National Energy Audit Tool (NEAT)
Users Manual (Version 8.2)
Draft Chapters 6 and 8

October 2006

Note: References in this draft manual in square brackets, "[ ]," are to sections in the January 2006 publication of "The Weatherization Assistant Users Manual for Administrative Features." A reference of "XX" is to a section which does not yet exist. All other references are to this document.

Chapter 6

The primary purpose of the Weatherization Assistant is to make energy efficiency measure recommendations applicable to specific homes. This purpose is fulfilled by gathering audit information on each dwelling and entering the information into the program. This descriptive data on each dwelling is entered under one of the Energy Audits buttons from the program Main Menu. For Version 8 of the Weatherization Assistant, the audits available are NEAT for site built homes and MHEA for manufactured, or mobile, homes.

You may initiate a new audit for a previously entered client in either of two ways: (1) by selecting one of the Energy Audit buttons on the Main Menu, then selecting the new record button,  , from the Audit Record Navigation Block (see Section [4.1], *Record Navigation*); or (2) selecting the Client button on the Main Menu, locating the client for which the audit is to be performed, selecting the Audit tab, and then clicking on either "Create New Site Built (NEAT) Audit" or "Create New Mobile Home (MHEA) Audit" (see Section [6.5], *Audits (Client)*), which ever is appropriate for this specific dwelling. Either method will take you to a Audit Information form for the respective audit type.

Since descriptive data for a site built home differs from that for a mobile home, many of the tabs and fields under these two Audit Main Menu items also differ. This chapter describes the data entered under the NEAT Main Menu item in describing a site-build home. Chapter 7 does the same for data pertaining to a mobile home, as found under the MHEA Main Menu item. Some information under the Audit Main Menu items is common to both NEAT and MHEA. This data is described once in Chapter 8. Specifically, data on the Status, Health and Safety, Itemized Costs, Utility Bills, Photos, and Measures tabs will be described there. In addition, some optional entries on the Heating tab and the Water Heaters form under the Baseloads tab will also be described in Chapter 8.

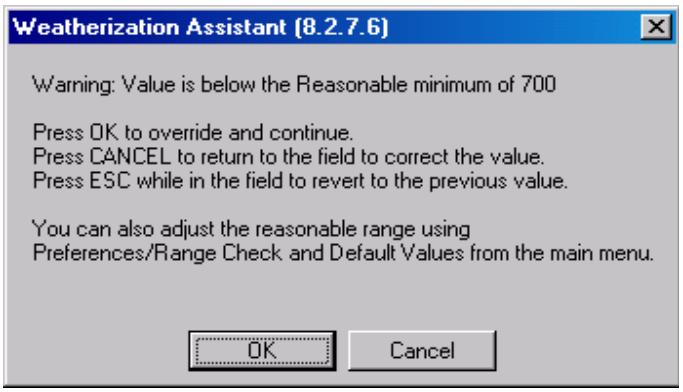
6.1 Data Entry in NEAT

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. Specifically for NEAT, this includes data under the Shell tab

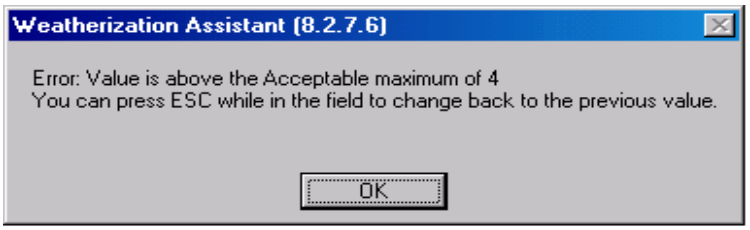
and its sub-tabs (Walls, Windows, Doors, Unfinished Attics, Finished Attics, and Foundations), as well as the Heating and Cooling tabs.

Form Views of each components' input forms discussed are included in this chapter. Blank input forms may be found in Appendix [A] under "NEAT Data Collection Forms (Blank)." These forms can also be printed from within the Weatherization Assistant (see Section [6.1], *Client Information*).

Entries whose description end in "Required" are mandatory and must have an appropriate value entered in them before you can proceed. Otherwise, the entries will be indicated as "Optional" and may be left blank Numerical entries have ranges associated with them within which the program will not question the value. Outside this range, the program will ask you to confirm the value by selecting the "OK" button or indicate your intent to change the value by selecting the "Cancel" button. You may adjust these ranges under Preferences (see Section [11.2], *Range Check and Default Values*). "Acceptable values" give ranges outside of which a value will not be accepted. Making such an entry will present you with an error message. Select the "OK" button to go back to the entry form. You will not be allowed to continue entering data until you change the entry to an acceptable value or use the "Esc" key to change the entry back to its previous acceptable value.



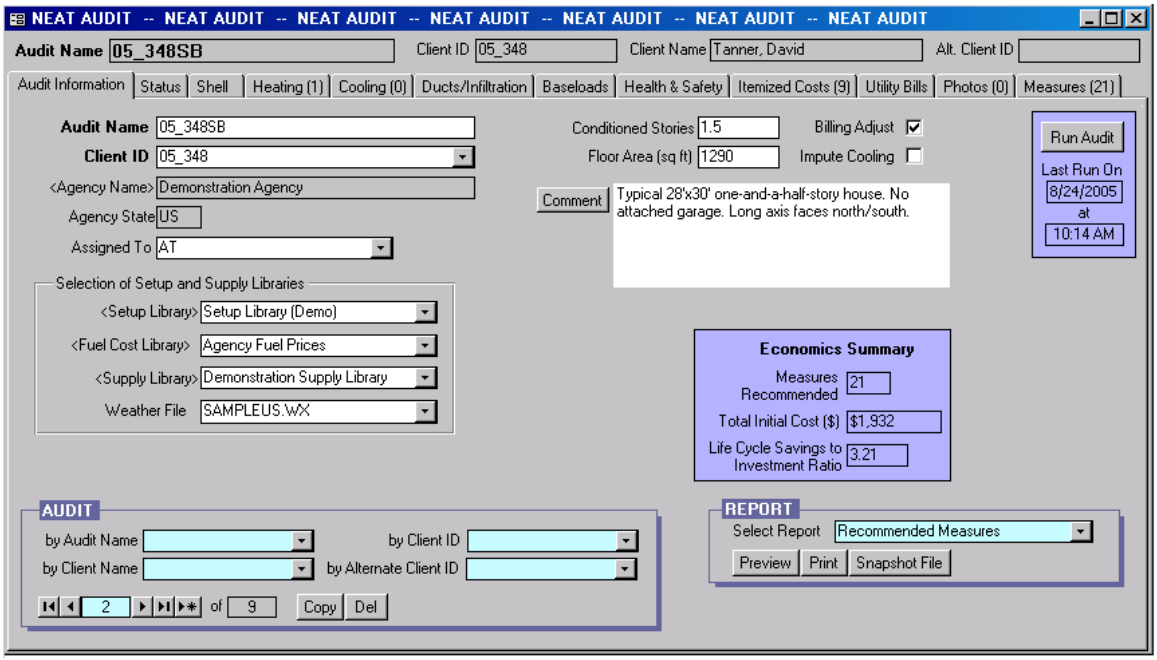
Warning indicating a numeric entry is outside the "reasonable range"



Warning indicating a numeric entry is outside the "acceptable range"

6.2 Audit Information (NEAT)

This tab on the main NEAT Audit form is used to enter overall audit information about the house and what libraries to reference for non-house specific data. Data entry items and controls visible on the form and common to both NEAT and MHEA Audits are described below:



The Audit Information form (NEAT)

Audit Name – Some convention should be adopted to supply each audit with a unique Audit Name. Most likely, each client will have only one audit associated with it. However, the possibility of multiple audits for a client should be considered. Since the Client ID must be unique for each client, the name of the client's audit might contain or somehow reference this Client ID. When first initiated, an audit will be given an Audit Name of the form "Audit (#)," where the "#" is a number forcing the name to be unique. You should replace this default name with a name of your choosing. Required.

Client ID – This field will display the Client ID of the client for whom the audit is being performed. If the audit has been initiated using the "Create New Site Built (NEAT) Audit" or "Create New Mobile Home (MHEA) Audit" buttons on the Audits tab of the Client Main Menu item, this field will automatically be filled with that client's Client ID. If, the audit is initiated using the new record button, ▶*, in the

Audit Record Navigation Block on the form itself, the Client ID will remain the same as the Client ID on the form prior to requesting the new audit. In this case, you may have to use the combo box list associated with the Client ID field to choose the correct client from those already in the database. When you do attempt to change the client, you will get a warning, since changing the client associated with an existing audit is not a normal operation. For a new audit, however, it is acceptable. The program simply does not know that this is a new audit. Required.

Agency Name / State – These un-editable fields display the Name and State of the Agency to which the Client whose house is being audited is assigned. The fields will be automatically filled in to correspond to the agency assigned to the Client whose audit is being performed, as displayed in the Client ID field immediately above. Changing the Client ID will immediately update the Agency Name and State, if needed.

Assigned To – Use the combo box list associated with this field to assign the Auditor in your agency who will be responsible for the dwelling. The list will contain only those contacts declared as Auditors on the Contacts tab of the Agency Main Menu item corresponding to the agency responsible for the client. Required.

Conditioned Stories – Enter the 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 a significant portion of its wall area is above-grade. You may enter a decimal (e.g. 1.5) for a split level or half story upstairs, though this degree of accuracy is normally not necessary. The value is used to determine an approximate distance between the lowest and highest points at which air infiltration can enter and exit the house. Default - 1. Required.

Floor Area (sq ft) – Enter the approximate number of square feet of floor area that is heated or cooled. Default - 1200. Required.

Billing Adjust – If selected and Pre-Retrofit Billing Data has been entered (see 8.11, *Utility Bills*), NEAT will compute adjusted measure savings estimates which reflect this billed usage. Both unadjusted and adjusted results will be reported in the Recommended Measure Report.

Impute Cooling – This entry was added to accommodate audits in extremely southern climates where neither heating or cooling equipment is present in the house. If selected, NEAT will "impute" cooling energy use assuming that an air-conditioner with SEER given in Key Parameters is present in the house. The feature is designed to allow installation of measures which could add to the occupants comfort even though energy cannot be saved.

Selection of Setup and Supply Libraries Data Block

The following four entries tell the program what libraries to reference for non-house specific data used by the audit.

Setup Library – Select the Setup Library from which the audit is to take measure costs, candidate measure information, and other key parameters. See Chapter [9], *Setup Library*, for additional information on the contents of the Setup Library. When you install the Weatherization Assistant on your computer, the installation routine will automatically copy the default setup library to a library under the "Your Agency Name" agency (which should have been renamed to be the name of your agency). Thus, for this agency, there will be at least one Setup Library to choose from. You may never have need for more than one Setup Library, making this selection a trivial one. However, see Chapter [9] for more information on the use of multiple setup libraries and the need to tailor the Setup Library copied from the default library to reflect your local conditions. Required.

Fuel Cost Library – Select from the Fuel Cost Library combo box the entry which contains the fuel costs to be used by the audit in calculating the dollar value of energy savings. A Fuel Cost Library is a subset of data under the Setup Library. Thus, only those fuel cost libraries under the chosen Setup Library will be available to choose from. If you change the Setup Library to be used by the audit, the Fuel Cost Library field will be automatically deleted, indicating the need to choose another entry, from the new Setup Library. If you have more than one utility supplying a particular fuel in your agency's boundaries, you may need to have more than one fuel cost library associated with your setup library. See Chapter [9], *Setup Library*, for more details. Required.

Supply Library – Although the Supply Library is used primarily in applying the optional feature of tracking your inventory (applied under Work Orders), the audit uses entries in the Supply Library for replacement refrigerators and water heaters. When you install the Weatherization Assistant on your computer, the installation routine will automatically provide you with an empty supply library. This empty supply library is sufficient to run the audit, although you will have no replacement refrigerators or water heaters to choose from unless you populate the supply library with these items. Unless an unusual situation arises, an agency will probably have only a single supply library. Multiple libraries would make tracking of inventory difficult because manual addition of the supplies in each supply library would be necessary to derive the total items available in the agency's inventory. See Chapter [10], *Supply Library*, for more information on supply libraries. Required.

Weather File – The audit must be told what climatic data to use in estimating the energy consumptions for the dwelling. Choose one of the approximately 220 weather cities listed in the combo box. They are listed in alphabetical order, first by state, then by city. You may wish to consider not only those cities in your state, but also cities which lie in another state near a border with your state. Required.

Comment – Audit comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. The Audit Comment is displayed on the Recommended Measures Report and the Input Report available from the Audit Report Block. You may also wish to include the comment in a user-designed report. Optional.

Economics Summary Block – For audits which have already had NEAT or MHEA produce recommendations, the Economics Summary block of data will display a summary of these recommendations: the number of Measures Recommended, the Total Initial Cost of these recommendations (using the audit's estimated measure costs prior to any modifications made in work orders to reflect actual costs), and the Life Cycle Savings to Investment Ratio (SIR) for all the recommended work on the house. If the audit has not yet been run on the house, the number of Measures Recommended will be "0" and the other fields will be blank. All of the fields within the Economics Summary block are un-editable.

Run Audit Button / Block – After completely describing the house to the audit with data entered under the tabs visible on the main audit forms, use the "Run Audit" button to have the audit perform its calculations and produce energy efficiency measure recommendations for the home. Within the same data block as the Run Audit button are un-editable fields showing the date and time the currently accessed audit was "Last Run On." If the audit has not yet been run for this specific house description, the date field will display "Not Run." An audit on a house may be run any number of times, but the recommendations from any previous runs will be overwritten. If you wish to run an audit on a house again, but save the recommendations from a previous audit on the same house, use the "Copy" button in the Audit Record Navigation Block in the lower left corner of the form to copy the house description. Then, give the new house description a new Audit Name (possibly a variant of the original name), make any modifications to the house description desired, then use the Run Audit button to produce another set of recommendations.

The Run Button is available from all Audit forms and may be activated from any of these forms once it has been decided that the building description is complete.

Audit Record Navigation Block – The Record Navigation block in the lower left corner of the form allows you to find, copy, delete, and navigate to existing audits in your database or to create new audits. See Section [4.1], *Record Navigation,* for information on using the Weatherization Assistant's Record Navigation Blocks. The combo box lists will display only the audits associated with the Agency currently selected (bookmarked) on the Agency Information tab under the Agency Main Menu item. Normally the agency selected on this tab is your agency, so the combo box lists will display only your agency's audits. If you have more than one agency defined in your database (e.g., your agency and the Sample Agency) and you want the combo box lists to display audits from all defined agencies, un-check the "Use the last bookmarked Agency record to filter find record lists," feature 9 from the Preferences / Features tab (see the indicated top in Section [11.4], *Features*).

Audit Report Block – The Audit Report Block located in the lower right corner of the NEAT and MHEA Audit Information forms allows access to the various reports available in the audit: (1) Recommended Measures, available only after an audit has been "Run;" (2) Input Report, summarizing all building description data entered in the audit as well as a summary of the Client data; (3) Heating System Summary, extracting only the Heating System information supplied to the audit; (4) Pressure Diagnostics Report / Form; and (5) the Health and Safety Summary, available if any health and safety issues were identified on any of the audit forms. Appendix A, *Sample Reports,* contains examples of these reports and forms. See Section [4.13], *The Report Block,* for the mechanics of using the Weatherization Assistant's Report Blocks.

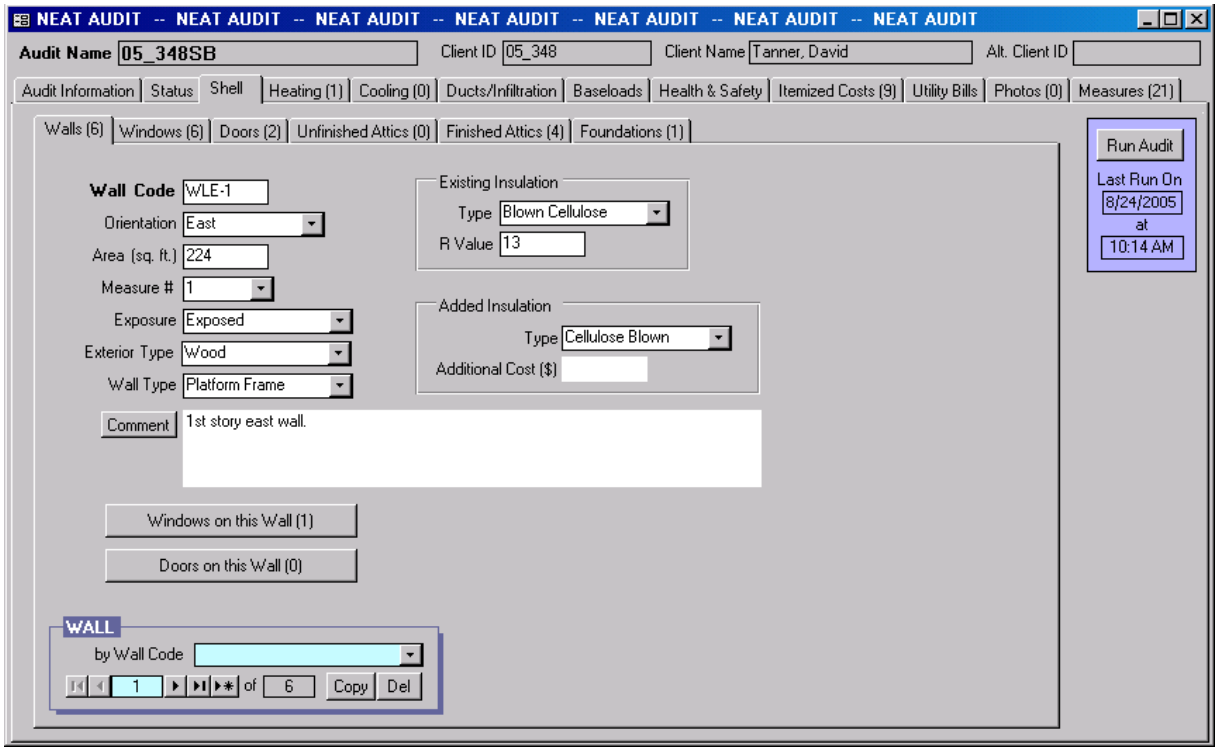
If you have selected the third party photo browser check box (Feature 2) on the Preferences/ Features tab, a Photo Folder field will appear on your Audit Information form just below the "Selection of Setup and Supply Libraries" data block. Use the Browse button to the right of this field to locate and select a location on your computer in which you have stored digital photos for this specific audit. Once selected, this location will be displayed in the Photo Folder field and remain there for all subsequent visits to this audit's data. Selecting the View button will present you with a photo browser in which you may view and edit these photos. See Section [13.1], *Digital Photos* for more information on viewing and editing photos. Note that the ability to store digital photos also exists at the Client level. You should develop a consistent policy regarding where you store reference to your photos.

6.3 Shell - Walls (Exterior)

In order for NEAT to save data and execute to produce recommendations, 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.

However, normally you will describe at least one exposed wall facing each of the four cardinal directions. Walls having different orientations differ in their heat transfer characteristics because of the different amounts of sunlight which fall on them. This is particularly important for the windows that may lie on the walls. Another criterion for separating walls of a home into multiple component descriptions in NEAT is their construction or insulation level. Walls which would benefit differently from installation of wall insulation or whose cost of insulating differ should be entered as separate wall components in NEAT. In order to describe all of the walls most efficiently, you may combine multi-storied walls that have the same orientation and construction. A maximum of 18 wall descriptions may be entered.

The following data items are used to describe each exterior wall having unique orientation and construction. All items on the Walls form are required except the "Comment" and "Additional Cost ($)."



The Walls form

Wall Code – The user-supplied wall codes identify wall sections to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. The codes must be unique for all wall descriptions within a given audit. Default wall codes are of the form "WL#" where the "#" is an integer insuring uniqueness of the code. You may wish to include characters in the code which indicate orientation, exposure, or some other characteristics. The wall code allows NEAT to subtract the correct window and door areas, entered in the Windows and Doors screens, from the corresponding wall area. The wall codes may also be helpful when labeling your drawing of the house's floor plan. NEAT will use the codes in output reports and work orders to identifying which walls should receive recommended insulation. (See Section XX, *Component Codes*). Required.

Orientation – Enter the closest cardinal compass direction the component faces, either North , South, East, or West. Required.

Area (sq.ft.) – Enter the total gross wall area in square feet of each wall segment, including the windows and doors in that wall area. Values to the nearest ten square feet are normally sufficient. Inaccuracy in this entry will mostly affect the quantity of wall insulation reported as needed should wall insulation be recommended. A decimal point is optional. This entry must be greater than zero. Required.

Measure # – The Measure Number divides the wall segments of a home into groups, each group receiving a separate single SIR for insulating the walls of the group. Give the same measure number to all walls you wish to be so grouped together. If all walls of a home are of consistent construction, you will likely want to obtain a single SIR for insulating all walls. In such a case, give all walls Measure Number 1. Reasons for giving some walls a different measure number might be differing existing insulation levels, differing costs for insulating, or differing Exposures. Frame walls with existing batt or blown (including "Other") insulation and all non-frame walls will be automatically dropped from a group unless the Added Insulation type for these wall segments is "User Type 2" (or whatever the user has defined this type to be). Walls which have been designated as un-insulatable (having an Added Insulation Type of "None") will also be automatically dropped from a group. (See "Added Insulation Type.") Measure numbers of groups must be consecutive, starting with "1." For example, a group "3" cannot be assigned unless groups "1" and "2" already exist. (See Sections XX and, *Component Codes* and *Measure Numbers*). Required.

Wall Exposure – The Exposure tells NEAT what conditions exist on the outside of the wall. NEAT gives you three choices: (1) Exposed to the outside air, (2)

Buffered by an unconditioned but enclosed space (for example, a garage or porch), or (3) adjacent to an unconditioned Attic. A wall adjacent to an unconditioned attic may be described either here or as a "Kneewall" under the Finished Attic tab. Required.

Exterior Type – Select the type of siding on the exterior surface of the wall, not the framing material or load-bearing structure. The six choices are: (1) Wood, (2) Metal or Vinyl, (3) Stucco, (4) Brick or Stone, (5) None, and (6) Other. The thermal characteristics of the "Other" selection are defined in the Setup Library (see [9.2]). NEAT assumes a layer of wood sheathing under the siding. Required.

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) Adobe, (6) Other. NEAT does not differentiate between "Balloon frame" and "Platform frame" Wall Types. The thermal characteristics of the "Other" selection are defined in the Setup Library (see [9.7]). Only the "User Type 2" Added Insulation Type will be considered for non-frame walls or frame walls with existing batt or blown insulation. (See Added Insulation Type, below.) Required.

Existing Insulation Type and R Value – Enter the type and R-Value of existing insulation found (inspect an electrical outlet, a drilled hole, or some other penetration). The six choices for the Type are: (1) None, (2) Blown Cellulose, (3) Blown Fiberglass (4) Rockwool, (5) Fiberglass Batts, (6) Polystyrene Board, and (7) Other. The thermal characteristics of the "Other" selection are defined in the Setup Library (see [9,2], *Key Parameters*). The default R-values displayed in the status bar assume a 3 ½ 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. Adding insulation to a frame wall will be considered only if "None" or "Polystyrene Board" is specified as the Existing Insulation Type. If "None" is chosen for the Type, the associated R Value field will not appear. Required.

Added Insulation Type – Indicate to NEAT the type of wall insulation you would expect to use to insulate the wall if the recommendation is made. NEAT currently allows entries of: (1) None, (2) Blown Cellulose, (3) User Type 1, and (4) User Type 2. Select "None" if conditions prohibit insulating this particular wall segment. The User Types of insulation are defined by the user under the User Define Insulation Types tab on the Setup Library form (see Section [9.7], *User Defined Insulation Types*). Following their definition, the names you enter there for these types of insulation will be displayed here as well as in all reports, instead of the "User Types" designation. The R-Values added to the wall cavity for these two types are also entered in the Setup Library. Only User-Type 2 insulation will be considered being

added to a frame wall with existing batt or blown (including "Other") insulation or to non-frame walls. Required.

Additional Cost ($) – Enter any added costs necessary to insulate this specific wall segment not normally associated with the wall insulation measure and, therefore, not accounted for in the measure costs in the Setup Library (see Section [9.5], *Library Measures*). For instance, enter additional labor costs for removing and repairing an unusual siding type. The cost is a total added dollar cost for this specific wall segment, not a cost per square foot of wall. The amount will be added to the cost computed from the wall area and cost per square foot specified under the Library Measures tab of the Setup Library. A blank entry indicates no additional cost. Default - 0. Optional.

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). Thus, you may wish to enter comments related to any observations made during the audit which might effect the installation of measures or repair work that is needed. If an "Additional Cost" has been specified for insulating the wall, this comment could be used to briefly explain the cost. Optional.

Windows on this Wall – Selecting this button will take you to a Data Sheet View (see Section [4.8], *Data Sheet and Form Views of Records*) displaying only those windows lying on the wall you are currently accessing. Except for this restriction the display is the same as if you had chosen the Data Sheet View from the Windows sub-tab from the Shell tab of the NEAT Audit (see Section 6.4, *Shell - Windows*). There is one other limitation. Execution cannot be initiated from this form. You are free to make any modifications to the window description from this form just as you would from the main Windows form. You may even choose to go to the Form View for a specific window, though you cannot initiate execution or navigate to other components from this form.

Doors on this Wall – This button behaves in an analogous manner as the "Windows on this Wall" button described above except it allows you to view the doors lying on the wall being accessed. See the description immediately above.

Wall Record Navigation Block – The Wall Record Navigation Block may be used to find and access existing wall descriptions for the audit being edited, copy or delete the currently accessed wall description, or initiate a new wall description for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

6.4 Shell - Windows

The Window form contains information needed to describe different window types. Each screen describes a specific type with given dimensions, shading, construction, etc. Windows of the same type and size on the same wall segment may be entered on a single record. In the Number of Windows field, indicate how many windows have this description.

A total of twenty-four window descriptions may be entered. If the twenty-four window records 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 inches 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.

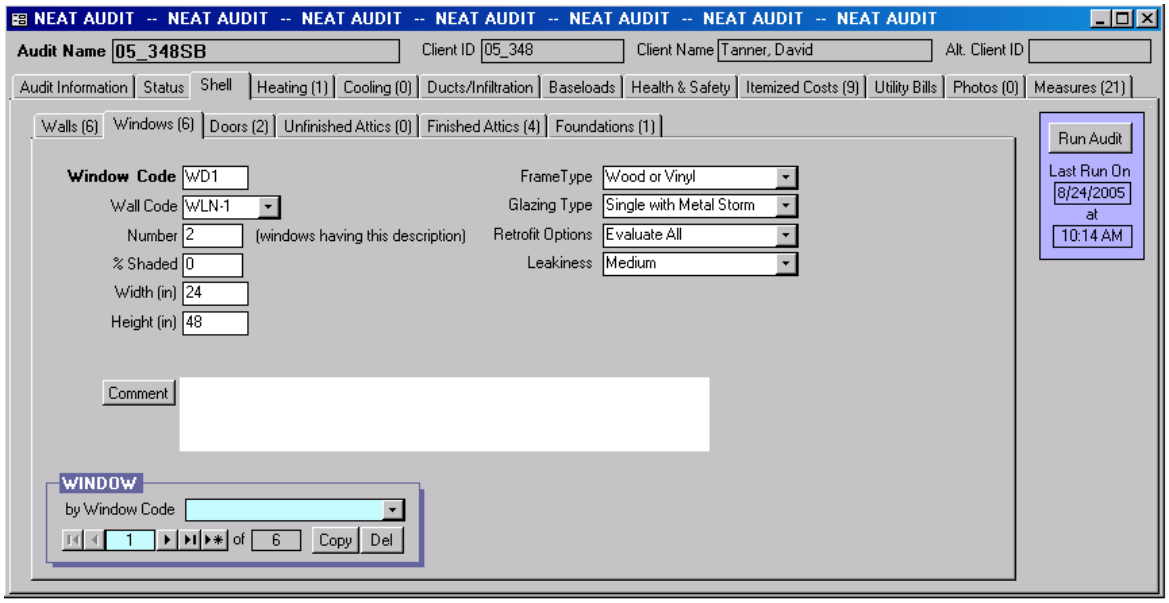
Be careful when adding or averaging window dimensions. Window treatments may be priced either by dimension or unit. As a result, if unrealistically large pseudo-windows have been described to NEAT by adding dimensions of individual windows, and window treatment measures have been priced by unit, erroneous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

The following data items are used to describe each window description. All but the "Comment" are required.

Window Code – The user-supplied window codes identify window descriptions you enter to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. The codes must be unique for all window descriptions within a given audit. However, if more than one window meets the description given, you may enter the description once and indicate the number which are so described. Default window codes are of the form "WD#" where the "#" is an integer insuring uniqueness of the code. You may wish to include characters in the code which indicate orientation or some other characteristics. The window code allows NEAT to assign window areas to specific

walls you describe on the Walls forms. The window codes may also be helpful when labeling your drawing of the house's floor plan. NEAT will use the codes in output reports and work orders to identify which windows should receive recommended energy efficiency measures. (See Section XX, *Component Codes*). Required.

Wall Code – Enter the Wall Code for the exterior wall on which the window lies. The acceptable Wall Codes, as determined by your input for the Exterior Walls, will be displayed in a combo-box list associated with the field. This dictates that you must enter a wall description before attempting to describe any windows which may lie on the wall. Specifying the Wall Code for each window allows NEAT to subtract window area from the appropriate gross wall area. (See Section XX, *Component Codes*). Required.



The Windows form

Number (windows having this description) – Enter the number of identical windows described by this record of data. Note that since one of the data entry items for windows is the wall on which the window lies, if the Number of windows is greater than one, it indicates more than one window lies on the indicated wall. 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. Required.

% Shaded – Enter the 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. Required.

Width and Height – Enter the width and height in inches of the window being described. NEAT will use these dimensions to estimate the glazing area of the window. NEAT will also use these dimensions to compute the area of the window to subtract from the appropriate wall area. For most windows, these dimensions can be the same as those of a retrofit window or storm window. If so entered, the auditor can refer to these dimensions if either of these measures prove to be cost-effective. Otherwise the required dimensions may be entered into the Comments field, which can then be copied to work orders, if desired.

Frame Type – Select the correct window frame and sash construction materials. The three choices are: (1) Wood or Vinyl, (2) Metal, and (3) Improved metal (metal frame with a thermal break).

Glazing Type – Select the window glazing types, depending on the number of panes of glass in the primary window and the characteristics of any storm window that may cover the primary window. The five choices are: (1) Single, (2) Single with wood storm, (3) Single with metal storm (4) Double pane, and (5) Single with bad storm. NEAT treats "Single with bad storm" as a single pane window without a storm. The entry is for the auditor's sue in conveying additional information.

Retrofit Options – Provides you with five options indicating different approaches to retrofitting the window: (1) Evaluate All. Allows NEAT to determine the most cost-effective approach , including possibly no action at all. (2) Weatherize. Indicates your decision to weatherize the window using caulk, weatherstripping, incidental repair, etc. (3) Replace. Due to damage beyond repair, you have decided that the window must be replaced. (4) Add Storm. (5) Evaluate None. For all but the first selection, NEAT views the action chosen as mandatory, producing a recommendation regardless of the SIR and not considering the other options. However, an estimated energy savings and SIR will still be determined. If the SIR is less than the accepted minimum, the action will have to be considered a repair.

Leakiness – Provide an estimate of the air leakiness of the window being described. The five choices are: (1) Very Tight, (2) Tight, (3) Medium, (4) Loose, and (5) Very Loose. Typical categories by window type are listed below. Additional guidance in the selection of the leakiness category can be found in Appendix XX. Degrade the leakiness description one level if the window panes themselves have become significantly loose in their mounting and/or a small (i.e. half-dollar-sized) piece of window is broken out. Degrade the leakiness two levels if there is a larger

hole in a window pane and/or an entire pane is missing. Upgrade the leakiness description one level if a storm window in average or better condition is installed. Required.

Fixed windows – The leakiness of a typical fixed window is Very Tight.

Casement Windows – The leakiness of a typical casement window is Very Tight.

Single- or double-hung (vertical slider) windows – The leakiness of a typical non-wood vertical slider window is Tight and the leakiness of a typical wood window found in older homes is Medium.

Horizontal slider windows – The leakiness of a typical horizontal slider window is medium.

Jalousie windows – The leakiness of a typical jalousie window is Loose.

Awning and hopper windows (casement design)– The leakiness of a typical awning and hopper window that are like casement windows is Very Tight.

Awning and hopper windows (awning design)– The leakiness of a typical awning window that is like a jalousie window is Medium.

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). Thus, you may wish to enter comments related to any observations made during the audit which might effect the installation of measures or repair work that is needed. Reasons for selecting a particular Retrofit Option for this window description would be an appropriate comment. Optional.

Window Record Navigation Block – The Window Record Navigation Block may be used to find and access existing window descriptions for the audit being edited, copy or delete the currently accessed window description, or initiate a new window description for the audit. See Section, *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

6.5 Shell - Doors

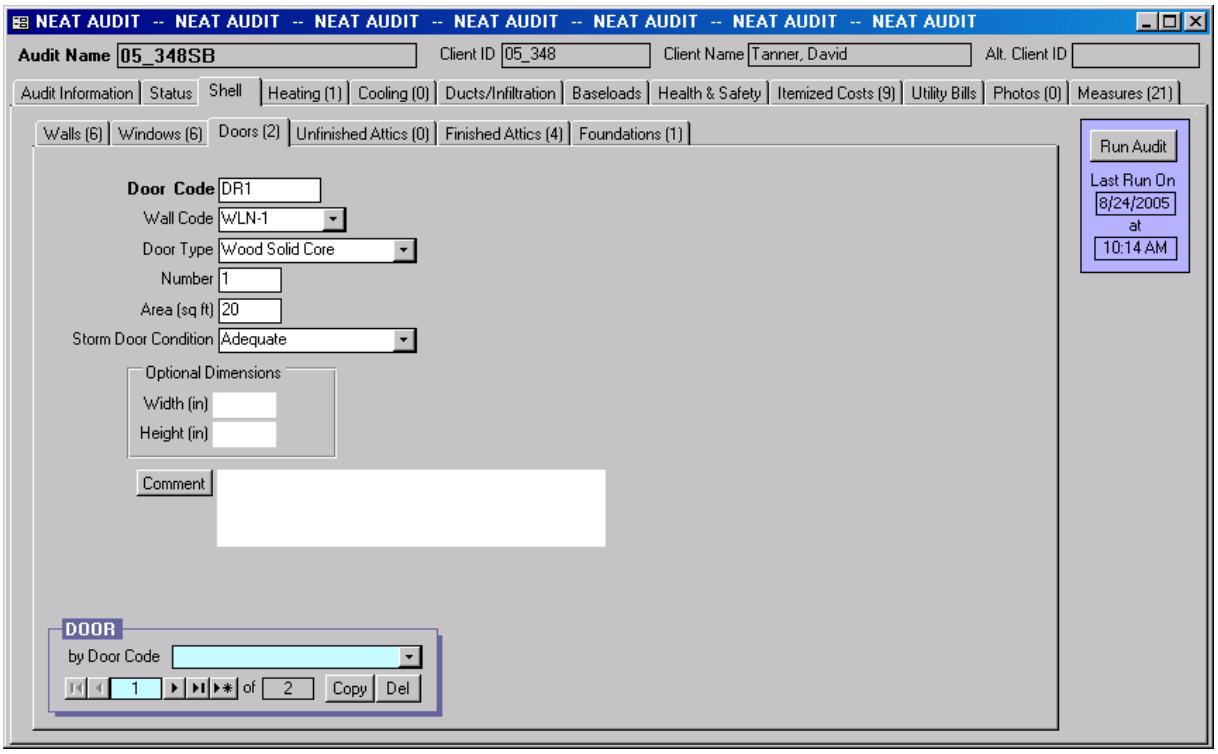
Storm doors or replacement doors are not evaluated within NEAT because they are normally not cost-effective measures, based solely on heat conduction savings. Storm doors or replacement doors may, however, be considered as repair items related to weatherization or as part of the air-leakage reduction work. If installed, their cost could be entered as part of the Infiltration Reduction Cost (see Section 8.3, *Ducts and Infiltration*) or a repair cost entered on the Itemized Costs form (see Section 6.10, *Itemized Additional Costs and User-Defined Measures*).

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 seen as wall area in the cost calculations for wall insulation. Each door must be associated with a previously defined wall. A maximum of ten doors (for all walls) can be entered per house.

Door data are presented in the following order:

Door Code – The user-supplied door codes identify doors you enter to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. The codes must be unique for all doors within a given audit. However, if more than one door meets the description given, you may enter the description once and indicate the number which are so described. Default door codes are of the form "DR#" where the "#" is an integer insuring uniqueness of the code. You may wish to include characters in the code which indicate orientation or some other characteristics. The door code allows NEAT to assign door areas to specific walls you describe on the Walls forms. The door codes may also be helpful when labeling your drawing of the house's floor plan. (See Section XX, *Component Codes*). Required.

Wall Code – Enter the Wall Code for the exterior wall on which the door lies. The acceptable Wall Codes, as determined by your input for the Exterior Walls, will be displayed in a combo-box list associated with the field. This dictates that you must enter a wall description before attempting to describe any door which may lie on the wall. Specifying the Wall Code for each door allows NEAT to subtract door area from the appropriate gross wall area. (See Section XX, *Component Codes*). Required.



The Doors form

Door Type – Select one of the five door types: (1) Wood Hollow Core, (2) Wood Solid Core, (3) Steel Insulated, (4) Single (pane) Sliding Glass, or (5) Double (pane) Sliding Glass. 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. Required.

Number – Enter the number of identical doors that match the description given on the remainder of the form. Default - 1. Required.

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

Storm Door Condition – Enter one of three choices for the storm door condition: (1) Adequate, (2) Deteriorated, or (3) None. NEAT treats "Deteriorated" the same as "None," the distinction allowing the auditor to convey added information. Required.

Optional Dimensions - Width and Height – Use these two entries to record the 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. Optional.

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. Optional.

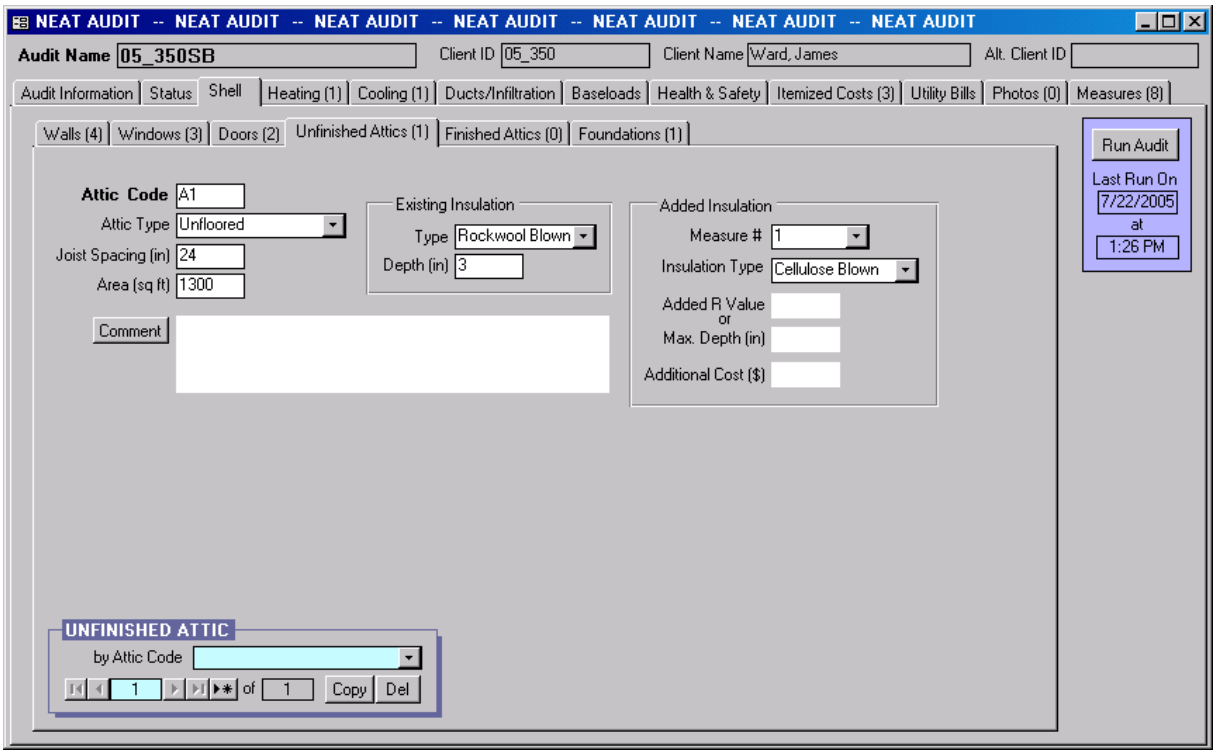
Door Record Navigation Block – The Door Record Navigation Block may be used to find and access existing door descriptions for the audit being edited, copy or delete the currently accessed door description, or initiate a new door description for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

6.6 Shell - Unfinished Attics

You may describe as many as seven unfinished attic areas to NEAT, though many houses will require only one. Some homes have had additions built onto them which may have attic areas which differ in characteristics from the attic of the original home. Use the Finished Attic form to describe any components of a finished attic, i.e. an attic area which contributes to the conditioned area of the home. Numerous fields on the unfinished attic form are also on the finished attic form.

Data regarding unfinished attics are presented in the following order:

Attic Code – The user-supplied attic codes identify attic components to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. All codes for the UNFINISHED and FINISHED attic components must be unique for a specific house. Default unfinished attic codes are of the form "A#" where the "#" is an integer insuring uniqueness of the code. The attic code may be helpful when labeling your drawing of the house's floor plan. NEAT will use the codes in output reports and work orders to identifying which attics should receive recommended insulation. (See Section XX, *Component Codes*). This field is found in both the Unfinished and Finished Attic forms. Required.



The Unfinished Attic form

Attic Type – Enter one of three choices: (1) Unfloored, (2) Floored, (3) Cathedral / Flat. NEAT does not treat "Unfloored" and "Floored" attics differently. However 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 Cost and the restriction on the total depth of insulation may be entered into the Max. Depth field. "Cathedral / Flat" pertains to any segment where the roof and ceiling surfaces are parallel. Required.

Joist Spacing – Enter the joist spacing in inches. This number is for reference and is not used in the calculations. However, it may be important to an insulation contractor installing batt insulation in the attic. Default - 24. Required.

Area – Enter the area in square feet of the ceiling or attic floor that borders a conditioned space. For "Cathedral / Flat" attic areas, enter the actual area of the slopped ceiling. This value must be greater than 0. This field is found in both the Unfinished and Finished Attic forms. Required.

Existing Insulation Type – Enter one of six choices: (1) None, (2) Cellulose Blown, (3) Fiberglass Blown, (4) Rockwool Blown, (5) Fiberglass Batts, or (6) Other. Select "None" if no insulation already exists, in which case the Existing Insulation

Depth field will automatically disappear. The R's per inch for the "Other" insulation type may be specified by the user in the Setup Library. This field is found in both the Unfinished and Finished Attic forms. Required.

Existing Insulation Depth – Enter the average depth of existing insulation, in inches, found in this attic segment. Compression around eaves may be ignored. This field will disappear if "None" is chosen for the Existing Insulation Type. This field is found in both the Unfinished and Finished Attic forms. Required.

Measure # – The Measure Number divides the attic segments (if more than one exists) of a home into groups, each group receiving a separate recommendation and SIR for insulating the attics of the group. Give the same measure number to all attics you wish to be so grouped together. If only one attic exists or all attics of a home are of consistent construction, you will likely want to obtain a single recommendation and SIR for insulating the attics. In such a case, give all unfinished attics Measure Number 1. If the home has one or more additions and the unfinished attics in these additions have differing existing insulation levels, costs for insulating, or restrictions, give them different measure numbers. Each attic will then receive the insulation recommendation most cost-effective in light of its existing condition. Measure numbers must be consecutive, starting with "1." For example, a group "3" cannot be assigned unless groups "1" and "2" already exist. (See Sections XX and, *Component Codes* and *Measure Numbers*). This field is found in both the Unfinished and Finished Attic forms. Required.

Added Insulation Type – Select the type of insulation to be added to the attic area should insulation be recommended: (1) None, (2) Cellulose Blown, (3) Fiberglass Blown, (4) User Type 1, and (5) User Type 2. Select "None" if conditions prohibit insulating the attic. "User Type 1" and "User Type 2" insulation types are defined by the user under the User Defined Insulation Types tab on the Setup Library form. Following their definition, the names you enter there for these types of insulation will be displayed here as well as in all reports, instead of the "User Types" designation. The R's per inch for these two types are also entered in the Setup Library (see Section [9.7], *User-Defined Insulation Types)*. Unless entries are present in either the Added R Value of Max Depth fields, the standard levels or R-Value (11, 19, 30, and 38) will be considered for the type chosen, with the most cost-effective recommended. This field is found in both the Unfinished and Finished Attic forms. Required.

Added R Value – If you wish NEAT to evaluate only a specific R-value of added attic insulation, enter the R-Value in this field. If left blank, NEAT will determine the most cost-effective level for you. If entered, all other levels will be ignored and the addition of the specified level will be considered mandatory. WARNING: If the

specified level proves not to be cost-effective, its addition will still be listed with the recommended measures. In such cases, it would be wise to run NEAT again, allowing the program to choose a cost-effective level, if one exists. This entry might be used if state codes dictate specific attic insulation levels. NEAT will hide this field if you have entered "None" for added insulation type. This field is found in both the Unfinished and Finished Attic forms. Optional.

Max. Depth – If there is a restriction to the depth of insulation which can exist in an attic, enter the depth (existing PLUS added), in inches, in this field. If no restriction exists, leave the field blank. It is expected that the insulation depth will be restricted at the eaves though it may be virtually unrestricted toward the interior of the attic. For floored attics, this depth will usually be the height of the attic floor joists (3 ½ in. or 5 ½ in.). 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) which will fit into the cavity, but also the level of insulation to exactly fill the attic cavity. Insulation costs use interpolations between costs of installing the standard levels, as given by the User in the Setup Library. NEAT will hide this field if you have entered "None" for added insulation type. This field is found in both the Unfinished and Finished Attic forms. Optional.

Additional Cost – Enter any additional costs not normally associated with installation of attic insulation. These might include the cost for cutting an opening into the attic or for insulating beneath an attic floor. The value is a lumped dollar amount, not per square foot. The amount will be added to the cost computed from the product of the area and cost per square foot specified under the Library Measures tab of the Setup Library. NEAT will hide this field if you have entered "None" for added insulation type. This field is found in both the Unfinished and Finished Attic forms. (Optional.)

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). Thus, you may wish to enter comments related to any observations made during the audit which might effect the installation of measures or

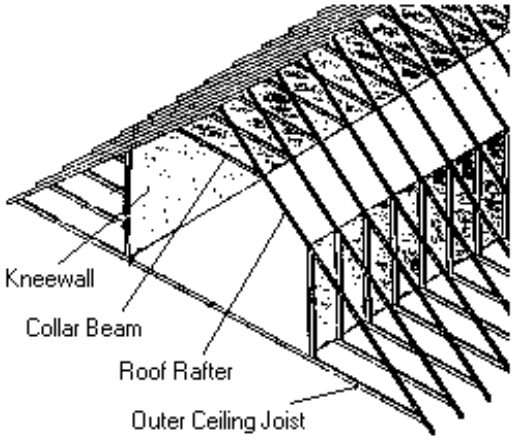
repair work that is needed. If you have specified a specific Added R Value, a Max. Depth, or an "Additional Cost" for insulating the attic, this comment could be used to briefly explain why such conditions exist. Optional.

Unfinished Attic Record Navigation Block – The Unfinished Attic Record Navigation Block may be used to find and access existing attic descriptions for the audit being edited, copy or delete the currently accessed attic description, or initiate a new attic description for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

6.7 Shell - Finished Attics

Use the Finished Attics form to describe components of a finished attic, i.e., an attic which contributes to the conditioned space of the home. Four types of finished attic components can be described to NEAT: the outer ceiling joist, the collar beam, kneewall, and roof rafter (see Attic Area Type, below). You may enter as many as 16 components in any combination of the four types.

The entries on the Finished Attic form are similar to those for the Unfinished Attic. Refer to Section 6.6, *Unfinished Attics*, for descriptions of the majority of fields. However, the following items should be noted:



Finished Attic Area Types

1. No Attic Floor Type is entered for the kneewall or roof rafter since these components cannot be floored or un-floored.
2. No Measure Number is requested for the kneewall. Insulation of a kneewall is automatically ranked separately.
3. The Added Insulation Type for the kneewall is assumed to be an R-13 faced fiberglass batt.
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 "None" is selected for the type of either the existing or added insulation, the corresponding depth entry will be hid.

The only entries which have been added to or altered from the Unfinished Attic form are the following:

Attic Area Type – Choose from the following four area types: (1) Outer Ceiling Joist, (2) Collar Beam, (3) Kneewall, and (4) Roof Rafter.

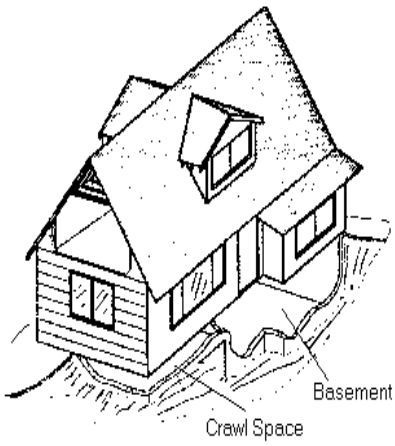
Attic Floor Type – This entry is analogous to the Attic Type on the Unfinished Attics form. It differs in that the "Cathedral/Flat" option has been eliminated. Such attic areas on the Finished Attics form would be entered as Roof Rafter segments. The remaining options are (1) Unfloored and (2) Floored. This field will disappear for Attic Area Types of Kneewall and Roof Rafter.

Finished Attic Record Navigation Block – The Finished Attic Record Navigation Block may be used to find and access existing finished attic components for the audit being edited, copy or delete the currently accessed finished attic component, or initiate a new finished attic component for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

6.8 Shell - Foundations

The Foundations tab is used to describe basements (finished and unfinished), crawl spaces, slab-on-grade foundations, and floors exposed to the outside air. Basements and crawl spaces are assume to have concrete block walls, though other cementitious materials will likely have similar characteristics.

Data entries used to describe foundation spaces are presented as follows:

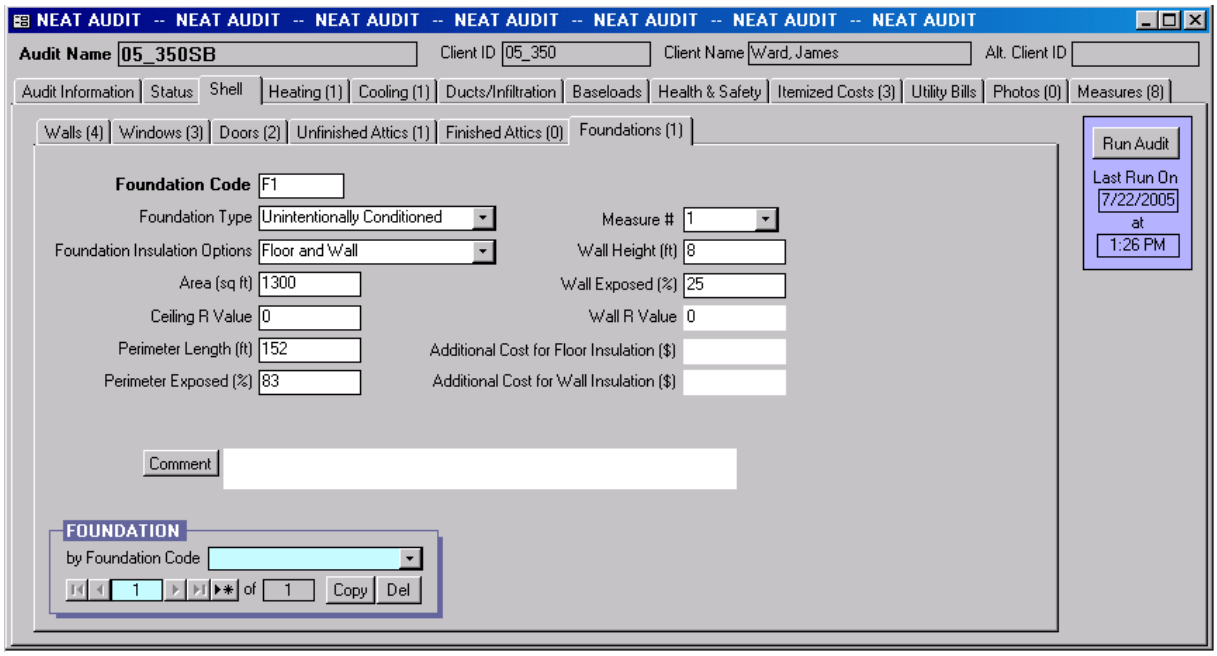


Foundation Spaces include basements and crawl spaces

Foundation Code – The user-supplied foundation codes identify foundation spaces to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. The codes must be unique for all foundation space descriptions within a given audit. Default foundation space codes are of the form "F#" where the "#" is an integer insuring uniqueness of the code. You may wish to include characters in the code which indicate the foundation space type or some other characteristics. The codes may also be helpful when labeling your drawing of the house's floor plan, particularly if there are more than one

foundation space. NEAT will use the codes in output reports and work orders to identify which spaces should receive recommended energy efficiency measures. (See Section XX, *Component Codes*). Required.

Foundation Type – Enter one of seven choices for the foundation space type: (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) Uninsulated Slab; (6) Insulated Slab; and (7) Exposed floor (an overhang or house on stilts). Required.



The Foundations form

Certain Foundation Space types do not require data in all fields of this component type while others 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.

Foundation Insulation Options – Indicate how you wish NEAT to consider insulating the foundation space. The choices are: (1) Evaluate Neither (do not consider either floor or wall insulation for the space), (2) Floor and Wall (allow NEAT to determine the most cost-effective of the two insulation strategies, (3) Floor Only, and (4) Wall Only. Regardless of the option chosen, NEAT will still not recommend a foundation insulation measure which does not meet the minimum SIR test. Some Foundation Types preclude consideration of certain insulation strategies (e.g. wall insulation for an exposed floor or a vented crawl space). These are automatically excluded. Sill insulation is considered separately from the Floor and Wall insulation measures addressed by this data field. However sill and floor insulation will never both be recommended for the same space, since the program assumes floor insulation includes insulation of the sill. Required.

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. Required.

Ceiling R-Value – Enter the R-value of the existing insulation in the ceiling over the basement or crawl space. The field will automatically disappear for Slab Foundation Types. Required.

Perimeter Length – Enter the length, in feet, of the floor perimeter bordering the outdoors. Do not include the perimeter that borders another foundation space. The default is the perimeter of a square with area given in the Area field. The value is used with the Wall Height to determine the space's wall area bordering the outside or ground. The field will disappear for the "Exposed Floor" Foundation Type. The value must be greater than zero. Required.

Perimeter Exposed (%) – Enter an estimate of the percent of floor perimeter for which the band (rim) joist is uninsulated and exposed to the outdoor air. (Do not enter the % symbol.) This entry is used only to determine what percent of the foundation space's rim joist will benefit from insulation. Default - 100. Required.

Measure # – The Measure Number divides the foundation spaces (if more than one exists) of a home into groups, each group receiving a separate recommendation and SIR for insulating. It is wise to give each foundation space a different measure number unless they are basically identical and you wish to have the same insulation strategy (Foundation Insulation Option) applied to each. Foundation spaces of different Types (e.g. "Non Conditioned" versus "Unintentionally Conditioned"), with differing existing insulation locations or levels, different costs of insulating, or different retrofit Insulation Options applied, will likely have different SIRs for implementing the indicated insulation strategy. Measure numbers must be consecutive, starting with "1."

For example, a group "3" cannot be assigned unless groups "1" and "2" already exist. (See Sections XX and, *Component Codes* and *Measure Numbers*). Required.

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 for the space.

Wall Exposed % - Estimate the percent of the basement wall or crawl space wall which is exposed to the outside air, i.e., above grade. Estimate an average if the exposure is not uniform. Do not enter the % symbol. Default - 100. Required.

Wall R-Value – Enter the R-value of insulation currently on the basement or crawl space wall. NEAT assumes this coverage is uniform. If only part of the wall is insulated either (1) adjust the Perimeter to subtract out the insulated portion and enter zero here, or (2) enter an area-weighted average R-Value. No entry is the same as "0." Optional.

Additional Cost for Floor/Wall Insulation ($) – Enter any additional costs not normally associated with insulating the foundation space. Separate entries are provided for the floor and wall insulation options, provided each are being evaluated (see Foundation Insulation Options). The value is a lumped dollar amount, not per square foot. The amount will be added to the cost computed from the subspace dimensions and cost per square foot specified under the Library Measures tab of the Setup Library. The cost for freeze protecting water pipes is an example of an additional cost for the foundation space insulation measures. Default - 0. Optional.

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). Thus, you may wish to enter comments related to any observations made during the audit which might effect the installation of measures or repair work that is needed. If you have specified an "Additional Cost" for insulating the foundation space or have specified a specific Insulation Option, this comment could be used to briefly explain why such conditions exist. Optional.

Foundation Record Navigation Block – The Foundation Record Navigation Block may be used to find and access existing foundation descriptions for the audit being

edited, copy or delete the currently accessed foundation description, or initiate a new foundation description for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

6.9 Heating - General Data

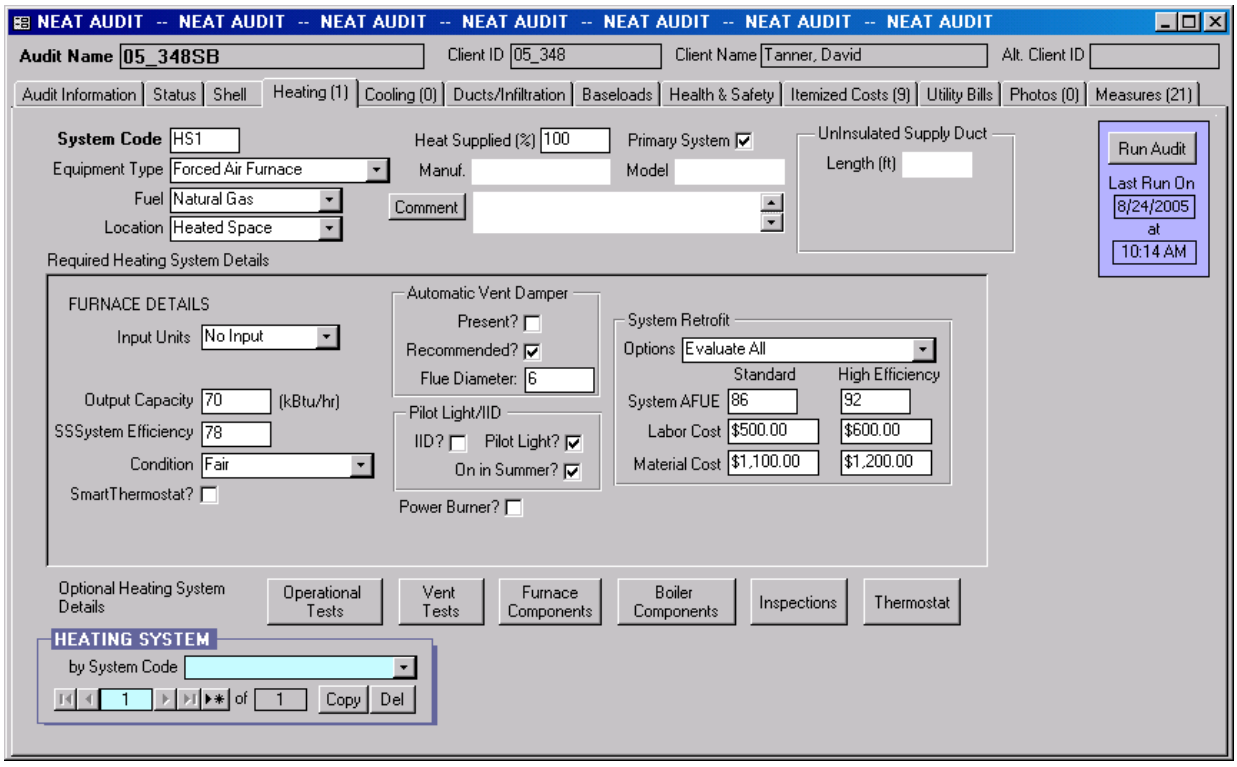
NEAT Version 8 allows the definition of a "Primary" heating system and as many "Secondary" systems as are required to describe all of the heat sources in a home. Describe the Primary system as the first record on the Heating forms. The primary system should be the system which supplies the majority of the heat to the home and on which NEAT will consider installing energy efficiency measures.

On succeeding Heating forms, describe any secondary sources of heat used in the home. NEAT version 8 allows you to specify that any secondary heating source will be eliminated if the Primary source is replaced. The program assumes any heat formerly supplied by such a secondary source will be supplied by the new Primary system following its installation.

The Heating forms are divided into three sections: a general description of the system at the top of each form, Required Heating System Details at the middle of the form, and buttons for entry of Optional Heating System Details at the bottom. Always enter data in the upper portion first, since the required system details will not be necessary for all Equipment Types and Fuels and may differ for others.

Data entry items included in the general description of the Heating forms is described in this section. Required and Optional System Details entries are described in the succeeding sections.

System Code – The user-supplied System Code identifies the heating system to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. The codes must be unique for all heating system descriptions within a given audit. Default heating system codes are of the form "HS#" where the "#" is an integer insuring uniqueness of the code. You may wish to include characters in the code that correspond to some characteristics of the heating system. The codes may also be helpful when labeling your drawing of the house's floor plan, particularly if there are more than one heating system. NEAT will use the codes in output reports and work orders to identify the system which should receives the recommended energy efficiency measures. (See Section XX, *Component Codes*). Required.



The Heating form

Equipment Type – Enter one of ten selections: (1) Gravity Furnace, (2) Forced Air Furnace, (3) Steam Boiler, (4) Hot Water Boiler, (5) Fixed Electric Resistance, (6) Portable Electric Resistance, (7) Heat Pump, (8) Vented Space Heater, (9) Unvented Space Heater, and (10) 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. The System Details portion of the form will vary depending on the Equipment Type selected here. Required.

Fuel – Enter one of seven selections for the heating system fuel: (1) Natural Gas, (2) Oil, (3) Electricity, (4) Propane, (5) Wood, (6) Coal, (7) Kerosene, and (8) Other. The heat content and price for the "Other" fuel type are set by the user under the Fuel Costs tab of the Setup Library. The System Details portion of the form may vary depending on the Fuel selected here. Required.

Location - Enter one of three locations of the heating system: (1) Heated Space (a space that utilizes a thermostat to control its temperature), (2) Unconditioned Space (a space not heated by a mechanical system), and (3) Unintentionally Heated Space (a space which is partially heated by waste heat from a furnace, boiler, un-insulated

ducts, or other heat producing appliance). The choice will affect the savings attributed to vent dampers. Required.

Heat Supplied (%) – Enter an estimate the percent of floor space that is heated by the heating system being described. Do not enter the % symbol. A discussion with household occupants will help you to arrive at this figure. The total of these entries on all heating system forms will be forced to be less than 100. Required.

Primary System – NEAT supports only one primary heating system per house. Use the Primary System check box to identify the Primary system. The Primary system should be that system that supplies the majority of heat and to which the heating retrofits will apply. If this check box is left unchecked, the system will be assumed to be a secondary system, unless it is the only system described. Checking the box for any heating system will automatically un-check the box for any other system you may have previously indicated as being the primary system. It is best to have the first heating system described be the Primary system.

Manufacturer, Model – Enter the name of the manufacturer and model of the existing heating system if needed for reference, possibly in establishing an appropriate replacement. The information will most often be found on the name- plate of the equipment. Optional.

Eliminate with Primary System Replacement – Use this check box to identify any secondary system that is to be eliminated by replacing the primary system. The percent heat supplied by any secondary heating system so identified will be attributed to the replacement primary system. This check box is applicable to secondary systems only.

Uninsulated Supply Duct Length – Enter the length, in feet, of uninsulated supply duct in unconditioned spaces. The value is used to estimate savings for the duct insulation measure. Entry is optional but must be entered if the Duct Insulation measure is to be evaluated. Entry is permitted for a ducted primary system only. Secondary systems are assumed to have no distribution system. Duct leakage characteristics are entered under the Ducts/Infiltration tab. Default 0. Optional.

Perimeter (of UnInsulated Supply Duct) – Enter the average perimeter, in inches, of uninsulated supply duct in unconditioned spaces. The value is used together with the Length to estimate the surface area of uninsulated duct in computing the savings and quantity for the duct insulation measure. Ducts are often of varying sizes in homes. Thus, this entry may be difficult to estimate. Though the quantity of insulation and the cost of this measure depend on the area of insulation computed using this parameter, the cost-effectiveness of insulating the ducts will most likely not be significantly affected. This field is accessed and required only for non-zero entries of

Uninsulated Duct Length. The field will automatically disappear if the Duct Length is set to zero. Conditionally required.

Location of Duct – Select the location of the uninsulated duct as either Attic or Subspace. If the Location is "Subspace," the duct is assumed to be in the largest unintentionally heated space described by the user on the Foundations forms, else, in an unconditioned space. If the location is "Attic," an attic environment is assumed surrounding the duct. If uninsulated ducts exist in both attic and subspace locations, choose the space having the greatest uninsulated duct surface area. The field is presented and required only if the Uninsulated Duct Length is greater than 0. The entry will automatically disappear if the value for Uninsulated Duct Length is changed to zero or erased. Conditionally required.

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). Thus, you may wish to enter comments related to any observations made during the audit which might effect the installation of measures or repair work that is needed. Heating system comments may include observations of equipment conditions, reasons for selecting specific Retrofit Options, or reference to health and safety items. Note that comment fields are also available under each of the Optional Heating System Details buttons. Optional.

Heating System Record Navigation Block – The Heating System Record Navigation Block may be used to find and access existing heating system descriptions for the audit being edited, copy or delete the currently accessed heating system description, or initiate a new heating system description for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

Optional Heating System Details – Version 8 of the Weatherization Assistant has added an optional capability of documenting a relatively extensive number of heating system observations which may be encountered during an audit of the dwelling. Input forms for this data are accessed through buttons at the bottom of the Heating form in both NEAT and MHEA. See Section 8.2, *Optional Entries under the Heating Form*, for discussion of this optional data.

6.10 Required Heating System Details Sub-Form

The data requirements for the Required Heating System Details sub-form of the Heating form varies depending on your responses for the general heating system data.

For most electrical resistance systems, no further data is needed and the form is not activated. Electrical equipment is assumed 100% efficient, although distribution losses may be described by the data associated with the Un-Insulated Supply Duct fields and the Ducts and Infiltration form. Electric furnaces do require entry of an Output Capacity.

For Heatpumps, the only information required from the details sub-form is the HSPF:

HSPF (Heating Seasonal Performance Factor) – 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. A default value for the HSPF is provided. However, replacement of the heat pump should not be performed based on energy savings computed using the default. Default - 6.5. Conditionally required.

For other systems, most of the controls of the heating systems sub-form become activated. One exception is that oil-fueled systems ask about the presence of a retention head burner while systems using other fuels require data regarding the pilot light, IID, and power burner.

Three parameters on the heating systems sub-form—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.

The required data is presented as follows:

Input Units and or Input Rating – Enter the appropriate Input Rating Units from the menu provided. The choices are: (1) No Input, (2) KBTU per Hour, (3) Gallons per Hour, (4) Lbs per Hour, and (5) CCM (cubic centimeters per minute). Then enter the actual value in the following field. The value can be measured or taken directly from the nameplate of the furnace, boiler, or space heater. If no input rating is

available, choose "No Input" for the Units. The Input Rating field will then be hid. The input rating is used only with the Output Capacity to provide a default heating system Steady State Efficiency. If other means of obtaining a system efficiency are available, there is no need to obtain an input rating and the "No Input" menu item may be selected. Required / Conditionally required.

Output Capacity – Enter the output of the furnace, boiler, or space heater in kBtu/hr. The value can be measured, taken directly from the nameplate of the heating system, or approximated. If a value for Input Rating has been entered, it will be used with the Output Capacity to provide a default Steady State Efficiency. The default for Output Capacity is based on system type. Required.

SS (Steady-State) System Efficiency – Enter the measured or estimated steady-state efficiency of the primary heating unit. Defaults are based on the system types or previously entered data for Input Rating and Output Capacity. This parameter affects the savings of most envelope measures and should be as accurate as possible. Beware of replacing a heating system based on anything but a measured efficiency. Required.

Condition – Select one of three choices to describe the current condition of the primary heating unit: (1) - Good, (2) Fair, (3) Poor (but working). This response for the Primary system is used to estimate an efficiency increase resulting from a tune-up. The poorer the condition, the greater will be the estimated efficiency increase. Required.

Smart Thermostat? – Indicate whether the existing thermostat control allows automatic ("smart") setback of the heating setpoint. The number of degrees assumed for the setback may be adjusted in Key Parameters of the Setup Library. The presence of a smart thermostat will affect the annual consumption computed by NEAT and prevent the smart thermostat measure from being evaluated for the Primary system. If the occupants manually set their thermostat back in winter and would, therefore, not benefit from an automatic thermostat, indicate one as present.

Automatic Vent Damper Present? – Indicate whether the heating system flue is equipped with an automatic vent damper. Presence of an existing automatic vent damper associated with the Primary system will prevent installation of one from being evaluated.

Automatic Vent Damper Recommended? – Indicate whether the installation of an automatic vent damper would be recommended if found cost effective. In some areas local codes prohibit their use. If selected, NEAT will recommend installation only if found cost effective. If not selected, the measure will not be considered. This check box will be visible only if you have indicated that such a damper does not already exist.

Flue Diameter – If installation of an automatic vent damper is to be considered, enter a suggested diameter in inches for use by the contractor in obtaining the part. Whether this field is accessed depends on the previous two entries. Conditionally required.

IID? – Indicate whether the heating system uses an IID (intermittent ignition device). This device consists of an electric igniter that eliminates the need for a standing pilot light. Presence of an existing IID will prevent NEAT from evaluating the IID measure for the Primary system. This check box is visible for gas- or propane-fueled primary furnace and boilers only.

Pilot Light? – Indicate whether the heating system uses a pilot light. This check box is visible only if you have indicated that an IID is not present.

On in Summer? – Is the pilot light on the heating equipment left on through the summer? This check box is visible only if you have indicated the presence of a pilot light. This entry affects the savings assigned to the IID measure.

Power Burner Present? – Indicate whether the heating system is equipped with a Power Gas Burner. Power burners use blowers to better mix the fuel and combustion air. This device is normally found on oil or coal furnaces or boilers that have been converted to natural gas. This check box is visible only for gas- or propane-fueled primary furnace-boilers.

Retention Head Present? – Indicate whether the primary heating system is equipped with a Retention Head Oil Burner. This device provides higher combustion efficiency by mixing the oil and air more vigorously. This check box is visible only for oil-fueled equipment.

Retention Head Recommended? – Indicate whether the installation of a retention head burner would be recommended if found cost effective. If selected, NEAT will recommend installation only if found cost effective. If not selected, the measure will not be considered. This check box will be visible only if you have indicated that a retention head burner does not already exist.

System Retrofit Data Block

The System Retrofit data block will appear on the right of the Required Heating System Details sub-form for the Primary heating system. It asks for information associated with the tuneup and replacement measures for the system.

System Retrofit Options – Select one of six choices regarding tune-up or replacement of the primary heating unit: (1) Evaluate All. Evaluate both heating system replacement (standard and high efficiency) and system tuneup and recommend

the most cost-effective option, if any. Replacement system efficiencies and costs for both standard and high-efficiency replacements will be requested in subsequent fields. (2) Tuneup Performed. A tuneup of the system has already been performed. The SSSystem Efficiency given on the form is the efficiency of the tuned up system. NEAT will not evaluate the system tuneup measure. Replacement system efficiencies and costs for both standard and high-efficiency replacements will be requested in subsequent fields. (3) Tuneup Mandatory. Inspection of the heating system has indicated that a system tuneup is all that is necessary. NEAT will evaluate and recommend the system tuneup, regardless of its cost-effectiveness. The tuned up system will then be used in evaluating other measures not considered mandatory. No system replacement will be considered. (4) Std (Standard) Replacement Mandatory. NEAT will consider replacement of the existing heating system with a standard efficiency system as mandatory. This may be the result of an unsafe yet un-repairable existing system. NEAT will recommend the replacement regardless of its cost-effectiveness. The replacement system efficiency and cost for the standard unit will be requested in subsequent fields. The efficiency of the replacement system will be used in evaluating other measures not considered mandatory. No system tuneup or high efficiency replacement will be considered. (5) High Efficiency Replacement Mandatory (natural gas, propane, and oil fueled furnaces and boilers only). NEAT will consider replacement of the existing heating system with a high efficiency system as mandatory. This may be the result of an unsafe yet un-repairable existing system. NEAT will recommend the replacement regardless of its cost-effectiveness. The replacement system efficiency and cost for the high-efficiency unit will be requested in subsequent fields. The efficiency of the replacement system will be used in evaluating other measures not considered mandatory. No system tuneup or standard efficiency replacement will be considered. (6) Don't Replace. No system replacement (either standard or high-efficiency) will be considered. The tuneup measure, however, will still be considered and recommended if cost effective. Required.

(Retrofit) System AFUE – Enter the AFUE (Annual Fuel Utilization Efficiency) for the replacement units. The AFUE will most often be given on the unit label or in the unit specifications. Entries will be required for either or both the standard and high-efficiency units, depending on the choice made for System Retrofit Options. Conditionally required.

Labor and Material Costs – Enter the Labor and Material cost associated with replacing the primary heating system. Default values are those specified by the user under the Library Measures tab of the Setup Library. Entries will be displayed for either or both the standard and high-efficiency units, depending on the choice made

for System Retrofit Options. NEAT adds the labor and equipment costs in computing the SIR and reporting costs. Thus, the total cost (labor plus equipment) may be entered in either field, with $0.00 entered for the other of the two fields, with no adverse consequences. Do not enter $0.00 in both Labor and Material Cost fields for either replacement unit. Required.

6.11 Cooling

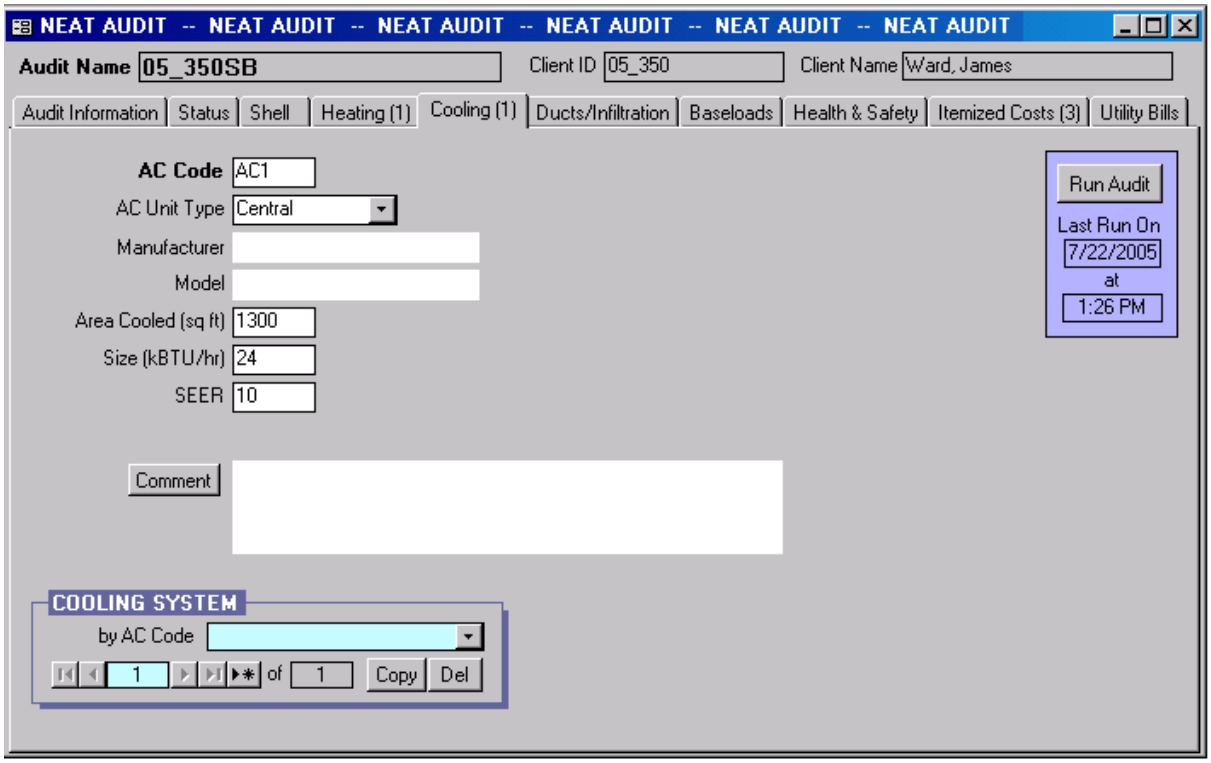
NEAT allows you to describe as many as five air-conditioning units in a home. Data entry items on the Cooling forms are presented in the following order:

AC Code – The user-supplied air conditioning codes identify cooling equipment to you and the computer. The codes may have up to twenty characters. However, space restrictions in many reports suggest a lesser number of characters (perhaps three to five) to preserve readability. Entries are not case-sensitive. The codes must be unique for air-conditioning units within a given audit. Default AC Codes are of the form "AC#" where the "#" is an integer insuring uniqueness of the code. You may wish to include characters in the code which indicate the unity type some other characteristics. The codes may also be helpful when labeling your drawing of the house's floor plan, particularly if there are more than one unit, such as multiple window air-conditioners. NEAT will use the codes in output reports and work orders to identify which units should receive recommended energy efficiency measures. (See Section XX, *Component Codes*). Required.

AC Unit Type – Enter one of four choices: (1) Central, (2) Window, (3) Heat Pump, or (4) Evaporative (cooler). NEAT will consider the Heat Pump Replacement measure only if at least one of the air-conditioners described is of type "Heat Pump" (see Section XX, *Heatpump Replacement*). If the "Evaporative" AC Unit Type has been chosen, the fields for Size, SEER, and Year Purchased will be automatically hidden. Required.

Manufacturer, Model – Enter the manufacturer and model of the existing air-conditioning unit if needed for reference, possibly in establishing an appropriate replacement. Optional

Area Cooled – Enter an estimate of the floor area in square feet of that part of the house cooled by the air-conditioner. This entry is fairly important, affecting the cooling energy consumption predicted by NEAT as well as the savings of cooling measures. The sum of all areas cooled by listed equipment may be less than the total floor area of the house, but should not be greater. Required.



The Cooling form

Size - Enter the output capacity of the unit in Kbtu/hr. The value is often printed on the nameplate of the air-conditioner. Otherwise enter an estimate. Required.

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

If an SEER can not be estimated, leave the field blank and press [Enter] while accessing the field. NEAT will display the Year Purchased field for alternate entry. Optionally required.

Year Purchased – 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, if

it is not provided. This entry is hid if a value has been provided in the SEER field. Optionally required.

Comments – Comments may be entered directly in the comment field on the form. Or, select the Comment button to the left of the field, which will take you to the Comment Editor. This text editor is similar to Window's Notepad and may be used to edit extended comments. The total comment may have up to 65,000 characters. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). Comments included on the Cooling form may include observations of equipment conditions or the need for specific maintenance, such as low refrigerant charge or dirty coils. Optional.

Cooling Record Navigation Block – The Cooling Record Navigation Block may be used to find and access existing cooling equipment descriptions for the audit being edited, copy or delete the currently accessed cooling equipment description, or initiate a new cooling equipment description for the audit. See Section [4.1], *Record Navigation*, for information on using the Weatherization Assistant's Record Navigation Blocks.

Chapter 8

Chapters 6 and 7 of this manual addressed entry of building description data specific to NEAT and MHEA. The Weatherization Assistant contains additional building and audit description data which is common to both site-built and mobile homes. This chapter describes the information entered under the Audit Main Menu items which are common to both building types. This includes data under the Status, Health and Safety, Itemized Costs, Utility Bills, Photos, and Measures tabs under the Audit Main Menu items for both NEAT and MHEA. In addition, some optional entries on the Heating tab and the Water Heaters form under the Baseloads tabs for each building type are also described.

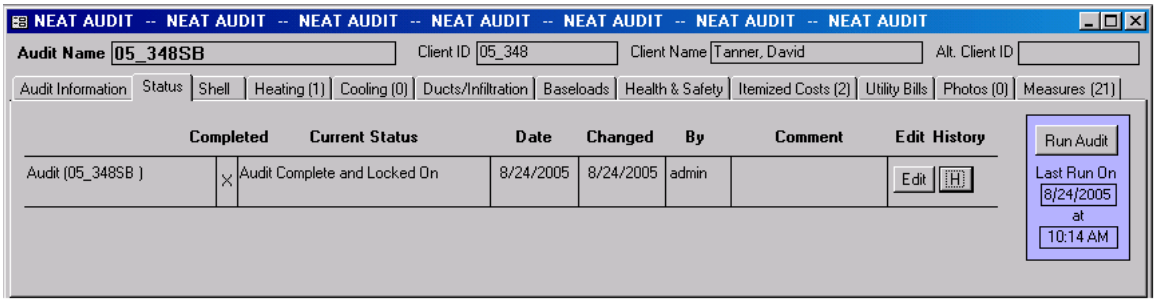
8.1 Status (Audit)

The Status tab under the Audit Main Menu item allows you to view the status of the audit currently being accessed. The setting and tracking of statuses is an optional feature in the Weatherization Assistant.

The Audit level status settings available are:

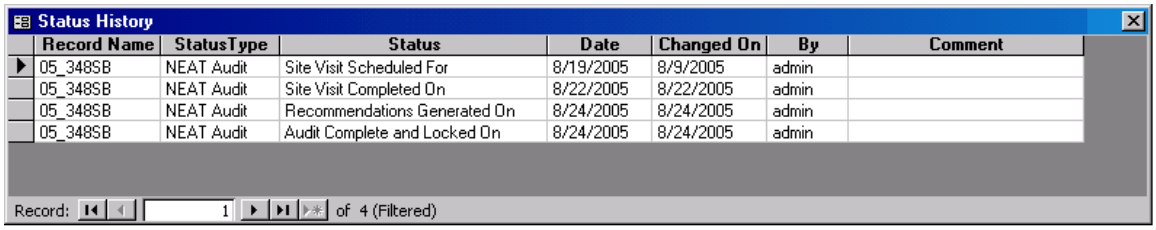
Audit
Site Visit Scheduled For
Site Visit Completed On
Billing Data Collected On
Recommendations Generated On
Audit Complete and Locked On*
Walk Away by Auditor On*
Delayed On
Denied On
Other

The Status tab displays not only the current status of the audit, but the date the status became effective, the date it was last changed, and who changed it. You are also shown any comment which has been appended to this current status setting. A Completed column on the form will display an asterisk (*) when a status setting indicates completion or closure of the activity associated with the status category. For the audit category, this corresponds to those settings followed by the asterisk in the table above.



The Status form

Status settings are changed by selecting the Edit button at the right of the row indicating the current status for the audit. You will be presented with the Status Editor form. Choose the "H" button to see a history of all settings for the current audit.



The Status History table

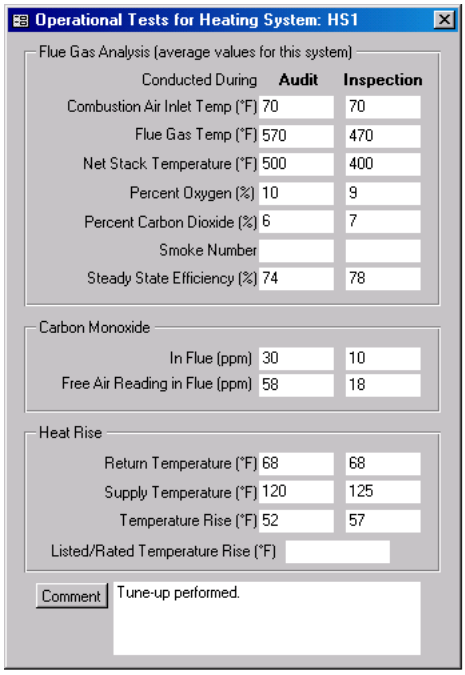
See Section [13.3], *Status Tracking* for additional information on the Status tabs and changing status settings.

8.2 Optional Entries under the Heating Form

Version 8 of the Weatherization Assistant has added an optional capability of documenting a relatively extensive number of heating system observations which may be encountered during an audit of the dwelling. Some of these items constitute potential health and safety concerns. These details are accessed from buttons lying to the right of the "Optional Heating System Details" title at the bottom of the Heating form under the Audit Main Menu item. You must complete the description of the existing heating system before accessing these optional details. Not all buttons will be applicable to the heating system described on the Heating form. No attempt is made in this manual to describe correct procedures for obtaining the measurements or performing the inspections. You should refer to literature on standard HVAC practices or consult with a qualified HVAC contractor.

Optional Heating System Details - tests, measurements, and inspections

A summary of the items contained under each of the buttons is given below. Each form allows addition of an extended comment if necessary. Close each form using the customary Windows X box in the upper right corner. Each form must be closed before any other form can be accessed.



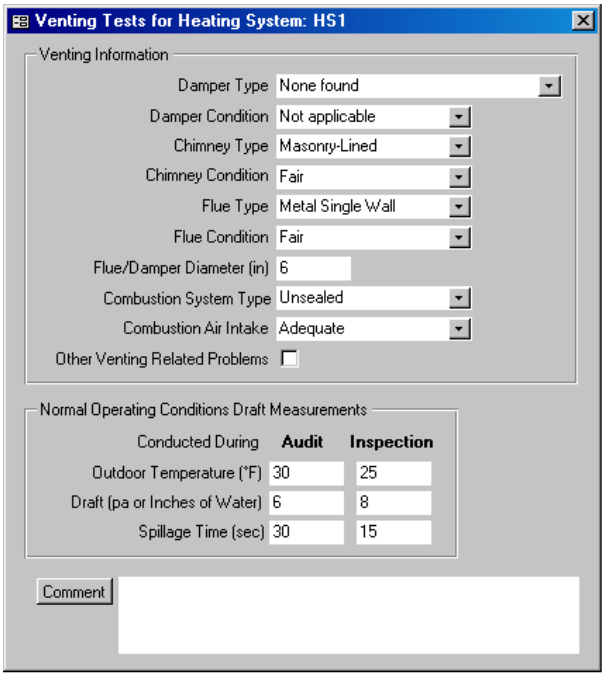
Operational Tests form for heating systems

Operational Tests – This form allows recording information resulting from three measurement procedures: (1) flue gas analysis, (2) carbon monoxide measurements, and (3) the heat rise across the heat exchanger. The form allows recording of these measurements before and after work has been performed – "Conducted During Audit" and "Conducted During Inspection," respectively.

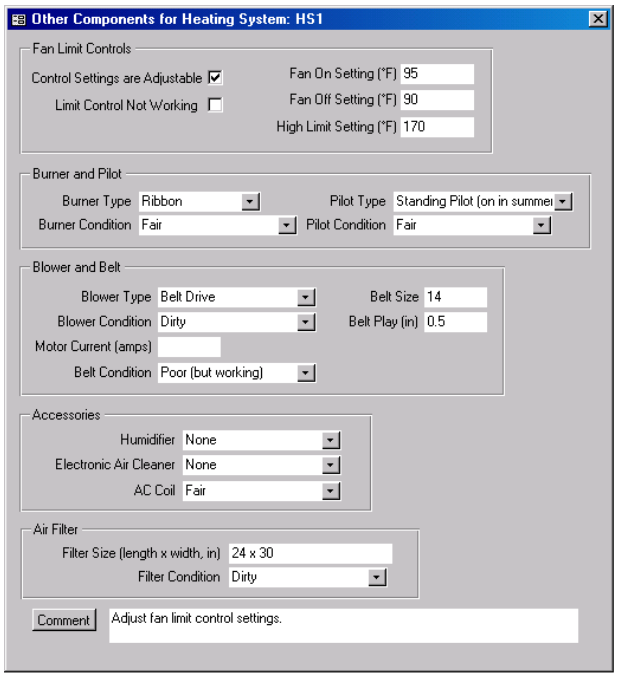
Vent Tests – Information recorded under the Vent Tests button pertain to the characteristics of the flue and damper as well as before and after draft measurements on the flue associated with the heating system.

Furnace Components – This form allows entry of characteristics for various furnace components including the fan limit controls, burner, pilot, blower, belts, air filter, and accessories (humidifier, air cleaner, and air-conditioner coil).

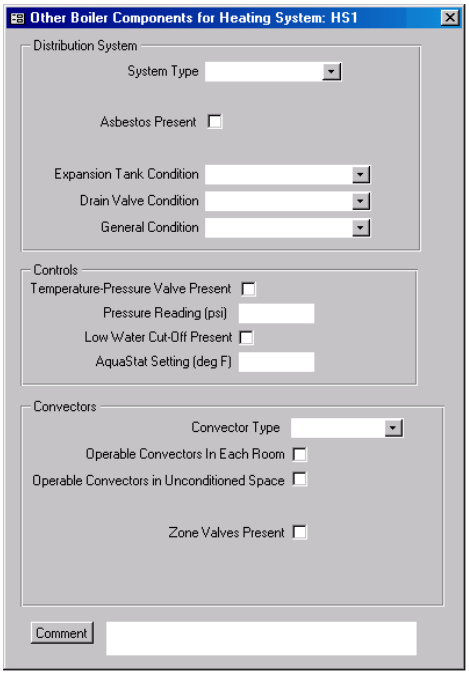
Boiler Components – If the heating system is a boiler, this tab allows description of the boiler type, its overall condition, and the condition of the expansion tank and drain valve. Additional information can be entered describing the associated controls and convectors. The presence of asbestos associated with the boiler constitutes a potential hazard and may also be noted. See the description under Section, *Health and Safety*, on how the Weatherization Assistance handles health and safety items.



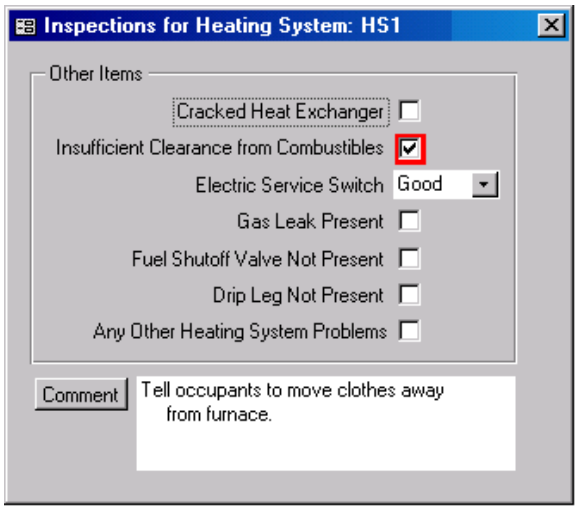
Vent Tests form for heating systems



Furnace Components



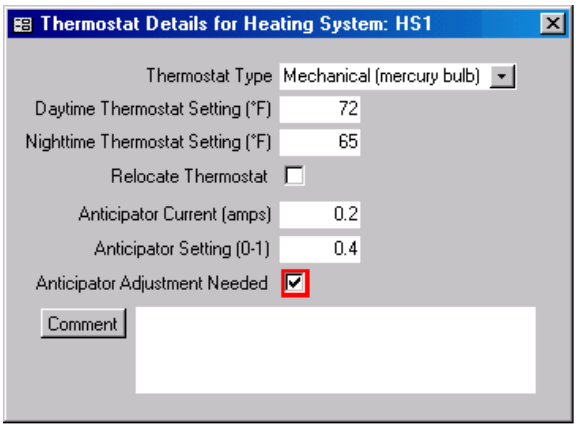
Boiler Components



Inspections for heating systems

Inspections – This form contains mostly check boxes identifying potential hazards associated with the heating system, such as a cracked heat exchanger, insufficient clearances, gas leaks, etc. See the description under Section 8.9, *Health and Safety*, on how the Weatherization Assistance handles health and safety items.

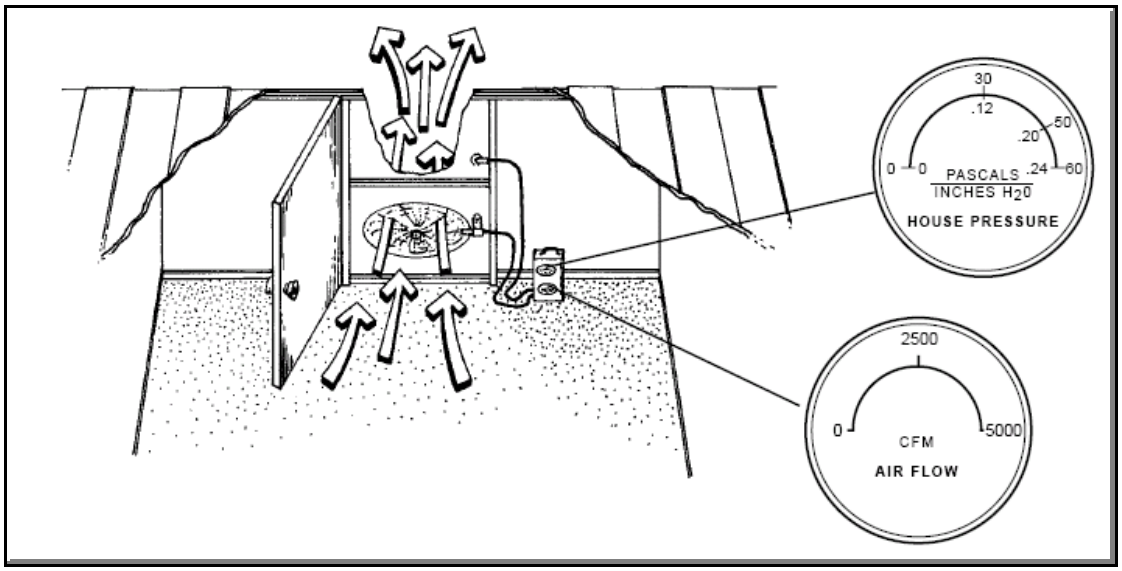
Thermostat - Characteristics associated with the thermostat used by the heating system are entered on this form, including its type, set points, and anticipator settings.



Thermostat Details

8.3 Ducts and Infiltration

Both NEAT and MHEA provide means to evaluate the effectiveness of infiltration reduction work and duct sealing. Note, however, it does not direct this work. It assumes that available procedures of locating and repairing air leaks are being used. Air leakage reductions from specific weatherization activities cannot be predicted accurately with calculations.



The Blower Door—Used to locate and quantify envelope air leakage

What information you provide regarding ducts and infiltration will depend on what measurements you are accustomed to taking during an audit.

Blower doors pressurize (or depressurize) a house to some pressure differential (measured in Pascals, PA) with respect to the outside. They can then measure the cubic feet per minute (CFM) of air passing through leaks in the house at that pressure differential. Since the pressure differential is greater than under normal circumstances, the air leaks are exaggerated above what they would be normally, allow easier detection.

A duct blower works in a similar manner as the blower door, except that it pressurizes only the ducts in the house with respect to the remainder of the house and outdoors. Similarly, it will provide the CFM leaking from the ducts at this pressure differential.

All forms under the Ducts/Infiltration tab have a standard Comment field capable of holding up to 65,000 characters. Access the comment's text editor by selecting the Comment button to the left of the field. Text from other sources may be copied and pasted into the Comment Editor's window. Audit component comments are displayed on the Audit Recommended Measure Report and the Input Report. In addition, all audit comments are made available to Work Orders for importing to any specific work order (see Section [8.1], *Work Order Information*). If leakage sites are located during the initial blower door setup, you could use the comments section to identify to the crew or contractor where these sites are.

Six different modes of data input relating to ducts and air infiltration are available with a seventh in MHEA applicable to mobile homes. The first 3 below assume that no duct leakage measurements are available. For all of these cases, leave the Evaluate Duct Sealing check box, located on the Ducts & Infiltration form, unchecked.

1. No duct or infiltration measurements available

If you wish to run NEAT without duct and infiltration measurement data (either because your program doesn't address these components or because measurements are not available at the time you run NEAT), you can do so by accessing the Ducts & Infiltration form, leaving the Evaluate Duct Sealing check box unchecked, then supplying entries for the only two required fields on the form:

Post Infiltration Reduction, Whole House Leakage (CFM) – If your audit procedure has established a target post-retrofit CFM leakage rate, enter it here. Otherwise, use the default value of 2500 CFM. Default - 2500. Required.

Post Infiltration Reduction, Pressure Differential (PA) – Enter either the pressure differential on which your target leakage rate is based or accept the default of 50 PA, corresponding to the default leakage. Default - 50. Required.

These settings will allow NEAT to make logical recommendations for the other measures it considers while not addressing the infiltration or duct leakage. The reason a post-retrofit air leakage is required rather than a pre-retrofit value, is that NEAT assumes some air leakage reduction is likely to occur, particularly if the initial reading is significantly higher than the default or target level. Estimates of savings for other measures will be more accurate if they are based on the air leakage characteristics of the house after this reduction is accomplished, rather than at its pre-retrofit level.

2. Only Pre-infiltration reduction air leakage readings are available.

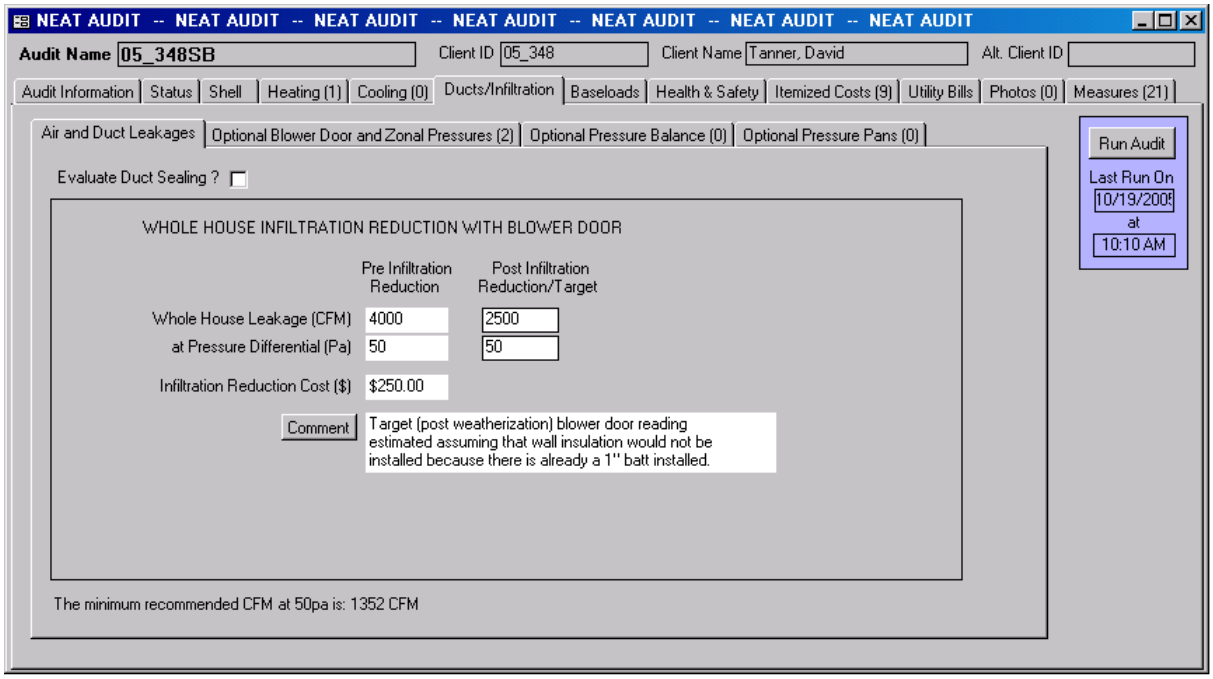
If your audit procedure regularly takes pre-infiltration reduction blower-door readings but has no post-reduction values at the time NEAT is run, you may choose to run NEAT without infiltration and duct leakage data, as described in 1 above.

Or, you may enter these readings in the Pre Infiltration Reduction, Whole House Leakage and Pressure Differential fields. However, you must still enter values in the required Post-Infiltration Reduction fields. You could enter a target post-retrofit air leakage rate appropriate for the house. NEAT will then compute an energy savings associated with this reduction. If no infiltration reduction work is deemed necessary for the house, enter the pre-retrofit rate into the post-retrofit fields since, in this case, both pre- and post-retrofit levels will be the same and the post-retrofit levels are required for NEAT to run.

If post-retrofit air leakage rate readings become available at some future time, the house description could be recalled, the readings entered, and an appended report printed. However, this may not be worth the time, especially if a target value you chose is any where near the final reading obtained.

3. Pre- and post-infiltration reduction air leakage readings are available but no duct readings.

Enter data in all fields available on the Whole House Infiltration Reduction with Blower Door form. The Evaluate Duct Sealing check box remains unchecked.



The Ducts/Infiltration form - No duct readings available

Pre-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) – These entries are from blower door measurements of air leakage before sealing. The CFM reading is normally taken at a pressure differential of 50 Pa, if such can be reached. Pre-retrofit entries are optional but, if provided, used to estimate savings from air sealing. Pre-retrofit entries will not affect savings computed for other measures. Air leakage rate default - 2500. Pressure differential default - 50. Optional.

Post-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) – These entries are from blower door measurements after air sealing. The CFM reading is normally taken at a pressure differential of 50 Pa, if such can be reached. 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 (CFM50) may be obtained as follows: CFM50 = ACH × House volume ÷ 3. Air leakage rate default - 2500. Pressure differential default - 50. Required.

Infiltration Reduction Cost – Enter the cost in dollars spent to reduce air infiltration from the pre-retrofit to the post-retrofit level. If a cost is entered together with the above entries of pre- and post-infiltration reduction blower-door data, an SIR, in addition to the energy savings for the air-leakage reduction, will

be computed and reported (see Section XX, *Energy Saving Measure Economics*). Optional.

The remaining modes of data entry for the Ducts & Infiltration forms provide means of estimating the cost-effectiveness of duct sealing as well as infiltration reduction. NEAT provides input fields to accommodate three different common duct leakage measurement techniques: Whole House Blower Door Measurements; Blower Door Subtraction; and Duct Blower Pressure Tests. In addition to these three techniques, MHEA accommodates a fourth, Pressure Pan Measurements. To access the forms needed, select (check) the Evaluate Duct Sealing check box on the Ducts / Infiltration form. You will then be presented with the Duct Leakage Method drop-down list. It is from this list that you choose one of the three or four duct leakage measurement techniques. Once you have made your selection, the form's input fields will be altered to accommodate that particular method.

Each of the data input modes associated with the three measurement techniques requires duct operating pressure inputs. Since they are common to all three modes, they will be described once here. The readings are taken during normal conditions with the air handler fan on. Small holes (afterwards repaired) can be drilled in the supply plenum near the air handler and in the return plenum in which to insert pressure probes. It is recommended that a digital gauge be used to then measure the pressure inside of these plenums with respect to the room or part of the house in which they are located. The data entry fields for this data lie under the Duct Operating Pressures title on each of the forms. The four duct operating pressures required are:

Pre Duct Sealing Supply (Pa) – Enter the supply duct - house pressure difference before implementing any duct-sealing measures. Required.

Pre Duct Sealing Return (Pa) – Enter the return duct - house pressure difference before implementing any duct-sealing measures. Required.

Post Duct Sealing Supply (Pa) – Enter the supply duct - house pressure difference after implementing any duct-sealing measures. Required.

Post Duct Sealing Return (Pa) – Enter the return duct - house pressure difference after implementing duct-sealing measures. Required.

The additional entries necessary for each of the three input modes will be discussed separately below. They are arranged in order of complexity, the simplest first. Unfortunately, the simplest tends to also be the least accurate.

4. Pre/Post Whole House Blower Door Measurements

This technique of estimating duct leakage uses whole house blower door leakage measurements before and after duct sealing to estimate the duct leakage reduction accomplished. To provide this method some assumption had to be made with regard to the order in which duct sealing and infiltration reduction work was performed. NEAT assumes that the duct sealing is accomplished first, followed, at some point, by the infiltration reduction.

Most of the entries required are from readings you would normally take to estimate the whole house infiltration. These readings are simply taken before any duct leakage or infiltration reduction work has been performed, then after duct sealing is accomplished - but before infiltration reduction work, then a third time after both duct and infiltration reduction work has been performed. Note, for all readings, the vents and registers of the distribution system should remain open, thus making the ducts as much a part of the conditioned space as possible.

The entries required are described separately below:

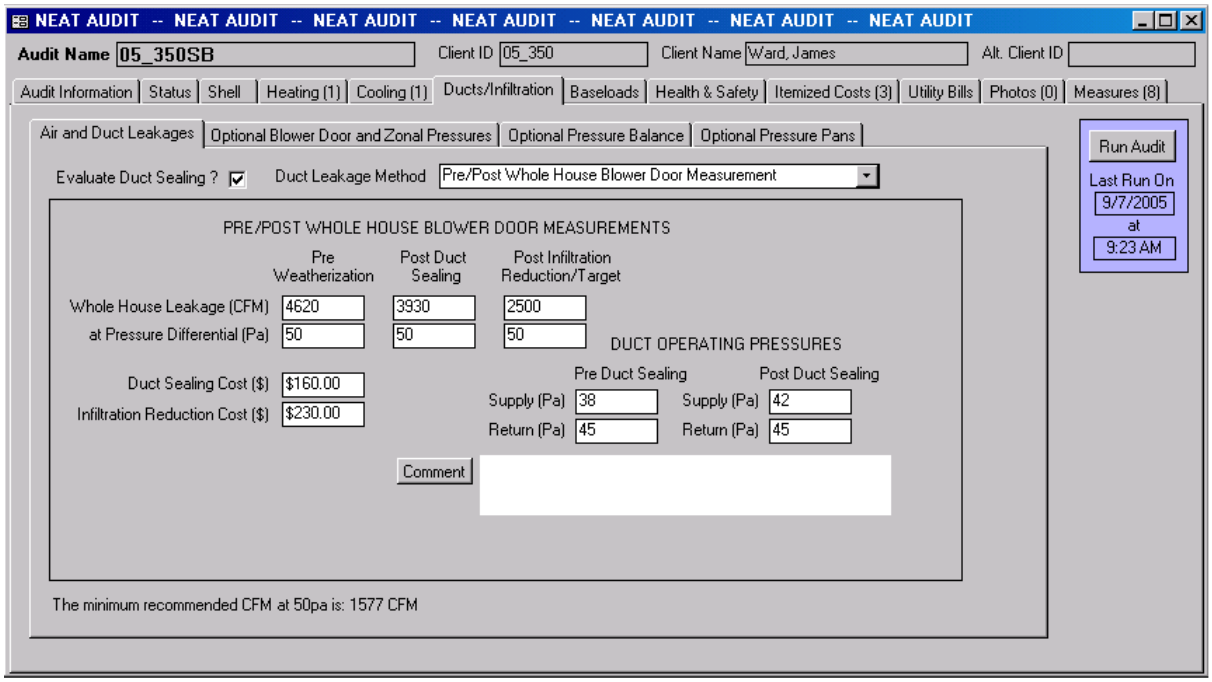
Pre-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) – Same as in (3) above, but no longer optional. Required.

Post Duct Sealing, Whole House Leakage (CFM) and Pressure Differential (Pa) – These entries are from blower door measurements of whole house air leakage after duct sealing efforts, but before air infiltration reduction work. Air leakage rate default - 2500. Pressure differential default - 50. Required.

Post-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) – Same as in (3) above, but no longer optional and is assumed to be from readings taken after both duct sealing and infiltration reduction efforts have been accomplished. Required.

Duct Sealing Cost – Enter the cost in dollars spent to reduce the duct leakage from the Pre Infiltration Reduction (and, therefore, the pre duct sealing) to the Post Duct Sealing level. Required.

Infiltration Reduction Cost – Enter the cost in dollars spent to reduce the air infiltration from the Post Duct Sealing (and, therefore, the pre infiltration reduction) to the Post Infiltration Reduction level. Required.



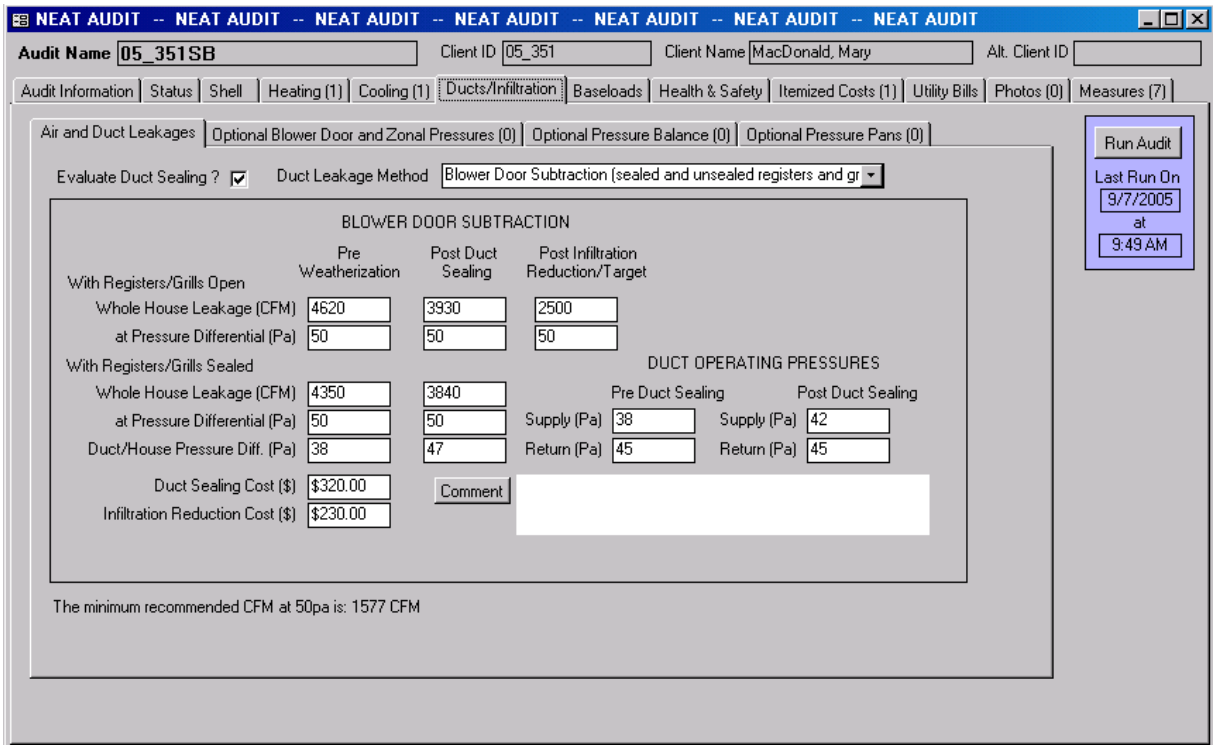
The Ducts/Infiltration form - Pre/Post Whole House Blower Door duct measurements

5. Blower Door Subtraction

This method uses the same readings as the Whole House Blower Door technique but adds analogous readings, both before and after duct sealing, during which the distribution system has been sealed off from the rest of the house. Use cardboard, plastic, tape, etc., to temporarily cover and seal all registers and grills on both the supply and return side. This essentially allows subtraction of the house leakage from the duct plus house leakage to isolate the leakiness of the ducts. One additional reading is required to help compensate for duct leakage to the conditioned space, the duct - house pressure differential with the ducts and registers sealed and the house pressurized (or depressurized) to the same degree as for the other CFM readings (normally 50 Pa).

Note, it is normally recommended that this technique not be used if the measured duct - house pressure differential is less than 20 Pa, indicating that the duct system is very well connected to the house interior. This is commonly true in homes which use building cavities for a significant part of the duct work.

The data entry items for this input mode are as follows:



The Ducts/Infiltration form - Blower Door Subtraction duct measurements

Pre-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) (with registers/grills open) – Same as in (3) above, but no longer optional. Required.

Pre-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) (with registers/grills sealed) – Same as immediately above except with registers and grills sealed. Required.

Pre-Infiltration Reduction, Duct House Pressure Differential (Pa) (with registers/grills sealed) – Enter the measured pressure differential between the duct system and the house with the house pressurized (or depressurized) to the same degree as for the CFM readings immediately above (normally 50 Pa). This measurement can be taken at the supply or return plenum, or at a supply register or return grill by punching a small hole through the masking tape or other material used to temporarily seal the grills, and inserting a pressure tap or hose connected to a pressure gauge. Required.

Post Duct Sealing, Whole House Leakage (CFM) and Pressure Differential (Pa) (with registers/grills open) – Same as in (4) above. Measured after duct sealing efforts, but before air infiltration reduction work. Required.

Post-Duct Sealing, Whole House Leakage (CFM) and Pressure Differential (Pa) (with registers/grills sealed) – Same as immediately above except with registers and grills sealed. Required.

Post-Duct Sealing, Duct House Pressure Differential (Pa) (with registers/grills sealed) – Same as Pre-Infiltration Reduction value obtained above, but measured after duct sealing efforts, but before air infiltration reduction work. Required.

Post-Infiltration Reduction, Whole House Leakage (CFM) and Pressure Differential (Pa) (with registers/grills open) – Same as in (4) above. Required.

Duct Sealing Cost – Enter the cost in dollars spent to reduce the duct leakage from the Pre Infiltration Reduction (and, therefore, the pre duct sealing) to the Post Duct Sealing level. Required.

Infiltration Reduction Cost – Enter the cost in dollars spent to reduce the air infiltration from the Post Duct Sealing (and, therefore, the pre infiltration reduction) to the Post Infiltration Reduction level. Required.

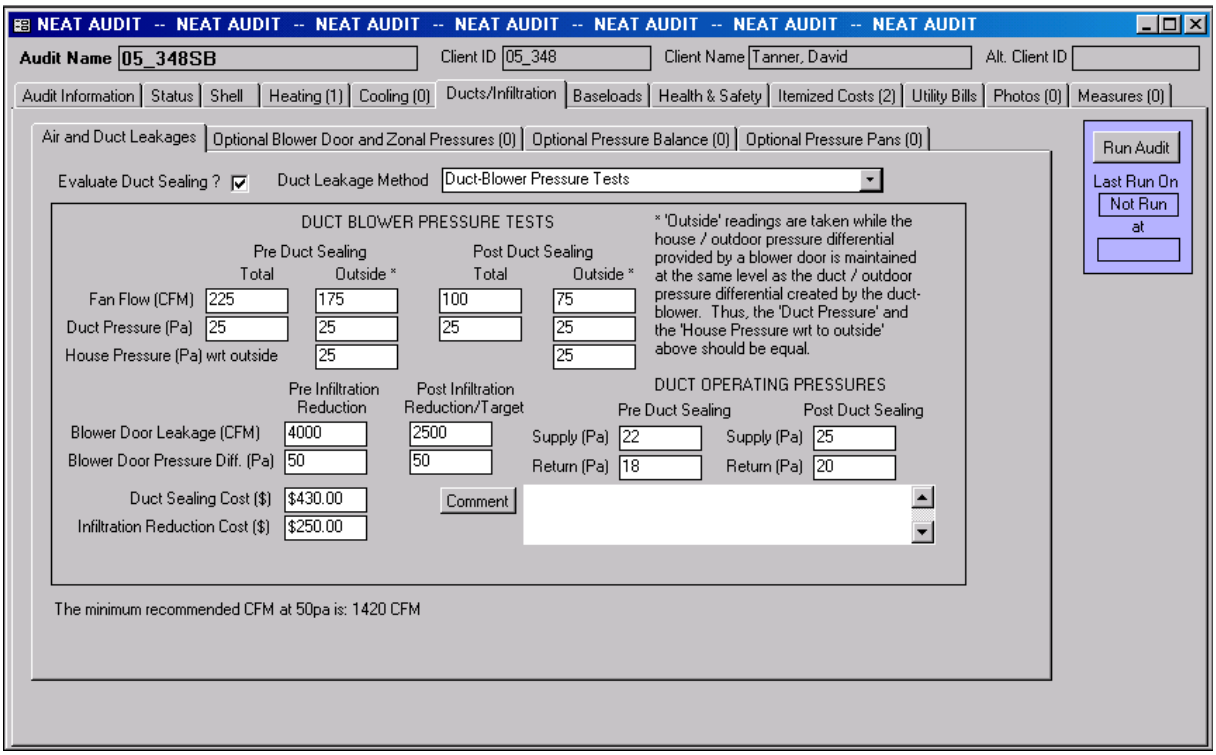
The Duct Operating Pressures entries are described in the introductory material to mode 4.

6. Duct Blower Pressure Tests

This method involves use of both a duct blower and a blower door. A duct blower pressurizes the duct system which is sealed off (by taping the registers and grills) from the remainder of the house. The measured CFM through the duct blower is then equal to the total air leakage from the ducts to both the outside and interior of the house. To obtain leakage to only the outside, the blower door is used to pressurize the entire house to the same pressure, with respect to the outside, as the ducts. With no pressure differential between the house and the ducts, any leakage recorded by the duct blower must then be to the outside. The leakage will be at whatever duct/outside pressure differential is established by the duct blower. This technique of determining duct leakage is more accurate than the other means, but also the most time-consuming. It requires both a duct blower and a blower door.

The Duct Blower—Used to measure duct leakage. (Courtesy of The Energy Conservatory)

The data entry items for this input mode are as follows. Each of the items is determined and entered twice, once before (Pre) permanent duct sealing occurs, and again afterwards (Post).



The Ducts/Infiltration Form - Duct-Blower Pressure Tests measurements

Pre/Post Duct Sealing Total Fan Flow (CFM) and Duct Pressure (Pa) – Enter the CFM measured through the duct blower with the duct pressurized with respect to the house and outside. For these measurements, the registers and grills are temporarily sealed off (taped) from the remainder of the house.

Pre/Post Duct Sealing Outside Fan Flow (CFM) and Duct Pressure (Pa) – Enter the CFM through the duct-blower measured before/after duct sealing and with the house at the same pressure difference with respect to the outside as the ducts. While the duct-blower is used to pressurize the duct system, a blower-door will be used to pressurize the house. For these measurements, the registers and grills are temporarily sealed off (taped) from the remainder of the house.

House Pressure (Pa) wrt outside – Enter the pressure differential between the house and the outside as created by the blower door. Note, for accurate determination of the duct leakage, this pressure differential should be the same as, or as close as possible to, the pressure differential between the ducts and outside.

The Duct Operating Pressures entries are described in the introductory material to mode 4. The remainder of the entries on this form relate to the infiltration reduction efforts and are the same as given in mode 3 above.

8.4 Optional Entries under the Ducts/Infiltration Form

Air and duct leakage measurements used by the NEAT and MHEA audits are entered on the "Air and Duct Leakages" sub-tab located under the "Ducts/Infiltration" tab of these audits. These data include whole house blower-door readings before and after retrofit as well as other blower-door and duct measurements if the Evaluate Duct Sealing check-box is selected. See the respective users manuals of these audits for more information on these entries.

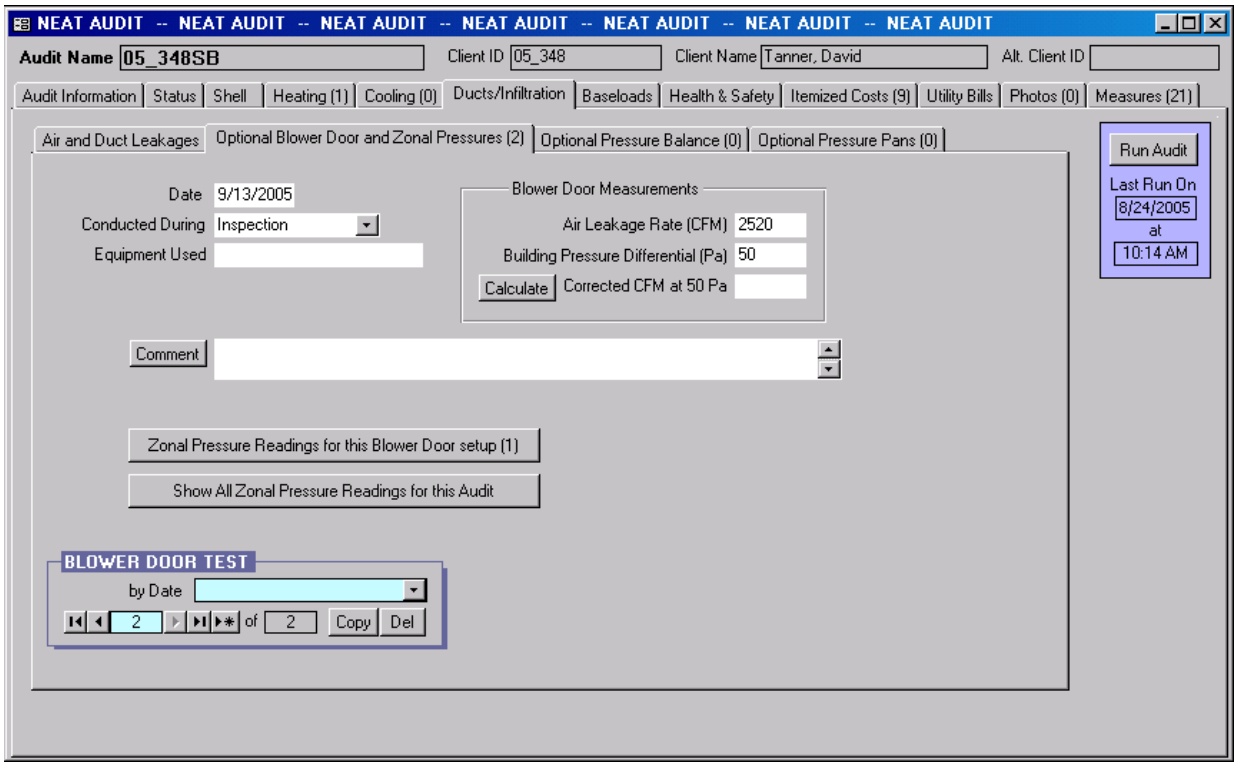
Additional blower-door-related readings may be taken for diagnostic purposes. These optional readings may be recorded under three additional sub-tabs under the "Ducts/Infiltration" tab: "Optional Blower Door and Zonal Pressures," "Optional Pressure Balance," and "Optional Pressure Pans." The data which may be recorded under each of these sub-tabs will be discussed briefly below.

Optional Blower Door and Zonal Pressures

Blower-door readings other than those used by the audits may be taken to measure the effects of various activities on the infiltration rate (e.g., dense pack insulation installation), during an inspection of the work, or at other times. This sub-tab allows these additional blower-door readings to be recorded as well as zonal pressure readings which might also be taken at the same time. Note that multiple records of data may be entered accommodating any number of sets of readings. All of the entries are optional.

Entries on this form include a date on which the blower-door readings were taken, the occasion during which they were taken, and the equipment used. The "Conducted During" comb-box items are: "Audit," "Pre-Installation," "During Installation," "Post-Installation," "Inspection," and "Other."

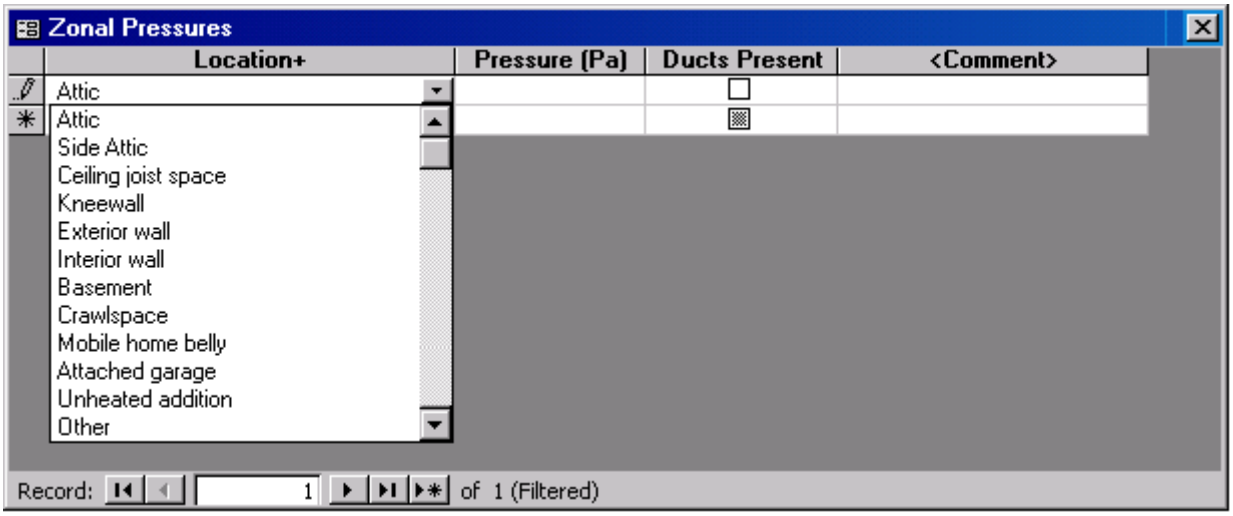
The "Air Leakage Rate (CFM)" and "Building [to outside] Pressure Differential (Pa)" are recorded in the "Blower Door Measurements" block on the form. If the pressure differential is other than 50 Pascal, selecting the "Calculate" button will automatically apply the "Can't Reach 50" factor to provide you with a CFM at 50 Pascal in the adjoining field.



Optional Blower Door and Zonal Pressures sub-form

If "Audit" has been selected in the "Conducted During" combo-box, you will be asked on exiting the form if you wish to overwrite any value which might already exist in the "Pre Infiltration Reduction" fields on the "Air and Duct Leakages" form—the values used by the audits in computing energy savings from infiltration reduction efforts—with the leakage rates just entered. Choose "OK" to copy the data to the "Air and Duct Leakages" form or "Cancel" to reject the offer. Data on the "Optional Blower Door and Zonal Pressures" sub-form will be unaffected, regardless of your choice.

Zonal pressures are pressure differences between the main part of the house where the blower-door has been installed and various zones of the house, such as attics, basements, attached garages, etc. These measurements may be made in conjunction with a blower-door measurement for a variety of reasons, such as to help identify the possible location of leakage sites, to locate where the functioning air barrier is, or to identify potential health and safety problems associated with a combustion appliance.



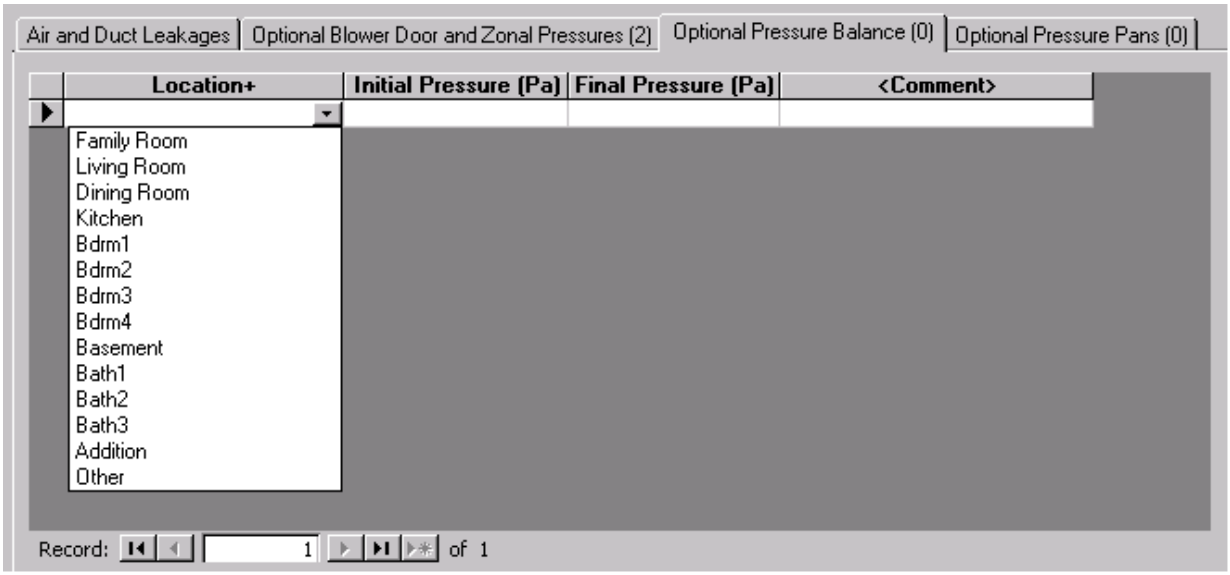
Zonal Pressures form

Zonal pressure readings associated with a specific blower-door setup can be recorded by selecting the "Zonal Pressure Readings for this Blower Door setup" button. This will take you to the Zonal Pressures form in which the readings may be entered. On this form, you may enter the Location of the zone using the choices in the combo-box list or by entering a location of your own if none of the choices meet your needs. Enter the Pressure differential found, in Pascal, and whether any ducts are present in the zone. You may also enter any comment.

Selecting the "Show All Zonal Pressure Readings for this Audit" button will display all zonal pressure readings from all blower-door setups for the audit. The form is the same as the Zonal Pressures form except for an additional column designating your selection of "Conducted During" for each setup. Entries may be altered when viewed from this form.

Optional Pressure Balance

When the air handler of a central forced air furnace or air-conditioner is on, it provides conditioned air to rooms throughout a house. The air that is supplied is intended to be returned to the furnace or air-conditioner through the return registers. If supply air is blocked from reaching a return, pressure differences can be created between the space and the location of the return register(s). This can hinder the supply air from being delivered to the space as well as create a negative pressure in the remainder of the house, increasing infiltration.



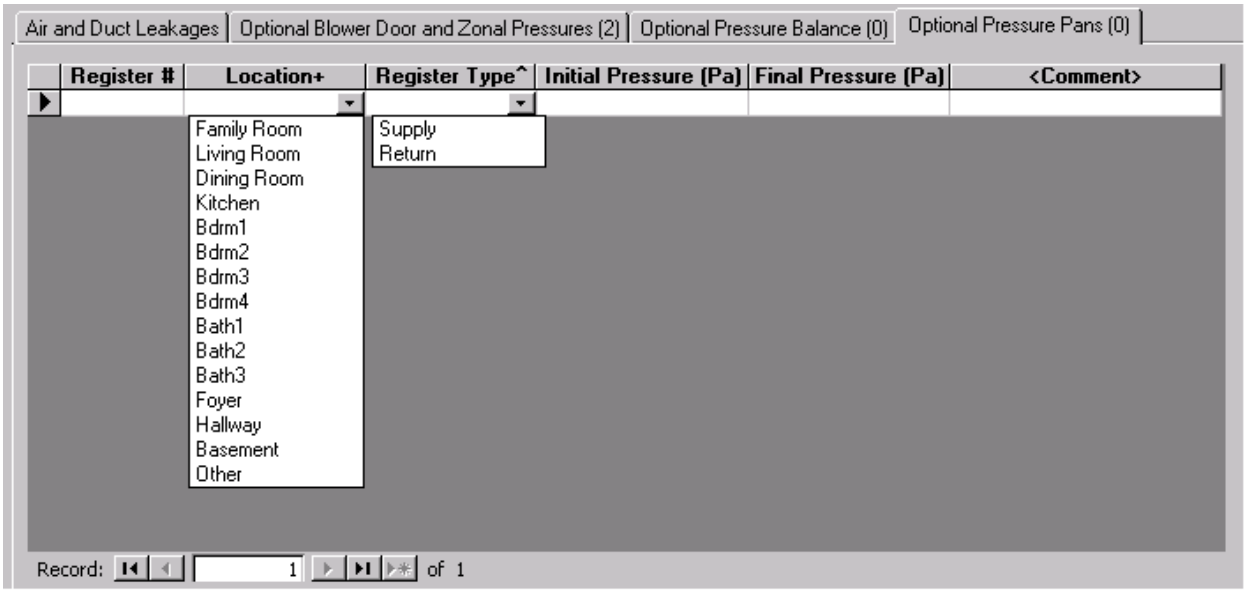
Optional Pressure Balance form

The Optional Pressure Balance form allows you to record pressure differentials between various rooms of the house and the main body of the house (where the return registers exist). The measurements are taken with the air handler operating. The measurements do not involve use of a blower-door.

Enter each Location or room using the choices in the combo-box list or by entering a location of your own if none of the choices meet your needs. Enter the Pressure differential, in Pascal, found, between the room and the location where the return registers exist. Space is provided for you to enter this pressure differential both before and after any efforts to balance the pressure, such as undercutting a door. Comments may be entered for each entry.

Optional Pressure Pan

Pressure pan measurements are taken with a home depressurized to 50 Pascal using a blower-door. A pressure pan which fits snugly over a register and attached to a digital manometer is used to measure the pressure differential at each supply or return register with respect to the home. No pressure difference indicates that the duct leading to the register is at the same pressure as the house and that little or no leaks to the outside exist in that branch of the ducts.



Optional Pressure Pans form

Enter an optional Register # to uniquely identify the register, possibly referenced in a drawing. Then enter the room in which the register is located using the choices in the "Location" combo-box list or by entering a location of your own if none of the choices meet your needs. Next, identify the register as Supply or Return. Enter the Pressure differential, in Pascal, found, between the register and the home. Space is provided for you to enter this pressure differential both before and after any efforts to seal the ducts. Comments may be entered for each entry.

8.5 Base Loads - Water Heaters

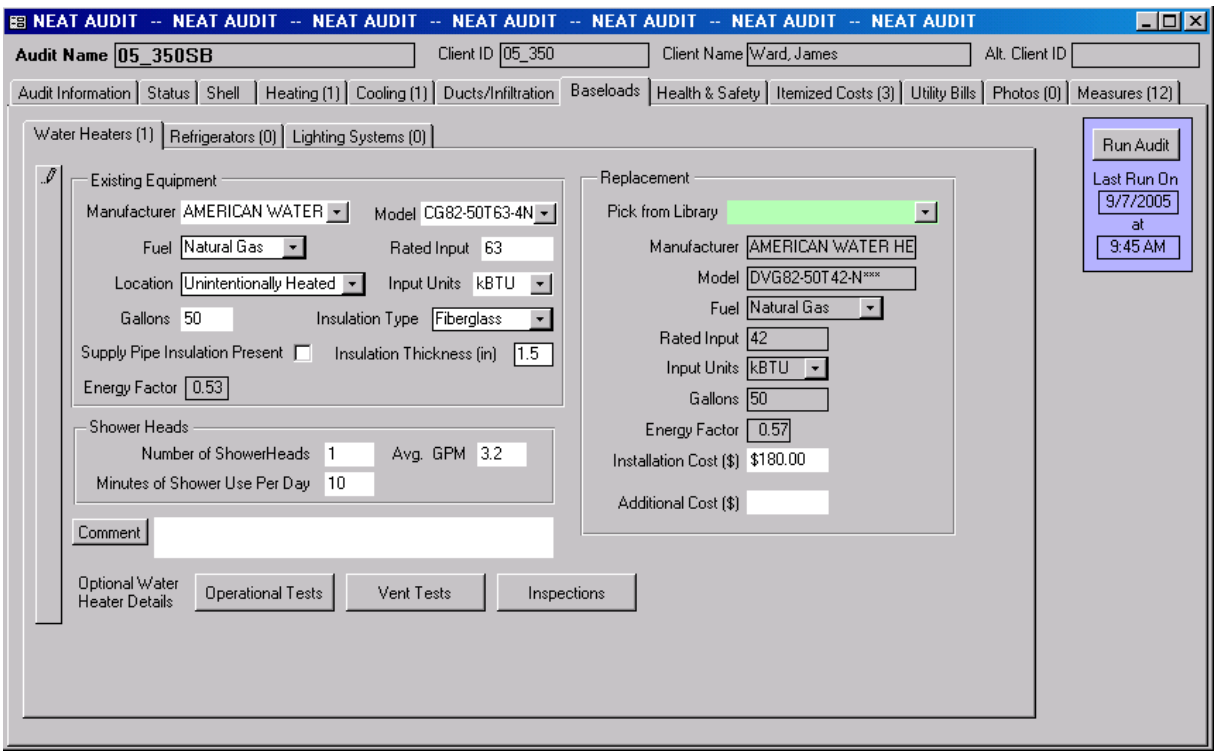
Both NEAT and MHEA evaluate several water heating measures: water heater replacement, tank insulation, pipe insulation, and low-flow showerheads. The data required by the program on the Water Heaters form depends on what combination of these measures you have chosen to evaluate in your program. Only those data entry fields necessary to evaluate the water heating measures you have selected in the Setup Library associated with a specific audit will appear on the form.

Because of the data needed to evaluate the measure, if water heater replacement is to be considered, both the existing water heater and its replacement must be found in the database provided by the program. This is why most of the fields in the

Replacement block of data are grayed and unaccessible for input. These fields will be automatically filled in when you select a replacement unit from the database.

NEAT and MHEA will evaluate replacing an existing unit with a unit using a different fuel. However, if this is to be considered, the replacement costs should include whatever cost is involved in making the fuel for the replacement unit available, e.g. piping the natural gas to the location of the replacement unit.

The data on the Water Heaters form are divided into three blocks: Existing Equipment, Shower Heads, and Replacement. Data under the Existing Equipment block are presented as follows.



Baseloads - Water Heaters form

Manufacturer – Enter the existing water heater's manufacturer's name. You may use this field to either enter a manufacturer of your own choosing or to search the look-up tables for a matching entry. However, if you are evaluating replacing the existing unit, you must locate the manufacturer and model of the unit in the data base in order for NEAT to have the efficiency data necessary to evaluate the replacement. Otherwise, this entry is optional.

Model – Enter the existing water heater's model number. As for the manufacturer, you may use this field to either enter a model of your own choosing or to search the look-up tables for a matching entry. However, if you are evaluating replacing the existing unit, you must locate the manufacturer and model of the unit in the data base in order for NEAT to have the efficiency data necessary to evaluate the replacement. Otherwise, this entry is optional.

Fuel Type – Select the fuel used by the existing water heater from the three choices: 1 - Natural Gas; 2 - Electric; 3 - Propane. The entry is required for all water heater measures. If the manufacture and model have been successfully chosen from the data base, this field will be entered automatically.

Water Heater Location – Select one of three locations for the water heater: 1 - Heated Space (space that utilizes a thermostat to control its temperature); 2 - Unheated Space (space not heated by a mechanical system); or 3 - Unintentionally Heated (space which is heated by waste heat from furnace, boiler, or other heat producing appliance).

Gallons – Enter the capacity of the existing water heater in gallons. If evaluating replacement of the unit and the capacity of the replacement unit differs substantially from the capacity of the existing unit, you will receive a warning.

Supply Pipe Insulation Present – Indicate whether pipe insulation exists on at least the first five feet of pipe exiting the water heater. Required only for pipe insulation measure.

Energy Factor – This un-editable field displays the Energy Factor of the existing water heater when ever the unit has been located in the database of water heaters. This field is displayed only when water heater replacement is being considered.

Rated Input / Input Units – These two fields give the value and units of the value (kBtu or kW) of the existing unit. The data is required only for evaluating the water heater replacement measure. However, the data will automatically be supplied when an existing unit is selected from the database. Thus, the user should never have to enter this data.

Existing Insulation Type – Select one of two insulation types used in the existing water heater: 1 - Fiberglass; 2 - Polyurethane. Often an access plate can be removed to view the insulation and determine its type and thickness. This entry is required only for evaluating the tank insulation measure.

Existing Insulation Thickness – Enter the thickness, in inches, of insulation in the existing unit. If an insulating wrap already exists, include its thickness as well. Often an access plate can be removed to view the insulation and determine its type and thickness. This entry is required only for evaluating the tank insulation measure.

Three data items are present in the Shower Heads data block. None of the items will be displayed if the low-flow showerhead measure has not been selected in the Setup Library.

Number of Shower Heads – Enter the number of showerheads used in the house for which replacement with low-flow models needs to be evaluated. Required only for the low-flow showerhead measure.

Minutes of Shower Use Per Day – Enter the total minutes per day the shower-heads are in use. Combine the times for each shower-head being considered for replacement. Required only for the low-flow showerhead measure.

Average GPM – Enter the average flow rate in gallons per minute of all shower-heads being considered for replacement. You can determine this easily using a container of known volume and a stop watch. Required only for the low-flow showerhead measure.

Most of the data items in the Replacement data block cannot be entered individually. They are automatically filled in when the user chooses a replacement water heater from the "Pick from Library" data entry field. The fields are analogous to those of the same name in the Existing Equipment data block except they apply to the replacement unit. See the discussions of these fields in the material above. The three remaining fields are discussed below. The entire Replacement data block will disappear if the replacement water heater measure has not been selected in the Setup Library associated with the job.

Pick from Library – Choose the replacement water heater from the entries in this combo-box. The selections displayed will be those you have entered in the Supply Library (see Section [10.3], *The Hot Water Equipment and Refrigerator Forms*).

Installation Cost – If you have entered unit costs for your replacement water heaters in the Supply Library, these costs will be copied into this field when a unit is selected for use. You are free to alter this cost here if the unit cost changed. Also, if the unit cost entered in the supply library does not include the labor cost associated with installation, you would add it to this value, unless you choose enter this cost in the Additional Cost field.

Additional Cost – Enter any additional cost associated with installation of the water heater not included in the value entered above. This may include labor costs, delivery changes, or the cost of disposing of the old unit. Optional.

Comment – Enter any comments associated with the water heating you want displayed on the output reports. If you use the Weatherization Assistant's work order feature, the comment will be available to include there. Optional.

8.6 Base Loads - Refrigerators

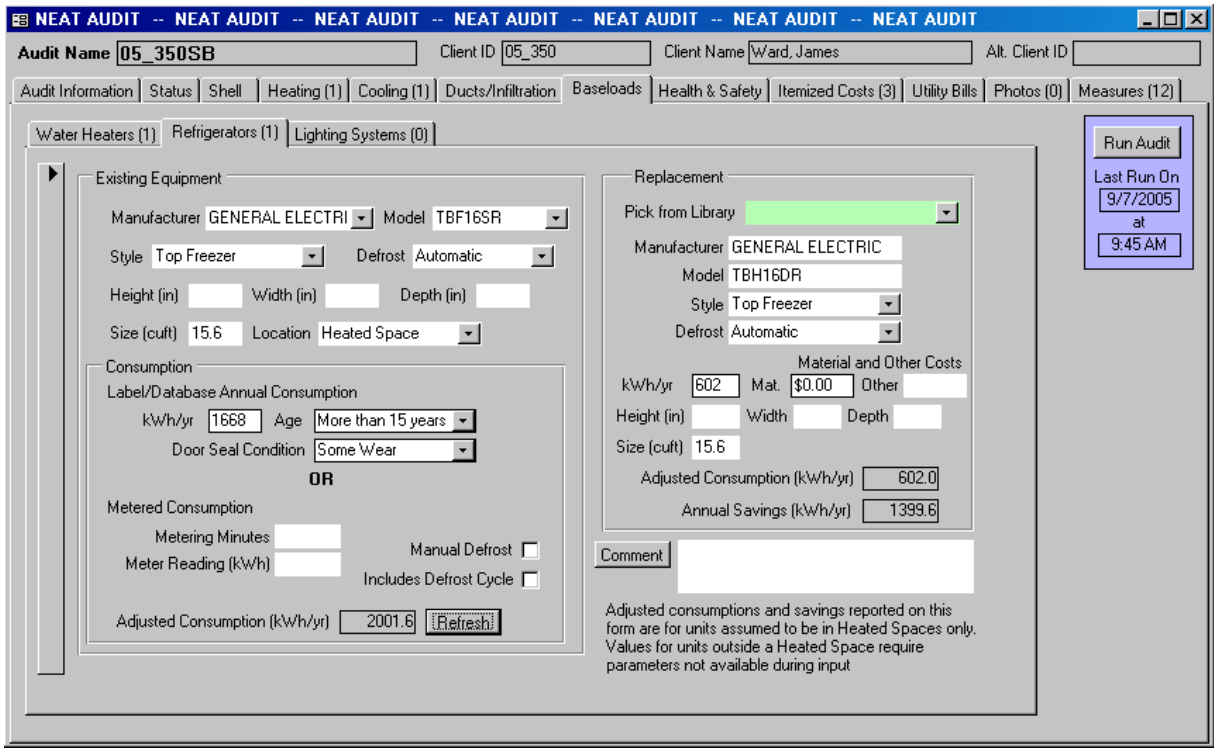
NEAT includes a refrigerator replacement measure (see Section XX, *Refrigerator Replacement*). In order to evaluate the potential savings obtained from replacing an existing refrigerator with a newer, more efficient unit, NEAT needs to know an estimate of the existing and new refrigerators' annual energy use, in kWh/yr. This data can be obtained in either of three ways:

1. The Association of Home Appliance Manufacturers (AHAM) and an office of the Department of Energy (DOE) have accumulated the results of efficiency tests for many manufacturers' models of refrigerators. The data base containing their data has been incorporated into the Weatherization Assistant. Thus, if you are able to locate the manufacturer and model in the look-up table provided, the required annual consumption will be entered for you.
2. Refrigerators are sold with labels that list the estimated annual energy consumption in kWh/yr. If such an energy guide label is available for either the existing or new units (more likely for the latter), it can be used as the source for this required input.
3. Small meters exist which are capable of relatively easily monitoring the consumption of a refrigerator. If you use one of these meters, the program asks for the kWh consumed by the refrigerator during the monitoring period and the number of minutes monitored.

Additional inputs adjust the consumption data for the ambient temperature of the space in which the refrigerator is located, the existing refrigerator's age, the condition of the seals, and defrost cycles.

The data input is grouped into data blocks asking for general information on the existing unit, the energy consumption of the existing unit, and data regarding the replacement unit. The data entry descriptions for the existing unit are given below:

Manufacturer – Enter the existing refrigerator's manufacturer's name. You may use this field to either enter a manufacturer of your own choosing or to search the look-up tables for a matching entry. This entry is optional unless you are using the data look-up tables to identify the unit.



Baseloads - Refrigerators Form

Model – Enter the existing refrigerator's model number. You may use this field to either enter a model number of your own choosing or to search the look-up tables for a matching entry. This entry is optional unless you are using the data look-up tables to identify the unit.

Style – You may record the style of the existing unit. The choices are: (1) Top Freezer, (2) Side by Side, (3) Single Door, (4) Single Door w/Freezer, (5) Bottom Freezer, and (6) Other. These styles correspond to those given in the Weatherization Assistant's database of refrigerators. If you choose an existing refrigerator whose Style is available from this database, this entry will be entered automatically. Optional.

Defrost – You may enter the defrost characteristics of the existing unit. The choices are: (1) Automatic, (2) Manual, (3) Partial Automatic, and (4) Other. These types correspond to those given in the Weatherization Assistant's database of refrigerators. If you choose an existing refrigerator whose defrost type is available from this database, this entry will be entered automatically. Optional.

Height, Width, Depth, Size – Enter the dimensions of the existing unit. These entries are always optional. However, if entered for both the existing and replacement

units, NEAT will compare the entries and produce a warning if the entries indicate a possible size problem related to the replacement. If you used the look-up tables to identify the existing unit and dimensions are available from the tables, these dimensions will be entered automatically. Optional.

Location – Select one of three locations for the refrigerator: 1 - Heated Space (space that utilizes a thermostat to control its temperature); 2 - Unheated Space (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). Default - Heated Space. Required.

The Consumption data block accommodates entries required to estimate the existing unit's current annual consumption from any of the three sources described above. If the consumption is to be estimated from an energy guide label or from values in the look-up tables, the following three entries will be used.

kWh/Yr – Enter the kWh/yr consumption listed on the energy guide label for the existing unit, if one exists. If you have used the look-up tables to identify the existing unit, this value will be entered automatically. The entry is not required if you are using metered consumption data.

Age – Select one of the categories describing the age of the existing unit: 1 - Less than 5 years; 2 - 5 to 10 years; 3 - 10 to 15 years; 4 - More than 15 years. If you used the look-up tables to identify the existing unit and the data is available from the tables, this data will be entered automatically. The age from the tables will be based on the first year the model was sold. If you know that the existing model is newer than that indicated from the tables, change the entry. The entry is not required if you are using metered consumption data.

Door Seal Condition – Select the choice of Door Seal Condition which best describes the current condition of the existing refrigerator's door seals: (1) Good, (2) Some Wear, and (3) Gaps Visible. The entry is not required if you are using metered consumption data.

If you use metering to determine the consumption of the existing refrigerator, enter data into the "Metered Consumption" portion of the Consumption data block.

Metering Minutes – If you are using metered consumption data, enter the number of minutes you metered the existing refrigerator. Metering should be performed for at least 180 minutes (3 hours). You should attempt to prevent refrigerator door openings during the metering period. This entry is not required if the kWh/yr field has been used to provide the consumption data.

Meter Reading – Enter the metered consumption in kWh for the period specified by the Metering Minutes. This entry is not required if the kWh/yr field has been used to provide the consumption data.

Manual Defrost – Is the existing unit manual defrost? This entry used for metered consumption only.

Includes Defrost Cycle – Indicate in this check box whether or not the metered consumption entered above included a defrost cycle. This can be determined if either the consumption or refrigerator interior temperature is being monitored by the presence of a peak in either of these parameters extending several times higher than the surrounding peaks.

Regardless of the method you choose to estimate the current refrigerator consumption, the Adjusted Consumption field at the bottom of the Existing Equipment block of data will display the program's estimate, adjusted for location, age, condition of seals, and defrost cycles possibly present during metering. If you change data after this value's original display, you may need to select the "Refresh" button in order to update the value.

Consumption data is also necessary for the replacement refrigerator. This data will be provided either from the energy guide label on the replacement unit, or from values of pre-selected replacement units in your library of replacement refrigerators. This library is defined by you in the Setup Library (see Section [10.3], *The Hot Water Equipment and Refrigerator Forms*). Data for the replacement refrigerator is entered on the right side of the form in the Replacement data block. It includes the following fields:

Pick from Library – Use this drop-down box to select a replacement unit from your library of refrigerators. If this field is used, the entry must match a unit listed in your library.

Manufacturer – Enter the manufacturer of the replacement refrigerator. If your selection of a replacement has been made from your library of replacement refrigerators, this data will be entered automatically. Optional.

Model – Enter the model number of the replacement refrigerator. If your selection of a replacement has been made from your library of replacement refrigerators, this data will be entered automatically. Optional.

Style, Defrost – These fields are analogous to those of the same name in the Existing Equipment data block except they apply to the replacement unit. See the discussions of these fields in the material above. If your selection of a replacement

has been made from your library of replacement refrigerators, this data will be entered automatically. Optional.

kWh/Yr – Enter the annual consumption in kWh/Yr for the replacement refrigerator. This value may be obtained from the energy guide label of the replacement unit. Otherwise, if your selection of a replacement has been made from your library of replacement refrigerators, this data will be entered automatically.

Material and Other Costs - Enter the purchase (material) price of the replacement refrigerator and any other installation or disposal costs associated with the refrigerator replacement. Note that any costs incurred in disposing of the old existing refrigerator must be included in this Other cost.

Height, Width, Depth, Size - Enter the dimensions of the replacement unit. These entries are always optional. However, if entered for both the existing and replacement units, NEAT will compare the entries and produce a warning if the entries indicate a possible size problem related to the replacement. If you choose your replacement from your library of replacement refrigerators and dimensions are available in the library entry, these dimensions will be entered automatically. (Optional.)

The Replacement data block contains two un-editable fields. The Adjusted Consumption field displays an adjusted annual kWh/yr for the replacement unit. The only adjustment made for the new unit is based on the number of occupants. A larger number of occupants will slightly raise the adjusted consumptions. The Annual Savings field displays the difference between the adjusted annual kWh of the existing and replacement refrigerators. This will be the savings used to determine the savings to investment ratio in NEAT or MHEA unless the refrigerator is not located in a "Heated Space." If the refrigerator is outside the heated space, additional temperature dependency adjustments will be made which cannot be performed until the job is actually executed.

Comments - Enter comments about the refrigerator replacement you may want to appear in the NEAT audit report. (Optional.)

8.7 Optional Entries under the Baseloads Water Heaters Form

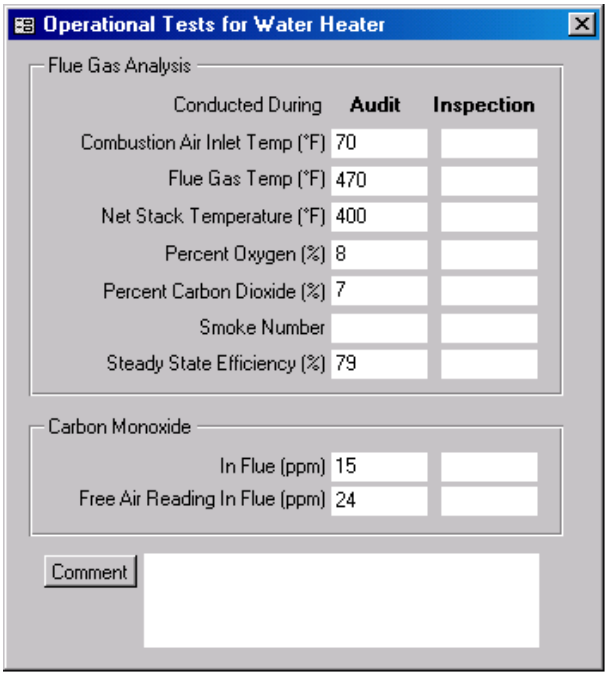
Similar to the feature described above for heating systems, the Water Heaters form under Baseloads also has an optional capability of documenting observations associated with the water heater which may be encountered during the audit. Some of these items may also constitute potential health and safety concerns. These details

are accessed from buttons lying to the right of the "Optional Water Heater Details" title at the bottom of the form. You must complete the description of the existing water heater before accessing these optional details. Not all items under these buttons may be applicable to the specific water heater described. No attempt is made in this manual to describe correct procedures for obtaining the measurements or performing the inspections. You should refer to literature on standard HVAC or plumbing practices or consult with a qualified plumber.

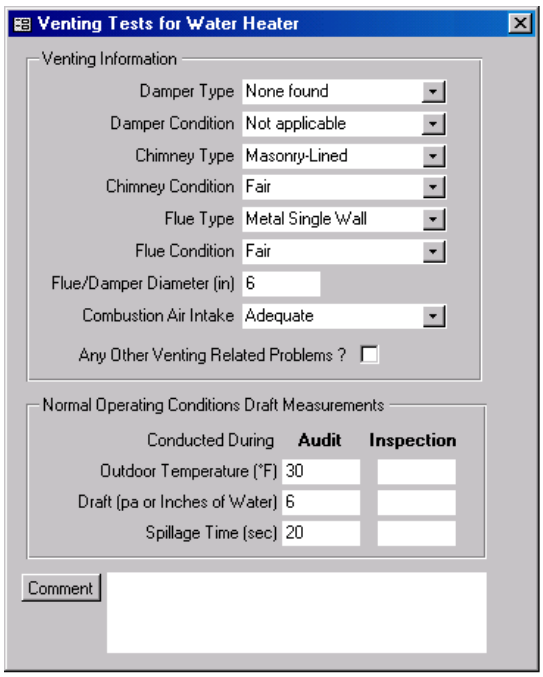
Optional Water Heater Details - tests, measurements, and inspections

A summary of the items contained under each of the buttons is given below. Each form allows addition of an extended comment if necessary. Close each form using the customary Windows X box in the upper right corner. Each form must be closed before any other form can be accessed.

Operational Tests – This form allows recording information resulting from flue gas analysis and carbon monoxide measurements performed in association with the water heater. The form allows recording of these measurements before and after work has been performed –"Conducted During Audit" and "Conducted During Inspection," respectively.



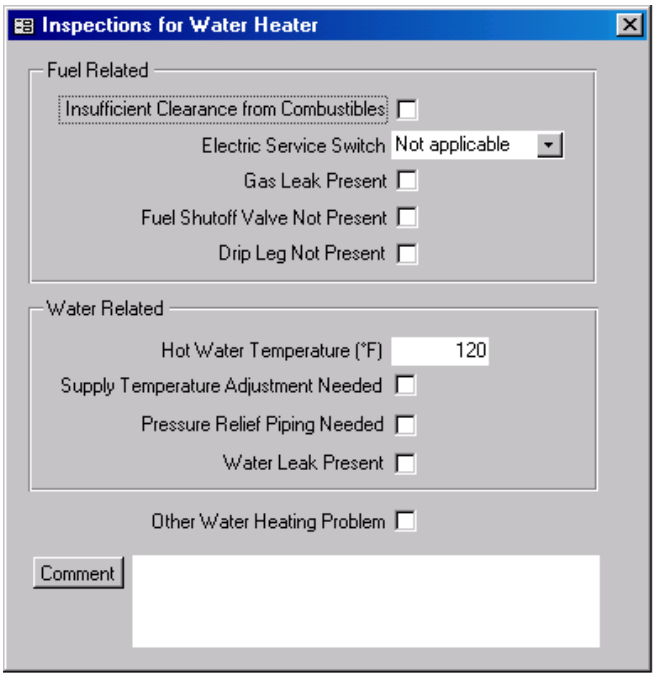
Operational Tests for water heaters



Vent Tests for water heaters

Vent Tests – The same Vent Tests form is used for both the Heating System and the Water Heater. Information recorded includes characteristics of the flue and damper as well as before and after draft measurements on the flue associated with the water heater.

Inspections – This form contains mostly check boxes identifying potential hazards associated with the water heater. Fuel related items include insufficient clearances, gas leaks, and lack of a fuel shut off. Related to the water itself are check boxes regarding the water temperature, pressure relief, and presence of leaks. See the description under Section 8.9, *Health and Safety*, on how the Weatherization Assistance handles health and safety items.



Inspections for water heaters

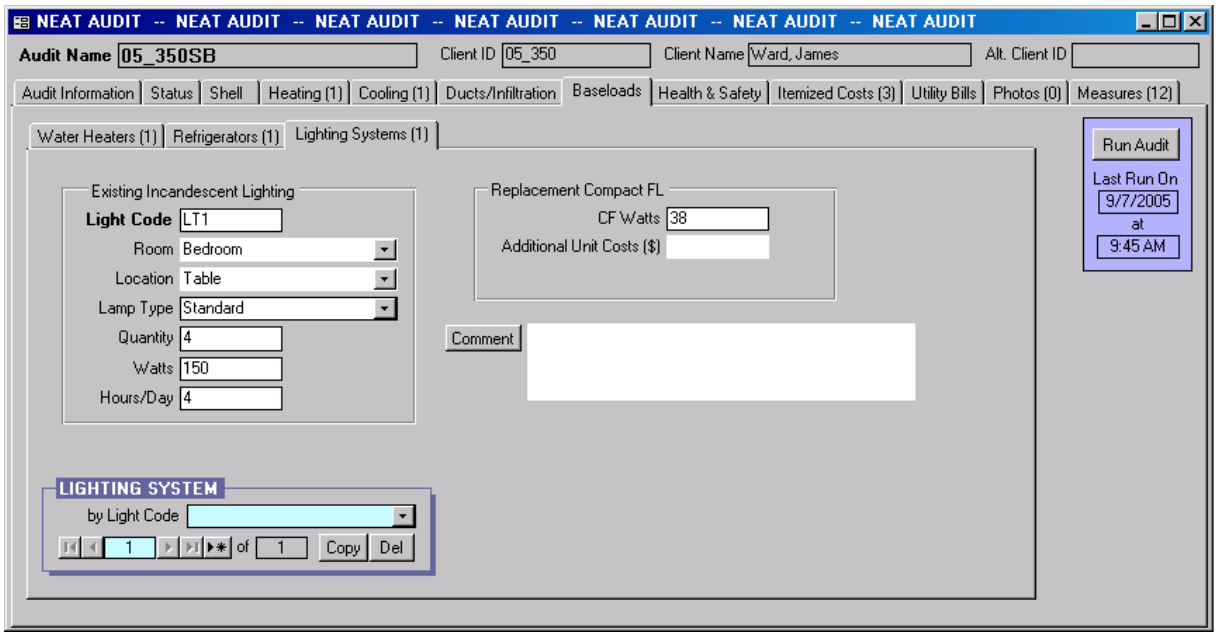
8.8 Base Loads - Lighting Systems

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. If the Lighting Retrofits measure has been turned off in the Candidate Measures form of Key Parameters, this form will not be accessible.

Entries on this form are a follows:

Light Code – The Light Code allows you to identify the specific Light description in the NEAT reports. NEAT will provide default entries of the form "LT#," where the # is the next higher consecutive integer above the number of lights already described.

Room – Enter the room in which the lights being described are located. The seven choices are: (1) Family Room, (2) Kitchen, (3) Living Room, (4) Rec Room, (5) Dining, (6) Bedroom, and (7) Utility. The entry is for the auditor's use in locating the lights for possible later retrofit. Optional.



Baseloads - Lighting Systems

Location (of existing incandescent lamps) – Describe the location of the lighting fixture/s within the room using one of the following selections: (1) Ceiling, (2) Floor, (3) Table, and (4) Wall. This entry is for the auditor's use only in locating the lights for later retrofit. Optional.

Lamp Type (of existing incandescent lamps) – Indicate the type of the existing incandescent lamp, either Standard or Flood (reflective or spot). 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. Required.

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. Required.

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. Required.

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 the lamp. You should target this measure to lamps with substantial on-times. The entry is required with no default. Required.

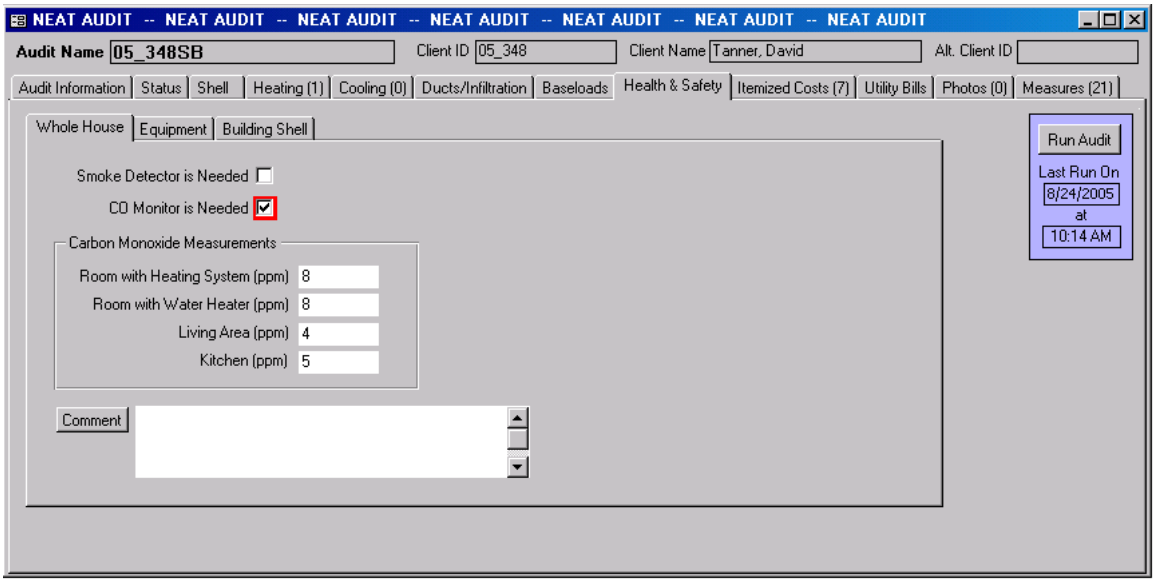
Replacement CF Watts – Enter the wattage of the compact fluorescent which is to replace the existing lamp. The lighting measure will use the standard replacement wattage closest to your entry. The default for this field is the wattage of the compact fluorescent bulb which will give approximately the same light output as the wattage of incandescent lamp entered in the Watt field for the existing lamp. Required.

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.

8.9 Health and Safety

In addition to the potential health and safety hazards which can be identified under the Heating and Water Heater tabs, the Health & Safety tab permits identification and description of additional safety concerns. These additional safety related tests are divided into three categories: Whole House, Equipment, and Building

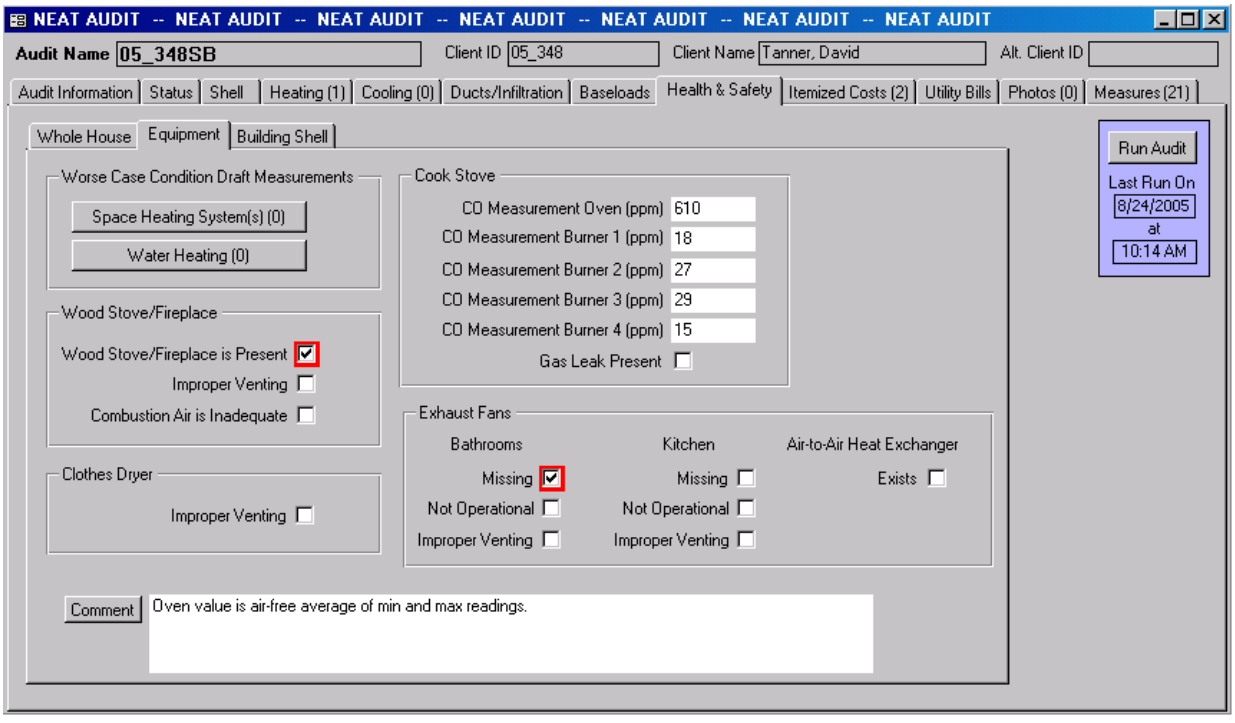


Health & Safety - Whole House

Shell. Each will be discussed separately below. Each form also provides the opportunity to record extended comments. In addition, the Weatherization Assistant's extended handling of health and safety issues will be discussed below. This discussion applies to similar issues and hazards which may have been identified under the Heating or Water Heater tabs.

Whole House – This form allows the need for smoke or CO detectors to be identified as well as carbon monoxide concentrations in various rooms of the home to be recorded.

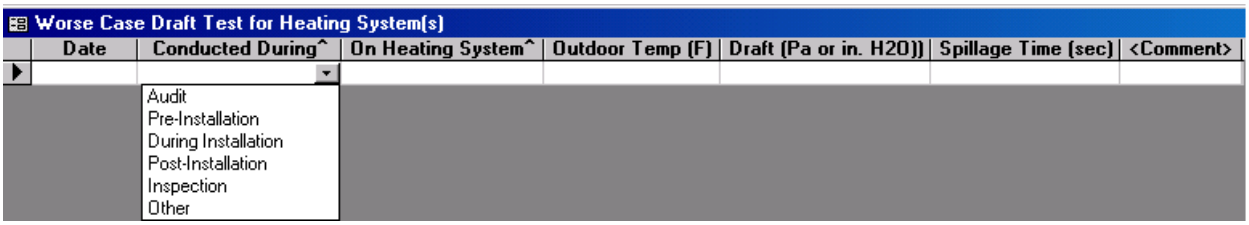
Equipment – This form is divided into data blocks addressing (1) Worse Case Condition Draft Measurements (for heating systems and water heater), (2) Wood Stove/Fireplace, (3) Clothes Dryer, (4) Cook Stove, and (5) Exhaust Fans and Heat Exchanger.



Health & Safety - Equipment

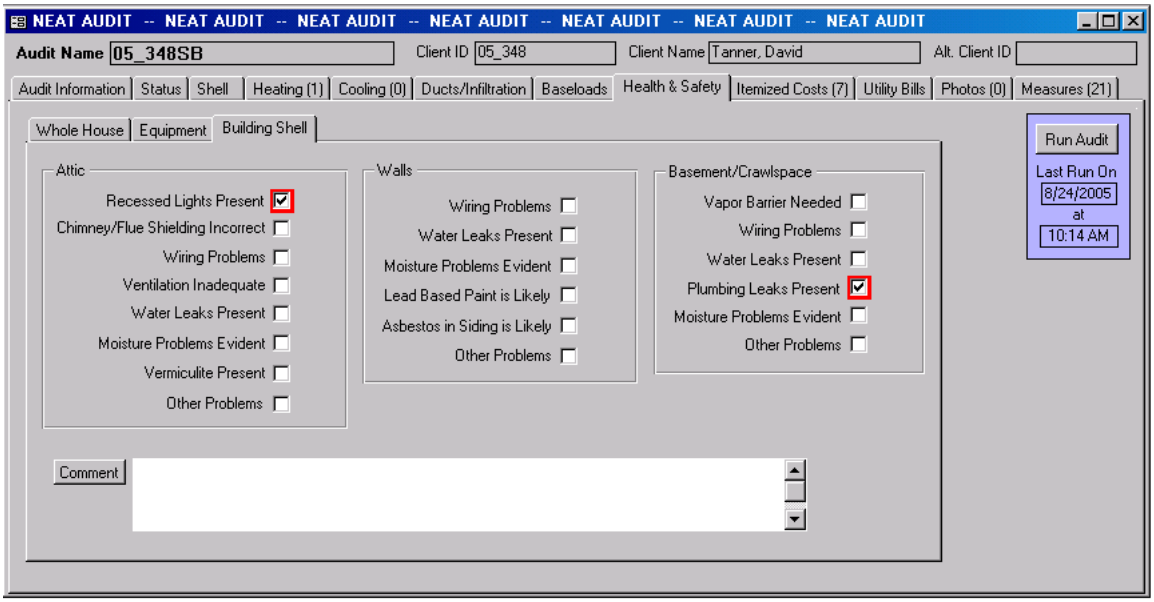
The worst case draft tests allow multiple measurements to be recorded in a spread sheet format. NEAT and MHEA allow these measurements to be taken for each of the heating systems described on the Heating tab. Improper venting is a concern for wood stoves, fireplaces, clothes dryers, and exhaust fans. In addition, wood stoves or fireplaces may have inadequate combustion air, and bathroom or kitchen exhaust fans may be missing or not operational. Individual burner and oven CO measurements can

be recorded for a gas cook stove. A gas leak associated with the gas stove can also be identified.



Heating system worst case draft tests table

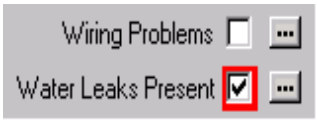
Building Shell – The Building Shell tab is divided into data blocks for Attic, Walls, and Basement/Crawlspace. All three of these areas have the potential for wiring problems, water leaks, or moisture related problems. In the attic, additional concerns may be related to recessed lighting, the chimney/flue, or the presence of vermiculite. Walls may use lead based paint or have asbestos siding. The basement may be in need of a vapor barrier or exhibit plumbing problems. All areas can also be described as having Other Problems, which could be explained in the comments.



Health & Safety - Building Shell

Handling of Health and Safety Issues – With the introduction of Version 8 of the Weatherization Assistant comes an extended capability to handle health and safety issues. Most of the data items under the Health & Safety tab, as well as some under

the Heating and Water Heater tabs, have check boxes which indicate potential hazards. When selecting such a check box, a red broad border is drawn around the box. All such noted hazards are reported under both the Heating System and the Health & Safety Summary Reports for the audit.



Two check boxes, one indicating a hazard

In addition, a pre-defined weatherization activity suggesting action to remedy the condition is associated with each potential hazard. These activities are defined under the User Defined Measure tab of the Setup Library (see Section [9.6], *User Defined Measures*). If you have selected the feature to "Automatically generate Itemized Cost Records for Health and Safety Problems," on the Preferences / Feature tab (see the indicated topic in Section [11.4], *Features*), the program will present you with additional options. When you select a check box indicating a potential hazard, the Weatherization Assistant will ask you if you wish to add a specific Health and Safety remedial measure as an Itemized Cost to your recommended measures lists. You may review the specific Itemized Cost by clicking on the small square with three periods in it,  , which will be located just to the right of the check box. Thus, using this feature, you may supplement your recommended measures produced by running the audit with activities you intend to perform to alleviate potential health and safety issues.

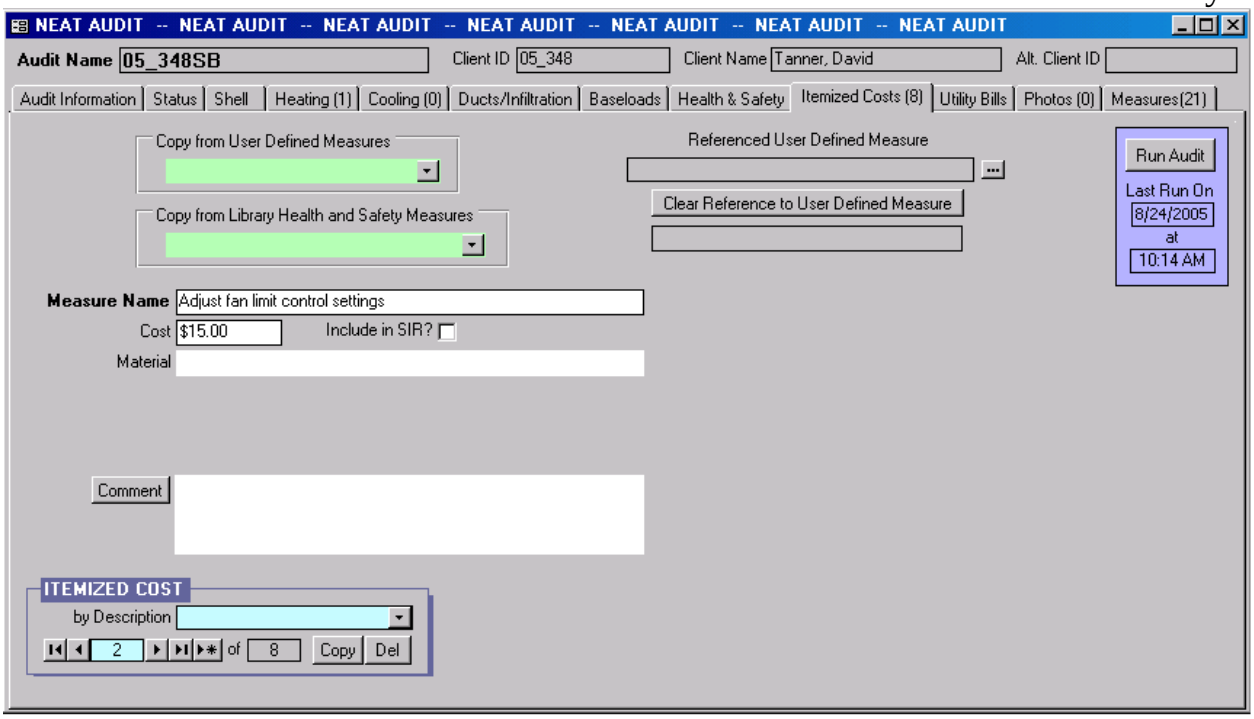
8.10 Itemized Costs

The Itemized Cost form on the Audits Main Menu item allows you to enter additional costs which are expected to be incurred during weatherization that are not associated with any specific activity otherwise addressed by the audit. The items described on the form may have energy savings attributed to them. However, for the purposes of this form, this energy savings would have to be assigned by the user.

You may specify these activities by supplying information to each individual data field in the specific audit you are currently referencing. Used in this mode, the form behaves as it did in Version 7 of the Weatherization Assistant with the exception that you may specify the units of the energy saving as kWh, MMBtu, or therms. See the "Itemized Additional Costs and User-Defined Measures" sections in the Version 7 NEAT or MHEA User's Manuals for additional information on entering data on this form.

Beginning with Version 8, you may alternatively call up activities you have previously defined in your Setup Library and copy them to the audit. This is accomplished by using the "Copy from User Defined Measures" or "Copy from

Library Health and Safety Measures" combo boxes. The former list will include costs and measures you have defined in your Setup Library (see Section [9.6], *User Defined Measures*). The latter are health and safety remediation items which come as part of the program. and are the same items that are accessible from the Health and Safety tab of the audit (see Section 8.9, *Health and Safety*). By choosing an item from either of these combo box lists, the remaining information on the form will be automatically copied from the Setup Library to the form, overwriting any existing information on the form. The Measure Name will appear not only in the Measure Name field, but also in the un-editable field under "Referenced User Defined Measure." An entry

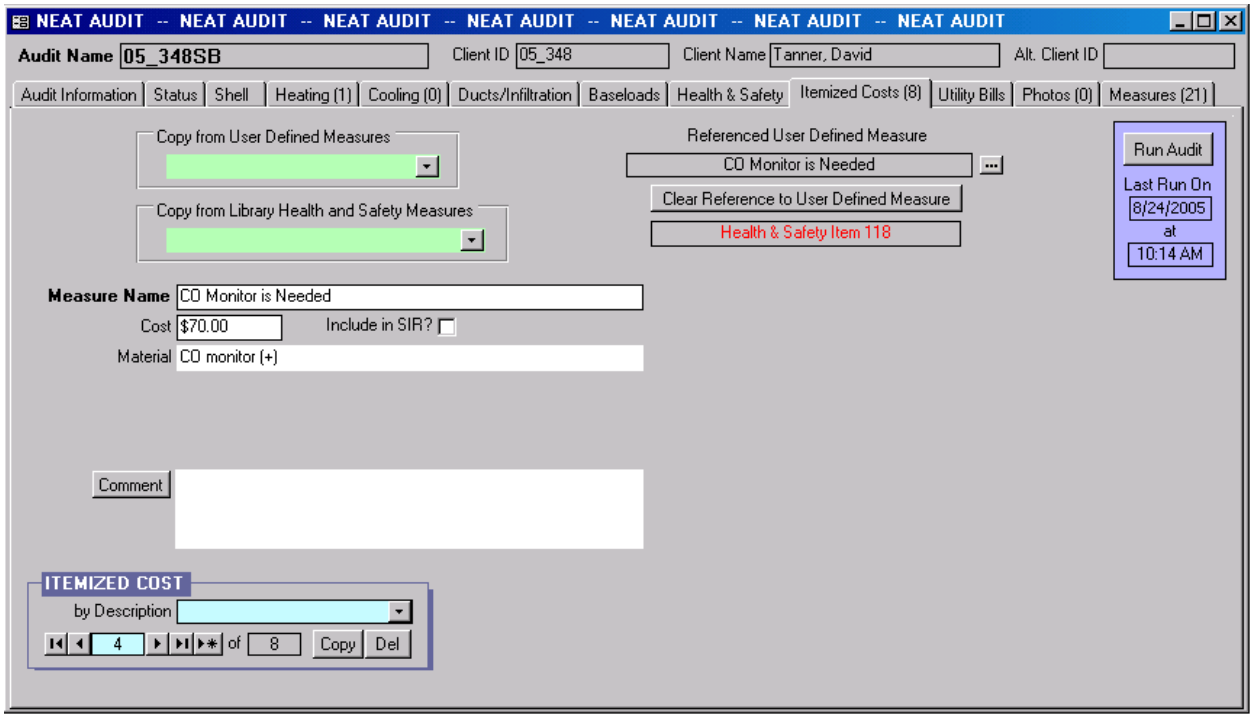


Itemized Costs form (specific to audit)
Note: The entry could have had a "Material" associated with it

in this un-editable field is your indication that the measure displayed on the form is a copy of one previously defined in the Setup Library. In addition, if the measure was selected from the list of Health and Safety items in the Setup Library, the text, "Health & Safety Item #" will appear in red in another un-editable field in the same area of the form, where the # is a number uniquely identifying the specific health and safety item in the Setup Library.

There is one major difference between a measure totally specified on the form and one copied from the Setup Library. The former can have only one component to its cost and material description, that entered on this form. On the other hand, items

defined in the Setup Library can have multiple material/labor components, each with its own individual cost associated with it. In this latter case, only the component designated by the user in the Setup Library (presumably the major component) will be displayed in the Material field, followed by a plus sign (+), indicating that there is more to the material description of the measure than this single entry. The Cost field, however, will display the total cost of the measure, comprised of the sum of the individual component costs. You may review the complete description of the user-defined measure in the Setup Library by clicking on the small square with three periods in it,  , which will be located just to the right of the un-editable display of



Itemized Costs form (health & safety measure taken from Setup Library

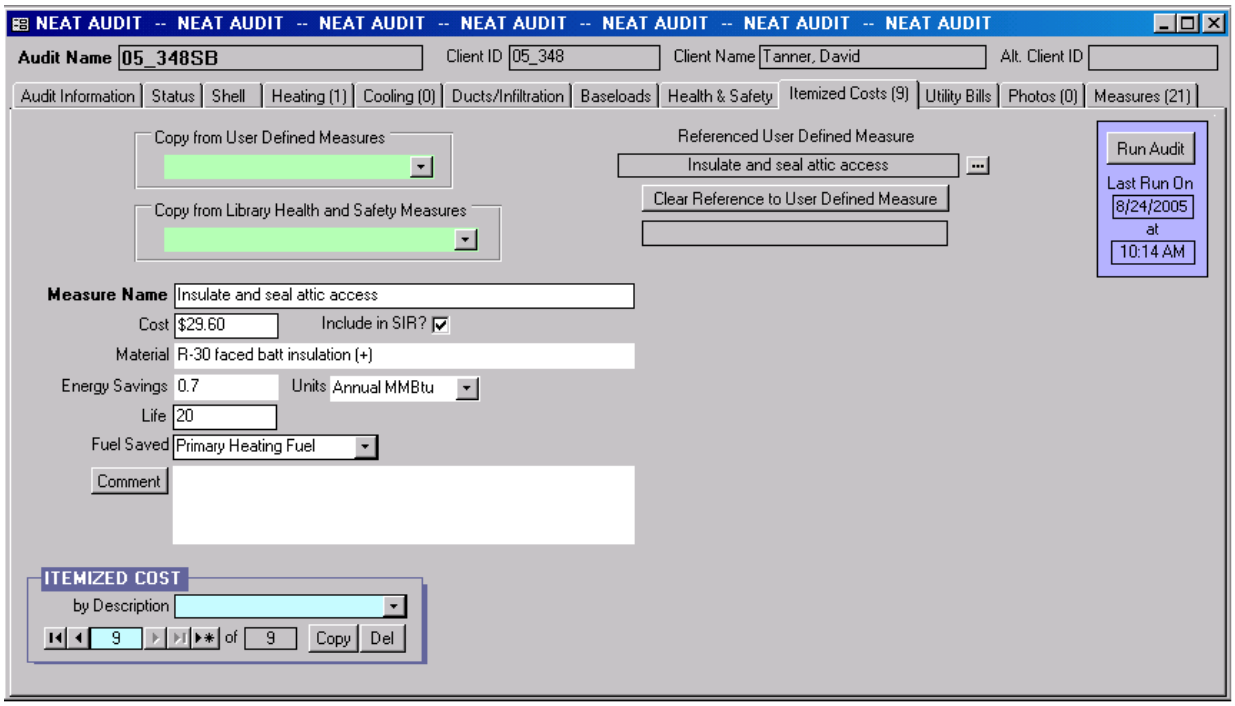
the measure name. Note, however, this button takes you to the actual Setup Library entry. Any changes to the measure made at this point will change the measure description for all future references.

Although the display of a measure copied from the Setup Library will show only one component on the Itemized Cost form of the Audit, the complete description with all of its individual components will be available in any work order created from the audit. Any modifications to the measure can be made at that time.

If you have chosen to copy a pre-defined item in creating an Itemized Cost and you do not want this detailed material costing to be forwarded to the Work Orders,

click on the "Clear Reference to User Defined Measure" button. You are then free to alter any of the entries displayed on the Audit's Itemized Cost form for this item. However, now only the single Material and Cost entered there will be associated with the item and forwarded to the Work Orders. WARNING: Modifying the information for an Itemized Cost or User Defined Measure generated by copying an item from your Setup Library without first clearing the reference to the pre-defined item will cause inconsistencies in data reported in the NEAT or MHEA Recommended Measures report and that reported in the Work Orders.

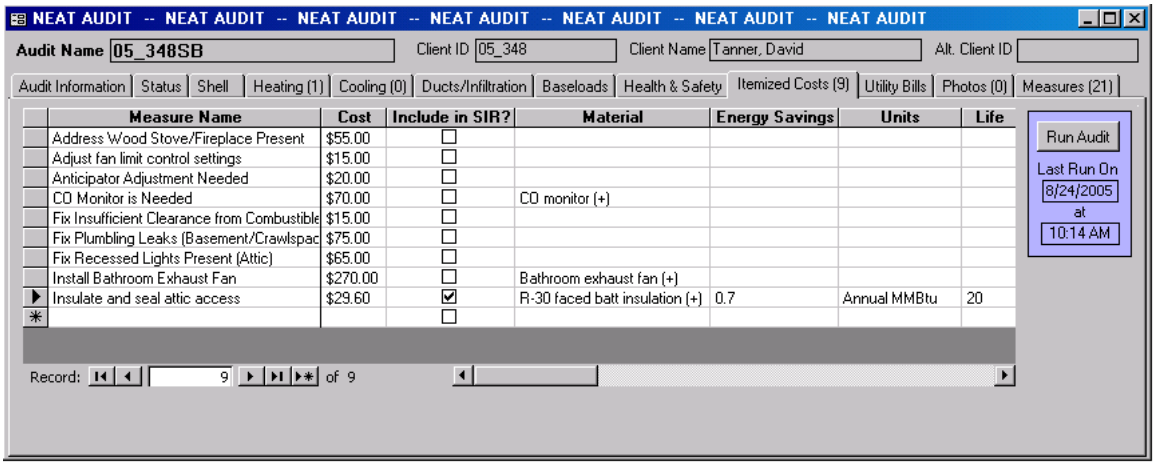
A comment field is available to add any comment you feel appropriate. If the entry on the Itemized Cost form has been copied from the user-defined items in Setup,



Itemized cost with energy savings (copied from the Setup Library)

the comment will initially be populated with whatever comment you entered for the item entered there.

A Data Sheet view of the Itemized Cost form is available. However, care must be taken if any changes are made from this view, as it may not be obvious which measures are copies of pre-defined measures from Setup.



Data Sheet View of Itemized Costs form
Note: Columns not displayed include "Fuel Saved," "Health & Safety Item #," and "Comment."

8.11 Utility Bills

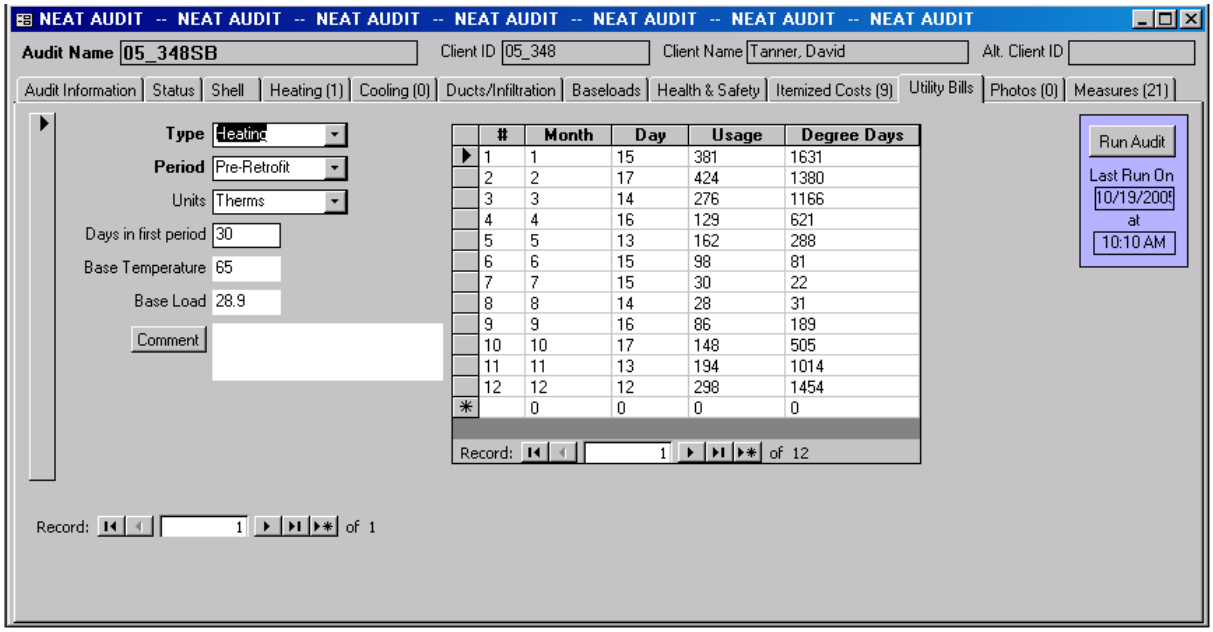
Although optional, utility billing data you enter into the Weatherization Assistant for the homes you weatherize can be a valuable source of information. NEAT and MHEA allow you to compare its consumption predictions with pre-retrofit billing data (see Section XX, *Heating and Cooling Energy Comparisons*). Then, if you desire, it will adjust the measure recommendations and savings to reflect this actual consumption.

Post-weatherization billing data may also be input to the programs 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.

Both NEAT and MHEA permit entry of four sets of utility bills: pre- and post-retrofit heating and cooling energy usage. 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.

The programs 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 the billing data features unless you can successfully divide the electric bills into their heating and cooling components before entering the data.

The billing data feature works 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.



Utility Bills Data Entry Form

The billing periods entered must be consecutive. They may extend from one year into the next, but must span one year or less. Thus, no two periods can include any of the same days of the year in two years. The number of periods entered must be 12 or less. Examples of entries are (1) twelve consecutive monthly readings, (2) one annual consumption, or (3) any number of periods, 12 or less, spanning less than an a years time.

Each of the four sets of entries has the following data requirements:

Type - Select either 1- Heating or 2 - Cooling as the major purpose for which the fuel entered is used. The fuel may also supply non-heating or cooling end uses, such as cooking or water heating. However, you will have to enter an estimate of this "Base Load" in a subsequent field.

Period - Select whether the data being entered pertains to a 1 - Pre-Retrofit or 2 - Post-Retrofit period. Only pre-retrofit data will be used for measure savings adjustments.

Units - Select either 1 - Therms or 2 - kWh depending on the fuel source and season for which data is to be entered. Normally cooling data will be 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 Setup Library (see Section [9.3], *Fuel Costs*). Most natural gas contains approximately ten therms per mcf and one therm per ccf of natural gas. Other fuels may require additional conversion, such as gallons of propane or oil. However, note the warning above regarding recording bulk fuel consumption.

Days in first period - Enter the number of days included in the first billing period. Subsequent periods are assumed to be contiguous, thus allowing determination of their lengths.

Base Temperature - The Utility Bills 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 is to be entered, base temperatures for these HDD or CDD values are required. Assume a base temperature of 65 F for HDDs and 78 F for CDDs, unless different base temperatures are listed on the utility bills.

Base Load - Enter an estimate of the average base load consumption per month in the units chosen in "Units" above. The period consumptions entered likely result from not only heating or cooling, but also from use of appliances, such as stoves, water heaters, or refrigerators. The Weatherization Assistant needs to separate this "base load" consumption from the heating and cooling consumption. This entry is an estimate of this base load consumption for an average 30-day month.

To determine the base load for the heating fuel yourself, select a month when the heating equipment did not operate, most likely during summer. This month should be one of normal household occupancy—no long term visitors or household vacations.

Determine the heating fuel consumption for that month, in the units selected in the "Units" field.

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 programs will adjust this value to correspond to each of the billing periods, regardless of their duration. You may wish to leave this field blank until after entering the actual billing data for the periods. A default value for the base load will then be computed that reflects the period data entered.

Comments - Enter any comments regarding this particular set of billing data you wish to be displayed in the output reports.

The above data is entered once per set of billing data. The following data are required for each billing period within a set. They appear on the right side of the input screen in a tabular format.

Month - Enter the number of the month in which the meter reading corresponding to the billing period was taken (e.g. January - 1; February - 2, etc.).

Day - Enter the day of month on which the meter reading corresponding to the billing period was taken.

Usage - Enter the consumption during the billing period. The units are those selected in the "Units" field to the left.

Degree Days - Enter the number of heating or cooling degree-days (depending on the "Type" selected) corresponding to the period.

8.12 Photos (Audit)

If you have selected the Photo Browser check box (Feature 1) on the Preferences/ Features tab, the Photos tab will appear on the Audit form. From this tab, you may select, view, and edit digital photos for the specific client currently being referenced. See Section [13.1], *Digital Photos*, for more information on this feature. Note that the ability to reference digital photos also exists at the Client and Work Order levels. You should develop a consistent policy regarding where you reference your photos.

8.13 Measures (Audit)

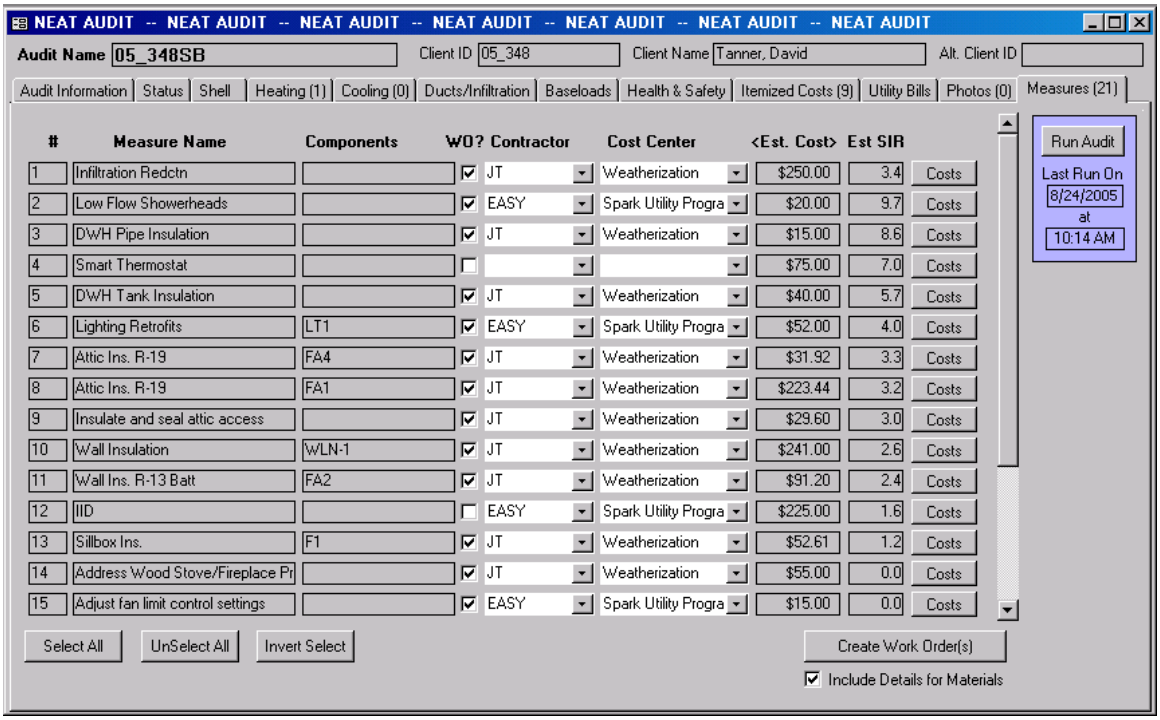
New to Version 8 of the Weatherization Assistant is the optional feature of creating work orders. If you want these work orders to be created based on the results from running either the NEAT or MHEA audits, the Measures tab of the Audit Main Menu item is the starting point for this process. An alternate use of the work order feature is to tailor the NEAT and MHEA recommendations to reflect actual conditions or to add as much detail to the measure descriptions and costs as desired.

Following execution of either audit program, the Measures tab will list all measure recommendations [similar to the listing in the Recommended Measures report, see "Audit Report Block" in Section 6.2, *Audit Information*, and Appendix [A]. For each measure, the measure name, any building component designations applicable to the measure (see the appropriate NEAT or MHEA User's Manual), the total measure cost, and SIR will be displayed. Notice that "Est" prefaces the cost and SIR header names. This reminds the user that these are estimated costs and SIRs based on estimated costs, used by the audits to make their initial recommendations and may not be the same as actual costs and SIRs seen following implementation of the measures. These are all un-editable fields, reflecting the assumptions used by the audits and their recommendations. A breakdown of the costs for the standard audit measures can be viewed by either double clicking the mouse on the Cost entry itself or selecting the Costs button to the right of the measure description. However, these displays are still un-editable.

The following items on the Measures tab can be altered and are used in creating the work order(s) associated with the audit.

WO? – The header name is short for "Include in work order?" Check this box for each measure you want transferred to a work order. Measures not selected will not be sent to a work order. You may wish not to send a specific measure to a work order because a work order already exists which includes the measure or because you are rejecting the audit's recommendation with regard to the measure. The "Select All," "UnSelect All," and "Invert Select" buttons at the lower left of the form allow you to accept all of the recommended measures, reject (unselect) all, or invert the selection currently seen from the check boxes.

Contractor – This field allows you to assign each measure to a contractor. The selection will determine how many work orders are created from the measure list. All measures assigned the same contractor will be included in the same work order. The choices displayed in the combo box list will be all Agency Contacts defined as



Itemized Cost with energy savings (copied from the Setup Library)

Contractor or Crew (see Section [5.2], *Contacts (Agency)*). The entry is optional. All measures with an unassigned Contractor that are selected for transfer to a work order will be assigned to the same work order with the contractor un-designated. If you have assigned a Default Contractor to a particular measure in the Setup Library (see "Default Contractor/Crew" under "The General Task Description" in Section [9.6], *User Defined Measures*) and that measure is recommended, the default contractor will automatically be entered for you. However, you may still change the selection if you desire. Optional.

Cost Center – If you are tracking costs that are incurred by different funding sources or programs, assign the cost of implementing this particular measure to the appropriate Cost Center. The choices available in the combo box list will be those you have defined under the Cost Center tab on the Agency Main Menu item for your agency (see Section, *Cost Centers*). The entry is optional. If the entry is left un-assigned, work orders can still be developed, but total costs over multiple audits will not tracked. The costs which are assigned to the various cost centers are not the estimated costs displayed on this Measures tab. They are the actual costs declared in the work orders themselves (see "Quantity (Actual)" and "Unit Cost (Actual)" under

"The Materials/Labor Details Sub-Form" in Section [8.3], *Measures (Work Order)*). If you have assigned a Default Cost Center to a particular measure in the Setup Library (see "Default Cost Center" under "The General Task Description" in Section [9.6], *User Defined Measures*) and that measure is recommended, the default cost center will automatically be entered for you. However, you may still change the selection if you desire. Optional.

When you are satisfied with the choices made for the entries described above, you will need to decide whether you wish to transfer the estimated costs associated with each measure to the work orders you are about to create. The costs transferred will include the detail displayed by selecting the Costs buttons to the right of the measure descriptions on the form. For measures copied to the audit from the Setup Library (see Section 8.10, *Itemized Costs*), this detail will include as many costing components as were defined in the Setup Library (see "The Materials/Labor Details Sub-form" in Section [9.6], *User Defined Measures*). If you do wish to include the cost data, select the "Include Details for Materials" check box in the lower right of the form. Work orders will be created having their estimated costs identical with the detailed costing of each measure as seen by the audit.

If you would rather create work orders with no cost data associated with the measures, do not select the "Include Details for Materials" check box. This may be chosen in order to make it easier to enter costing of the measures in the work orders, perhaps expected to have greater detail than available from the estimated costs used by the audits. The costing used by the audits will still be available to you in the work orders and you may still transfer these costs to the work orders individually, measure by measure, if you so choose.

Select the "Create Work Order(s)" button when ever you are ready to actually create the work orders based on the information provided on the Measures tab. If you have previously created work orders from this specific audit, a form will be displayed asking if you prefer to (1) Save the previously existing work orders and create additional work orders – leaving the potential for duplicate measures being included, (2) Replace all work orders previously generated from the audit with new ones based on the criteria currently on the Measures form, or (3) Cancel the request to create work orders. Any work orders not created from this specific audit are unaffected by the request to create work orders from this Measures tab of the audit. Thus, if you used the Work Order tab under the Client Main Menu item to initiate and then fill in work orders for a client, then ran an audit for the same client and asked to create work orders based on the audit recommendations, the two sets of work orders will exist for the same client. The program's behavior is intended to address situations where

agencies may implement some measures outside an audit (such as from a priority list), but use the audit for recommendations on other measures.

The program will next provide a small window displaying how many work orders were created as a result of your selections on the Measures tab. This should correspond to the number of unique contractors, including un-designated, you indicated on the form. Pressing the OK button will take you to the Work Order Main Menu item for the first work order created as a result of your request. You will see a work order whose default name will be of the form, "WO/<Client ID>/<Contractor ID>/#." The <Client ID> is the Client ID supplied for the Client on the Client Information tab of the Client Main Menu item and the <Contractor ID> will be the Contact User Name assigned to the Agency Contact designated as a Contractor or Crew on the Contacts tab of the Agency Main Menu item. The "#" is an integer assigned to insure uniqueness of the Work Order Name.

Having created work orders from the audit recommendations, you are prepared to make any modifications to them before printing out the actual work orders. See Chapter [8], *Work Orders*, for additional information.