field has been entered previously during this session.

HEATING ENERGY CONSUMPTION COMPARISON

Period End Date	Days in Period	Consumption (Therms) Actual	Consumption (Therms) Predicted	Degree Days (Base 65 F) Actual	Degree Days (Base 65 F) Predicted
1/31	31	165	336	1044	1117
2/28	28	162	266	937	920
3/31	31	120	200	680	732
4/30	30	86	65	272	334
5/31	31	70	15	103	120
6/30	30	21	1	9	24
7/31	31	0	0	0	4
8/31	31	0	1	0	16
9/30	30	21	11	34	80
10/31	31	95	52	223	282
11/30	30	111	164	599	629
12/31	31	170	285	941	970
Total	365	1024	1397	4842	5227
% Difference			36%		8%

Press any key to continue

Pre-Retrofit Cooling Bill Data Entry Sc Default Value 120

Enter date meter read (month/day) and number of days in first period.		Enter the corresponding fuel consumption for each period. (therms)	Enter the number of CDD's in each period. (Optional)
/ 4/30/	30	120	16
/ 5/31/		147	128
/ 6/30/		630	306
/ 7/31/		780	421
/ 8/31/		640	378
/ 9/30/		380	173
/__/__/			
/__/__/			
/__/__/			
/__/__/			
/__/__/			
/__/__/			

Enter the base temperature for the CDD values entered 65.__
Enter base load (therms/month): 120.0_
Accept default/displayed values in customary manner. Home key returns to input.
The default value is a base load in therms/month estimated from billing data.
The value in the input field has been entered previously during this session.

Appendix B - Audit Example

COOLING ENERGY CONSUMPTION COMPARISON

Period End Date	Days in Period	Consumption (kWh) Actual	Consumption (kWh) Predicted	Degree Days (Base 65 F) Actual	Degree Days (Base 65 F) Predicted
4/30	30	0	11	16	24
5/31	31	23	78	128	130
6/30	30	510	276	306	324
7/31	31	656	389	421	435
8/31	31	516	329	378	396
9/30	30	260	152	173	219
Total	183	1965	1235	1422	1528
% Difference		-36%		7%	

Press any key to continue

NEAT - Version 6.1 Oct. 1997 Executed: Wed Nov 05 11:32:39 1997

House Description: Morris
Building Identifier: SAMPLE Climate: ST. LOUIS, MO
Auditor: N. Watts Audit Date: 6-13-93

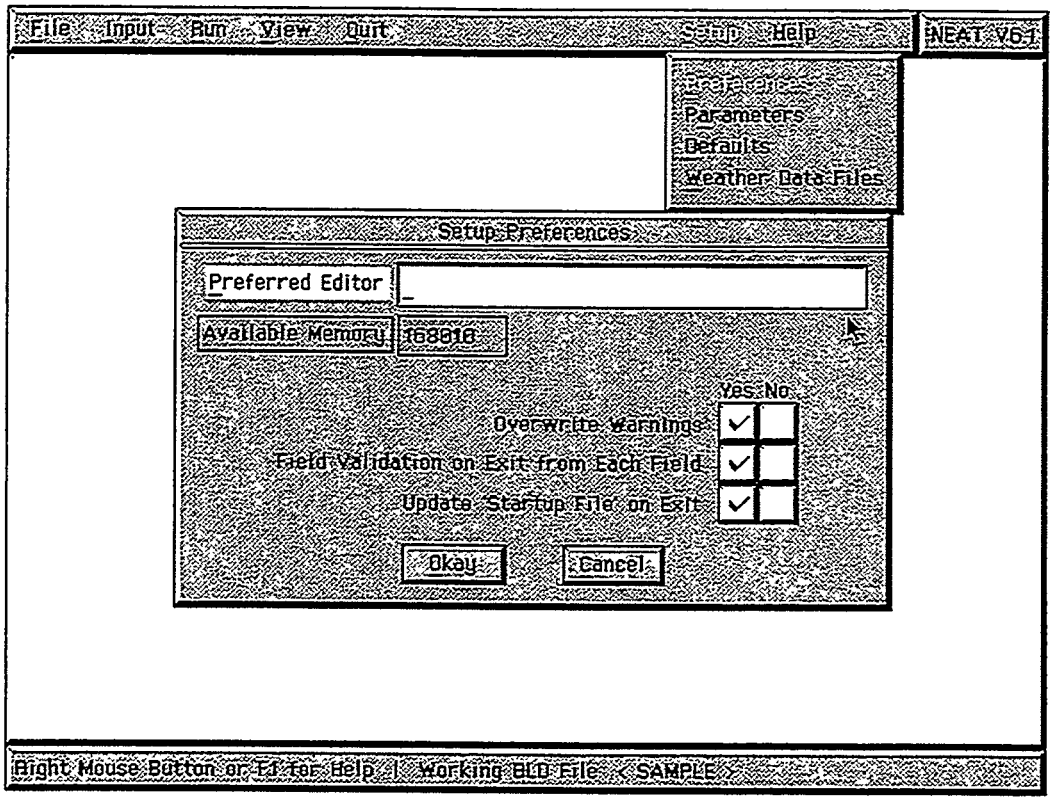
Results following application of billing data adjustment factors

Recommended Measure	Component	Annual Savings Heating (MBtu)	Heating ($)	Cooling/Elect. (kWh)	Cooling/Elect. ($)	Total (MBtu)
Infiltration Redctn		8.1	43	109	9	8.5
Insulate DHW Htr		0.0	0	0	0	2.5
Wall Ins. R-11 Batt	KNW	11.2	59	125	11	11.6
Fill Ceiling Cavity	RRT	17.2	91	193	17	17.9
Lighting Retrofits	LT1 ,LT2 ,LT3 ,LT4	0.0	0	4338	371	14.8
Smart Thermostat		4.5	24	0	0	4.5
Sillbox Ins.	F2	0.7	3	-0	-0	0.7
Floor Ins. R-11	F1	6.5	34	-2	-0	6.5
Wall Insulation	S1,W1,N1,E1	14.6	77	138	12	15.1
Wall Insulation	N2,E2	1.6	8	-7	-1	1.6

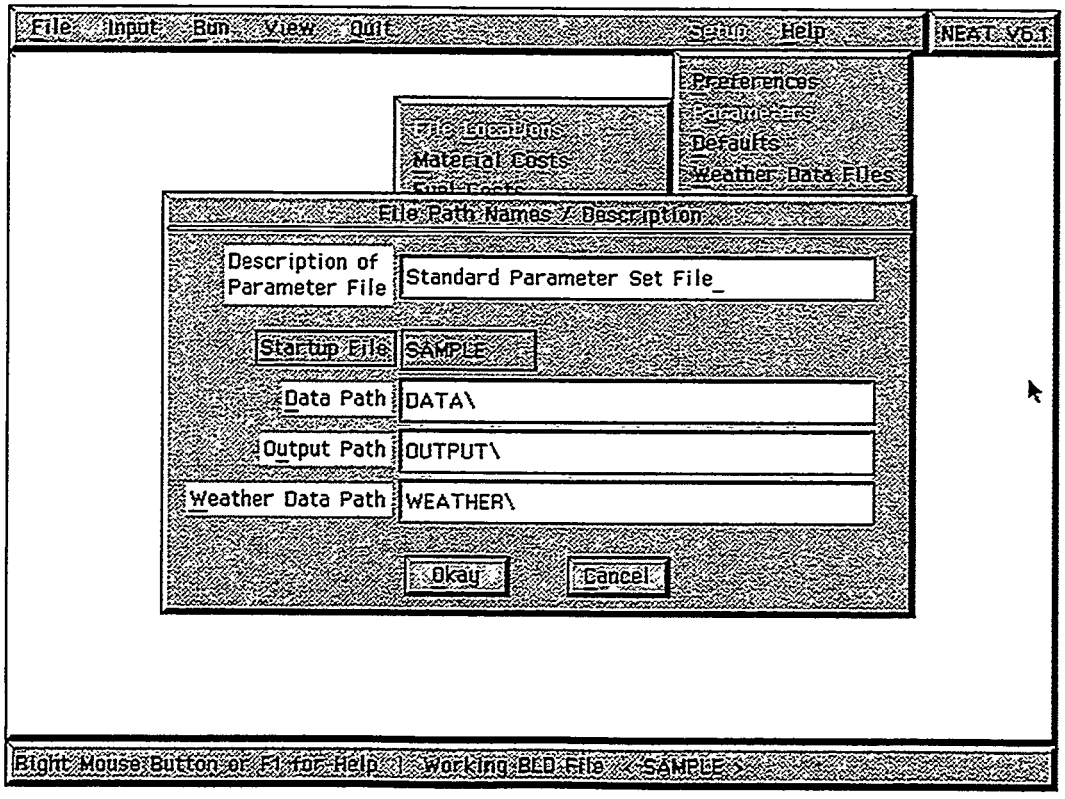
Recommended Measure	Component	Measure Savings ($/yr)	Measure Cost ($)	SIR	Cumulative Cost ($)	Cumulative SIR
Window replaced			70	-	70	-
Door repaired			20	-	90	-
Infiltration Redctn		52	310	1.4	400	1.0
Insulate DHW Htr		63	40	12.8	440	2.1
Wall Ins. R-11 Batt	KNW	70	93	9.9	533	3.5
Fill Ceiling Cavity	RRT	107	151	9.4	683	4.8
Lighting Retrofits	LT1 ,LT2 ,LT3 ,LT4	371	279	6.5	962	5.3
Smart Thermostat		24	65	4.0	1027	5.2
Sillbox Ins.	F2	3	10	3.8	1037	5.2
Floor Ins. R-11	F1	34	219	2.0	1256	4.6
Wall Insulation	S1,W1,N1,E1	89	623	1.9	1880	3.7
Wall Insulation	N2,E2	8	94	1.1	1974	3.6
Flue moved			30	-	2004	-

Appendix C - Setup Screens

Preferences



File Locations



Material Costs

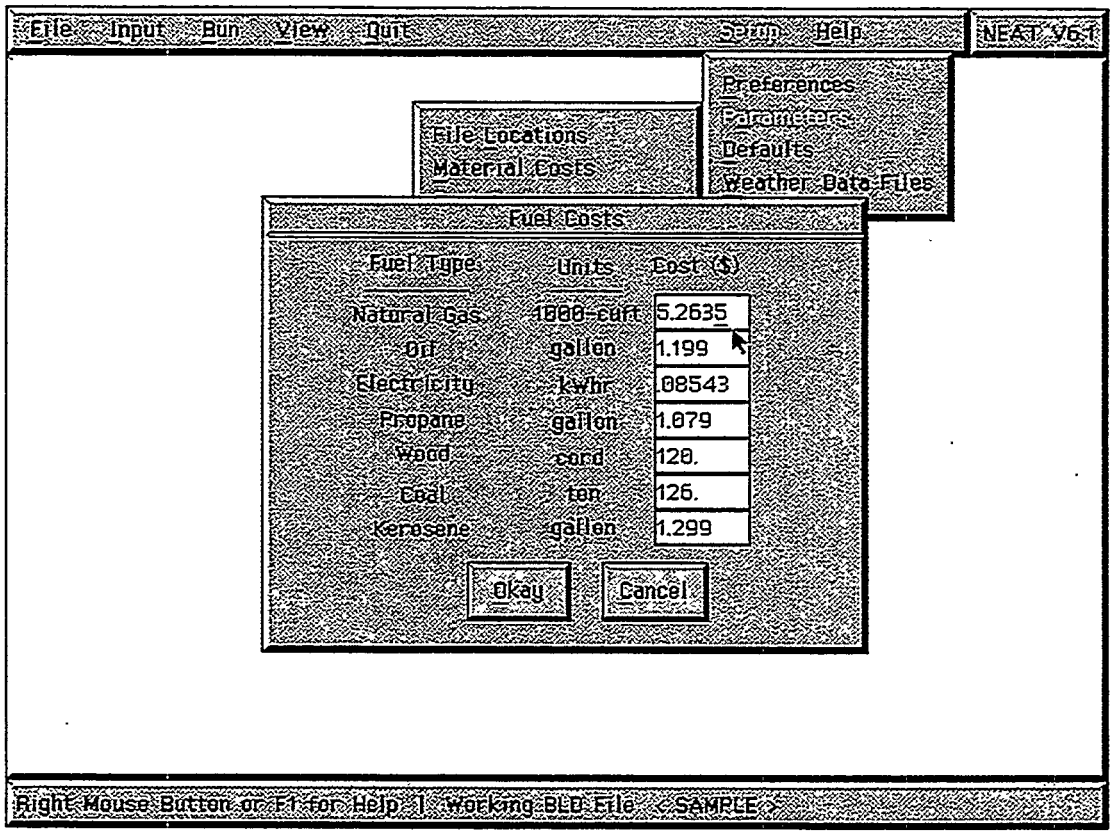
Material	Type	Life (yrs)	Unit	Cost Matrl	($/Unit) Labor	Cost / Item ($)
Ceiling Insulation	Celluls,Blwn - R-11	20	Sqft	.0732	.1540	
Ceiling Insulation	Celluls,Blwn - R-19	20	Sqft	.1264	.2582	
Ceiling Insulation	Celluls,Blwn - R-30	20	Sqft	.1995	.4015	
Ceiling Insulation	Celluls,Blwn - R-38	20	Sqft	.2527	.5057	
Ceiling Insulation	Fbergls,Blwn - R-11	20	Sqft	.17	.15	
Ceiling Insulation	Fbergls,Blwn - R-19	20	Sqft	.22	.20	
Ceiling Insulation	Fbergls,Blwn - R-30	20	Sqft	.25	.23	
Ceiling Insulation	Fbergls,Blwn - R-38	20	Sqft	.28	.26	
Ceiling Insulation	User Type 1 - R-11	20	Sqft	.0732	.1540	
Ceiling Insulation	User Type 1 - R-19	20	Sqft	.1264	.2582	
Ceiling Insulation	User Type 1 - R-30	20	Sqft	.1995	.4015	
Ceiling Insulation	User Type 1 - R-38	20	Sqft	.2527	.5057	
Ceiling Insulation	User Type 2 - R-11	20	Sqft	.17	.15	
Ceiling Insulation	User Type 2 - R-19	20	Sqft	.22	.20	
Ceiling Insulation	User Type 2 - R-30	20	Sqft	.25	.23	
Ceiling Insulation	User Type 2 - R-38	20	Sqft	.28	.26	
Wall Insulation	Blwn Cellulose	20	Sqft	.00	.59	
Wall Insulation	User Type 1 - R-11.0	20	Sqft	.00	.59	
Wall Insulation	User Type 2 - R- 5.0	20	Sqft	.00	.59	
Kneewall Ins.	Faced Batt - R-11	20	Sqft	.14	.15	
Sill Insulation	Faced Batt - R-19	15	Sqft	.24	.24	
Floor Insulation	Faced Batt - R-11	20	Sqft	.10	.24	
Floor Insulation	Faced Batt - R-19	20	Sqft	.28	.24	
Floor Insulation	Faced Batt - R-30	20	Sqft	.62	.24	
Foundation Ins.		20	Sqft	1.21		
Duct Insulation		20	Sqft	.37	1.10	
Vent Damper	Thermal	10	Each	57.11	75.00	
Vent Damper	Electrical	10	Each	135.11	100.00	
IID		10	Each	146.50	75.00	
IID/Elec Vent Dmp		9	Each	281.61	175.00	
Flame Ret Hd Burner		10	Each	540.00		
Furnace Tuneup		2	Each	0.00	45.00	
Replacement Furnace		15	Each	1600.00		
High Eff. Furnace		15	Each	2100.00		
Replacement Boiler		15	Each	2100.00		
Space Heater	Gas - 8 kBtu/h	15	Each	300.00		
Space Heater	Gas - 55 kBtu/h	15	Each	900.00		
Space Heater	Oil - 40 kBtu/h	15	Each	500.00		
Space Heater	Oil - 75 kBtu/h	15	Each	1250.00		
Space Heater	Kerosene - 10 kBtu/h	15	Each	1000.00		
Space Heater	Kerosene - 40 kBtu/h	15	Each	1450.00		

Material Costs (Cont)

Material	Type	Life (yrs)	Unit	Cost Matrl	($/Unit) Labor	Cost / Item ($)
Smart Thermostat		15	Each	35.00	30.00	
Storm Window		15	Sqft/E	0.00	0.00	51.0
Window A/C	5,000 Btu	15	Each	399.00	100.00	
Window A/C	15,000 Btu	15	Each	550.00	200.00	
Window A/C	25,000 Btu	15	Each	685.00	225.00	
Central A/C	2 Ton	15	Each	1400.00	150.00	
Central A/C	3 Ton	15	Each	1770.00	250.00	
Central A/C	4 Ton	15	Each	2100.00	275.00	
A/C Tuneup		5	Each		210.00	
Evaporative Cooler		15	Each	400.00	400.00	
Heatpump	2 Ton / 24 KBtu/h	15	Each	1900.00	150.00	
Heatpump	3 Ton / 36 KBtu/h	15	Each	2300.00	250.00	
Heatpump	4 Ton / 48 KBtu/h	15	Each	2500.00	275.00	
Awnings		10	Lnft/E	0.00	0.00	55.0
Sun Screen	Fabric Mesh	12	Sqft/E	0.00	3.50	
Sun Screen	Louvered	20	Sqft/E	0.00	5.75	
Window Film		5	Sqft/E	0.00	2.50	
Low-E Window		15	Sqft/E	0.00	0.00	100.0
Compact Fluorescent	5 Watt	10	Each	11.00		
Compact Fluorescent	7 Watt	10	Each	9.00		
Compact Fluorescent	9 Watt	10	Each	9.50		
Compact Fluorescent	13 Watt	10	Each	12.00		
Compact Fluorescent	18 Watt	10	Each	13.50		
Compact Fluorescent	25 Watt	10	Each	16.00		
Compact Fluorescent	26 Watt	10	Each	18.00		
Compact Fluorescent	38 Watt	10	Each	21.00		
Compact Fluorescent	11 Watt Flood	10	Each	17.00		
Compact Fluorescent	15 Watt Flood	10	Each	17.00		
Compact Fluorescent	18 Watt Flood	10	Each	17.00		

Appendix C - Setup Screens

Fuel Costs



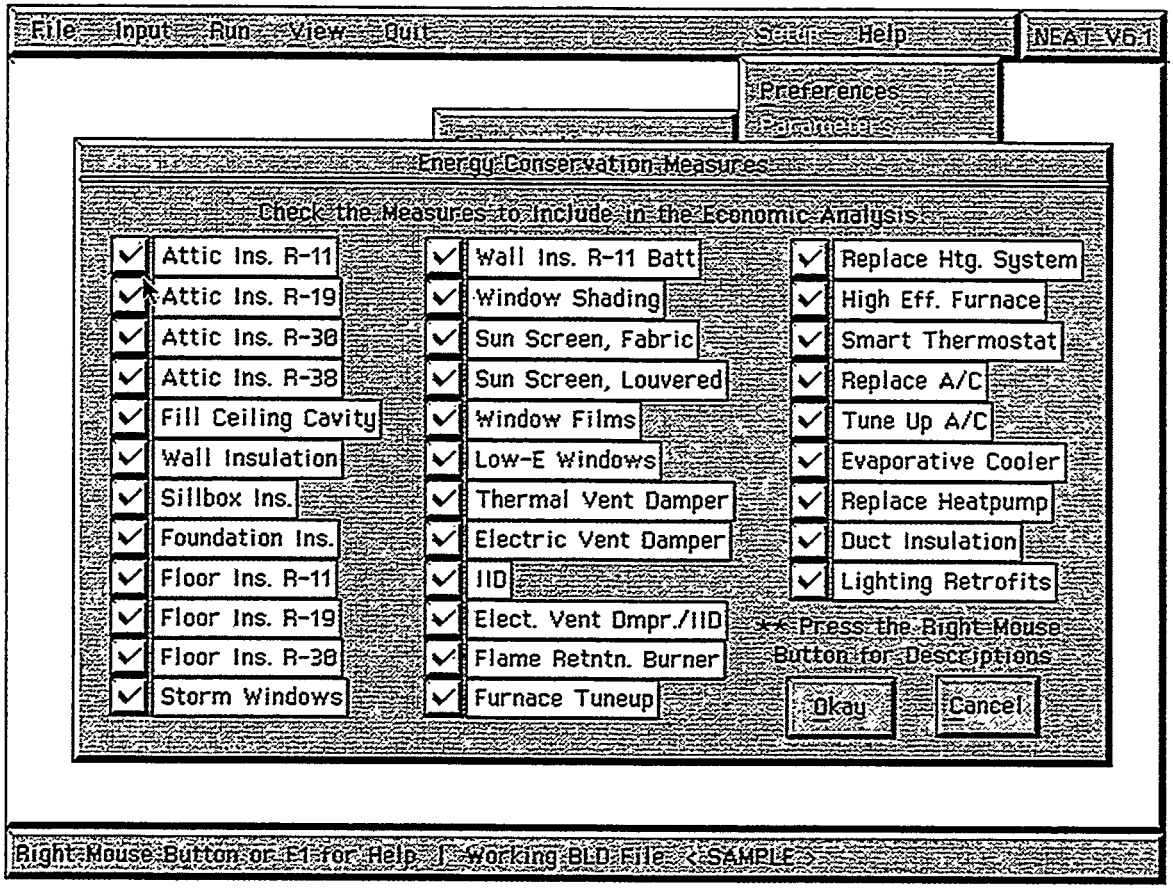
Fuel Escalation Rates

Fuel Escalation Rates - From current year (0)

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Electric	1.00	1.01	1.01	1.01	1.01	1.01	1.00	0.99	0.99	0.98	0.98	0.97	0.97
Oil	1.00	1.02	1.04	1.04	1.05	1.06	1.06	1.08	1.08	1.09	1.09	1.09	1.10
Propane	1.00	1.00	1.01	1.01	1.02	1.03	1.02	1.03	1.03	1.05	1.05	1.04	1.05
Natl Gas	1.00	0.99	0.99	0.99	0.99	0.98	0.98	0.98	0.97	0.96	0.95	0.95	0.94
Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wood	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Year	13	14	15	16	17	18	19	20	21	22	23	24	25
Electric	0.96	0.95	0.94	0.93	0.93	0.93	0.93	0.92	0.92	0.91	0.91	0.90	0.90
Oil	1.10	1.10	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09
Propane	1.06	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.05	1.05	1.05	1.05
Natl Gas	0.93	0.92	0.92	0.91	0.91	0.91	0.91	0.90	0.90	0.90	0.89	0.89	0.88
Kerosene	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Coal	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Wood	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Candidate Measure Selection

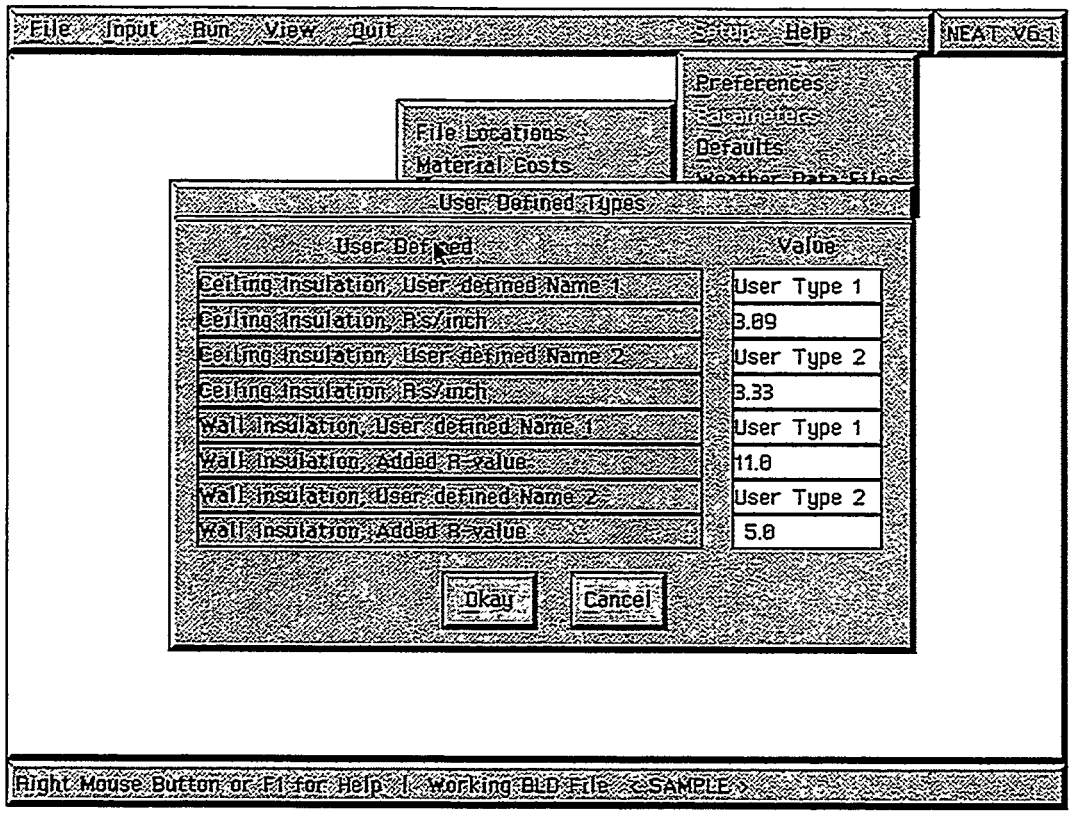


Parameter Modification Screens

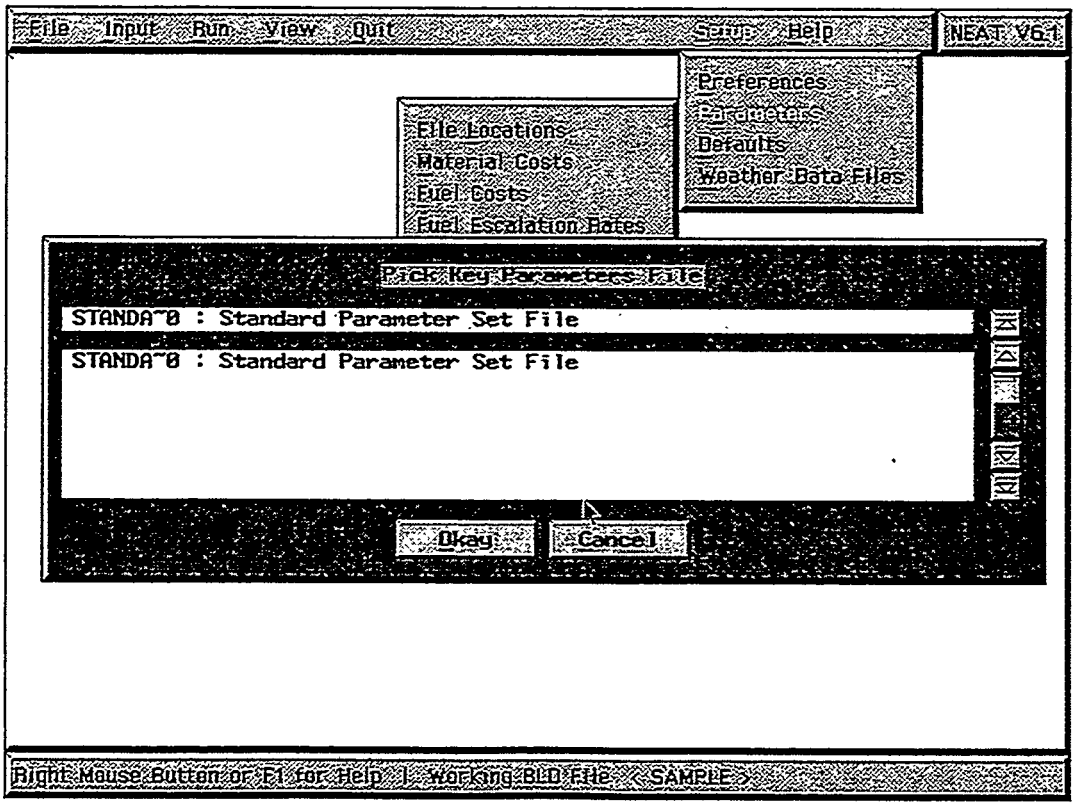
Parameter Modification Sceen

3.8 Real discount rate (%)
1.0 Minimum acceptable SIR
68.0 Daytime heating setpoint (F)
68.0 Nighttime heating setpoint (F)
78.0 Daytime cooling setpoint (F)
78.0 Nighttime cooling setpoint (F)
6.0 Night setback (F)
4.0 Average annual outside film coefficient (Btu/hr-sqft-F)
2900. Base value of free heat from internals (Btu/hr)
0.85 Cooling sensible heat ratio (Not used in versions after 5.2B)
4.42 Uninsulated R-value associated with "Other" wall type
0.6 R-value of "Other" exterior wall type
3.06 R's/inch of "Other" insulation type
12.0 R-value added by foundation wall insulation measure
81.0 Furnace replacement AFUE (%)
80.0 Boiler replacement AFUE (%)
92.0 High efficiency furnace replacement AFUE (%)
1.0 Heat content for natural gas (therms/ccf)
9.5 Window A/C replacement SEER
9.5 Central A/C replacement SEER
9.5 Heat pump replacement SEER (Cooling)
7.5 Heat pump replacement HSPF (Heating Seasonal Performance Factor)
_N_ Do you wish to impute cooling savings when no air conditioning is present?
_10.0_ SEER used to impute cooling savings

User Defined Types

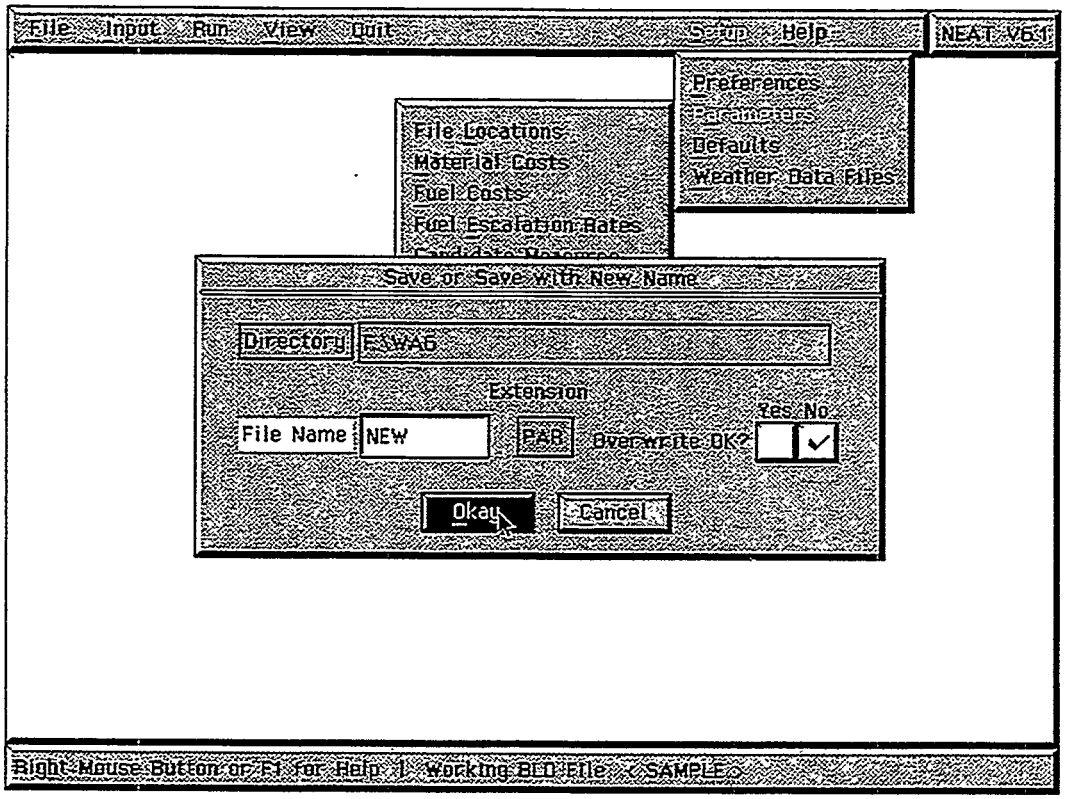


Choose Parameter File

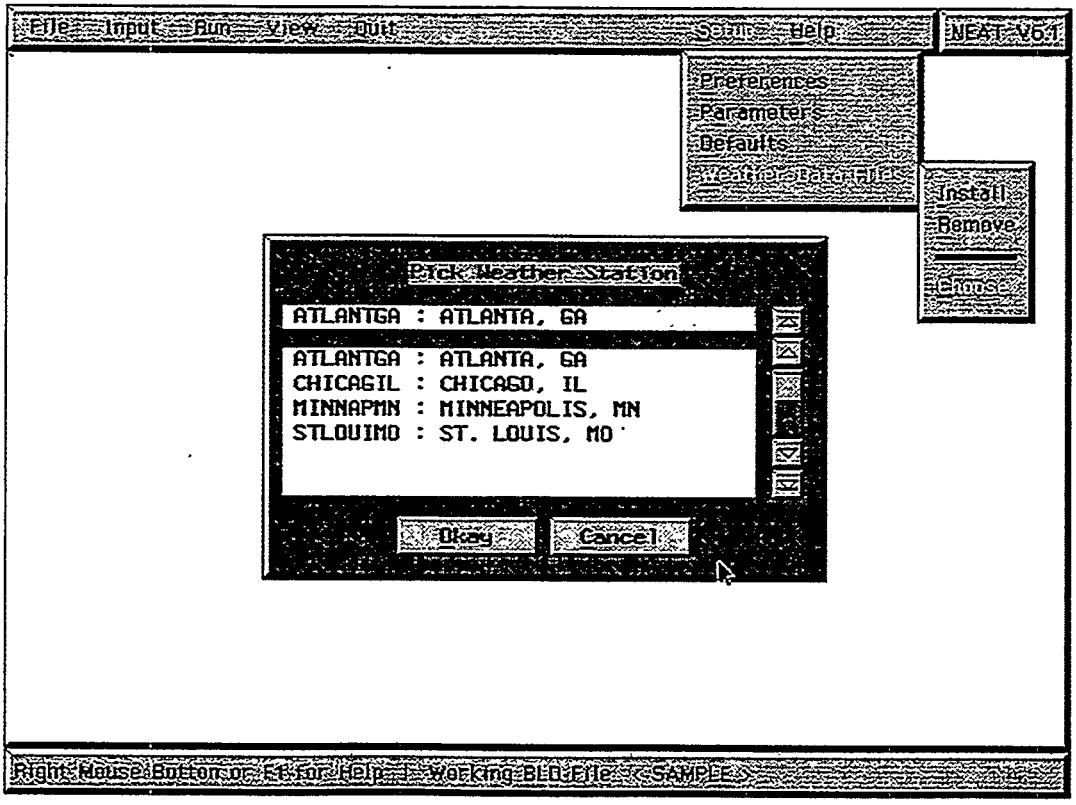


Appendix C - Setup Screens

Save Parameter File



Choose Weather Station



Here are all NEAT data input forms, presented in the order of a typical audit. To see how these forms are completed, refer to Appendix B, *Audit Example*.

National Energy Audit Input Form

General House Data

House Descriptor: _____

Auditor: _____

Date of Audit: _____

Number of Conditioned Stories _____

Living Space Floor Area (Sqft) _____

Average Number of Occupants _____

Pre-Retrofit Air Leakage Rate from Blower Door (CFM) _____ (Optional)
Pre-Retrofit Blower Door Pressure Differential (Pa) ____ (Optional)

Post-Retrofit Air Leakage Rate from Blower Door (CFM) _____
Post-Retrofit Blower Door Pressure Differential (Pa) ____

Cost of Air Leakage Rate Reduction ($) _____

Exterior Walls

Wall Code	Wall Dir	Wall Exp	Ext. Type	Wall Type	Wall Area (sq.ft.)	Existing Insulation		Added Insulation		Comments	Meas. No.
						Type	R	Type	Added Cost		

Wall Direction: N - North; E - East; S - South; W - West.
Wall Exposure: E - Exposed; B - Buffered; U - Unconditioned attic.
Exterior Type: 1 - Wood, Masonite; 2 - Aluminum, Steel, Vinyl; 3 - Stucco; 4 - Brick, Stone; 5 - None; 6 - Other.
Wall Type: 1 - Balloon frame; 2 - Platform frame; 3 - Masonry, Stone; 4 - Concrete block; 5 - Other.
Insulation Type: 0 - None; 1 - Blown cellulose; 2 - Blown fiberglass; 3 - Rock wool; 4 - Batt fiberglass; 5 - Rigid board styrofoam; 6 - Other.
Added Insulation Type: 0 - None; 1 - Blown cellulose; 2 - User Type 1; 3 - User Type 2

National Energy Audit Input Form (Continued)

Windows

	Windows				Retrofit Storm Windows				
Wall Code	Number of Windows	Frame Type	Glazing Type	Shaded %	Width (in)	Height (in)	Cost ($)	Comments	Window Code

Frame Type: 1 - Wood; 2 - Metal; 3 - Improved metal
Glazing Type: 1 - Single; 2 - Single with wood storm; 3 - Single with metal storm; 4 - Double pane; 5 - Single with bad storm
Shaded Percentage: Example: 20% - Eaves; 100% - Porch.
Retrofit Storm Window Cost: If other than default cost.

Note: "Wall Code" is keyed to sketch of floor plan.

Doors

	Door			Storm Doors				
Wall Code	Number of Doors	Door Type	Area (sq.ft.)	Condition	Width (in)	Height (in)	Comments	Door Code

Type: 1 - Wood, hollow-core; 2 - Wood, solid-core; 3 - Steel, insulated; 4 - Other.
Door Area: Standard door area is 20 square feet.
Condition: 1 - Adequate; 2 - Deteriorated; 3 - None.

Note: "Wall Code" is keyed to sketch of floor plan.

National Energy Audit Input Form (Continued)

Unfinished Attic Areas

Attic Code	Type	Joist Space (in)	Floor Area (sqft)	Exst Ins Type	Exst Ins Dpth (in)	Add Ins Type	Add Ins Max Dpth (in)	Addtnl Instln Cost	Comments	Meas No

Type: 1 - Unfloored; 2 - Floored; 3 - Cathedral.
Joist Space: Default value = 24.0 inches
Insulation Type (with depth default values for existing insulation): 0 - None; 1 - Blown cellulose (5 in.); 2 - Blown fiberglass (6 in.); 3 - Blown rockwool (6 in.); 4 - Fiberglass batt (6 in.); 5 - Other (6 in.).
Additional Insulation Type: 0 - None; 1 - Blown cellulose; 2 - Blown fiberglass; 3 - User Type 1; 4 - User Type 2
Maximum Depth: Press "Enter" if unlimited

Note: "Attic Code" is keyed to sketch of attic floor plan.

Finished Attic Areas

	Type	Area (sq.ft.)	Exist. Insul. Type	Exist. Insul. Depth (in)	Additional Insul. Type	Additional Insul. Maximum Depth (in)	Additional Installation Cost	Comments	Meas. No.
Outer Ceiling Joist									
Collar Beam									
Kneewall	XXX								
Roof Rafter	XXX								

Outer Ceiling Joist, Collar Beam Type: 1 - Unfloored; 2 - Floored.
Insulation Type: 0 - None; 1 - Blown cellulose; 2 - Blown fiberglass; 3 - Blown rockwool; 4 - Fiberglass batt; 5 - Other.
Additional Insulation Type: 0 - None; 1 - Blown cellulose; 2 - Blown fiberglass; 3 - User Type 1; 4 - User Type 2
Maximum Depth: Press "Enter" if unlimited.

National Energy Audit Input Form (Continued)
Foundation Spaces

		Floor		Perimeter		Wall			Insulation			
Fndn Code	Type	Area (sqft)	Ins R	Lngt (ft)	% Exps	Hgth (ft)	% Exps	Ins R	Mode	Added Cost	Comments	Meas No

Type: C - Conditioned; N - Non-conditioned; V- Vented non-conditioned; U - Unintentionally conditioned; S - Slab, uninsulated; I - Slab, insulated; E - Exposed floor.
Mode: 0 - None; 1 - Floor or Wall; 2 - Floor only; 3 - Wall only.

Lighting

	Existing Incandescent Lamps					CF Lamps			
Room	Location	Type	Watts	Qty	Hrs/D Used	Watts	Added Cost	Comments	Lamp Code

Location: C - Ceiling; F - Floor; T - Table; W - Wall
Type: S - Standard; F - Flood

Air Conditioners - Central / Window

Unit Code	Unit Type	Size kBtu	Area Cooled	SEER	Year Bght	Manufacturer	Model	Comments

Unit Type: 1 - Central; 2 - Window.
SEER / EER: Enter if known. Otherwise press enter and give approximate age in next column.

Heating Systems

Primary System:

System Type: _____
HSPF: _____
Fuel Type: _____
Location Type: _____

Secondary System:

Fuel Type: _____

System Efficiency: _____

"Smart Thermostat" (Y/N): _____

Uninsulated duct length in unconditioned spaces (ft.): _____

Average perimeer of duct in unconditioned spaced (in): _____

Location of uninsulated duct (S/A): _____

% of Heat Supplied: _____ Comments: _____

System Type: 1 - Gravity furnace; 2 - Forced-air furnace; 3 - Steam boiler; 4 - Hot water boiler; 5 - Electric resistance, fixed; 6 - Electric resistance, portable; 7 - Heat pump; 8 - Unvented space heater; 9 - Vented space heater; 0 - Other.
Fuel Type: 1 - Natural gas; 2 - Oil; 3 - Electricity; 4 - Propane; 5 - Wood; 6 - Coal; 7 - Kerosene.
Location: 1 - Intentionally heated; 2 - Unheated; 3 - Unintentionally heated.
Location of duct: S - Subspace; A - Attic
Note: Use the appropriate form depending on the fuel type and heating system type.

National Energy Audit Input Form (Continued)

Primary Furnace - Boiler, Gas / Propane-Fueled

Manufacturer: _____ Model: _____

Input Rating (kBtu/h): _____ Output Capacity (kBtu/h): _____

Steady-State Efficiency (%): _____

Pilot Light: Present? ____ (Y/N) On in summer? ____ (Y/N)

IID Present? ___ (Y/N) Power burner present? ___ (Y/N)

Vent Damper: Present ___ (Y/N) Recommended ___ (Y/N) Diameter (in) ___

General Condition: ___ Tuneup/Replacement Status: ___

Estimated Replacement Costs: Labor _____ Equipment _____

Comments: _____

_____

General Condition: 1 - Poor; 2 - Fair; 3 - Good
System tuneup/replacement status: 1 - Tuneup/replacement optional; 2 - Tuneup already performed; 3 - Tuneup mandatory; 4 - Replacement mandatory.
Enter estimated replacement costs if different from default value.

National Energy Audit Input Form (Continued)

Space Heaters / Other Systems

Manufacturer: _____ Model: _____

Input Rating Units _____ Value _____ Output Capacity (kBtu/h) _____

Steady State Efficiency (%) _____

Vent Damper: Present? _____ (Y/N) Recommended? _____ (Y/N) Diameter (in) _____

General Condition: ___ Tuneup / replacement status: ___

System Replacement: Labor Cost _____ Equipment Cost_____ SS Efficiency (%) ___

Repair / Replacement: _____

_____

_____

Input Rating Units: 0 - No input; 1 - kBtu/hr; 2 - gal/hr; 3 - lb/hr.; 4 - ccm
General Condition: 1 - Poor; 2 - Fair; 3 - Good
System tuneup / replacement status: 1 - Tuneup / replacement optional; 2 - Tuneup already performed; 3 - Tuneup mandatory; 4 - Replacement mandatory.

Primary Furnace - Boiler, Oil-Fueled

Manufacturer: _____ Model: _____

Input Rating Units _____ Value _____ Output Capacity (kBtu/h) _____

Steady State Efficiency (%) _____

Vent Damper: Present? _____ (Y/N) Recommended? _____ (Y/N) Diameter (in) _____

Burner: Flame Retention Head Present? _____ (Y/N) Recommended? _____ (Y/N)

General Condition: ___ Tuneup / Replacement Status: ___

Estimated Replacement Costs: Labor _____ Equipment _____

Comments: _____

_____

Input Rating Units: 0 - No input; 1 - kBtu/hr; 2 - gal/hr; 3 - lb/hr; 4 - ccm
General Condition: 1 - Poor; 2 - Fair; 3 - Good
Tuneup / replacement status: 1 - Tuneup / replacement optional; 2 - Tuneup already performed; 3 - Tuneup mandatory; 4 - Replacement mandatory.
Enter estimated replacement costs if different from default value.

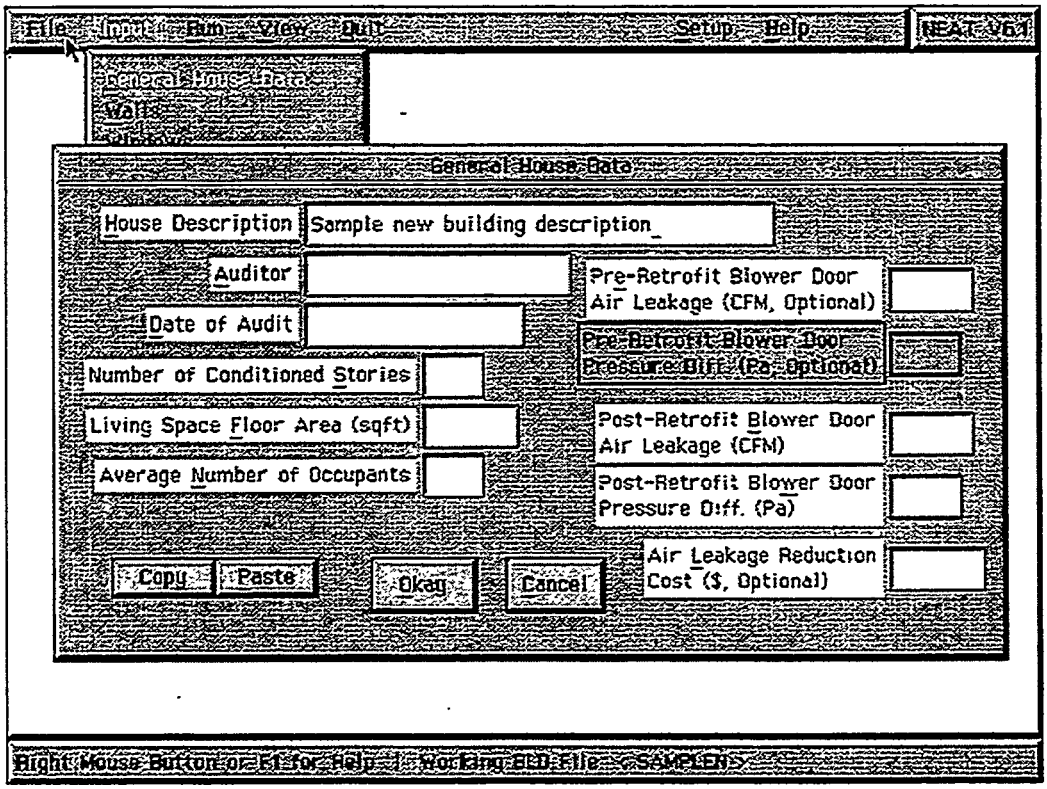
Itemized Additional Costs and User Defined Measures

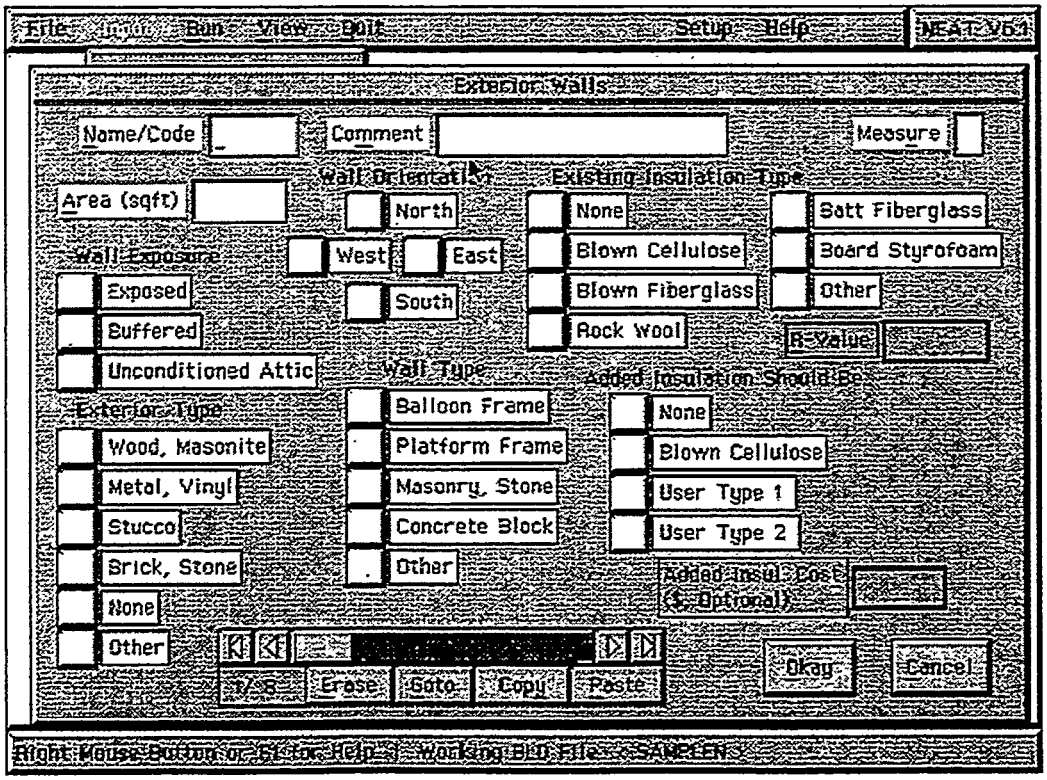
Item Description or User-defined Measure Name	Cost ($)	Incl in SIR	Materials Required	Annual Savings (MBtu)	Fuel Saved	Life-Time (Yrs)

Fuel Saved: 1 - Natural gas; 2 - Oil; 3 - Electricity; 4 - Propane; 5 - Wood; 6 - Coal; 7 - Kerosene.

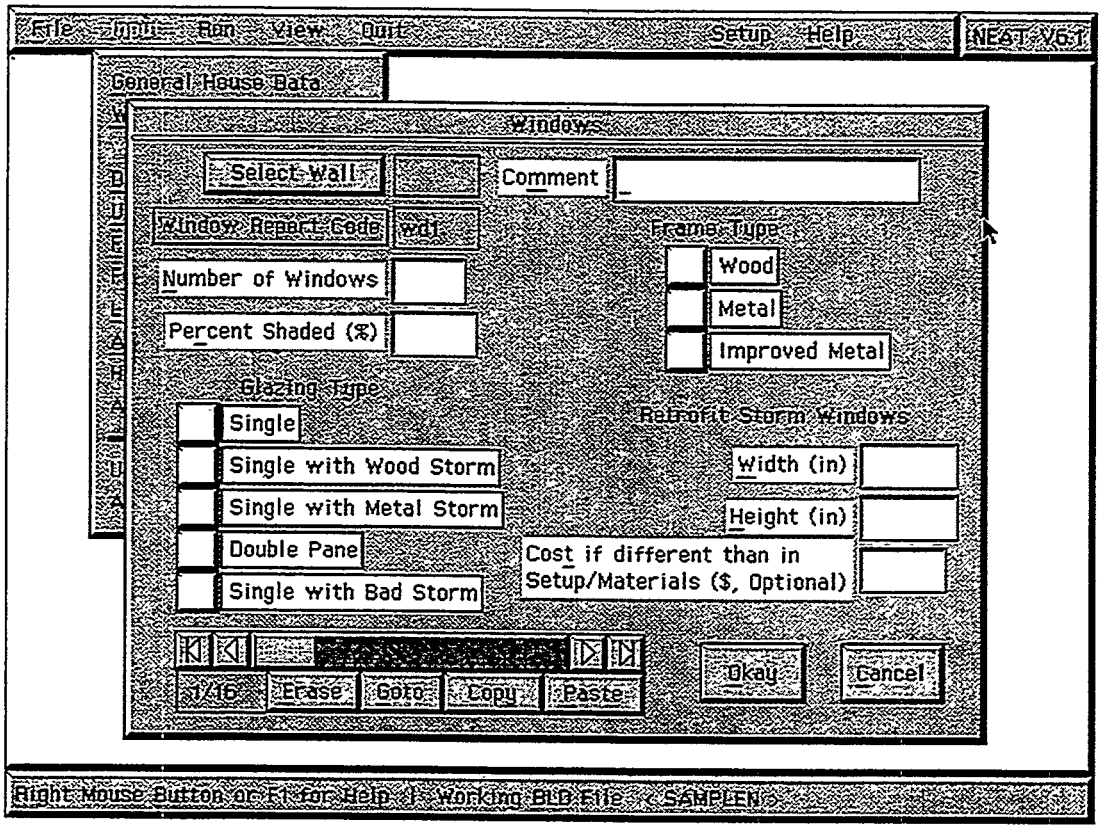
Appendix E - GUI Version Input Forms

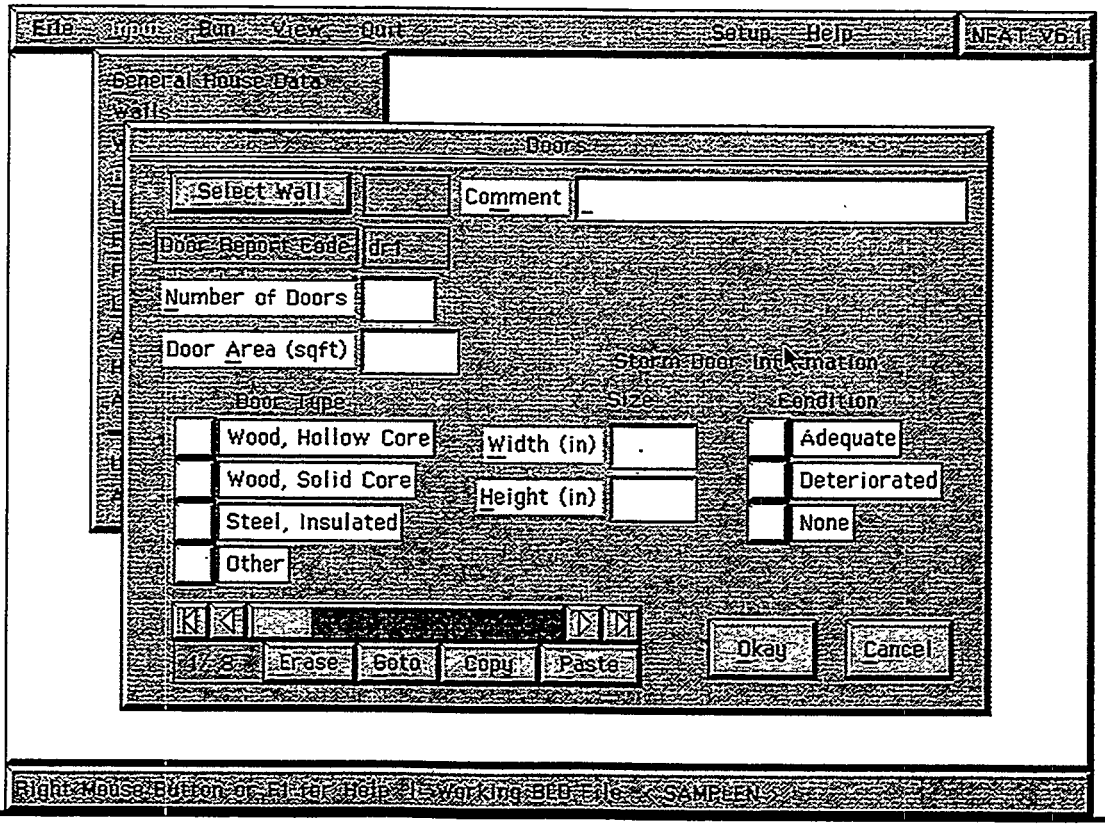
Here are all NEAT data input forms, presented in the GUI Version of NEAT. They may be compared one-to-one with the text version forms of *Appendix D*.



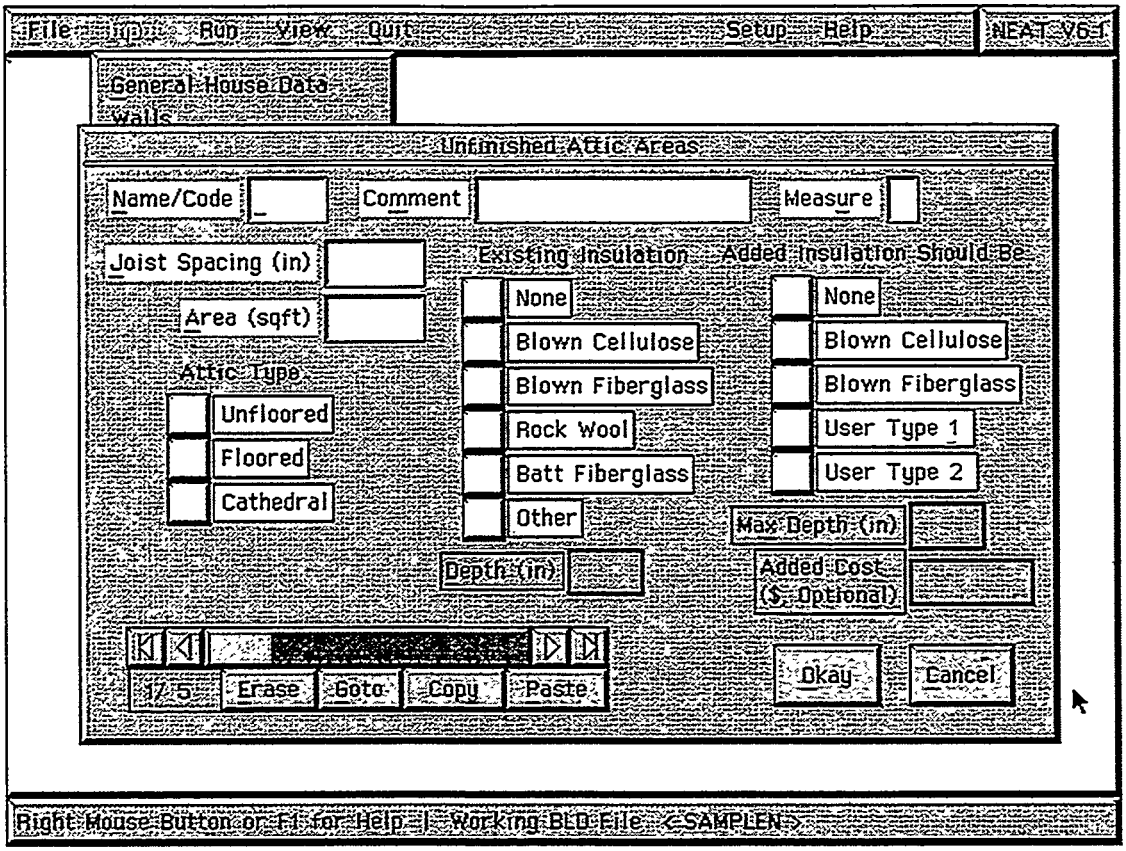


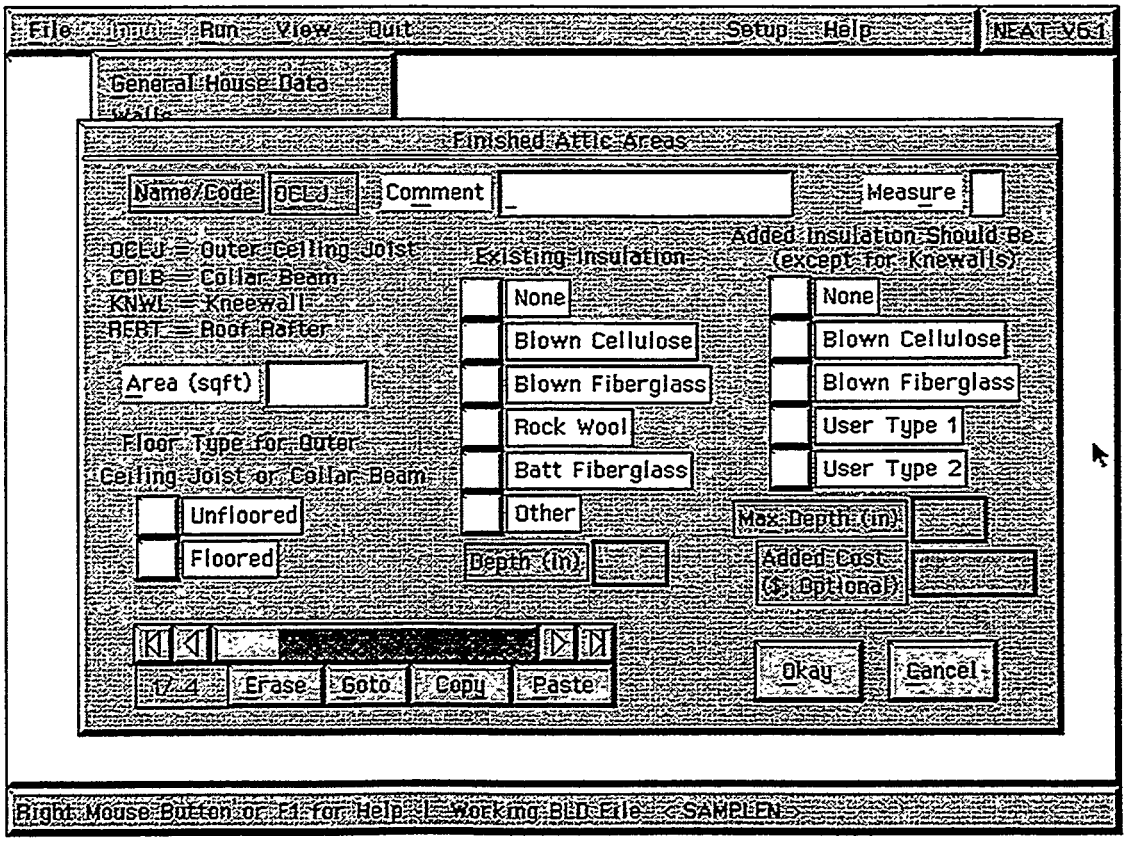
Appendix E - GUI Version Input Forms



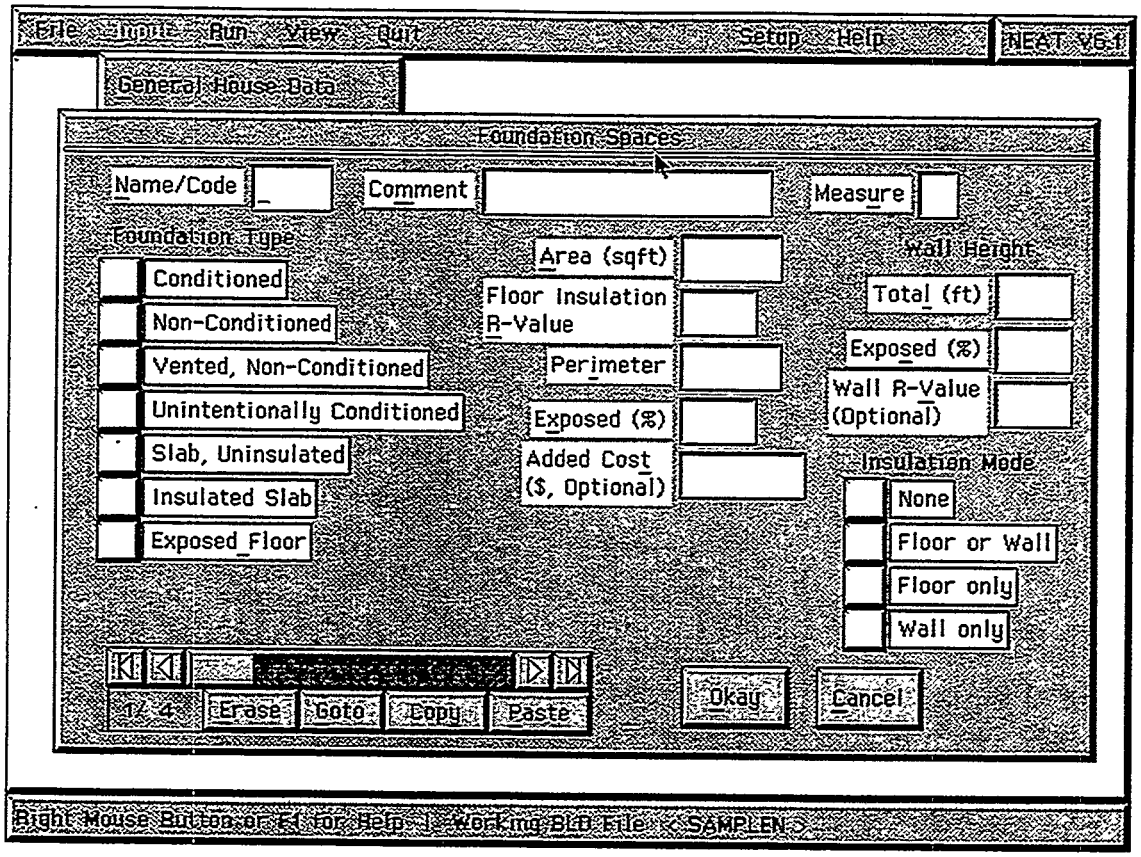


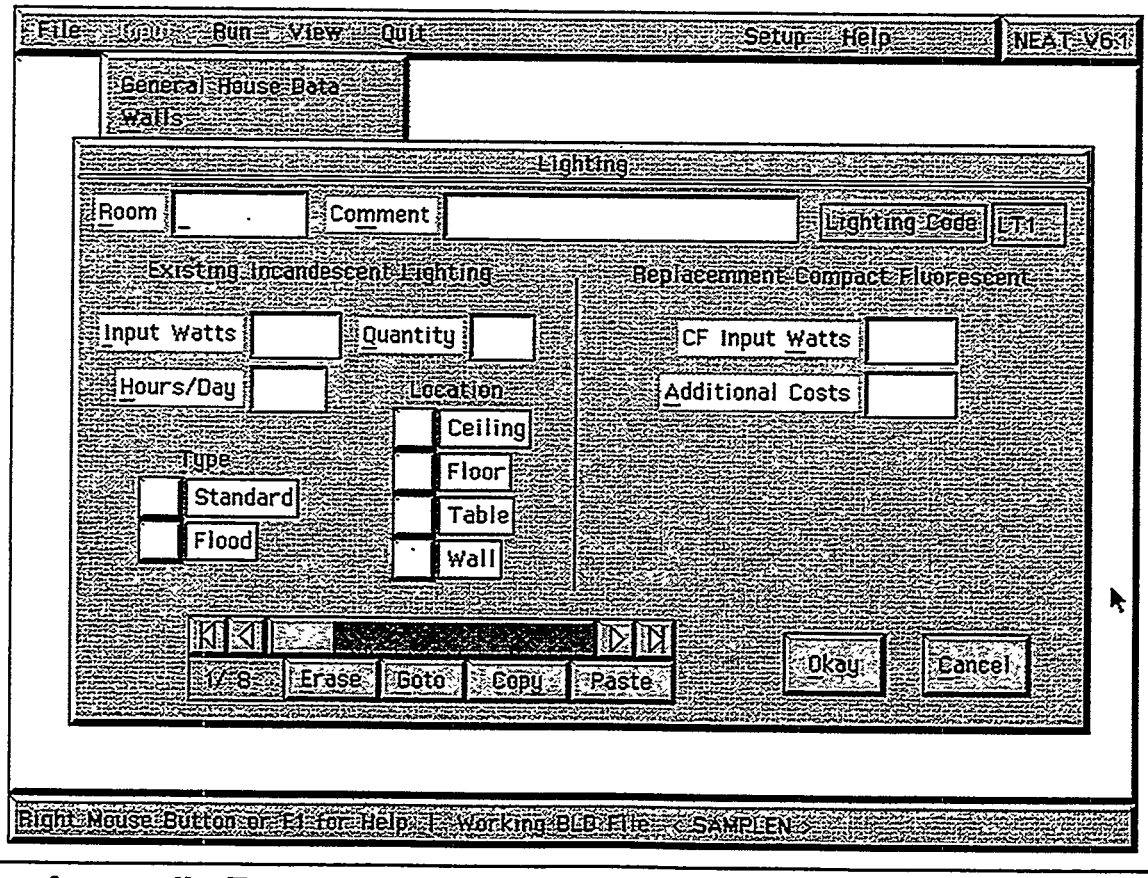
Appendix E - GUI Version Input Forms



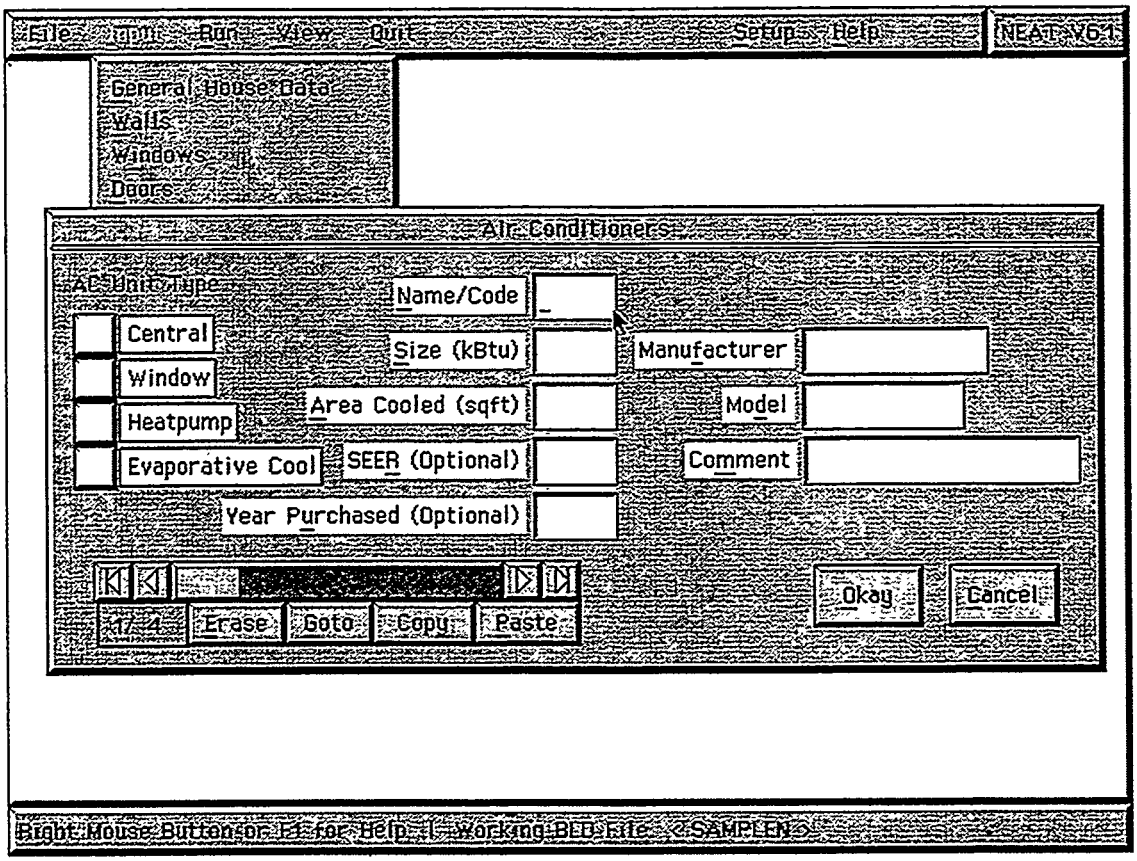


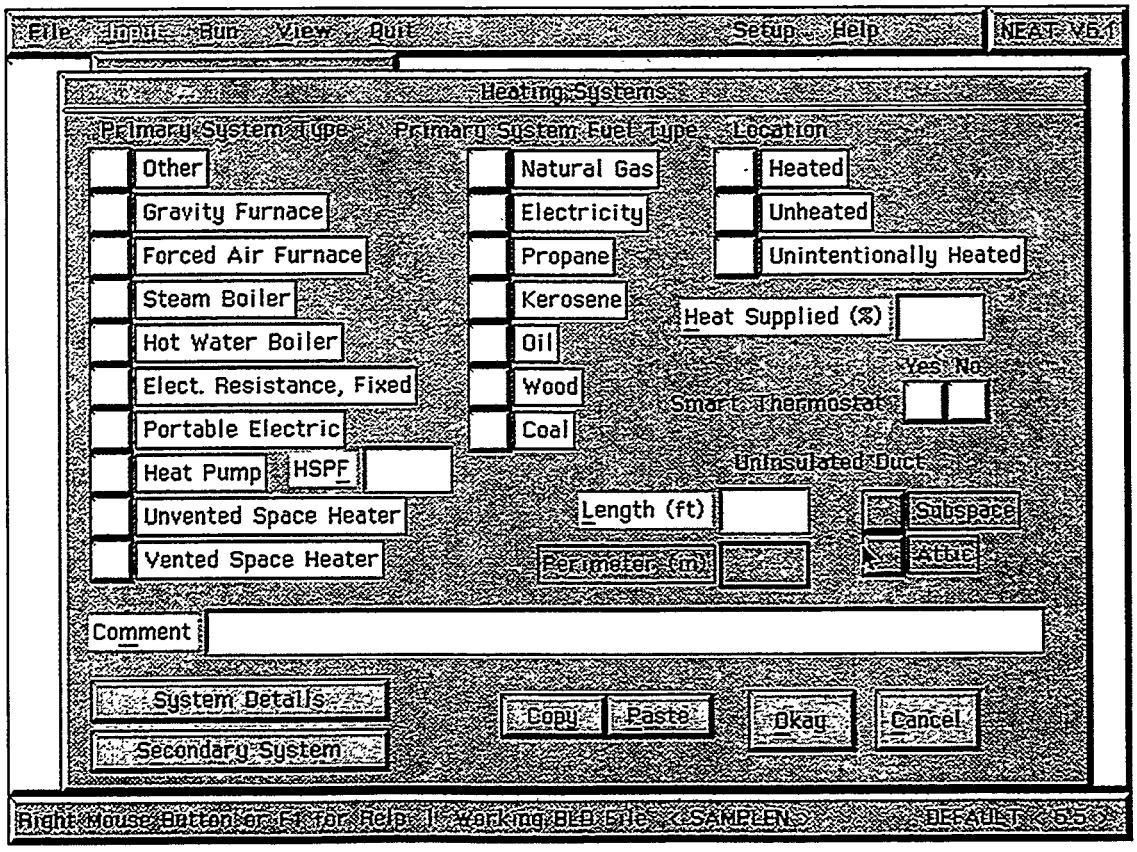
Appendix E - GUI Version Input Forms



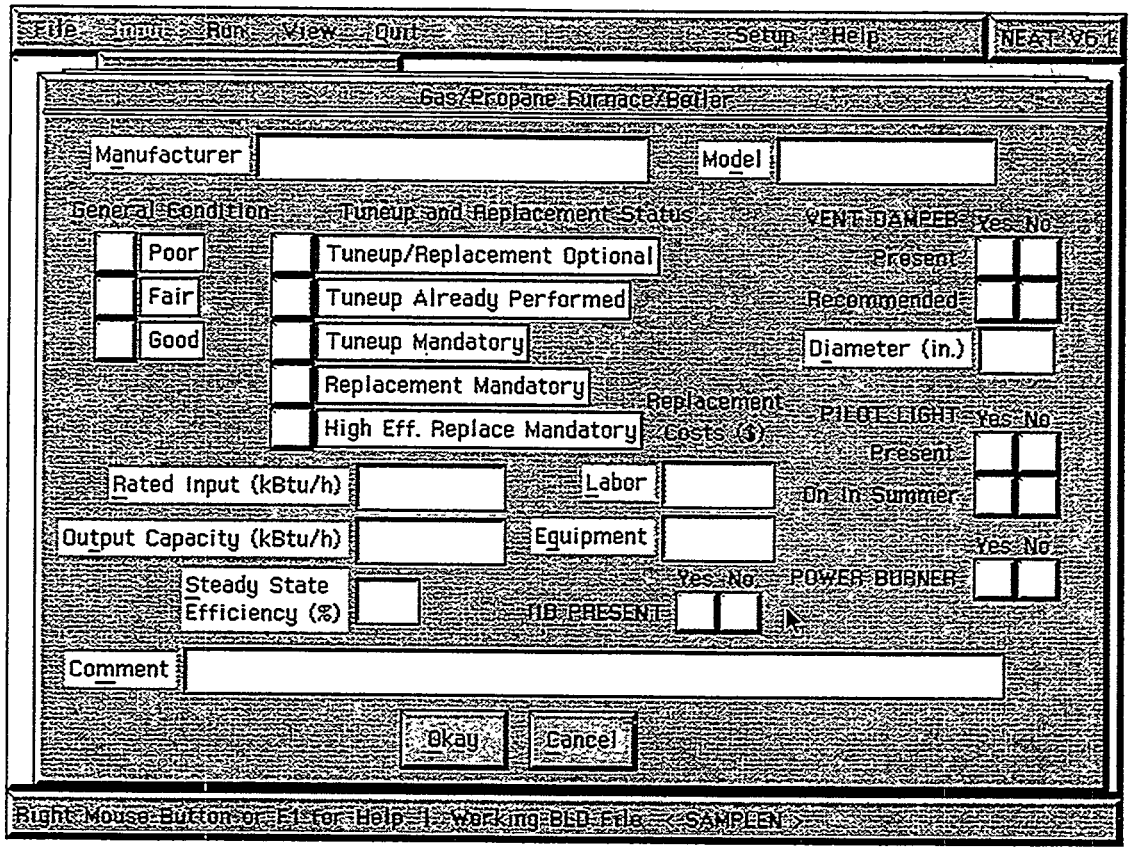


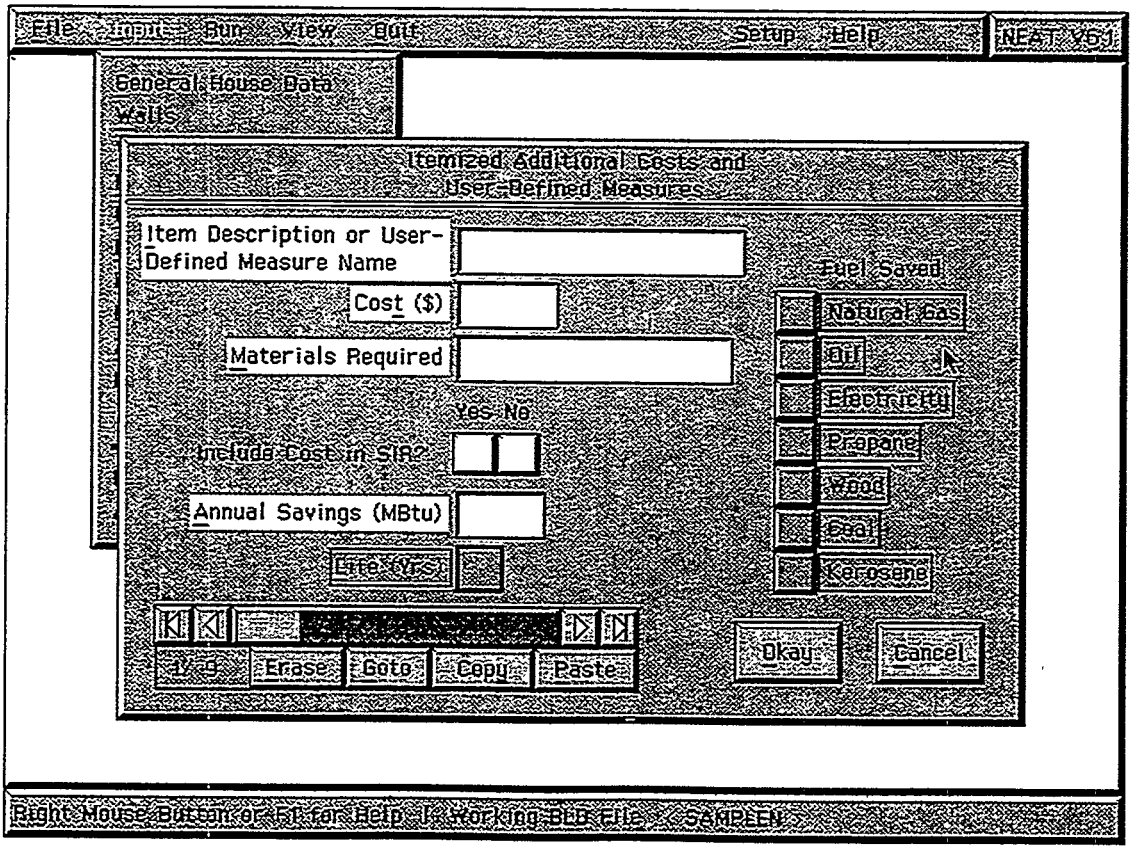
Appendix E - GUI Version Input Forms





Appendix E - GUI Version Input Forms





Audit - The process of identifying energy conservation opportunities in houses. As used here, NEAT audit means a computer selection technique which optimizes the Savings-to-Investment Ratio of various energy conservation measures.

Auditor - A person who performs an audit.

Balance point - For heating, the balance point is the outside temperature above which no heating is needed. For cooling, the balance point is the outside temperature below which no cooling is needed.

Band joist - A horizontal framing member resting on top of the foundation.

Base temperature - Base temperature is the outdoor temperature below which heating or above which cooling systems are used. Assume a base temperature of 65°F for HDD's and 78°F for CDD's, unless a different base temperature is listed on the utility bill.

Boot - The process of turning on or re-initializing a computer.

British thermal unit - The quantity of heat required to raise one pound of water one degree Fahrenheit.

Buffered - A wall which is protected by an unconditioned, attached enclosure—like a garage or an enclosed porch.

Building description - Information used to describe the house to NEAT.

Building identifier - An string of 8 or less typed characters that uniquely identifies a particular house receiving a NEAT audit.

Btu - Acronym for British thermal unit.

Ccf - One hundred cubic feet (usually natural gas).

CDD - Acronym for Cooling Degree Day.

Ccm - Cubic centimeter per minute. Refers to fluid flow.

Cfm - Cubic feet per minute.

Ceiling joist - The horizontal wood framing member that holds up the ceiling (see outer ceiling joist).

Character - A single digit, letter or symbol.

Code - Abbreviated names composed of a group of letters and/or numbers that identify a particular line of data on the NEAT data entry screens. NEAT uses the codes to identify lines of data and cross reference input screens.

Collar beam - A horizontal piece of lumber that ties the rafters together near the peak of the roof, and forms the ceiling for a section of a finished attic.

Combustion tester - A device used to analyze the steady-state efficiency of combustion heating units.

Component - A segment of a building normally described by a single line within the NEAT building description data input, having sufficiently uniform construction and orientation to be

considered as a single unit (for example, a portion of a house's exterior walls facing the same direction with similar construction and retrofit potential).

Conditioned - Intentionally heated or cooled areas of the home are conditioned.

Cooling degree day (CDD) - During a 24 hour period, each degree that the average daily temperature is above the base temperature (usually 78°F) constitutes one cooling degree day unit.

Cost-effective - Having an acceptable Savings-to-Investment Ratio to the person using the term. The standards for cost-effectiveness vary.

Cursor - A flashing line or rectangle on the computer screen that tells you where a letter, number or space will appear when you next strike a key.

Cumulative - Including all previously identified items or items higher on the list.

Default - A choice made by the computer representing a typical value of the number in question.

Dialog box - A box which pops up on the computer screen containing a sentence which provides instruction, asks a question, or gives a choice.

Directory - (See "sub-directory.") A named collection of files grouped together for convenience of the computer user in finding and accessing the files. A root directory is named by the drive (for example, c: or a:).

Discount rate - The percent by which a dollar today is worth more than a dollar one year from today. For example, when you put money into a 5 percent savings account, you are agreeing that today's dollar is worth a dollar and five cents of next year's currency.

Disk - The physical devices on which information (files) are stored on the computer. Two broad types exist: 1. Hard disks, integral parts of the computer itself; 2. Floppy disks (or diskettes), which are portable and may be transferred from one computer to another. Floppy disks are either 5 1/4" or 3 1/2" in size.

Disk Operating System (DOS) - The Disk Operating System is the software that controls the operation of the computer, and is normally included with the computer purchase.

Draft diverter - A device located in exhaust pipes, used to prevent outside air from flowing into the pipe.

DOS - Acronym for Disk Operating System.

DOS prompt - A computer symbol containing the cursor, the name of the disk drive, and the directory currently accessed. For example, the DOS prompt C:\>SAM_ means that the computer is ready for your command, while accessing the directory named SAM on the C: drive.

EER - Acronym for Energy Efficiency Ratio.

Electric damper - See "vent damper."

Energy cost escalation rate - The energy cost escalation rate is the federal government's best guess of how much energy costs will increase above the rate of inflation from one year to another.

Energy efficiency ratio (EER) - A measurement of energy efficiency for room air conditioners. The EER is computed by dividing cooling capacity—measured in British Thermal Units per hour (Btu/hr)—by the watts of power used. This is a steady-state efficiency.

Envelope - The physical boundary of a building (i.e., wall, roof) which encloses the interior space.

Exposed - In the context of NEAT "exposed" means that a building component is in direct contact with the outside air.

Field - An entry blank on the screen used for data entry or comments.

File - A collection of information stored in the computer, referenced by a "file name" normally selected by the user. Examples of information stored in files include a letter, a report, data, or instructions for the computer to perform a specific function.

Flame retention head oil burner (FRHOB) - A modern, improved efficiency oil burner that burns the oil more completely through enhanced mixing of the oil particles with air.

Floor joist - The framing members (often 2x8 lumber) which support the floor.

Floppy disk - See "disk."

FRHOB - Acronym for Flame Retention Head Oil Burner.

Hard disk - See "disk."

Heat anticipator - A device located in a thermostat which can be adjusted to prevent overshooting the desired thermostatic set point.

Heating degree day (HDD) - During a 24 hour period, each degree that the average daily temperature is below the base temperature (usually 65 °F) constitutes one heating degree day unit.

HDD - Acronym for Heating Degree Day.

IID - Acronym for Intermittent Ignition Device.

Infiltration - Air leakage in or out of a building under natural conditions rather than under artificial pressurization by a blower door.

Input rating - The rate of the fuel's theoretically available energy the furnace, boiler, or space heater is capable of receiving (kBtu/hour; gal/hour; lb/hour; ccm).

Intermittent ignition device (IID) - A device that automatically ignites the gas burner on a gas heater only when the thermostat calls for heat, thus saving the energy that a continuous pilot light consumes.

Joist - A horizontal, wooden framing member supporting a floor or ceiling.

Kilowatt-hour - A unit of energy (usually in reference to electricity).

Kneewall - A short wall that separates the unconditioned part of a finished attic from the conditioned part. The kneewall borders the floor and sloping ceiling.

Low-E window - A multi-pane window with a metalized coating on one of the interior surfaces. Low-E windows save energy during the winter by reflecting heat rays originating in the house back indoors. During the summer, low-E windows reflect solar heat outdoors. Low-E windows have a higher R-value than standard windows.

Measure number - Measure numbers group together building parts which will have the same energy treatment. Assign the same measure number to a group of components of the same type which should be considered together when determining the SIR for retrofitting the components.

Mcf - Thousand cubic feet (usually natural gas).

Measures - Energy conservation projects under consideration for a house which are analyzed by NEAT.

Menu box - A box which pops up on the screen at the appropriate time and gives the user a selection of numbered or lettered choices.

NEAT - Acronym for the WAP-supported energy audit—the National Energy AudiT.

Outer ceiling joist - The portion of the ceiling joist extending from kneewall to roof rafter.

Output capacity - The rate of actual heat delivered by the heating device after flue losses and combustion inefficiencies are considered (in kBtu/hr).

Pascal - A unit of pressure (kilogram-per-square meter).

Random access memory (RAM) - This is memory that can be changed. It is the primary type of memory storage.

RAM - Acronym for Random Access Memory.

Re-boot - See "boot."

Real discount rate - See "discount rate."

Report - The product of the NEAT audit is a report that lists the measures with their costs, savings, and SIRs. The report also contains a materials list for the recommended measures.

Retention head - See "flame retention head oil burner."

Retrofit - The process of improving the efficiency of a system, such as adding insulation to the walls of a house.

Rim joist - See "band joist."

Roof rafter - A sloping wooden framing member supporting the roof.

Savings-to-investment ratio (SIR) - A ratio of the lifetime savings-to-initial investment. The SIR calculates the "present value" of dollars saved by an energy conservation measure, by adjusting the future savings to reflect energy cost escalation rates and discount rates. A SIR of one indicates that the investment will pay for itself over the lifetime of the measure. A SIR greater than one indicates an earlier recovery of initial investment.

Seasonal energy efficiency ratio - A measurement of energy efficiency for central air conditioners. The SEER is computed by dividing cooling capacity—measured in British thermal units per hour (Btu/hr)—by the watts of power used. This seasonal efficiency accounts for start-up, jacket, and flue losses.

SEER - Acronym for Seasonal Energy Efficiency Ratio.

Setup - Selection number 3 in the Main Menu. 'Setup' contains material cost data, fuel prices, key parameters, weather data, fuel escalation rates, and measures to be considered, all of which can be altered to meet the auditor's specifications and local conditions.

Screen - The contents of a single screen of the computer. NEAT has 11 screens on which to enter data for a particular residence.

Sheathing - The rigid exterior covering over wall studs in the exterior walls of wood-frame houses. Plywood and asphalt-impregnated fiberboard are common sheathing materials.

Sill box - The area bounded on three sides by the rim joist, sill plate, and sole plate.

SIR - The acronym for Savings-to-Investment Ratio.

Slab-on-grade - A concrete foundation resting on a surface even with level ground.

Space bar - The bar-shaped key at the bottom of the keyboard that inserts a space between letters or numbers when struck.

Steady-state efficiency - The efficiency of a combustion heater reflecting how much of the fuel's theoretically available heat exits the heat exchanger.

Stud - A vertical framing member that is the structure of the wall of a wood frame home.

Sub-directory - (See "directory.") Located one step down in the directory hierarchy. Sub-directories are used for the purpose of organizing directories just as a file cabinet organizes files.

Tabular screen - A screen describing a general component type (i.e., Exterior Walls or Doors), that has several lines of input available for specific components. **Thermal damper** - See "vent damper."

Therm - A unit of energy. One therm equals 29.3 kilowatt-hours.

Unconditioned space - An area within the house's envelope which is not intentionally heated or cooled.

Vent damper - A device that conserves energy by closing part or all of the flue when a heater is not burning fuel. Vent dampers prevent heated air from escaping up the flue while the heater is not operating.

Wall code - The letter/number system used to identify each exterior wall on the floor plan. Analogous codes exist for windows, doors, attics, subspaces, and air conditioners.

Window frame - The sides, top, and sill of the window which forms a box around all the window components.

Window sash - The part of the window that surrounds and supports the glass.

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Annual Heating/Cooling Degree Hours / 24 From Weatherization Assistant Weather Files

Name of City	Degree-Hours / 24		Name of City	Degree-Hours / 24		Name of City	Degree-Hours / 24	
	Heating	Cooling		Heating	Cooling		Heating	Cooling
ABILENE, TX	3032	2579	FLINT, MI	7103	674	PATUXENT RIVER, MD	4141	1370
AKRON, OH	6359	809	FORT SMITH, AR	3734	2190	PHILADELPHIA, PA	5113	1185
ALBANY, NY	6888	830	FORT WAYNE, IN	6341	900	PHOENIX, AZ	1672	4044
ALBUQUERQUE, NM	4618	1546	FORT WORTH, TX	2643	2595	PIERRE, SD	7668	1142
ALLENTOWN, PA	5979	865	FRESNO, CA	3173	2078	PITTSBURGH, PA	6174	782
ALPENA, MI	8208	490	GLASGOW, MT	8989	744	POCATELLO, ID	7353	861
AMARIILO, TX	4648	1611	GOODLAND, KS	6500	1098	POINT MUGU, CA	2430	340
APALACHICOLA, FL	1534	2735	GRAND ISLAND, NE	6830	1188	PORT ARTHUR, TX	1628	2656
ARCATA, CA	5091	10	GRAND JUNCTION, CO	6042	1398	PORTLAND, ME	7424	447
ASHEVILLE, NC	4537	864	GRAND RAPIDS, MI	6949	792	PORTLAND, OR	4879	452
ASTORIA, OR	5331	90	GREAT FALLS, MT	7989	578	PRESCOTT, AZ	4937	1245
ATLANTA, GA	3215	1602	GREEN BAY, WI	8147	602	PROVIDENCE, RI	6148	774
AUGUSTA, GA	2938	1971	GREENSBORO, NC	4023	1419	PUEBLO, CO	5775	1340
AUSTIN, TX	2026	2930	GREENVILLE, SC	3496	1480	RALEIGH-DURHAM, NC	3778	1507
BAKERSFIELD, CA	2529	2461	HARRISBURG, PA	5411	1127	RAPID CITY, SD	7529	868
BALTIMORE, MD	5137	1267	HARTFORD, CT	6507	902	RED BLUFF, CA	3278	2098
BANGOR, ME	8168	406	HELENA, MT	8149	578	REDMOND, OR	6923	621
BARSTOW, CA	2405	2964	HOUSTON, TX	1580	2883	RENO, NV	6417	950
BATON ROUGE, LA	1814	2556	HURON, SD	8590	979	RICHMOND, VA	4166	1466
BILLINGS, MT	7466	817	INDIANAPOLIS, IN	5831	1133	ROANOKE, VA	4451	1268
BINGHAMTON, NY	7551	550	INTERNATIONAL FALLS, MN	10582	304	ROCHESTER, MN	8250	612
BIRMINGHAM, AL	3020	1907	JACKSON, MS	2602	2345	ROCHESTER, NY	7112	741
BISMARCK, ND	9283	751	JACKSONVILLE, FL	1561	2655	ROCK SPRINGS, WY	8731	492
BOISE, ID	6185	1009	KANSAS CITY, MO	5007	1775	ROSWELL, NM	3961	2034
BOSTON, MA	5874	772	KINGSVILLE, TX	1066	3617	SACRAMENTO, CA	3304	1340
BROWNSVILLE, TX	728	3687	KNOXVILLE, TN	4005	1531	SALEM, OR	5278	472
BRYCE CANYON, UT	9432	293	LA CROSSE, WI	7417	845	SALT LAKE CITY, UT	6137	1293
BUFFALO, NY	6830	659	LAKE CHARLES, LA	1718	2686	SAN ANGELO, TX	2512	2801
BURLINGTON, IA	6234	1109	LAKEHURST, NJ	5498	1065	SAN ANTONIO, TX	1805	2913
BURLINGTON, VT	7948	528	LAREDO, TX	1082	4105	SAN DIEGO, CA	1461	670
CAPE HATTERAS, NC	2740	1696	LAS VEGAS, NV	2795	3192	SAN FRANCISCO, CA	3703	213
CARIBOU, ME	9564	284	LEWISTON, ID	5702	895	SANTA MARIA, CA	3700	294
CASPER, WY	7895	794	LEWISTOWN, MT	8345	478	SAULT STE MARIE, MI	9409	272
CEDER CITY, UT	6259	994	LEXINGTON, KY	4862	1278	SAVANNAH, GA	2227	2222
CHARLESTON, SC	2414	2075	LITTLE ROCK, AR	3420	2165	SCOTTSBLUFF, NE	7330	928
CHARLESTON, WV	4876	1192	LONG BEACH, CA	1928	929	SCRANTON, PA	6410	789
CHARLOTTE, NC	3574	1584	LOS ANGELES, CA	1969	510	SEATTLE, WA	5529	242
CHATTANOOGA, TN	3896	1622	LOUISVILLE, KY	4756	1497	SHERIDAN, WY	7712	679
CHERRY POINT, NC	2709	1802	LOVELOCK, NV	6233	1262	SHERMAN, TX	2920	2463
CHEYENNE CITY, WY	7613	574	LUBBOCK, TX	4000	1962	SHREVEPORT, LA	2466	2441
CHICAGO, IL	6331	1104	LUFKIN, TX	2095	2669	SIOUX CITY, IA	6993	1149
CHINA LAKE, CA	2752	3213	MACON, GA	2643	2153	SIOUX FALLS, SD	7925	955
CINCINNATI, OH	5251	1155	MADISON, WI	7826	677	SOUTH BEND, IN	6466	876
CLAYTON, NM	5193	1052	MASON CITY, IA	7931	832	SPOKANE, WA	6984	620
CLEVELAND, OH	6313	822	MASSENA, NY	8440	552	SPRINGFIELD, IL	5607	1344
COLORADO SPRINGS, CO	6440	757	MEDFORD, OR	5523	919	SPRINGFIELD, MO	4790	1414
COLUMBIA, MO	5265	1367	MEMPHIS, TN	3359	2147	ST. LOUIS, MO	5090	1544
COLUMBIA, SC	2942	2177	MERIDIAN, MS	2763	2232	SUNNYVALE, CA	3034	390
COLUMBUS, OH	5723	967	MIAMI, FL	283	4011	SYRACUSE, NY	6987	704
CONCORD, NH	7583	696	MIDLAND, TX	2954	2347	TALLAHASSEE, FL	1760	2506
CORPUS CHRISTI, TX	1065	3505	MILES CITY, MT	8260	975	TAMPA, FL	884	3145
CUT BANK, MT	9135	382	MILWAUKEE, WI	7214	648	TOLEDO, OH	6638	839
DALLAS FORT WORTH, TX	2604	2649	MINNEAPOLIS, MN	8134	885	TONOPAH, NV	6061	1062
DAYTON, OH	5803	1073	MINOT, ND	9374	605	TOPEKA, KS	5459	1552
DAYTONA BEACH, FL	1009	2699	MISSOULA, MT	7928	487	TORONTO, ONT	7558	584
DEL RIO, TX	1656	3159	MOBILE, AL	1795	2397	TRAVERSE CITY, MI	7744	597
DENVER, CO	6411	972	MOLINE, IL	6383	1077	TRUTH OR CONSEQUENCES,	3880	1724
DES MOINES, IA	6724	1078	MONTGOMERY, AL	2572	2198	TUCSON, AZ	2025	3167
DETROIT, MI	6730	743	MONTREAL, QUE	8270	490	TUCUMCARI, NM	4367	1690
DILLON, MT	8582	444	MOUNT SHASTA, CA	5810	743	TULSA, OK	3964	2185
DODGE CITY, KS	5484	1616	NASHVILLE, TN	3858	1729	WACO, TX	2443	2969
DULUTH, MN	10017	303	NEW ORLEANS, LA	1526	2610	WASHINGTON, DC	4410	1494
EAGLE, CO	8843	533	NEW YORK, NY	5029	1076	WEST PALM BEACH, FL	281	3893
EAU CLAIRE, WI	8393	778	NEWARK, NJ	5105	1108	WHIDBEY ISLAND, WA	5424	61
EDMONTON, ALB	11206	160	NORFOLK, VA	3737	1603	WICHITA FALLS, TX	3378	2463
EL PASO, TX	2857	2429	NORTH BEND, OR	4808	20	WILMINGTON, DE	5211.	1169
EL TORO, CA	2195	970	NORTH PLATTE, NE	7339	969	WINNEMUCCA, NV	6812	1136
ELKO, NV	7570	894	OAKLAND, CA	3215	171	WINNIPEG, MAN	10906	433
ELY, NV	8081	602	OKLAHOMA CITY, OK	4036	2019	WINSLOW, AZ	5148	1516
ERIE, PA	6533	588	OLYMPIA, WA	5852	318	YAKIMA, WA	6220	861
EVANSVILLE, IN	4847	1446	OMAHA, NE	6274	1310	YOUNGSTOWN ,OH	6728	700
FARGO, ND	9410	765	ORLANDO, FL	796	3171	YUCCA FLATS, NV	5202	1775
						YUMA, AZ	1171	4424