

Calcs-Plus

Achieving Leak free Ducts for Energy Code Compliance: Smoke Test and Verify

By Jon Klongerbo - Calcs-Plus

Recent changes in the Florida Energy Code may require builders to re-evaluate energy efficiency measures included in their homes in order to pass code. One credit, the leak-free duct credit, provides a 9% benefit for code compliance. For comparative purposes, including this credit has about the same impact as raising the air conditioning (AC) system SEER rating from 13 to 15. However, verification is required by a state certified energy rater.

Leak-Free Duct Credit Specifics

To receive the duct system credit, leakage must be less than 3% Total Duct Leakage (3 cfm/100 square feet). Or the leakage must be less than 9% Total Duct Leakage, and less than 3% leakage to unconditioned spaces (Out Leakage). Since less than 3% Total Duct Leakage is extremely difficult to achieve (air handlers alone leak 1-3%), only the second option, 9% Total Duct Leakage with 3% Out Leakage, will be covered in this article. Sampling is prohibited for receiving this energy code credit.

A blower door must be used in conjunction with a duct tester to measure Out Leakage. The duct tester alone is used to measure Total Duct Leakage. The blower door-duct tester combination is required to test for the practical and achievable option. No substitutes for estimating duct leakage (such as pressure pan testing) are allowed. When claiming the duct leakage credit, measurements entered into the state's duct compliance form and general energy code compliance form (Form 600A) must be submitted to the building department and signed by both the rater of record and building official.

Effort to receive the Leak-Free Duct Credit

Although the credit is reasonable and achievable, it is by no means automatic. Conscientious efforts must be taken to identify areas of leakage early-on, prior to final system testing. Detecting and fixing problems at rough-in can be both a time and cost-saver. Once the final installation is complete, a leakage test is performed on the entire air distribution system, including the air handler enclosure, to verify that the system meets the duct leakage credit specifications.

Smoke testing the ductwork at rough-in will identify leaks and allow duct installers to remediate any failures early on. Smoke testing involves temporarily sealing the register boxes and introducing theatrical fog into the duct system under slight pressure. Previously invisible leaks can be identified easily and repaired with this *qualitative* testing method. This step is imperative, since a failure at final testing will be costly, difficult to remediate and delay the CO. Other advantages of performing a smoke test at rough-in include:

- Better home comfort, lower operating costs and fewer client call-backs.
- Reduced installation costs by remediating problems at rough-in.
- Improved installation quality control, therefore creating an optimal performing duct system.
- Protection of duct system from contamination because temporary seals remaining on registers throughout construction.
- Improved indoor air quality and home durability and reduced health and safety problems associated with duct leakage.
- Better subcontractor performance, since work is thoroughly inspected and failures remediated.
- Complementary effort to demand side management and energy efficiency programs which require specific duct leakage results for program participation.



Portable Smoking System Configuration when connected



Most Remote register temporarily unsealed to allow fog to flow through entire Duct System



Duct Technician attending to leakage identified by smoke testing. Failures addressed now, will not be measured as leaks later, when it is too late or too difficult to correct them.

Smoke Testing Field Results

Recent smoke tests conducted by the author gathered data on 82 homes. All of the homes were constructed in the same subdivision, by the same builder, using the same AC contractor. All homes were single story with single system installations. A subjective grade was given to each duct system based upon the severity of leakage observed before sealing. A "tight" system indicated no observed failures. A "leaky" system could be a severe failure, multiple failures or a combination.

The AC contractor was aware that all houses were to be smoke-tested and failures remediated. Though some crews were able to install tight systems after a period of adjustment, 23 homes (28%) still had Level 4 or 5 leakage at initial inspection. Rotation of crews, new personnel, work load, and crew work interruptions during installation most likely accounted for these high leakage results.

Comparative Level of Leaks (scale from 1-5)

	Tight				Leaky	Avg.
Level	1	2	3	4	5	2.68
Count	22	15	22	13	10	Total 82

Cost of Smoke and Duct Testing for Energy Code Credit

On a single system house you should expect a cost between \$250 and \$350 for final duct testing and approximately the same cost for smoke testing. The cost of smoke testing could easily be included as a quality control requirement in AC contractor's installation agreement. Additional variables, like travel distance and volume of homes being tested, could alter these prices somewhat.

Conclusion

As a builder, a tight duct system should be specified in the duct system installation contract. Most other energy efficiency measures installed in your homes come with advance specifications. But, since duct system leakage is a factor of installation rather than a defined, absolute specification, it must be tested to determine the quality. Verification by an experienced third party will assure both you and your homeowners that you are receiving what you have paid for. The leak-free duct credit is confirmation of installation quality and it bestows upon the conscientious builder a significant credit towards energy code compliance.

Jon Klongerbo is a state-certified residential energy rater who has performed hundreds of duct tests in support of different Federal, State and Utility programs and for diagnostic investigations. He is currently involved with private development and introduction of innovative, practical and understandable duct testing systems and protocols for common usage.