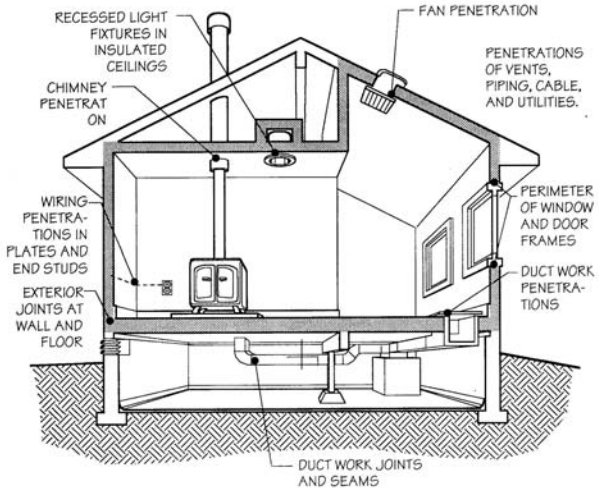
Renovating Older Homes

" Updating Older Homes Can Create Other Problems"

Al Tibbs, CIAQT

Since 1992 I have performed 5000 residential home inspections as the owner of Closer Look Inspections. It is my estimate that approximately 65 - 70% of those 5000 homes were older than 25 years. The buyers of these homes often discuss their plans for the home during the inspection. The most often mentioned updates are adding new windows, improving insulation and adding new siding. These would be the updates that would be considered by most consumers purchasing older homes around the country. All of the items mentioned are good candidates for updating to add value and comfort to an older home. However, these updates could also cause some very serious problems if not carefully planned for.



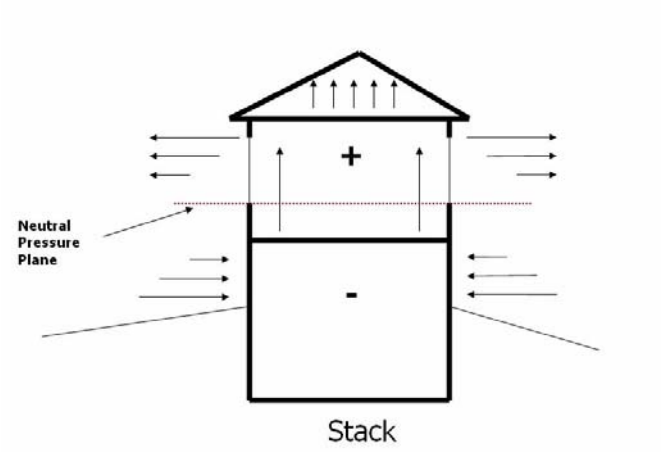
The drawing on the right shows some of the not so familiar building leakage areas not considered by do-it-yourself home renovators. If the insulation is increased but the leakage is left unattended, little improvement will result. This will result in wasted effort and money and the home will still be losing energy and remain more uncomfortable than it should be.

Before beginning any updating projects, the home should be evaluated by a professional energy consultant that has the equipment to properly evaluate leakage, retrofitting costs, ventilation, combustion appliances and other factors. The consultant can use state of the art equipment to provide the most accurate information from which retrofitting plans can be made. The equipment includes blower door, infrared imaging device, manometers, combustion analyzer and indoor air quality monitors that can locate, analyze and record critical building parameters which require attention when retrofitting a home. The energy consultant should also have a good working knowledge of balancing air systems (supply & return), proper draft for combustion appliances, building tightness limits (BTL), depressurization tightness limits (DTL), indoor air quality (IAQ) and building codes and standards.

The first step in readying a home for retrofitting should be completing an evaluation of existing combustion appliances to evaluate draft, combustion air, pressure effects, etc. on the presently installed systems. This valuable information will help the consultant to develop a proper strategy for tightening the building without cutting off required combustion air and draft. In many cases, the home may need to be retrofitted with mechanically supplied combustion or make-up air to meet the code and standard requirements. After completing this evaluation of combustion appliances it is time to proceed with the project by determining the thermal boundary in the building. The thermal boundary will be the boundary which separates the conditioned from the unconditioned spaces in the building. It is along this boundary where the most cost effective improvements can be made. In some cases the boundary is self evident, while in other cases, it will require the experience of the consultant and some more complicated computations to determine the best locations for this boundary.

After the combustion systems are evaluated and the thermal boundaries are determined, it is time to begin gathering the required information to allow decisions to be made about which updates will be the most cost effective and efficient. The consultant will now employ the state of

the art equipment mentioned earlier to begin gathering the needed information for complete evaluation. This information will include building pressures, indoor air quality parameters, estimated air leakage and the locations of the leakage, thermal pathways (leakage may use building cavities, etc. to enter the building in one location and cause a draft in another), amount of fresh air ventilation for dilution of indoor air contaminants and odors and other information.



The consultant will know how to evaluate such considerations as "stack effect" which is created due to the difference in buoyancies between warm and cooler air. This effect can play a major role in drafts, back drafting, de-pressurization of the combustion air zone (CAZ), moisture and condensation problems (attic mold) and the introduction of contaminants such as radon into the building. Remember, air, and hence moisture is moved by building pressures. The stack effect will worsen as the temperature differences between indoor/outdoor air widens and may not be as evident when temperature differences are smaller. These factors must be taken into consideration by the consultant when performing such tests as "worst case depressurization". Other factors which can play a role in stack effect are combustion appliance which are opened to the building (open combustion), chimney's located on outside walls (colder chimney's do not draft as well) and previous updates, for example if a new high efficiency heating system has been installed using pvc pipe venting and the water heater was left vented to the chimney alone, this could be a big problem. An enclosed combustion heating system vented into the same chimney as a water heater can sometimes cause back-drafting to occur at the water heater draft diverter and should be evaluated as part of the first step.

Building Tightness Limits (BTL's) should be carefully considered and measured by a qualified professional both before and after any building tightening operations. There is such a thing as a building being too tight. If the level of leakage drops below the BTL after retrofitting and tightening then some form of continually operating mechanical ventilation should be installed to maintain good indoor air quality. The problem lies in the fact that many builders and retrofitting contractors today, while trying to create tight homes for energy efficiency do not measure performance either before, during or after construction. There could be some correlation between this fact and the higher level of reported carbon monoxide poisonings today. In years past, natural ventilation in single family homes was considered to be sufficient. However today, that may not be the case and builders as well as consumers should be aware that tighter homes mean less natural ventilation.

ASHRAE 62-2001 requires that maintaining good indoor air quality requires 15 CFM per person (assuming a minimum of 5 persons) or 0.35 air changes per hour (ACH), whichever is greater must be supplied by either natural air leakage and/or continuously operating ventilation. It is important that these figures be verified in all buildings after any building tightening has occurred[1].

There are two methods by which this required ventilation can be determined. Either can be used in determining that the requirements are met.

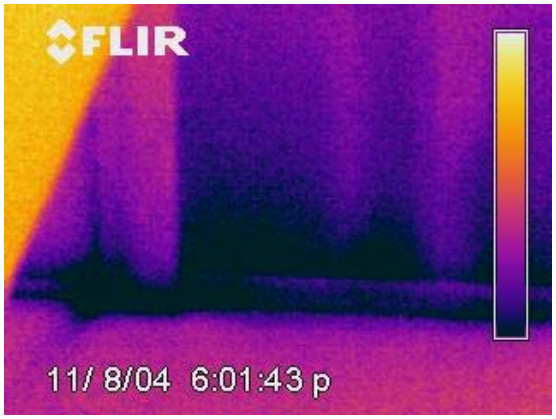
1. ASHRAE Standard 62-2001
2. ASHRAE Standard 62-2001, ASHRAE Standard 119 and ASHRAE Standard 136

[1] **Survey of Tightness Limits for Residential Buildings**, Rick Karg, R.J. Karg and Associates, July 2001

Many retrofitting projects are simply adding insulation, windows, new heating system, etc. to an older home. While these additions may add to the value of the home, they may do little to conserve energy if other factors such as building tightness are not considered. One very common mistake I see on homes which have added additions is cathedral ceilings are added to provide a more roomy feeling. Most of these ceilings have recessed or “can lights” installed. It is critical that the proper light be installed when installing these can lights. The fixture should be marked as airtight and also include an IC rating which allows for insulation cover. If not properly installed, these lights can be a source of air leakage, condensation problems, mold and other issues. Fiberglass batt insulation, when installed properly should not be compressed. Compressing the insulation reduces it’s effectiveness and R-value. This may also lead to a compromise in the thermal and air barriers surrounding the conditioned space of the home.

After considering all factors it becomes apparent that home improvements may not always achieve the intended results. Updating an older home to be energy efficient requires that the entire building be evaluated as a whole and that proper verification testing be performed to assure that the desired results are achieved. On new homes, a commissioning process should be performed that assures that all building components and mechanical equipment perform as intended. Simply assuming that contractors are going to do the right thing could be an unsafe and costly decision, especially where retrofitting is concerned. The only way to verify the effectiveness of any building operation or component is to measure the performance and compare it to intended performance documents or other acceptable standards.

By utilizing available equipment such as balometers, blower doors, indoor air quality monitors, particulate monitors, infrared imaging devices and experience in the field a qualified consultant can measure performance, make repair and retrofitting recommendations and verify results. This assures that your hard earned dollars achieve the intended results.



The image on the left was taken during an energy survey and shows a large amount of cold, unconditioned air entering the home from the crawlspace. The darker areas indicate colder areas along the base moldings. This is a common leakage point which should be sealed. In new home construction, areas such as this can be dealt with more effectively during the construction phase. By following some very simple procedures during construction, some of the more common areas of leakage can be effectively avoided. This results in savings to the builder as well. There will be less callbacks if a builder can avoid some of these common problems during the construction phase when they are much cheaper and easier to address.

About the Author: Al Tibbs, CIAQT has performed over 5000 residential and commercial building inspections. Al acts as a consultant to home and building owners, contractors, attorneys and others involved in real estate and building. Al is the owner of Closer Look Inspections in Cleveland, OH and has been in the construction field for over 28 years. He is also an ICC certified combination inspector, certified in HVAC system balancing, diagnostics and combustion analysis and a certified member of the Association of Energy Engineers.