

## Large Building Air Leakage Training School rev-2010-08-24

Seattle/Tacoma, Washington  
Thursday to Saturday, Sept 16 to 18, 2010

### Introduction

Retrotec's first large building training course received ovations from attendees for its innovative use of building simulators. The simulators delivered a comprehensive learning experience in a short period of time. We also made extensive use of pre-training online, to take care of most of the rote learning, and to get all of the attendees up to the same level of knowledge, so that the course could be held at a much higher level.

Our next , three day, seminar will help introduce large building air leakage testing to Washington State, the first State to mandate this kind of testing. We anticipate that Washington's courageous forward thinking will make them a nursery for new ideas, methods and technologies. At our Seattle seminar, we will discuss all areas of residential and large building testing, and commissioning. The result, we hope, is better designs, better construction, and better performance in all areas of energy conservation, air quality and structural longevity.



## Online Training Outline

Retrotec's online training courses provide attendees with an understanding of proper test techniques for air leakage measurement. Each level consists of lessons, videos and presentations that are the equivalent to attending 3 to 6 days of classroom training. Passing levels 1, 2 and 3 will properly prepare you for taking full advantage of the live Large Building Air Leakage Training School in September. Beginners may spend 6, 10 and 24 hours, respectively, on each level before successfully completing the exams, while experts may be able to write the exams after a few hours of scanning the material to pick up concepts they may not have thought of.

By completing the online training prior to the school, attendees will get more out of using the training simulators, participating in the lively interactions and listening to the guest expert speakers, who will delve deeper into the concepts and methods of air leakage testing. Completing the online training courses, and then taking the three day training school, will allow participants to spread out their learning over a longer period of time thereby avoiding mental exhaustion. Most people learn by doing, so the three-day course will center largely on experiential learning, which depends on having a solid understanding of the material beforehand, coming with well-informed questions and having some experience to contribute.

Once certification is completed and an exam passed, participants will get unlimited technical support for the level they have passed and a website listing for their testing services on [www.retrotec.com](http://www.retrotec.com).

**retrotec** Level 1: The science of air leakage in buildings

Retrotec ▶ AT101 ▶ Quizzes ▶ 2.1 Quiz (AT101) ▶ Attempt 1

Info Results Preview Edit

### Preview 2.1 Quiz (AT101)

Start again

Page: 1 2 3 4 (Next)

**1** This energy conserving measure is NOT one of the top 4 in terms of return on investment?  
Marks: 1

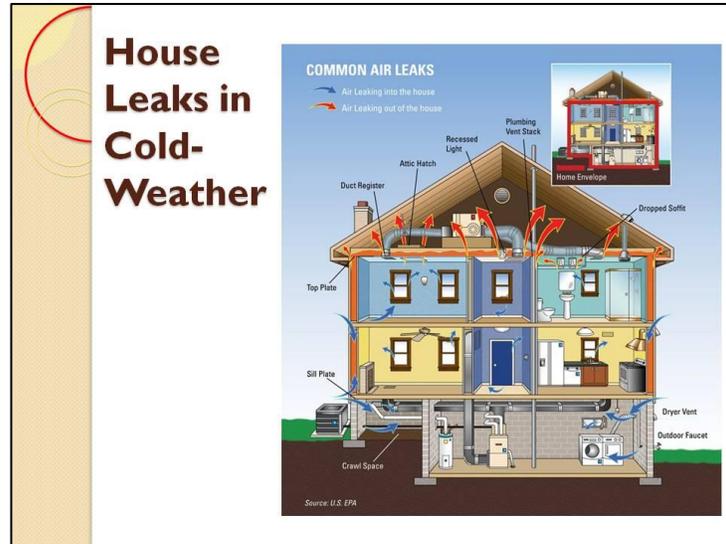
Choose one answer.

- a. Air leakage control
- b. Hot water heater blankets
- c. Setback thermostats
- d. New windows

## Level 1: Air Leakage Building Science

Level 1 is an introduction to air leakage measurement. This is ideal for new testers, witnesses or clients who need to understand the fundamentals of air leakage testing, why it is valuable, how it's done and what kinds of results to expect. The training is designed to give a good overall understanding of air leakage in buildings. This level consists primarily of a book style presentation which must be read or alternatively can be watched in video format. The following topics are covered:

- Introduction to air leakage
- Problems in houses
- Why houses leak
- Solution – build tight
- Solution – ventilate right
- Benefits of an instrumented audit
- Energy Star DIY air sealing guidelines
- Residential duct systems
- Introduction to high rise buildings



A typical image from our Level 1 energy training.

### Level 1 Certification

Pass the On-line exam with 85% or better and receive a certificate with 2 BPI credits and tech support on basic building science.

Webinar: September 1<sup>st</sup>

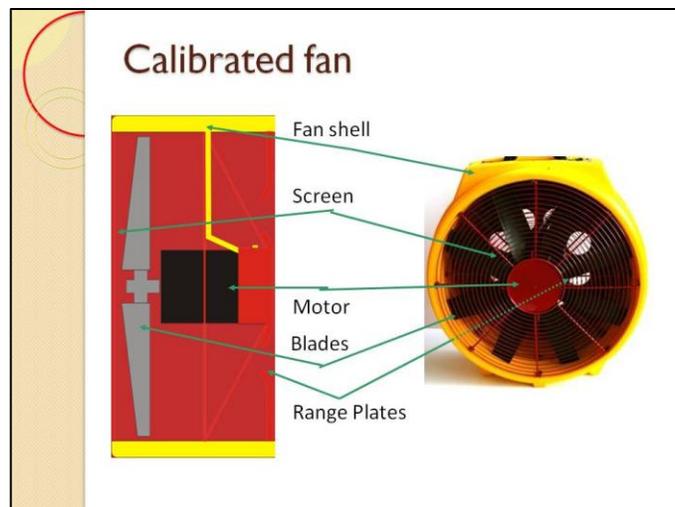
Questions and answers on demonstration and exercises.

## Level 2: Residential single family air leakage measurement

This training level is designed to give the student a good working knowledge of the principles behind air leakage measurement. Participants will receive a detailed understanding of how pressure gauges and calibrated fans work, which will make it easier to learn how to operate them properly. Participants will also learn how to properly set up a building, and how to achieve test pressures manually, automatically or with a computer. Common trouble shooting issues will also be covered.

This level consists of book style presentations and videos. A wide array of reference materials is supplied that is optional to Level 2, but is often the logical next step in the learning process. The following is a list of level 2 material:

- Measuring air leakage – overview
- About the pressure gauge
- How a door fan works
- Choosing a test direction
- Setting up the building
- Installing the door fan
- Setting up the gauge (DM-2)
- Test manually
- Test automatically
- DM-2 results
- Pressure gauge tests
- Measuring duct leakage
- Measuring apartment air leakage
- Overcoming pressure fluctuations
- Calibration and field checks
- Problems and troubleshooting



Anatomy of a fan - an image from Level 2 energy training.

### Level 2 Certification

Pass the On-line exam with 85% or better and receive a certificate with 2 BPI credits and tech support on single fan residential testing.

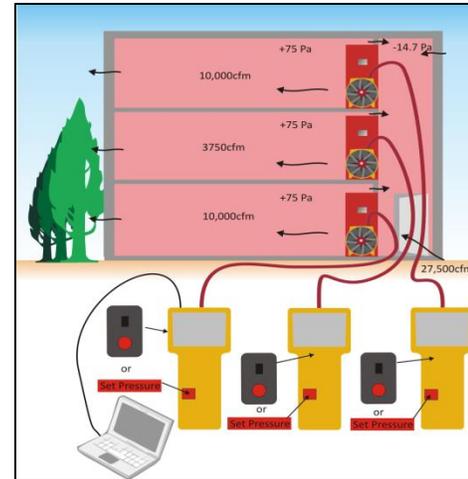
Webinar: September 2<sup>nd</sup>

Questions and answers on levels 1 and 2, demonstrations and exercises.

### Level 3: Large Building Air Leakage Training

Level 3 will give you a good idea of the real problems that occur in high-rises, why they leak, and where they leak. You will gain a better understanding of the benefits of airtightness, the theory of air barriers and the importance of ventilation in well-designed high rise buildings. The following topics are covered:

- Air barrier and ventilation systems
- Envelope durability, safety, and air quality
- Case studies of large building leakage tests
- Pressure and airflow in air leakage testing
- Pretest inspections and preparing the building
- Test equipment setup configurations
- Handling bias pressures due to wind and stack
- Manual and automated test results
- Locating and sealing air leaks
- USACE and LEED testing protocols



Questions that will be answered in the comprehensive Level 3 training include: What components of a building can be measured and what do existing standards require? What are acceptable air leakage levels and what kind of air leakage levels occur typically in high-rise buildings? How does measuring air leakage in a high-rise differ from residential testing? Different buildings require many different test setups which can in some cases become fairly complicated to meet the requirements of various testing standards. What kind of problems will you run into and how can they be solved? How do I determine how much equipment is needed for a particular test and what considerations must be made in quoting a test? A series of calculation exercises will give you an experiential understanding as well.

Example of a slide in Level 3 of a set-up configuration for testing large building.

It is necessary to completely understand the effect of stack wind and HVAC pressures on door fan testing. To that end we have developed a test rig that will demonstrate all three of these phenomena and make you familiar with how they can affect your results. You will be shown how to make calculations and how to prove them experimentally as well as how to gather data on buildings to demonstrate bias pressures in action. The practical side will cover the measurement of building volumes and areas, the pretest inspection and the correct preparation of the building. Correct door fan set up, taking readings and acquiring results. Once the leakage rate is determined then you will need to know how to locate these leakage sites.

#### Level 3 Certification

Pass the On-line exam with 85% or better and receive a certificate with 8 BPI credits and tech support on single fan residential testing.

#### Webinar: September 3<sup>rd</sup>

Questions and answers on level 3 demonstrations and exercises.

## **Large Building Air Leakage Training School Outline**

Seattle, WA September 16-18, 2010

Washington State is an energy efficiency leader by being the first state to require buildings with over six stories to have the air leakage rate of the entire building measured. The city of Seattle is including even more buildings in its requirements, and will surely become a breeding ground for this applied expertise. It is no coincidence that Retrotec has chosen Seattle for its large building training school.

Over the course of this three-day program, case studies of air leakage measurement in a wide range of buildings will be presented, in addition to theoretical information and practical experience for all participants. Not only will test methods be demonstrated but each group will have their own high-rise building simulator, allowing them to perform a variety of automated tests for a number of different configurations.

You will also meet and hear from real testers who perform energy auditing on large buildings regularly. Air Barrier, infrared, long term monitoring and HVAC presentations will be included in the school program, and will provide a leading edge look into how these disciplines are incorporated into air barrier testing.

This course qualifies you for 12 BPI CEU's.



Retrotec's first large building school, held in Vancouver BC. Students are working on a large building simulator to gain practical experience in a short time period.

## Day 1: Air leakage training for residential homes

The goal during the first day is to ensure that all students have an equal understanding of the basics of air leakage. From there we will move on to the measurement of duct leakage, house leakage and duct leakage to outdoors. Students will have plenty of time to get completely familiar with the use of testing equipment (duct testers, blower doors/door fans, gauges) and the reading of results as required in any geographical area, directly from the gauge. During roughly half of the day, each student will perform test after test with different configurations using a simulator that acts like a house with a duct system. Automated software will also be used to perform the same tests where thousands of readings are taken automatically to create very accurate test results. Experiments will be done to identify perturbations that typically occur during a test due to wind, stack, HVAC and accidental door openings.

### Day 1 Schedule:

QA on Level 1 and 2 On-Line training. Making sure we all have the same basics.

Demonstration of duct leakage test demo on Simulator

Students perform a duct test

Demonstration of house leakage test on simulator

Students perform house leakage test

Demonstration of duct leakage to outdoors on simulator

Students perform duct leakage to outdoors on simulator

Demonstration of combustion appliance zone testing

Students perform combustion appliance zone testing on simulator

Review of duct and house leakage standards in USA with discussion

How to sell energy conservation retrofits without government subsidy

Opportunities in small commercial buildings

LEED testing requirements, how to record results and present them

Automated software driven tests

Handling unstable testing conditions such as wind, stack and HVAC operation



Two versions of our house and duct leakage simulators used for training sessions with trainers and testers.

## **Days 2 and 3: Air leakage training for large buildings plus Guest expert speakers**

The goals of the second and third days are to first identify the essential differences between testing problems that occur in large buildings and residential houses, and then to delve deeper into the impacts of air leakage in large buildings. The inadequacy of existing ASTM air leakage testing standards will be discussed and the USACE air leakage testing protocol for large buildings offered as an alternative.

The effects of stack, wind and HVAC flows on air leakage measurements will be demonstrated so that everyone will have a clear idea on the interlining physics of what is occurring and how to deal with these situations while testing. Buildings considered difficult to test such as 60+ story buildings, multi-compartmented buildings and very long buildings will be analyzed and testing problems experienced in the real world will be brought forward along with solutions. Case studies will be presented on numerous large buildings to show, not only what level of results are achieved but the kind of testing problems that could be expected to be encountered during a large building test.

After discussing all of the various testing configurations possible on large buildings, each student will perform a test on a 3 to 10 story simulator that emulates a building with one door fan mounted in each floor using both a common set point and also separate set points for each floor. Another simulator will also have a stairwell with entrance and exit points that will serve to demonstrate problems associated with putting large amounts of airflow through the restrictions posed by doorways.

Detailed testing procedures for complying with existing large building testing standards will be reviewed but not so much with an eye towards looking at every detail but rather to understanding our future needs for large building testing methods. Tackling difficult testing situations will be discussed and experienced testers will be invited to submit their real-life testing situations, where we will provide ideas and alternatives for methods and solutions to gritty problems.

*Special guest speakers will present on the following topics:*

Jason Teetaert, SMT, Vancouver, BC

Title: Structure Monitoring Technology for the building enclosure walls and roofs

Paul Jennings, UK

Title: For 10 years every large building in the UK has been tested for leakage -- what we learned

Jeff Black, WS Electrical & Air Conditioning, Inc., Decatur, AL

Title: HVAC interactions with air barriers.

Bob Thurn, CEO Building Performance & Testing, LLC, Fairway, KS

Title: Air barriers: what works and what doesn't

Scott Wood, Scott Wood Associates, LLC, Tacoma, WA

Title: Infrared inspection of large buildings

Lee Durston, BCRA, Tacoma, WA

Title: Air leakage test results on a variety of large buildings

Rob Bombino, RDH Building Engineering Ltd., Seattle, WA

Title: Diagnosing large building problems

## **Training school logistics**

Attendees should bring:

- a lap top equipped with demo version of MultiFanTestic (download demo at [www.retrotec.com/products/software/fantestic](http://www.retrotec.com/products/software/fantestic))
- a positive attitude

Large Building School Location – Cedarbrook Lodge (<http://www.cedarbrooklodge.com/>)

- “Green” facility, biodegradable “to-go” containers, composting, home-grown food
- Surrounded by 18 acres of natural restored wetlands
- 24hr fitness centre, walking trails

Transportation

- Sea-Tac airport shuttle service + light rail to downtown Seattle

Accommodations

- group rate available at Cedarbrook Lodge for USD159.00/night

## **Pricing information**

Online training and Three-day training school package

**USD \$3400**

Before the school you will receive:

- online training lessons and exams to be completed before school. Takes 2 days for basics and residential and 4 days for large building lessons.
- access to 4 webinars designed to discuss issues uncovered in the training materials

During the 3-day school you will get:

- Personal access to over \$240,000 of test equipment
- Experience every testing problem and situation we have encountered in the past 20 years and conduct exercises to resolve them
- Discussions of every real-world problem encountered by all the experienced testers in the room
- Numerous short action-packed presentations that will provide context for everything you're learning
- Breakfasts and lunches included

After the school, you will receive:

- ongoing support for your testing activities
- listing on Retrotec’s website to advertise your services
- updates on the latest in this fast growing field of large building commissioning

## **Registration**

Please click on the link in the email you received to register, or paste this address into your browser ([https://www.regonline.ca/retrotec\\_training](https://www.regonline.ca/retrotec_training)).

## Colin Genge Bio

Training materials were developed primarily by Colin Genge, with assistance from several colleagues and researchers in the industry. Colin has over 30 years experience designing, and building hardware and software for a variety of complex air leakage measurement applications



used in large building testing. He has single handedly proposed, then written, the NFPA enclosure integrity test procedure that is currently used in over 60 countries worldwide. He has researched and written peak pressure analysis for clean agent discharges. He has been involved in tests in large buildings since 1986 and has offered technical support to large building testers in the UK where Retrotec equipment is used to test over 50% of all the buildings in that country. Recently, Colin has proposed and written the bulk of the USACE air leakage testing protocol. He performed the initial research necessary to establish a robust procedure that would eliminate the numerous testing problems inherent in using ASTM E779 and 1827 residential testing methods. This new method eliminates the numerous testing problems he has observed in large building tests over the years.