C H A P T E R 3, Continued

Completing the Residential Analysis Worksheet

STEP 3: NET WALL AND DOOR AREAS

Step 3 helps you organize the information you will need about the opaque wall and door portions of the building envelope. The net wall area is the gross wall area minus window and door areas. You will need to group wall and door areas by:

+ Position - exterior or adjacent, see definitions below;
+ Construction type: For walls- concrete block, wood frame, face brick on wood frame, face brick on concrete block, log, or steel stud; For doors - wood or insulated; and,
+ R-value of insulation added to the wall.

Three tables are provided for calculating each type.

Tables 1 and 2: Exterior Walls

Use Tables 1 and 2 to calculate the net wall area for exterior walls of different types or insulation. Exterior walls are those which separate conditioned space from unconditioned unenclosed space.

Table 3: Adjacent Walls

Use Table 3 to calculate the net area of adjacent walls. Adjacent walls and doors are those which separate conditioned space from unconditioned, but enclosed spaces, such as a garage.

Gross Wall Area

Use the same wall construction descriptions you used in Step 1. Start at one corner of the plans, list the LENGTH and HEIGHT of each wall group on the worksheet for Step 3. Use exterior wall measurements. Include all wall areas which divide conditioned (heated and/or cooled) from unconditioned (neither heated nor cooled) spaces. Multiply the LENGTH of the wall by the HEIGHT of the wall to find the AREA. For information on calculating the areas of non-rectangular walls, see Chapter 5, "Special Cases: Non-Rectangular Walls."

A simplified way to calculate wall area for walls of the same type and height is to add all the wall LENGTHs together, enter this in the box titled SUBTotal, and then multiply the subtotal by the wall HEIGHT.

Include walls which separate conditioned space from attic space, such as knee walls or the walls of skylight shafts, in the ceiling calculation; not in the wall calculation. Add the areas of special case walls to the area of like type walls in Step 3, or the ceiling areas in Step 4 as appropriate. See Figure 8.

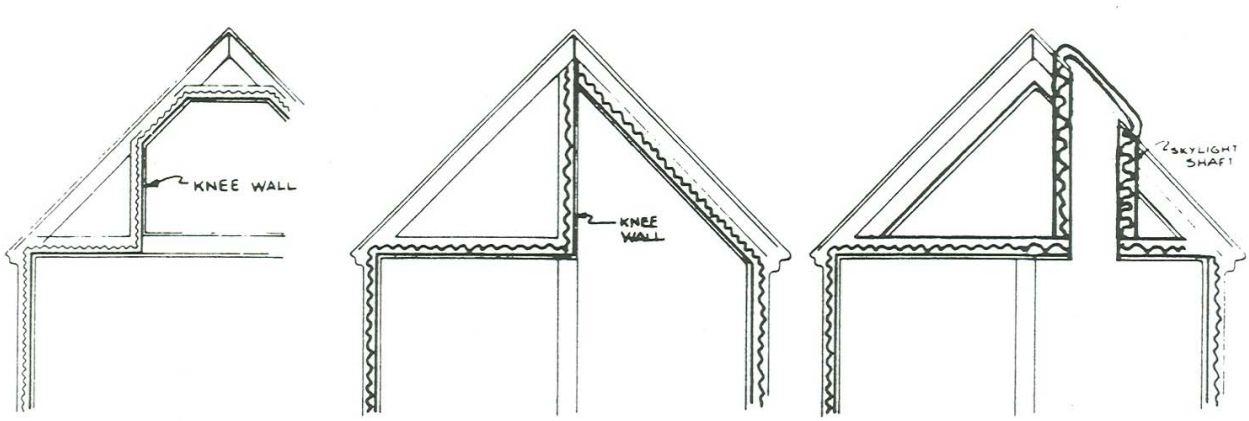

Figure 8. *Knee Walls and Skylight Shafts*

Do not include common walls. Common walls are those separating one conditioned tenancy from another in multifamily dwellings. See Figure 9.

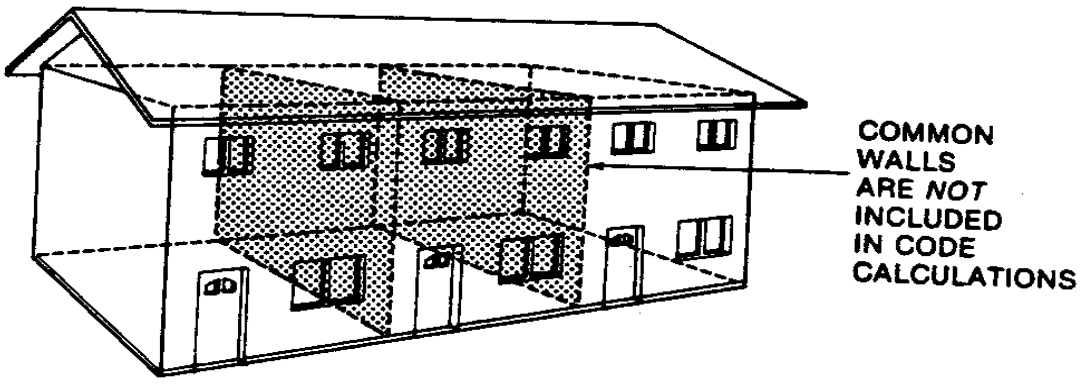

Figure 9. *Common Wall*

Doors

In each table of Step 3, there are spaces provided for calculating the areas of doors located on that particular wall type. Include all doors that separate conditioned from unconditioned space. The Code classifies doors as either wood or insulated. Standard door sizes and rough opening areas are listed in the Standard Door Size table at the bottom of the worksheet for your convenience. If other size doors are used, calculate the rough opening area. Record the door TYPE, door AREA, and number (NO.) of doors in the appropriate columns on the worksheet. Record the doors in Table 1, 2 or 3 along with the wall in which it is located.

TABLE 1. EXTERIOR WALLS

WALL TYPE: _____*Frame*_____

INSULATION R-VALUE = __*11*_____

WALL	LENGTH	X	WIDTH	=	AREA
W1	*4.7'*		*8.0'*		
W2	*4.0'*		*8.0'*		
W3					
SUBTOTAL	*8.7'*		*8.0'*		*69.6 sq ft*

GROSS WALL AREA SUBTOTAL

DOORS ON EXTERIOR WALL

TYPE	AREA	X	NO.	=	AREA	–	GLASS	=	NET AREA
Wood	*21.6 sq ft*		*1*		*21.6 sq ft*		*0*		*21.6 sq ft*

NET DOOR AREA SUBTOTAL

GLASS AREA FROM STEP 1 *0*

GROSS WALL AREA SUBTOTAL	–	NET DOOR AREA SUBTOTAL	–	GLASS AREA	=	NET WALL AREA
69.6 sq ft		*21.6 sq ft*				*48.0 sq.ft.*

Multiply the AREA by the number of doors to obtain the door AREA subtotal for each type. If there are windows in any of the doors whose area is one-third or more of the door's area, enter the area of the glass in the GLASS column by the appropriate wall and DOOR TYPE. Make sure you have included the circled glass area from Step 1.

Subtract the GLASS area to arrive at the NET AREA. Add all the NET AREAS to obtain the NET DOOR AREA SUBTOTAL for each type. If the glass area is less than one-third of the door, calculate the total door areas as opaque door.

Glass Area

To calculate the GLASS AREA by wall type, turn back to Step 1 of the worksheet. Find at the bottom of the Step 1 table the GLASS AREAS BY WALL TYPE you calculated earlier. Enter these areas in the Step 3 table in the GLASS AREA FROM STEP 1 block which corresponds with the appropriate wall type. Check to make sure that you have not included the area of any glass in doors under both door GLASS and in the GLASS AREA FROM STEP 1 calculation.

Net Wall Area

At the bottom of each Step 3 table, enter the GROSS WALL AREA SUBTotal, NET DOOR AREA SUBTotal, and GLASS AREA from Step 1. Subtract the NET DOOR AREA and GLASS AREA from the GROSS WALL AREA SUBTotal to obtain the NET WALL AREA for each wall type.

STEP 4: CEILING AREA

Step 4 helps you organize information about the ceiling areas of the building. The Code groups ceilings into three types:

+ Under attic;
+ Single assembly (no attic); and,
+ Concrete deck.

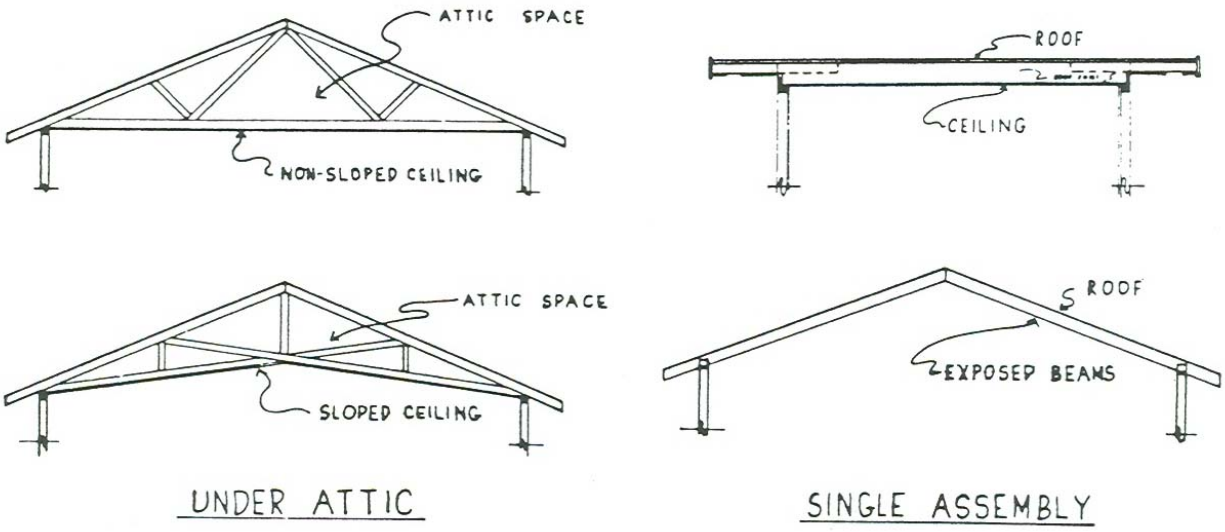

Figure 10. *Ceiling Construction Types*

As with the walls, you will need to group the ceiling areas by types and insulation R-value. Calculate each group separately.

The method used for calculating the area will depend on whether the ceiling is a sloping or non-sloping ceiling. List the areas calculated under the ceiling type. See Chapter 5, "Special Cases: Sloped Ceilings."

The ceiling area will usually be equal to the conditioned floor area if:

+ The house has only one-story;
+ The ceiling R-value is the same throughout;
+ The house has non-sloping ceilings; and
+ The house contains no cantilevered areas.

In this case the ceiling area can be taken directly from the conditioned floor area in Step 2. If the house has all non-sloping ceilings, but does not meet all the other criteria, use the following procedure to calculate the ceiling area.

For non-sloping interior ceilings, divide the conditioned space into rectangles using the house plans. Do not include any unconditioned spaces, such as garages. Make sure that each rectangle contains only one type of ceiling. Use the wall dimensions given on the house plans. Record the LENGTH and WIDTH measurements of each rectangle on the table for that ceiling type and insulation level. Calculate the ceiling AREA for each rectangle by multiplying the LENGTH times the WIDTH. Add the AREAs of the rectangles to obtain the TOTAL for each type of ceiling.

Table 1: Ceilings Under-Attic

CEILINGS UNDER-ATTIC may be non-sloping, usually constructed with conventional trusses, or sloping, such as those constructed with scissors trusses. See Figure 11.

To qualify as an under attic ceiling assembly, it must separate conditioned space from the unconditioned space of a ventilated attic. A sloped ceiling configuration qualifies as an under attic ceiling assembly, if the airflow in the ventilated attic air space is uninterrupted and parallel to the ridge. Calculate these areas in Table 1 of Step 4.

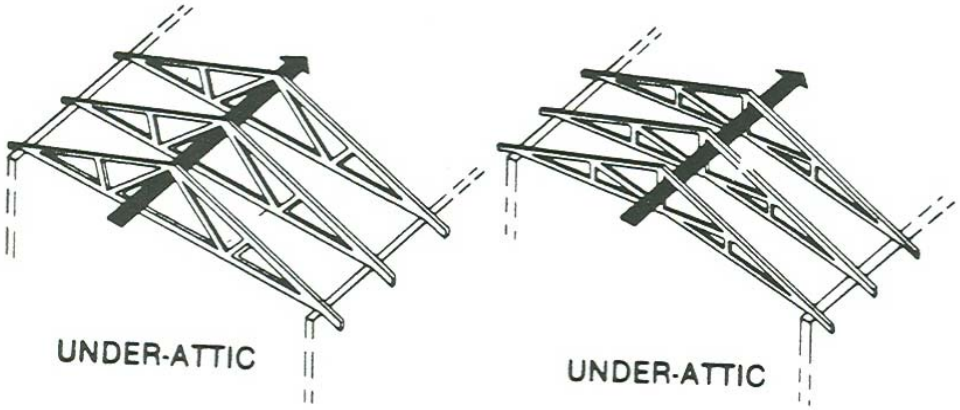

Figure 11. ***Ceilings Under-Attic***

Attic Radiant Barrier. The Code provides credit against the ceiling load for attic vented-skin/radiant barrier systems. This system is constructed of a foil product placed near or glued/stapled to the roof deck to form a vented air channel. See Figure 12.

To claim heating and cooling credit for **attic radiant barrier** systems:

1. The foil product must be mounted between truss top chord or rafters and must have an operative surface with an emissivity of .06 or less. The high reflective surface must face downward toward the attic airspace;
2. The air channel must be vented at each end by continuous soffit and ridge vents.
3. The radiant barrier shall be installed so as to cover gabled ends.
4. Printing on the radiant barrier shall not exceed 2% of the surface area.

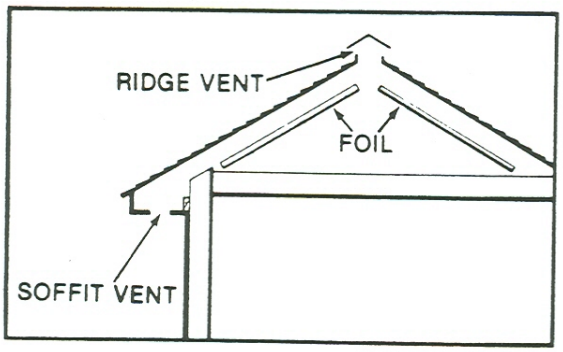

Figure 12. *Attic Vent-Skin/Radiant Barrier System*

Table 2: Single-Assembly Ceiling

Calculate SINGLE-ASSEMBLY CEILINGS in Table 2. A single-assembly roof/ceiling system separates conditioned interior space from outdoor climatic conditions. Boxed-rafter and exposed deck-and-beam roof/ceiling assemblies are examples of single assembly systems. See Figure 10.

Table 3: Other Ceilings

Use Table 3 for ceilings that vary in type (e.g. concrete deck) or in insulation level.

When a sloped ceiling exists, the area of the ceiling will be greater than the area of the floor directly under it. For information on calculating the area of sloped ceilings see Chapter 5, "Special Cases: Sloped Ceilings."

Be sure to include in the ceiling calculation the areas of any vertical walls which separate conditioned space from the attic, such as knee walls or the walls of skylight shafts. See Step 3. Deduct from the ceiling area and add to the horizontal glass area in Step 1 the skylight rough openings. For information on calculating the area of knee walls, see Chapter 5, "Special Cases: Non-Rectangular Walls."

STEP 5: SLAB PERIMETER

Step 5 helps you calculate the slab edge perimeter. The perimeter of a slab-on-grade floor is the entire outside edge of the slab exposed to unconditioned space. Sum the total length around the conditioned area of the house to determine the length of the conditioned perimeter. Use the exterior wall measurements as the slab edge perimeter for concrete slabs. Do not measure around the exterior walls of unconditioned spaces such as garages or utility rooms, but follow the path of the wall insulation. Include both exterior and adjacent wall sections. See Figure 13.

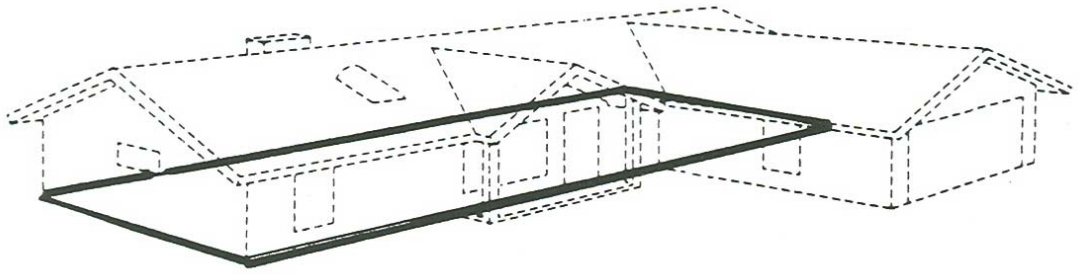

Figure 13. *Conditioned Slab Perimeter Measurement*

For most houses with slab-on-grade floors, the wall lengths you have measured in Step 3 will correspond to these measurements. Check to make sure that you are including only the walls which meet the criteria in the previous paragraph. If this is the case, add all the wall length subtotals, both exterior and adjacent, to determine the total SLAB PERIMETER.

STEP 6: DUCTS, COOLING, SPACE HEATING, AND WATER HEATING

Step 6 helps you organize information about the equipment. Obtain the efficiencies of the equipment from the equipment supplier or manufacturer. This information may also be obtained from a product directory such as those listed in the Appendix, "Equipment Efficiency Directories List." If less efficient equipment or components are installed after you submit the code compliance form to the building department, you will need to correct the Energy Code calculation to ensure compliance. However, if you install a more efficient system, this may not be necessary. Check with your local building department about their policy.

DUCT SYSTEMS

To calculate both cooling and heating points, you will need to know:

1. The location of the ducts: conditioned space, unconditioned space, or attic with radiant barrier;
2. The R-value of the ducts if they are not in conditioned space; and,
3. Whether or not return air ducts are used.

Ducts in Conditioned Space. For ductwork to qualify as "in conditioned space," the ducts must be located on the conditioned side of the insulation envelope and situated in such a manner that any air leakage will be into the conditioned space. Ducts located in conditioned space should be insulated to levels which prevent condensation. Ducts located in dropped ceilings in dropped soffits or between floors where perimeter walls are insulated may qualify. If these criteria are met, the ducts qualify as IN CONDITIONED SPACE. Check the box marked IN CONDITIONED SPACE on Step 6.

Ducts in Unconditioned Space. The Code considers ducts located in attics, crawl spaces, garages, single assembly ceilings or otherwise outside the building insulation envelope as "ducts in unconditioned space." The R-value of the duct includes the value of the duct itself and any insulation in which the duct may be embedded. Duct insulation minimums depend on the location of the duct. Ducts in attics have a minimum code requirement of R-6. Indicate the R-values of the ducts on the worksheet. Air handling units are considered part of the air distribution system.

Duct systems contain **supply** air ducts that transport the conditioned air from the air handler to the rooms. Duct systems generally include **return** air ducts or plenums that recirculate the room air back to the air handler to complete the cycle. Systems having no return air ducts or plenums between the air intake and the air handler will qualify as systems without return ducts. Systems located in mechanical closets that communicate with the conditioned space are examples of this type of system. Check to show whether the systems include supply and return air use in conditioned or unconditioned space. For heating and/or cooling systems which contain no ducts or plenums (for example: wall mounted through the wall room units), check the block labeled NO DUCTS. If the duct system has more than one R-value or type, see Chapter 5, "Special Cases: Dual Duct Insulation Levels."

Ducts in Attics with Radiant Barrier, IRCC or White Roof. This case is similar to the “Ducts in Unconditioned Space” category, but the multipliers are better because attic temperatures are not as high. An attic radiant barrier meeting the criteria of section 13-607.1.A.4-.5 of the Code must be installed to use these multipliers.

COOLING SYSTEM

On the Step 6 table, record the efficiency level for the system you plan to install. CENTRAL units are rated by SEER (Seasonal Energy Efficiency Ratio), or EER (Energy Efficiency Ratio). Package Terminal Air-Conditioners etc. (PTACs) and Room Units are rated by Energy Efficiency Ratio (EER). Gas absorption and gas-driven air conditioners are rated by a coefficient of performance (COP). If you do not plan to install air conditioning, check the box labeled NONE; in the calculation itself assume a 10.0 SEER air conditioner has been installed. For additions utilizing an existing air conditioning system, check EXISTING.

Cooling Credit

The Code considers certain technologies as reducing energy use for cooling. These technologies are given credit based on the estimated savings due to the technology. Cooling credit may be claimed for:

1. CEILING FANS;
2. MULTIZONE PRACTICE;
3. VENTILATION; and,
4. PROGRAMMABLE THERMOSTATS.

A summary of the requirement follows. For more detailed information, see section 13-607.1.A.1 through 13-607.1.A.4. of the Code.

Ceiling Fans. To claim the cooling credit for ceiling fans, you must install one fan in each of the bedrooms and one in each primary living area (living room, family room, or great room). "L" shaped rooms where the smaller portion is 8' x 10' or larger must have fans installed in both larger and smaller areas, except where part of the "L" is a dining area. Fan blades must be sized based on room dimensions as prescribed by the Code.

Multizone. Cooling credit may be taken for **multizone** practice if:

+ Two or more spaces (zones) are completely separated from one another;
+ There are no more than 40 square feet of openings between the zones, which must be closeable. Except: Between stories in a multi-story house, or where separate return air ducts/plenums are provided and rooms may be isolated by closable doors;
+ Each zone which provides independent conditioning has a separate thermostat; and,
+ No zone shall constitute more than 75% of the total conditioned area;

Ventilation. The ventilation credit may be claimed for either passive **cross ventilation** or a **whole house fan**. Credit may be taken for either one of these systems, but not for both. Credit may not be taken for both cross ventilation and ceiling fan. Houses claiming the ventilation credit must provide door catches or louvers for all interior doors. In addition, the following prescriptive standards must be met for cross ventilation or whole house fans.

For **cross ventilation** credit to apply:

+ All primary living area (living room, family room, or great room) and the main bedrooms must be cross ventilated;
+ Each room must have a minimum screened aperture area totaling at least 12 percent of the floor area of the room;
+ Total aperture area must be provided by at least two distinct windows; and,
+ Each window may not have more than 70 (seventy) percent of the total aperture area.

To claim ventilation credit using **whole house fan** (WHF):

+ The fan must provide a minimum of 20 air change per hour for the entire house; and,
+ The house attic must have gable, ridge or roof vents whose total opening (the area which is cut out) equals at least 4 times the ceiling cutout area for the fan.

Programmable Thermostats. To claim credit for **programmable thermostats**:

+ The thermostat must be capable of being set to 78^{o}F from 3 pm to 9 am and to 83^{o}F from 9 am to 3 pm.

HEATING SYSTEM

Record on the table in Step 6 the type of space heating equipment you plan to install. For all equipment, you will need to record the efficiency rating.

Electric . Electrical heating systems include:

+ Strip (resistance coils); and
+ Heat pumps (reverse cycle air-conditioning).

If you are installing an electric resistance heating system, check the box labeled ELECTRIC STRIP and enter COP = 1.0. If you are installing a HEAT PUMP, a Package Terminal Heat Pump (PTHP) or a Room Unit, you will need to record the efficiency level of the equipment on the table. These systems are rated by either Heating Seasonal Performance Factor (HSPF) or Coefficient of Performance (COP).

Combustion. Typical combustion heating systems are:

+ Natural gas furnaces;
+ L P gas furnaces;
+ Combination water/space heating systems
+ Oil-fired.

If you are installing a combustion system, check the box labeled NATURAL GAS, LP GAS, OR OIL.

If you do not plan to install a heating system, check the block marked NONE. For additions to existing buildings where an existing system will be utilized, check EXISTING.

Heating Credit

The Code considers certain technologies as potentially reducing electric energy use for heating. These technologies are given credit based on the estimated savings due to the technology. The Code recognizes the following:

+ Programmable thermostat;
+ Multizone applications;
+ Natural gas; and,
+ LP gas or fuel oil.

Programmable Thermostat. To claim credit for **programmable thermostats**:

+ The thermostat must be capable of being set to 72°F from 7 am to 11 pm and 67°F from 11 pm to 7 am.
+ The thermostat must have features which prevent supplemental heat from being automatically engaged for winter credit.

Multizone credit. Heating credit may be taken for **multizone** applications. The requirements of heating credits are the same as those given previously under "Cooling Credits" (See page 51). If all the criteria have been met, check the box marked MULTIZONE.

Natural Gas, or LP Gas. If you have indicated the use of NATURAL GAS, or LP GAS under HEATING SYSTEM, then under HEATING CREDIT give the efficiency rating of the NATURAL GAS or LP GAS system. Gas and oil furnaces are rated by AFUE (Annual Fuel Utilization Efficiency); heat pump are rated by their coefficient of performance (COP).

WATER HEATING SYSTEMS

Number of Bedrooms. On the Step 6 table, record the NUMBER OF BEDROOMS in the house. Any room with 70 square feet or more that is not part of the common living area and has a clothes closet is counted as a bedroom.

Efficiencies. Conventional ELECTRIC resistance, NATURAL GAS, and LP GAS water heaters, SOLAR water heaters with tanks, and DEDICATED HEAT PUMPS with tanks must be accounted for regardless of whether the system is a primary, backup, or supplemental system. Record the Energy Factor (EF) of the system you plan to install under WATER HEATING on the Step 6 table.

Water Heating Credit

The Code recognizes the following types of systems as also reducing energy use for heating water and treats them with a water heating credit:

+ Waste heat recovery unit (HRU);
+ Solar water heater without tank; and,
+ Dedicated heat pump (DAP) without tank.

If you are installing one of these credit systems, record the type and, where applicable, the efficiency under WATER HEATING CREDIT on Step 6. These systems may be supplemental systems or alternative systems with a backup system. In either case, you will need to report all systems. Report the conventional system type under WATER HEATING and the credit system under WATER HEATING CREDIT.

Heat Recovery Unit. A waste HEAT RECOVERY UNIT (HRU) removes superheat from the compressed refrigerant in an air conditioner or a heat pump, and transfers it to the water. Check whether the HRU is attached to an air conditioner or heat pump. To obtain credit, a HEAT RECOVERY UNIT must:

+ Be tested by an independent testing laboratory under the standard rating conditions specified in ARI Standard 470-80 with Florida regulatory modifications; and,
+ Have a minimum net useful heat exchange effect of fifty percent.

To show that the equipment meets these criteria either:

+ Submit a copy of Form 600D at the time of the permit application; or
+ Assure that the HRU bears a ARDM Certified Refrigerant Desuperheater seal.

See section 13-612.2.A.3.1 of the Code for more information.

Dedicated Heat Pump without tank. Add-on DEDICATED HEAT PUMPs recover heat from the air, much like a space-conditioning heat pump, and transfer it to water. Record the Energy Factor (EF) of the dedicated heat pump under WATER HEATING CREDIT: DEDICATED HEAT PUMP and the EF of the "add on" electric water heated under WATER HEATING.

Solar Water Heater without tank. SOLAR water heaters convert radiation from the sun into heat and transfer it to the water. They are rated by an Energy Factor obtained from the FSEC Directory. Record the Energy Factor of the system next to SOLAR, EF in Step 6.