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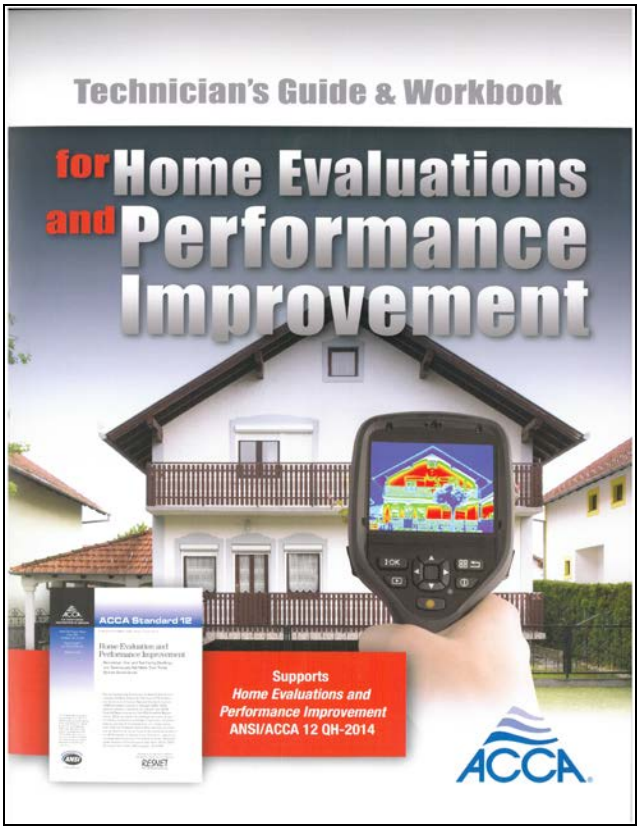
INSTRUCTOR'S LESSON PLAN For the: TECHNICIAN'S GUIDE & WORKBOOK for Home Evaluations and Performance Improvements



Instructors may customize any of the materials in this 4 day course to enhance their student's learning experience.

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INTRODUCTION

Home performance is evolving and tommorrow's technicians need far better documentation and technical skills than past generations of technicians. The home performance industry is in the process of making an educational and technological leap. Unfortunatly, many of today's technicians have not been trained or equiped to meet the today's requirements. By, covering the information in this Workbook in detail, you are preparing your students for today's market. Further, they will be in demand and have many opportunities throughout their careers because they will have the basic understanding and skill set to be successful in the evolving high-tech home performance industry.

The ANSI/ACCA 12 QH-2014 Home Evaluations and Performance Improvement was first completed and published in 2011 as the minimum standard for evaluating a residence with reguards to energy efficiency, water conservation, occupant comfort, and indoor air quality. The Standard was updated in 2014. QH Guide & Workbook was designed as a compendium to the 2014 QH Standard. HVAC design requirements are covered in courses on Manuals J, D, and S and Installation requirements for HVAC equipment are covered in the Technician's Guide & Workbook for Quality Installations.

Part 1: Curriculum Outline for *Technician's Guide & Workbook for Home Evaluations and Performance Improvement*

This course was developed for HVAC contractors and home performance professionals who requested more training material on the basics for undertaking a home performance evaluation. Contractor participation in editing and adding insight have made this course's materials industry neutral so they support every home performance certification type. The curriculum outline is intended for use by HVAC and Home Performance instructors at vocational-technical schools, training centers, and community colleges; to introduce students to industry-accepted home performance related measurements, auditing, and documentation procedures.

This curriculum has been designed for use with the *Technician's Guide & Workbook for Home Evaluations and Performance Improvement*, a "how-to" compendium for the ANSI/ACCA Standard 12 QH-2014 HVAC Home Evaluation and Performance Improvement (12 QH). It is designed to be used as a 4 day intensive classroom course, or may extended to 8 or more days by adding the recommended hands on exercises.

Course material covers the areas that are commonly taught in Home Performance programs from a 12 QH Standard application perspective. Over 750 power point slides designed for use with the Guide & Workbook are available through ACCA. They address the requirements for completing a home performance inspection and gathering the information required for a comprehensive residential audit. The instructor may select hands on exercises from recommended options in each section of the Guide & Workbook, or substitute for the hands on exercises with class discussions based on questions designed to encourage class participation.

The outline format allows the instructor to expand or contract the lesson plan to suit the needs of their students, and augment their available materials, or pre-existing lesson plans. At the end of the 4 basic 8 hour lessons, a student will understand the requirements for completing a comprehensive home performance site inspection and a comprehensive home energy audit. Additionally, there are five math review modules that focus directly on techniques for solving field math problems specific to the curriculum. One training technique is to use the math modules (as needed) in conjunction with the class lessons. Finally, the *Guide & Workbook* contains several appendices designed to be used in the field as reference materials. For example ASHRAE 62.2 for determining the make-up/outside air requirements.

Course Materials

- Student Text Book: *Technician's Guide & Workbook for Home Evaluations and Performance Improvement*

Instructor's Resources

- 4 day, 15 module power point slide presentation designed for 6-8 hour per day lectures (over 750 power point slides available for instructors; ACCA designed for use with the Guide & Workbook)
- Contained in this document, a 15-page Teacher's Answer Addenda and Guide for questions in the Guide & Work book and recommendations for spicing up the recommended hands on field testing (pages 7-20)
- Sample self-evaluation final exam answer sheet and exam (pages 21-33)
- Review Copies and Power Point Modules for the *Technician's Guide & Workbook for Home Evaluations and Performance Improvement* is available upon Request. Contact Don Prather at donald.prather@acca.org or by phone at 703-824-8867

See also, Part 4 of this volume.

Day 1

Part 1: 47 power point slides
Subjects:

- Purpose
- Scope
- Interview
- Basics Math Review
- Measuring/calculating Surface Area

Part 2: 59 power point slides
Subjects:

- Measuring/calculating Volumes
- Fossil Fuel health & Safety
  - CO Testing
  - CO Free Air Formula (NFG Tables)

Part 3: 44 power point slides
Subjects:

- CAZ Volume Sample Problems
- Air Free CO PPM Sample Problems

Part 4: 33 power point slides
Subjects:

- Gas/Oil Leakage Testing
- Unvented Combustion Appliances
- CAZ Test Area Measurement
- CAZ Test (Depressurization Test)
- Spillage Test

Day 2

Part 1: 57 power point slides
Subjects:

- Combustion Ventilation Sizing
- Combustion Air Ducting Inspection
- Insulation Introduction

Part 2: 56 power point slides
Subjects:

- Walls and Floors
- Ceilings and attics
- Roofs
- Doors
- Home's Age
- Framing Characteristics
- Windows and Glass
- Skylights

Part 3: 45 power point slides
Subjects:

- Ventilation
- Introduction to Electrical Energy Savings
- HVAC System Inspection
- Heat Exchangers and ESP

Part 4: 56 power point slides
Subjects:

- Duct System Inspection
- Exhaust System Inspection
- CAZ Test Area Measurement
- CAZ Test (Depressurization Test)
- Spillage Test
- Duct Leakage Testing

Day 3

Part 1: 57 power point slides
Subjects:

- Room Pressure Differences
- Water Heating Appliances
- Appliance Inspection
- Moisture
- Pools & Spas
- Unsafe Conditions

Part 2: 62 power point slides
Subjects:

- Discretionary Items For Cost Benefit
- Assessing Improvements
- Assessment Table Values for CO
- Assessment Table Values for Combustion Appliances

Part 3: 45 power point slides
Subjects:

- Assessment Table Values for Envelope Ventilation
- Assessment Table Values for Envelope Insulation
- Assessment Table Values for Airflow
- Assessment Table Values for HVAC Temperature Difference

Part 4: 56 power point slides
Subjects:

- Assessment Table Values Duct Leakage Testing
- Assessment Table Values Room Pressure Differences
- Assessment Table Values Hot Water Heating
- Assessment Table Values Appliances and Equipment
- Assessment Table Values Pools & Spas

Day 4

Part 1: 52 power point slides

Subjects:

- Assessment Table Discretionary Values
- Cost Benefit Analysis
- Presenting Performance Improvements

Part 2: 48 power point slides

Subjects:

- Implementing Identified Performance Improvements for Safety
- Implementing Identified Performance Improvements for Envelope
- Implementing Identified Performance Improvements for Ventilation

Part 3: 43 power point slides

Subjects:

- Implementing Identified Performance Improvements for Insulation
- Implementing Identified Performance Improvements for HVAC
- Implementing Identified Performance Improvements for Moisture and Pools & Spas
- Test Out Procedures

Part 4: Test

50 question multiple choice test used to evaluate how the information was received and understood by the class.

Part 2: Answer Addenda for QI Blue & Green Highlighted Sections

Among the questions in blue provided in the Workbook are a few questions that are designed to encourage class discussion so the instructor can encourage class participation. The vast majority of the questions are designed to drive home specific important points or to make sure the students can do the required calculations, find and identify the data needed, etc. Everything in the Guide & Workbook is part of a usefull knowledge base that is needed in the field today. By taking the class through the field exercises in the green sections, students will quickyly learn what the missed or didn't fully understand as they try to apply the principles taught.

Answers provided in this Teacher's Guide are designed to aid instructiors when they cover the material in class. In some cases additional correct responses may not be fully covered in this answer guide because there are many possabilities students could come up with. One final thing, the author wrote this Guide & Workbook so it could become a tool to be used to create a fun learning experience,so relax, use these questions as a means for interacting with your students and go with the flow and have some fun!

Test Your Knowledge Study Questions (Page 5)

1. Why is it important to have as many adults as possible who live in the home present for the interview process?
   Homeowner interviews need to identify occupant behaviors and use patterns. So it is good to have as many of the adults in the home as possible there for the interview.
2. Why are comfort related questions helpful in determining an energy savings plan?
   Information on hot and cold spots will generally give you a head start in locating problem areas and people with unusual comfort related issues. When you identify a person that is not comfortable within normal comfort temperature and humidity levels, their comfort will need to be addressed. Additionally, the questions provide information on how the homeowners think about their HVAC system. Note: Most homeowners equate their HVAC system and a refrigerator: plug it in, turn it on and forget it. Many need to be educated that an HVAC system needs regular maintenance like their car does.
3. Why would it be important to know how long the owners plan to stay in the home when making a home performance upgrade plan?
   If a homeowner plans to sell the home and move on in a short period of time they will not be as interested in energy saving and comfort upgrades as they will be in upgrades that increase the homes marketability or value. Thus, the recommendations should reflect those items as priorities.
4. If the home owners answer that they never change filters, what might that indicate?
   It could indicate they need education on filter changing requirements, or it could mean the filters are never dirty, it also could mean they have a service plan. Thus, the information is informative but it is not enough information to form a conclusion.
5. In addition to the required questions, why might you ask if the smoke detectors and CO detectors in the home are operational, and how old are they?
   Offering repair and replacement of these types of detectors is a good business practice for home improvement contracting businesses.

Hands on Lab or Field Exercises

1) **Practice asking and answering the questions on the list with another person or persons.**
   This is better if a third party listens and grades the interactions.
2) **Develop other questions that might be helpful for your geographical location.**
   For example, high altitude dry climates might ask about sparks when people walk to ascertain if a humidifier might be a good recommendation. Similarly, wet hot climates might need dehumidification.
3) **Identify and the take photographs of items that indicate some repairs may be required.**
   Practicing photography and camera use before going into the field is a good exercise and will allow for discussions on photo quality, lighting, what is trying to be shown, etc.
4) **Using the directions on a programmable thermostat, explain how to set it up for different operating times on the week days and the weekend.**
   It is important for the home performance evaluator to be able to read and understand how to set up numerous brands of thermostats. Practicing with several brands, and explain how they work is a great exercise.

Test Your Knowledge Study Questions (Page 10)

1. Explain what a snapshot test means and why the CO test is considered a snap shot test.
   A snapshot test is one that only takes a picture or reading that reflects the exact time and place where they were taken. The CO test reflects what is happening at a specific time at a specific location according to a specific test tool. Thus, it is considered a snapshot test and should not be represented as reflecting what the CO might be at another time.
2. Why is CO monitoring and recording important when combustion appliances are being tested?
   It is for the safety of the Technician as well as the safety of the home's occupants. If the appliance cause the CO to rise corrective action is required.
3. What is the accuracy requirement for a CO meter and why is the accuracy important?
   The meter must have a resolution of 1ppm and be capable of measuring CO levels from 0ppm to 2,000 ppm.
4. What should be done if the CO ppm goes to 25 ppm or higher when an oven is being operated during testing?
   If it is the broiler or oven, nothing is required. However, based on the Appliance Threshold Table, if it is a top burner that is being tested it will need to be repaired by a qualified appliance technician.
5. A Technician measured the O_2 at 10% by volume in the exhaust gas, and the CO at 300 ppm in the exhaust gas of a furnace using propane gas. Does it meet the 400 ppm table value?

   $CO_{AFppm} = (UCO_2 \div CO_2) \times CO_{ppm}$

   Thus: $CO_{AFppm} = (14.0 \div 10) \times 300 = 420ppm$

   Since 420 ppm is higher than the table value of 400 ppm; the furnace would fail the air free test.
6. A Technician measured the CO_2 at 10% by volume in the exhaust gas, and the CO at 150 ppm in the exhaust gas of a vented room heater using propane gas. Does it meet the 200 ppm table value?

   $CO_{AFppm} = (UCO_2 \div CO_2) \times CO_{ppm}$

   Thus: $CO_{AFppm} = (14.0 \div 10) \times 150 = 210$ ppm

   Since 210 ppm is higher than the table value of 200 ppm; the vented room heater would fail the air free test.

Hands on Lab or Field Exercises

1) **Practice verifying that a CO meter is calibrated and measuring CO correctly.**
   This is a good exercise to do and can be used to compare more than one type of meter.
2) **Do a depressurization test and complete the required documentation.**
   Using the same hose connections compare results between technicians using the same and/or different measuring tools.
3) **Do some online research on safe CO levels and determine if lower levels than those called for in the requirements might be worth addressing.**
   It is the opinion of many experts that the CO level in homes should be less than 5 ppm. Discuss the findings of the group based on their internet search.
4) **Measure exhaust gas on an appliance and use the formula to verify it meets the table values.**
   Have several students make the readings using more than one test instrument and compare the results using the formulas.

Test Your Knowledge Study Questions (Page 19)

1. Name 4 requirements for vent ducting.
   Answers should be from the following list:
   - Must be constructed of galvanized steel, or have equivalent strength, rigidity, and resistance to corrosion.
   - Where more than one fire block is removed, joint space and open stud areas may be used for running the duct (fire blocks are generally only found in multi-family housing units).
   - Duct must end in a location where it is not going to be blocked off.
   - Duct can only be used for one space; if there are two different equipment rooms, two separate duct systems are needed.
   - One duct cannot be used as both the upper and lower duct in an *Acceptable Type 1; Two Permanent Openings* system.
   - Ducts terminating in a vented attic space must not have a screen on them.
   - Horizontal ducts must not slope down towards the combustion air's source.
   - Cavity space in a building, or extra piping in a chimney, cannot be used to supply combustion air.
2. What is the maximum opening size for a screen on a vent that is in a vented attic?
   This is a trick question based on the list above there should be no screen on them.
3. What is a damper interlock switch and how is it used for combustion safety?
   The damper interlock switch will not allow the burner to come on unless the damper is open.
4. If a home with 10 ft. high ceilings, has an open floor plan and it is 1,500 ft^2 in total size and has three bedrooms where one is 12 × 12 ft. another is 10 × 12 ft. and the master suite is 300 square feet how many cubic feet of air space is in the home if the bedrooms are excluded from the total?
   First the total air space in cubic feet = 1,500 × 10 = 15,000 ft^3
   Next the area of the bed rooms in ft^3 = (144 + 120 + 300) × 10 = 5,640 ft^3
   The cubic air space excluding the three bedrooms is the difference between the two areas:
   15,000 – 5640 = 9,360 ft^3

Hands on Lab or Field Exercises

1) **Measure a home or a class room and calculate the cubic feet of space.**
   This is a good exercise to use for comparison of answers.
2) **Use the ft^3 total from Question 1 above to determine if a 500,000 Btuh furnace would need more combustion air provided.**
   This provides practice on the use of the formula.
3) **Calculate the area in cubic inches of the opening for some round duct based on field measurements.**
   Always a good practice to reinforce math formulas by having students work them out based on something found in the field.
4) **Pressurize some sealed pipes that have a few small holes in them (up to about 6" of water column (0.22 PSI) using a small compressor or students blowing into them), mix up some hand dish washing soap and water (50/50) and perform leak tests to locate the holes.**
   When this is done, students will have a chance to see how simple soap bubbles can identify a leaking point in a pipe.

Test Your Knowledge Study Questions (Page 22)

1. Explain what a snap shot test means and why the CAZ test is considered a snap shot test.
   A snapshot test is one that only takes a picture or reading that reflects the exact time and place where it was taken. CAZ tests are specific to the time, date, and existing conditions. Thus, it may not reflect the answer for a different day or time.
2. Why is performing a CAZ test a good idea when combustion appliances are being tested?
   Many answers will be provided for this question. One specific answer that should be included is: The CAZ test may show problems with the combustion airflow.
3. Explain how a smoke test works.
   The smoke test is simply providing smoke and seeing where it goes. Since the smoke in the air makes its pathway visible, the direction the air is moving can be evaluated by observing the smoke's travel pathway.
4. Explain what a back draft is.
   Note: some students may provide the answer from the movie. For our HVAC application, the short answer is: when airflow is going backwards through a combustion appliance or vent.

Hands on Lab or Field Exercises

1) **Do a CAZ test and record the required data.**
   This test can be done by several groups. (Opening an outside door or window a crack between groups can lead to differing results and a good discussion)
2) **Do a smoke test on an operating combustion appliance to prove it is not back drafting.**
   This is a good hands on exercise for students. They need to test all the way around the vent.
3) **Monitor CO during the test and record reading in the CAZ.**
   When the CAZ test is done, reminding the students to do the CO readings will drive home the point they need to keep more than one ball in the air to do a safe test!

Test Your Knowledge Study Questions (Page 24)

1. Explain what a snap shot test means and why the back draft test would be considered as a snap shot test.
   A snapshot test is one that only takes a picture or reading that reflects the exact time and place where they were taken. Note: if it seems like this point is being repeated…it is. It is important that students understand the test's limitations. Obviously, a backdraft test's results may change if the
2. Why is performing a back draft test a good idea when combustion appliances are being tested?
   Numerous answers are possible here, they should all include safety and safe equipment operations.
3. Explain why there is an instruction to wait for a period of time before doing a back draft test with smoke.
   There will probably be numerous answers written here, they should all include that a small backdraft at start up may not represent a real problem in a properly designed and installed venting system and the wait is designed to avoid false test failures for systems that operate properly.
4. Why is it important to note the slope of the vent pipe?
   The answers should include: the slope is for condensation control, and because the OEM directions say to do it.

Hands on Lab or Field Exercises

1) **Do a vent inspection and record the required data.**
   This is a good exercise for students, make sure they check the pipe sizing, slope, total pipe lengths, and number of elbows.
2) **Do a smoke test on an operating combustion appliance to prove it is drafting correctly.**
   This is a repeat of the test done in the last section that should reinforce they appliance is drafting properly.
3) **Measure and calculate the slope of the vent pipe.**
   This may seem like a simple exercise: many students will have no idea how to measure the slope or the angle using common tools. It is recommended that a level (at least 2 ft. long) and a measuring tape be used as one of the measuring methods.

Figure 25 (in the Guide & Workbook): Blaise Pascal

The Pascal (Pa), named after Blaise Pascal (see Figure 25), is a unit of measure in the international system of units (SI) that is equivalently used instead of pounds per square inch (psi): 6,894.757 Pa. = 1 psi. When the 50 Pa used for pressure testing a home is converted to psi we get a very small number:
50 Pa = 50 × 1 ÷ 6,894.757 = 0.00725 psi. Thus, for home pressure testing, the Pa is an easier number to use than the psi for doing pressurization and depressurization calculations.
Test Your Knowledge Study Questions (Page 28)

1. Explain why it is important not to do a pressure test if there is asbestos present in the home.
   Pressure testing may disturb the asbestos and if it gets into the airstream it can be a health safety issue. Blower door manufacturers provide a warning with their tools that say they should not be used when asbestos is present in the home.
2. What procedures other than the single point leakage test are acceptable?
   Multi-point testing procedures may be used.
3. What additional items need to be done if it is not a free standing single-family home?
   Additional checks that apply to two-family dwellings and townhomes:
   - For a two-family dwelling (e.g., a duplex) that is to be tested as one building, the Technician shall perform simultaneous air leakage tests of each unit and the CFM 50 values shall be added together to determine the building's envelope leakage rate.
   - For a row of Townhomes that are to be tested as one building, the Technician shall perform simultaneous air leakage tests, with neutral pressure difference between adjacent residences, and the CFM50 values shall be added together to determine the building's envelope leakage rate.

4. What does PACMs stand for?
   Presumed Asbestos Containing Materials
5. What problems can be caused by fire places if their dampers do not seal off the air?
   Soot can be pulled into the home causing damage to the interior if the flue damper is inoperable, or left open, or the damper doors do not provide a good seal. Some strategies to deal with it include laying a small rug in front of the fireplace to protect the building's carpeting, sweeping and vacuuming the ashes out and applying wet newspapers over any ash residue, etc.

Hands on Lab or Field Exercises

1) **Do a home evaluation searching for signs of asbestos.**
   This class inspection is safer when done in a newer home where there is no asbestos present as a prerequisite for a leakage test.
2) **Do single point leakage test and calculate the leakage.**
   Following the inspection, the students can do the test and results can be compared. Again, turning on a bathroom vent (unnoticed between student groups can provide a real life occupied home testing moment and skewed results for your students).
3) **Do a multi-point test in accordance with ASTM E779-10, or CAN/CGSB 149.10-M86.**
   This could be compared to the results from the single point test.

Test Your Knowledge Study Questions (Page 30)

1. Find the table value (see Appendix 2) for the minimum outside air requirement for a 1,632 ft^2 home with 4 bedrooms (see Appendix 2).
   1501-2000 with 4 bedrooms has a listed minimum outside air CFM of 98. Or, 98 CFM is required.
2. Explain why it is important to bring outside air into a home.
   Numerous answers can be expected for this question, main one is for health of occupants.
3. Explain why bringing in too much outside air would not be the best option for the homeowners.
   Again, numerous answers can be expected for this question, the main one that needs to be included is the cost of heating and cooling additional outside air.
4. Explain how you would determine if an exhaust fan that has the ducting in a hidden ceiling space was exhausting to the outside.
   The best answer is to look at the vent opening to see if the dampers are open (Figure 26).

Hands on Lab or Field Exercises

1) **Measure airflow through a 62.2 compliant make up air duct using one or more of the procedures approved in ANSI/ACCA 5 QI Standard-2015.**
   This exercise is important because it is so often done wrong in the field. Using several methods and tools can make this into an interesting assignment for the students.
2) **Locate the exhaust fans in a home and identify where the exhaust vent for each fan is outside of the home.**
   This is an important exercise and will build the student's confidence in being able to identify where vent fans with concealed ducting are exhausting.

3) **Work through the formula method in Appendix 2 (QH Guide & Workbook) using blower door data and compare the results with the table method.**
Based on calculations done by the author of this Guide & Workbook the answers should be within the accuracy range of the actual measuring tools that will be used for verification in the field. Note: In previous versions of 62.2 there was an advantage to using the formula method because the designer could use less outside air than allowable in the table values. That advantage seems to be gone with the new formula method.

Test Your Knowledge Study Questions (Page 37)

1. Why is measuring the insulation depth and identifying the type important in a home's energy use evaluation?
   The depth of the insulation is used to calculate the R-value. Often increasing the existing R-value will be a strong energy saving contender based on the cost of adding the insulation verses the added energy savings potential.
2. When would roofing materials be included in ceiling insulation calculations?
   When the roofing material is over a vaulted ceiling that is not vented it will be included in the calculation for the ceiling assembly.
3. Why are soffit baffles used in attic spaces?
   Soffit baffles are used to keep insulation out of the air pathway in vented attics.
4. Explain where duct R-value will and will not be a factor in a home's energy efficiency.
   When the duct is in the conditioned space the R-value is not a factor in the home's efficiency.
5. An insulation grade value is calculated using area data from a thermal scan done in a home with 1,500 square feet of inspected surfaces. The image showed 600 square feet of anomalies. What would the RESNET insulation grade be?
   First divide 600 by 1,500 and multiply by 100 to get 40%. This house is not insulated well enough to qualify for an insulation grade and will be a great candidate for insulation upgrades and repairs.
6. Why are almost all existing home insulation grade evaluations Type 2, Type 3 or no insulation installed?
   This is because very few homes have been examined and found to qualify as a Type 1 insulation installation. Thus, most homes R-value for the existing insulation can be upgraded and many upgrades can result in significant savings for the home owner.
7. Explain how infrared images can be used to evaluate the condition of existing insulation?
   Infrared imaging can offer a view of hot and cold spots within a wall. Thus, insulation may be evaluated through this non-destructive testing methodology.

Hands on Lab or Field Exercises

1) **Do a walk-through inspection as a class, and have individual students display one or more of their recorded answers for individual steps in this section.**
   This is a great way to open up discussion and to make sure the students are looking at insulation from a common viewpoint.
2) **Have students offer additions to the information displayed based on their findings. Discuss the differences.**
   This further analysis will make the students aware that there will be differences of opinion on values for insulation by different inspectors. It should help them to reconcile the differences in their observations.

3) **Use a thermal scanning tool to estimate if the insulation is Type I, II, or III in a wall and/or ceiling.**
   This is an excellent exercise because the students must calculate the areas and then compare them to the Insulation Type requirements.

Test Your Knowledge Study Questions (Page 47)

1. Explain where you might use an infrared thermometer to measure temperatures.
   Many answers here will be correct. One good use of the tool is to take a snapshot of what is happening in a room. In about 40 seconds the ceiling, floor, and all four wall temperatures can be taken along with an approximation of the supply and return air temperatures (to find out if the HVAC equipment is on/calling). Note: rooms on the same zone should be operating at similar temperatures.
2. Why is it helpful in forming a home performance evaluation to measure the room pressures in relation to the outside pressure?
   Rooms with a negative pressure WRTO the outside will tend to pull in outside air through cracks and openings. Thus, they will be hot or cold and will have unfiltered outside air entering them.
3. Explain why it is important to bring outside air into a home.
   There are many correct answers, one that should be included from an HVAC perspective is to control and filter make up air for exhaust fans.
4. Explain the limitations to the temperature difference test procedure.
   The test must be done on a day and time where there are measurable temperature differences due to a high heat or cooling load.
5. Explain how to place a static pressure probe and why a kinked or blocked tube would skew test measurement values.
   The static pressure probe gets placed with its tip pointing into the airstream. Blocked or kinked tubing may not allow the true pressure found at the static pressure probe to reach the measuring meter (a good exercise inn class is to hook up a SP probe and meter and then step on and off of the line and look at how the reading is changed).
6. Explain why it is important to measure the airflow across the heat exchanger.
   Airflow across the heat exchanger is critical for the heat exchangers proper and safe operation. Thus, it needs to be checked at initial startup and compared to the design requirements and again after system balancing is completed to make sure it still meets the OEM requirements.

Hands on Lab or Field Exercises

1) **Measure static pressure WRTO; step on tube and measure again; kink tube and measure again; change side of building for outside measurement.**
   This field exercise is designed to reinforce some of the difficulties encountered when measuring small pressure differences in the field so students will know when, why, and how to diagnose problems with accuracy, and make corrections.
2) **Do a gasketed pan test in the field.**
   When this test is coupled with other testing methods students can learn why it is not used to calculate an amount of airflow that is leaking out.
3) **Do a temperature difference test on a duct system?**
   Obviously a hot or cold day should be selected for this test. However, if it is done later on a moderate day it would drive home the point that it is a snapshot test and is only useful in

determining where additional insulation or insulation repairs may be needed.

4) **Do a RPD smoke test and evaluate the home envelope.**
   This will provide students with a visual reference on airflow when a room pressure difference (RPD) test is being done and allow them to have a basic visual understanding of where and how homes leak.

Test Your Knowledge Study Questions (Page 58)

1. Explain how a list of the appliances would be useful when developing an energy savings upgrade plan.
   The replacement of older inefficient appliances with energy efficient upgrades will result in increased monthly energy savings.
2. Explain why it is important to know the age and size of the hot water heater.
   Every hot water heater will eventually need to be replaced. Since a failed hot water heater often leaks, older hot water heaters should be placed on the replacement list as an option for the homeowners to consider. Knowing the size in both Btuh and storage in gallons is a key factor when a replacement is required.
3. How would you evaluate the drainage and the ground's slope around a home?
   Expect many answers here and look for slopes away from the home and/or signs of drainage problems such as water puddling or divots in the earth near the foundation.
4. How would you identify a history of water leakage through a ceiling or wall?
   Many correct answers centered on stains, mold, wood rot, standing water, etc.
5. What items would you document when evaluating a pool or spa?
   Answers should include the following:
   - Safety: Note type of suction inlet cover(s) and flow rating, GPM and Life Years are required to be embossed (made a part of) in approved covers.
   - The pump motor horsepower, type of controls, and timers being used for the pool or spa. Note: GPM should be less than the values the safety covers are rated for.
   - Type and size of filtration system (does it align with the pool pump GPM requirements?).
   - Heated pools: Record the type of pool heater, the water temperature, the location of the heater's on-off switches, if switch is separate from thermostatic control, and the pool/spa covers used.
6. What items would you document when evaluating plumbing fixtures?
   Older plumbing fixtures should be noted along with leaks or drips.
7. Explain what a Technician should do when unsafe conditions are found.
   Upon discovery of any condition deemed unsafe by the Technician, the Technician shall halt the audit process. The Technician shall leave the building and recommend that the occupants do the same until the situation is resolved.

Hands on Lab or Field Exercises

Note: All of the items listed below can be done by individual students in their entirety or can be done as a class exercise with groups responsible for completing parts. If groups do the parts it is recommended that each part be reported to the other groups on site with explanations on how the information was obtained.

1) **Gather the required data by doing a field evaluation for evidence of leaks.**
2) **Measure the grade slopes for a drainage evaluation around a building or a home.**
3) **Gather the required data by doing a field evaluation on a pool and/or a spa.**
4) **Gather the required data by doing a field evaluation on existing appliances.**
5) **Gather the required data by doing a field evaluation on existing plumbing fixtures.**

Test Your Knowledge Study Questions (Page 64)

1. Why is measuring the window area and identifying the type of glazing important in a home's energy use evaluation?
   Window area and glazing type is needed for doing the Manual J or auditing load calculations.
2. What is included in the window measurement?
   Expect many answers here, the basic is the window assembly includes the frame.
3. Why is the evaluation of the exhaust fan CFM and making sure they exhaust to the outside an important consideration when evaluating home performance?
   Outside/makeup air needs to be equivalent to the air exhausted. Thus, the total amount exhausted to the outside needs to be known.
4. Why is it important to identify and record the type of outdoor lighting fixtures?
   Many outdoor lighting fixtures can be upgraded resulting in substantial energy savings. Additionally, control strategies for outside lighting are often needed to ensure the lights operate when needed…not continuously 24-7.
5. The instructions say you can use a compass to identify which way windows are facing. Can you identify another way to document that information without a compass?
   Expect many answers here, all are correct. The goal here is to get the students thinking of creative ways to solve problems they will encounter in the field.

Hands on Lab or Field Exercises

1) **Do a walk-through inspection as a class, and have individual students display one or more of their recorded answers for individual steps in this section.**
   This can be done after each student has done an individual walkthrough.
2) **Have students offer additions to the information displayed based on their findings. Discuss the differences.**
   Encourage discussion and constructive student questions and additions.
3) **Identify exhaust fan outlets and inlets and then, using an airflow measuring tool, measure the exhaust fan CFM.**
   This is often done wrong in the field, so it is important to show students firsthand the difficulties of measuring exhaust fan airflow in the field. It is good to use several types of tools and to compare the CFM readings.

Test Your Knowledge Study Questions (Page 78)

1. Explain how you would use the table values to evaluate undiluted flue gasses for a hot water heater.
   The chart allows for 200 ppm air free CO for a hot water heater. Thus, the measured value should be 200 ppm or less.
2. What is the reason for determining what type of spa drain cover was in a spa?
   Safety, a missing drain cover or an outdated type of drain cover can hold onto someone in the spa due to the pumps suction power.
3. For duct leakage testing how would you prove that there was a 50% improvement?
   An as-found duct leakage in CFM must be measured before duct repairs are made. The Final leakage value is divided by the original as-found value and multiplied by 100. If the resulting value is 50% or above the duct leakage has been improved by 50%.
4. Name the items checked for moisture leaks and why each is important to verify.
   All leaks need to be identified and repaired before other home performance weatherization improvements can be accomplished. Items that must be checked for leaks include the

following:

- Plumbing fixtures and pipes
- Drainage issues that can cause leaks
- Exterior rating Good or excellent
- Interior rating Good or excellent.

5. What software is approved in the *QH Standard* for doing a cost benefit analysis?
   Approved software includes: RESNET approved software programs, Manual J programs that have energy modeling capabilities, and programs approved by the authority having jurisdiction.
6. Explain what supplementary information is and why it might be an important consideration before building performance upgrades are considered.
   Supplementary information that will affect the decision making process regarding building performance improvement opportunities need to be recorded along with any condition related elements that have been added. The condition related items include, but are not limited to:
   - The age of the item inspected.
   - Condition or operational ability of the item inspected.
   - Presence of hazardous materials or improper storage of combustible materials.
   - Performance improvements that may lead to building modification updates to meet new code requirements when changes are made (e.g., when replacing siding might also lead to a requirement for improving wall's insulation value, or changing out the furnace may require meeting a minimum outside fresh air requirement).

Hands on Lab or Field Exercises

1) **Fill out the home evaluation sheet as a class with values provided by the instructor.**
   A few values should not meet the comparative benchmarks and possibly some could be left out due to the type of home evaluated by the class in earlier field exercises.
2) **Verify what values meet the benchmark requirements and list ones that do not.**
   This is something that can be done in conjunction with the filling out of the evaluation sheet. What should be done about the requirement not being met should be discussed.
3) **Do a cost benefit analysis using approved software for one or more of the items listed in the home improvement table.**
   This provides the opportunity to see what would and would not save the home owner money and to address the cost of repairing safety items, leaks, and recommending appliance replacements.

Test Your Knowledge Study Questions (Page 83)

1. Take each of the proposal requirements and place them in one of the 4 steps based on their priority.
   This is a comprehensive listing based on the field work done thus far by the students. Note: this is where many will find out why they need to keep documentation. It is recommended that the instructor keep copies of the previous field exercises so the students can be saved and do the assignment in case they have lost their previous work.
2. Why is it important to include safety items not selected by the homeowners in the work scope in the documentation?
   Safety items the homeowner chooses to ignore should always be documented. Many of those will not exclude doing some of the home performance upgrades. For example improper wiring in the crawl space will not exclude other work not related to that circuit.

Hands on Lab or Field Exercises

Present a proposal (or a portion of a proposal) that includes a cost benefit analysis that addresses one or more of the improvement areas in table 4-1 that do not meet the comparative benchmark requirements.

This is good practice for the students in interacting with someone else while trying to convey a complex ordered list of recommendations. It is recommended that the instructor takes the part of the homeowner so questions can be asked based on things that need to be done together. For example the instructor may ask if they can just ignore the added insulation for now and downsize the AC for better efficiency.

Test Your Knowledge Study Questions (Page 83)

3. Take each of the proposal requirements and place them in one of the 4 steps based on their priority.

   This is a comprehensive listing based on the field work done thus far by the students. Note: this is where many will find out why they need to keep documentation. It is recommended that the instructor keep copies of the previous field exercises so the students can be saved and do the assignment in case they have lost their previous work.

4. Why is it important to include safety items not selected by the homeowners in the work scope in the documentation?

   Safety items the homeowner chooses to ignore should always be documented. Many of those will not exclude doing some of the home performance upgrades. For example improper wiring in the crawl space will not exclude other work not related to that circuit from being done.

Hands on Lab or Field Exercises

Present a proposal (or a portion of a proposal) that includes a cost benefit analysis that addresses one or more of the improvement areas in table 4-1 that do not meet the comparative benchmark requirements.

This is good practice for the students in interacting with someone else while trying to convey a complex ordered list of recommendations. It is recommended that the instructor takes the part of the homeowner so questions can be asked based on things that need to be done together. For example the instructor may ask if they can just ignore the added insulation for now and downsize the AC for better efficiency.

Test Your Knowledge Study Questions (Page 91)

1. Explain what is required by *QH Standard* when there are no code requirements for outside air?

   When there are no code requirements for outside air, .ASHRAE 62.2 guidelines should be followed and the 2012 International Energy Code (IECC) requirements should be met.

2. Name the insulation related requirement when cellulose is used as fill over pitched ceilings.

   When cellulose is used as fill over pitched ceilings (see Figure 76):

   - Only stabilized products are allowed to be used.
   - Loose fill fiberglass will only be used on a slope less than or equal to a 6:12 pitch, or the slope application approved by the manufacturer, whichever is less.
   - Roof cavities will be insulated with loose fill according to manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions.
   - Insulation will be installed to contractual R-value.

3. What are the airflow requirements for a bathroom exhaust fan?

   Existing venting for bathrooms and kitchens should comply with the 2012 International Residential Code §M1507 which for residential applications requires:

   - Bathroom venting minimums of 50 CFM intermittent, or 20 CFM for continuous fan operation.

4. What are the test out requirements when a home with combustion appliances has been sealed?

   Building performance improvements, or combinations of improvements, that effect the envelope tightness, should result in testing of the combustion appliances in accordance with §3.2.4, §3.2.5, and §3.2.6 (in the QH Standard). When unvented combustion appliances are present, confirm their listing to ANSI Z21.11.2, and their use as a secondary heat source. When the unvented appliance do not meet these requirements the Technician needs to have a copy of the homeowners signed acknowledgement that they were made aware of the noncompliant combustion appliance (s).

5. Explain how a vented attic works.

   Explanations should include a description of the soffit vent to bring in the air and a ridge vent or a high wall vent, roof copula etc. to remove the air at a higher point in the attic.

Hands on Lab or Field Exercises

1) **Visit a pool or spa and look for ASTM labels and switches called for in this section of the Guide.**

   This is better arranged during pool off hours so the students will not be distracted and can focus on the items that they are there to study.

2) **Measure an existing home's kitchen and bathroom exhaust to evaluate whether or not they meet the minimum requirements for airflow.**

   This is a good exercise to use more than one tool on for the measurement and again provides valuable field training on how difficult it can be to get accurate measurements for some locations. At this point it might be good to allow the students to guess which tool will do the best job of duplicating what is found doing a traverse.

Part 3: Sample Test and Answer Sheet

Questions in this test cover every section in the Guide& Workbook. Questions from the blue sections in the Guide & Workbook for the areas covered can be used the midterm exam if one is required. They may also be used for the final exam and augmented by the multiple choice sample test. The weighting for the final grading is up to the instructor, the original multiple choice test was designed to be pass-fail with a 70% cut off for passing. Because the multiple choice test touches on all of the sections, the results from the multiple choice questions could be used to determine where more time or emphasis is needed for future classes. Answers for sample multiple choice test which is shown in its entirety starting on the next page:

1. D
2. D
3. E
4. B
5. A
6. D
7. C
8. C
9. A
10. C
11. D
12. E
13. D
14. A
15. E
16. E
17. E
18. C
19. C
20. B
21. E
22. E
23. D
24. D
25. D
26. B
27. E
28. B
29. A
30. E
31. E
32. D
33. D
34. B
35. E
36. C
37. A
38. E
39. E
40. E
41. B
42. C
43. B
44. D
45. E
46. B
47. D
48. E
49. C
50. D

1. Which type of home is not covered in ANSI/ACCA 12 QH-2014?
   a. Single story ranch style home with a pool.
   b. Three story town house in a condo association.
   c. A ranch style duplex home.
   d. Apartment in a 3 story walk up.
   e. 25,000 square foot 3 level mansion.

2. How many basic interview questions are there for an ANSI/ACCA 12 QH-2014 compliant interview?
   a. 30
   b. 20
   c. 50
   d. 26
   e. 15

3. The first question for the basic interview questions "*Do you own or rent your home*?" is important for which of the following reasons?
   a. To fully understand how they plan to pay for the work to be done.
   b. As a warm up question so they feel comfortable with an easy first question.
   c. As an introductory question to establish who they make their home payments to.
   d. To determine if they really want the work to be performed.
   e. To establish ownership or owner's permission to authorize work.

4. Which of the following is not listed as a step for Carbon Monoxide testing in the 12 QH Technician's Guide?
   a. Take a sample during depressurization test.
   b. Perform a CO measurement during the combustion analysis test.
   c. Appliance must operate for at least 5 minutes before taking a sample
   d. Take a measurement of combustion gasses at the flue before the draft diverter and around the external perimeter of accessible vent piping joints.
   e. Measure the outdoor CO level before entering the home, this will be your baseline.

5. Which of the following is not listed on the National Fuel Gas table G6 in the 12 QH Technician's Guide?
   a. Condensing Boiler
   b. Vented room heater
   c. Gas (log) fire place
   d. Oven/broiler
   e. Wall furnace (BIV)

6. Which of the following is not required by the 12 QH Technician's Guide?
   a. For Gas lines, all fittings and joints in supply lines and appliances must be checked for leaks using a gas leak detector capable of measuring 20 ppm.
   b. Existing oil lines must be visually inspected for signs of oil leakage.
   c. Leak locations need to be identified and marked so the location of the leak can be seen clearly.
   d. To identify the exact leak location, a soap test must be performed.
   e. The homeowner must be notified.

7. Which is not a requirement when performing one of the CAZ area measurement calculations (volume) according to the instructions in 12 QH Technician's Guide?
   a. Must do a blower door test.
   b. Must calculate the net free area of the openings that supply combustion air.
   c. Must use the same National Fuel Gas Code formula for fan assisted and naturally vented appliances.
   d. Must measure the volume of the space providing the combustion air to the appliances.
   e. Must know the existing air changes per hour in the home

8. Which is not an inspection requirement in the 12 QH Technician's Guide for Acceptable Type 1: two permanent openings?
   a. Openings in vertical ducting must have a minimum free area of 1 in^2 per 4,000 Btuh based on the total Btuh input value.
   b. Openings in horizontal ducting must have a minimum free area of 1 in^2 per 1,000 Btuh based on the total Btuh input value.
   c. The minimum opening size is for air openings must be 2" or larger. That requirement is interpreted as meaning an opening of 2" by 2" for a rectangular area or 2" round. So, a door with a one inch undercut would not count but one with a two inch undercut would.
   d. One opening must be within 12" of the bottom of the closet (enclosed space).
   e. Spaces can be combined as part of the same total area when they are connected by openings in doors, or floors, having open free areas of 2 in^2 per 1,000 Btuh based on the total Btuh input

9. Which is not a requirement for the ducting for combustion air in the 12 QH Technician's Guide?
   a. Ducts terminating in an attic must have a screen on them.
   b. Duct must end in a location where it is not going to be blocked off.
   c. Duct can only be used for one space; if there are two different equipment rooms, two separate duct systems are needed.
   d. Horizontal ducts must not slope down towards the combustion air's source.
   e. One duct cannot be used as both the upper and lower duct in an *Acceptable Type 1; Two Permanent Openings* system.

10. Which is not a required step for setting up the CAZ test in the 12 QH Technician's Guide?
    a. Close all exterior windows and doors, and attic hatches. Temporary openings to the outside such as broken windows must be sealed.
    b. Drain traps must all be filled with water
    c. Turn off all indoor fans: bathroom exhaust, range hood, clothes dryer, powered attic ventilation fans. An interlock with the appliance and the exhaust air fan is required.
    d. Open or close interior doors to the CAZ, rooms with exhaust fans (e.g., bathroom), or other interior rooms, to achieve the highest pressure differential in the CAZ room with reference to (WRT) the outdoors.
    e. Make-up air systems, combustion air ducting, and ventilation systems are to remain as is.

11. What item listed below is not a preparation requirement for a blower door test?
    a. Turn off any exhaust fans, vented dryers, and room air conditioners.
    b. Ensure that all doors within the building envelope are open.
    c. Ensure all fires in fireplaces and wood stoves are extinguished. Close all fireplace and wood stove doors to prevent scattering of ashes.
    d. Ensure that the building envelope is complete by closing all windows and doors, attic access panels and pull downs, attic knee-wall doors, and fireplace dampers. Technicians shall temporarily seal holes that exist when the house is being lived in (such as bathroom vent fans).
    e. Adjust all combustion appliances so that they do not turn on during the test. It is a good practice to leave the keys to the vehicle driven to the site near an appliance as a reminder to turn them all back on when finished with the test.

12. Based on the RESNET insulation grades, what item below is not a requirement or an allowance for a Type 1 insulation installation?
    a. Installed so the insulation fills each cavity side-to side and top to bottom.
    b. There is one allowance for a less than perfect insulation installation: incomplete fill or compression of up to 30% of intended thickness, to up to 2% of the area.
    c. Installed so no substantial gaps or voids around obstructions.
    d. Installed so no exterior sheathing is visible through gaps in the material.
    e. There is one allowance for Gaps and voids to greater than 2% of the surface area the insulation occupies but less than 5%.

13. Based on the 12 QH technician's Guide, which of the following is not proper guidance for measuring building assembly areas?
    a. Measure floor dimensions in accordance with ANSI Z765-1996 with the exception of §3 Paragraph 6 (floor areas with ceiling heights of less than 5' will be included in finished square footage).
    b. Measure the house or assembly element (window, wall, ceiling, etc.) to the nearest inch, and record the square footage to the nearest square foot. Use exterior measurements; those measurements shall start at the exterior finished surface of the outside wall. Openings to the floor below shall not be included in the square footage calculation, with the exception of stairways; stairways and associated landings are counted as square footage on both the starting and ending levels.
    c. Do include the square footage of separate finished areas that are connected to the main body of the house by conditioned hallways or stairways.
    d. Do include the "footprint" of protruding chimneys or bay windows.
    e. For conditioned basements and crawlspaces, find dimensions of basement walls and floor. Divide walls into above and below grade sections.

14. Based on the 12 QH technician's Guide, which of the following is not proper guidance for determining the ceiling insulation R-value?
    a. Insulation in ceilings with an attic above need to be enclosed to attain a Grade I or II assessment.
    b. For loose fill applications, four measurements of the insulation level (the depth shall be representative of the entire attic area being examined) shall be taken. Multiply the minimum depth of insulation by its R-value per inch to obtain the total R-value.
    c. For sealed, unvented attic/roof assemblies, the interior sheathing/enclosure material are optional in climate zones 1-3, provided insulation is adequately supported and meets all other requirements, including full contact with the exterior (roof) sheathing.
    d. For ceiling insulation, eave baffles or equivalent construction is required to achieve Grade I or II
    e. The Technician should note the cavity insulation depth, and if framing elements are exposed, or covered (when covered the thickness that covers the framing should also be noted).

15. Based on the 12 QH technician's Guide, which of the following items is not listed as an item to be checked when evaluating a roof?
    a. Check if there is insulation applied to the underside of the roof sheathing, creating a cathedralized or encapsulated attic. Note R-value if insulation is present.
    b. Check for evidence of air leakage such as outside light entering the attic at the attic perimeter.
    c. Check if there is a radiant barrier applied to the roof.
    d. Check for signs of roof leaks or condensation in the attic.
    e. Check the angle of the roof soffits.

16. Which of the items listed below is not listed in the 12 QH technician's Guide as a method for determining whether the exterior door(s) is insulated (or not)?
    a. By its sound.
    b. By temperature transfer.
    c. By labeling.
    d. By thermal break.
    e. By the temperature rise method.

17. Which of the items listed below is not listed in the 12 QH technician's Guide as a method for determining a window's U-value?
    a. Use NFRC label on windows (it will display full window U-value).
    b. Use client provided documentation
    c. Look up product information in NFRC Certified Products Directory to determine U-value
    d. Consult manufacturer's literature
    e. Consult ACCA Manual S Table 3A, 3B, or 3C.

18. Which of the items listed below is not listed in the 12 QH technician's Guide as something that is required to ensure proper ventilation in a home?
    a. The minimum ventilation requirement must be determined.
    b. Verification that exhaust fans vent to the outside
    c. Verification that airflow into the home passes through a MERV 8 filter.
    d. Verification that clothes dryers vent to the outside
    e. Measurement of airflow through mechanical ventilation systems is required

19. Which of the items listed below is not listed in the 12 QH technician's Guide as something that needs to be evaluated for possible electrical energy savings?
    a. Appliances
    b. Lighting
    c. Electrical meter
    d. HVAC Systems
    e. Exhaust Systems

20. Which of the items listed below is not listed in the 12 QH technician's Guide as a requirement for the thermometer used to do the *Distribution Temperature Difference Test*?
    a. Have a temperature sensing probe at least 15" long (to better get an average temperature),
    b. Be capable of measuring sensible heat levels from 0 to 100°F (degrees Fahrenheit),
    c. Have a resolution of 0.1°F,
    d. Have an accuracy rate of $\pm$ 2.5%,
    e. Be calibrated as required by the manufacturer and have evidence of the calibration.

21. Which of the items listed below is not listed in the 12 QH technician's Guide as something that needs to be recorded for an inspection of the exhaust duct work?
    a. Record the type of ductwork.
    b. Record the R-value of duct insulation.
    c. Record obvious duct leakage
    d. Record any indications of previous duct sealing
    e. Record the values from the duct leakage test.

22. Which of the items listed below is not listed in the 12 QH technician's Guide as something that needs to be checked for an inspection of all exhaust fans?
    a. Record the type of ductwork.
    b. Location.
    c. Measured air flow.
    d. Determination of whether they are vented to the outdoors.
    e. Sone rating for sound level

23. Which of the items listed below is not listed in the 12 QH technician's Guide as something that needs to be checked for an inspection of all appliances?
    a. Age
    b. Efficiency
    c. Condition
    d. Brand
    e. Location

24. Which of the items listed below is not listed in the 12 QH technician's Guide as something that needs to be checked for an inspection of all lighting fixtures?
    a. Type of fixture
    b. Type of bulb
    c. Quantity of Fixtures
    d. Lumens provided per fixture
    e. Type of controls

25. Which of the items listed below is not listed in the 12 QH technician's Guide as something that need to be noted as a hazardous material during a durability inspection?
    a. Batteries
    b. Toxic Chemicals
    c. Pesticides
    d. LED bulbs
    e. Mercury

26. According to the 12 QH Technician's guide how much of the average utility bill is due to the HVAC system?
    a. 30%
    b. 40%
    c. 50%
    d. 60%
    e. 70%

27. According to the 12 QH Technician's guide which is not an approved method for measuring airflow across an HVAC system's heat exchanger?
    a. OEM CFM/ static pressure drop using the manufacturers table and the static pressure measurements.
    b. Traversing using a method approved by ACCA, AABC, NEBB, TABB that is in accordance with ASHRAE Standard 111 *Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.*
    c. Flow grid measurement method utilizing the grid manufacturer's directions and tables.
    d. Pressure matching method using the equipment manufacturer's tables or charts.
    e. Duct pressurization test at 25Pa & Gasketed Pan

28. Why is the Distribution Temperature Difference Test is done when the temperature outside is within 5^{o}F of the design day temperature for heating or cooling?
    a. Because discharge temperature and the return temperature are subtracted for the total difference.
    b. So it will more accurately reflect the actual load losses for duct insulation losses, low airflow, duct leakage, and long runs.
    c. The question is not a true statement, the Temperature Difference Test in the 12 QH is used to check out how well an AC system is functioning.
    d. This is a slap shot test only used when other methods are not available.
    e. This test may be used to evaluate the heating system temperature rise for airflow evaluation.

29. Which of the sets of tests listed below contains two qualitative duct leakage tests?
    a. Gasketed Pan & Blower Door Assisted Smoke Test
    b. Duct pressurization test at 25Pa & ANSI/SMACNA Air leakage Test
    c. Blower Door Assisted Smoke Test & ANSI/SMACNA Air leakage Test
    d. Duct pressurization test at 25Pa & Gasketed Pan
    e. Gasketed Pan & ANSI/SMACNA Air leakage Test

30. What tool is not ever used when doing a room pressure difference leakage test?
    a. Electronic Manometer
    b. Pitot Tube
    c. Static Pressure probe
    d. Oil Manometer
    e. Hot wire anemometer

31. Which of following instructions is not used for evaluating hot water heaters in the 12 QH?
    a. NACECA minimum required efficiency values.
    b. ENERGY STAR ratings
    c. The Technician shall make sure pipe insulation is a minimum of R-3.
    d. Record the hot water tank name plate data.
    e. None of the above

32. In the 12 QH which item listed below is not listed as evidence of plumbing leaks??
    a. Discoloration
    b. Stains
    c. Decomposing wood
    d. Lamination
    e. Oxidation

33. In the 12 QH the Technician needs to check pools and spas to make sure they have the following?
    a. Proper PH for water treatment
    b. Proper CL level in chlorine treated pools
    c. Proper water level control
    d. An ANSI listed drain cover
    e. An ASME labeled drain cover

34. Which plumbing fixture type does not need to be evaluated by the Technician when meeting the 12 QH water energy savings inspection requirements?
    a. Toilets
    b. Sinks
    c. Shower heads
    d. Aerators
    e. Faucets.

35. What is not included in the 12 QH table 4-1 that is designed for organizing the evaluation data?
    a. Comparative benchmarks
    b. Discretionary Items for cost/benefit analysis.
    c. Current measurements or values
    d. Improvement Areas
    e. Corrective Actions

36. What is not included in or entered into the CO section of 12 QH table 4-1?
    a. CO at vent piping
    b. Ambient CO level in CAZ
    c. Local Code requirements
    d. Appliance CO measured in PPM
    e. CO of undiluted flue gasses

37. What two values are required for envelope tightness evaluation in section of 12 QH table 4-1?
    a. CFM 50 and ACH 50
    b. CFM 25 and ACH 25
    c. CFM 50 and ACH 25
    d. CFM 25 and ACH 50
    e. Both of the required values are not listed above

38. are the two Temperature difference measurements that are recorded in the distribution system temperature difference section of the 12 QH table 4-1?
    a. Appliance measured TD from heat exchanger to supply grille.
    b. Appliance measured temperature from the heat exchanger inlet to the heat exchanger outlet.
    c. Appliance measured TD from the return grille to the heat exchanger inlet.
    d. A and B above
    e. A and C above

39. For duct leakage measurements that are recorded in the duct leakage testing section of the 12 QH table 4-1: which of the following is listed as a benchmark in the comparative benchmarks section?
    a. *For New Construction:* Ducts located inside the thermal envelope have no more than 10% total duct leakage (airflow in CFM: duct pressure 25 Pascal).
    b. *For New Construction:* Ducts located outside of the thermal envelope have no more than 6% total duct leakage (airflow in CFM: duct pressure 25 Pascal).
    c. *For Existing Construction:* No more than 20% total duct leakage (airflow in CFM: duct pressure 25 Pascal),
    d. *For Existing Construction:* 50% improvement on existing leakage rate or until 20% or better is achieved,
    e. All of the above

40. For Room Pressure Differentials section that of the 12 QH table 4-1: which of the following is listed as the benchmark, in the comparative benchmarks section?
    a. No more than 0.01 iwc. (3Pa) pressure difference (PD) between the area with the largest return air duct with respect to an interior room with the door closed
    b. No more than 0.012 iwc. (3Pa) pressure difference (PD) between the area with the smallest return air duct with respect to an interior room with the door closed
    c. No more than 0.012 iwc. (5Pa) pressure difference (PD) between the area with the largest return air duct with respect to an interior room with the door closed
    d. No more than 0.01 iwc. (5Pa) pressure difference (PD) between the area with the largest return air duct with respect to an interior room with the door closed
    e. None of the above

41. For the appliance and hot water heater sections that of the 12 QH table 4-1: which of the following is listed as one of the comparative benchmarks?
    a. As specified by the National Efficiency Conservation Act (NECA). (Applies to upgrades or replacements.)
    b. Appliances and Equipment efficiency as specified by ENERGY STAR.
    c. Insulate pipes to IEC 2003 §403.3. (Applies to upgrades or replacements.)
    d. Appliances and Equipment efficiency as specified by Save.Org
    e. National water conservation act (NWCA) appliance water usage tables.

42. For the moisture section in the 12 QH table 4-1: which of the following is not listed in the Current measurement or value section?
    a. Plumbing leaks
    b. Drainage issues
    c. Roof rating
    d. Exterior rating
    e. Interior rating

43. Supplementary information included in the 12 QH cost benefit analysis section does not include which item listed below?
    i. The age of the item inspected.
    ii. HVAC performance enhancements and ducting changes.
    iii. Condition or operational ability of the item inspected.
    iv. Presence of hazardous materials or improper storage of combustible materials.
    v. Performance improvements that may lead to building modification updates to meet new code requirements when changes are made (e.g., when replacing siding might also lead to a requirement for improving wall's insulation value, or changing out the furnace may require meeting a minimum outside fresh air requirement).

44. Which item listed below is not one of the considerations that need to be specifically accounted for between the Technician and the homeowner in the 12 QH cost benefit analysis section?
    a. All health and safety hazards will be addressed, and all safety hazards that required evacuation of the home will be repaired (or turned off and tagged so there is no danger present) before any other work is started.
    b. Submitted fixed-price proposals for the implementation of a building performance improvement must supersede estimates based on historical knowledge.
    c. The prioritization of building performance improvements may need to be updated in the fixed-price proposals when auditing data is used instead of the original baseline estimates that were based on historical knowledge.
    d. Company data supporting the best workmanship, best service, and lowest price available in the marketplace.
    e. Cost estimates and submitted fixed-price proposals must be based on implementing the improvement opportunities in accordance with recognized standards and procedures in §6.0 of the 12 QH.

45. Which item listed below is one of the considerations that need to be specifically accounted for between the Technician and the homeowner in the 12 QH cost benefit analysis section?
    a. All health and safety hazards will be addressed, and all safety hazards that required evacuation of the home will be repaired (or turned off and tagged so there is no danger present) before any other work is started.
    b. Submitted fixed-price proposals for the implementation of a building performance improvement must supersede estimates based on historical knowledge. The prioritization of building performance improvements may need to be updated in the fixed-price proposals when auditing data is used instead of the original baseline estimates that were based on historical knowledge.
    c. Cost estimates and submitted fixed-price proposals must be based on implementing the improvement opportunities in accordance with recognized standards and procedures in §6.0 of the 12 QH.
    d. The prioritization of building performance improvements may need to be updated in the fixed-price proposals when auditing data is used instead of the original baseline estimates that were based on historical knowledge.
    e. All of the items listed above.

46. Safety, including fossil fuel appliance and combustion Safety issues identified in the 12 QH do not include which one of the following items?
    a. High CO levels.
    b. Low CO_2 levels
    c. Fossil fuel leaks.
    d. Unlisted or defective appliances.
    e. Unvented combustion appliances used as primary heat source shall be presented as the highest priority.

47. Implemented identified envelope performance improvements 12 QH do not include the consideration of which one of the following items?
    a. Air leakage paths need to be found and sealed when they exist between attached, or drive-under garages, and the living space Existing interior or exterior moisture.
    b. All existing interior or exterior moisture issues shall be remediated prior to air sealing the building shell.
    c. Repairs and renovations to pre-1978 homes that have evidence of lead paint: must have lead mitigation plans that comply with the EPA's Renovation, Repair, and Painting (RRP) Program Rule
    d. Basement renovations must comply with the Doe's Basement renovation policy guideline (BRPG).
    e. Whenever air sealing represents 15% or more of the total building shell area, or whenever ducts outside the thermal envelope are sealed, the work scope must include pre- and post-installation blower door testing.

48. Implemented identified envelope performance improvements 12 QH includes a ventilation section. Which one of the following statements about the ventilation requirements would not be true?
    a. Air Mechanical ventilation airflow shall be measured in accordance with §5 in the Technician's Guide & Handbook for Quality Installations as outlined in ANSI/ACCA 5 QI -2015.
    b. Attic ventilation shall not be installed without first verifying the presence of an effective air barrier and thermal barrier between the attic and the living space. All existing interior or exterior moisture issues shall be remediated prior to air sealing the building shell.
    c. The Technician needs to install ventilation systems in accordance with OEM instructions. The system must also meet the local code requirements, and must be installed to meet the accepted industry practices.
    d. Where there are no code requirements for the design of outside/makeup air should meet the 2012 International Energy Code (IECC) requirements
    e. Where there are no code requirements for the design of outside/makeup air, that air should be set to comply with ASHRAE 62.1-2011 requirements

49. Documentation of type of insulating material and its R-value will be provided to the homeowners in accordance with 16 CFR 460-17 (CFR). The CFR is a law that states the installer must give the customer a contract or receipt that does not state which one of the following items for each area insulated and for each different type of insulation?
    a. Coverage Area.
    b. Thickness.
    c. U-Value.
    d. Date.
    e. Installers Signature.

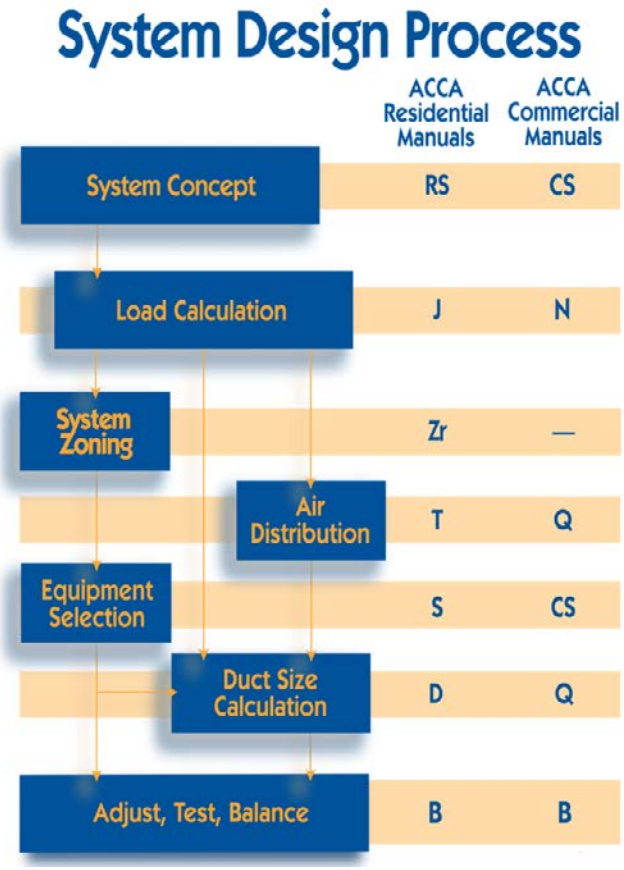
50. Implemented identified performance improvements 12 QH requires all of the following items except for one in the pool and spa section. Which one is not a requirement?
    a. Replacement HVAC systems serving indoor pools and spas shall be designed per ACCA Manual SPS 2010 *HVAC Design for Pools and Spas*.
    b. Vapor retardant covers on heated pools shall be tested and listed in accordance with ASTM F1346-91 – 2010 *Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs*. The Technician needs to check and see if existing covers have the ASTM labels, and to make sure any new cover being installed has an ASTM label
    c. All heated pools need to have a vapor-retardant pool cover that contacts the surface of the water. Covers for pools/spas heated 90^{O}F, or warmer, need to have an insulation value of at least R-12, unless 60% or more of the heat comes from a solar collector.
    d. Gas pool heaters must have a standing pilot, and all pool heaters must have a shut off switch that is separate from the control thermostat.
    e. New HVAC systems serving indoor pools and spas shall be designed per ACCA Manual SPS 2010 *HVAC Design for Pools and Spas*

OVERVIEW: *ACCA Training Offerings*

ACCA's Educational Offerings for an Evolving Marketplace

Updated 22 October 2015

As a supplier of educational programs in the HVACR industry for well over 50 years, three factors serve as driving forces within ACCA. First and foremost is to make sure ACCA educational programs and services are of the highest quality; second is to stay a step ahead of the emerging industry needs and trends so that ACCA can offer contractors what they need when they need it, and finally be cost effective in developing and delivering educational programs and services to contractors. ACCA's Standards have been widely recognized and accepted by all sectors of the HVAC industry and several have become code requirements. The chart on the right provides a snapshot view of how ACCA Manuals combine to cover the Design Process.



In advancing its training mission, ACCA avails itself to a number of approaches, from face-to-face training, to video/CD training solutions, to the online certificate program, to webinars, to ensuring its manuals/standards/guides are on the cutting edge of industry good practices, to develop educational plot forms for A) Contractors, B) Technicians, C) Consumers, D) Instructors, and E) Code Officials [see attached sheets for specifics on each].

FACE-TO-FACE TECHNICAL EDUCATION ('Classroom Setting')

(For more information, contact www.acca.org, or call 703-575-4477)

- **Residential Design For Quality Installations (RDQI):** A journeyman or higher level, three-day course covering Residential Design for Quality Installations includes: Manual J8® (Load Calculations), Manual D® (Duct Design), and the ANSI/ACCA 5-QI-2014 (HVAC Quality Installation Specification). Also included are: Manual T® (Air Distribution Basics), Manual S® (Equipment Selection), and ACCA's Duct Slide Rule, that provides the students with all of the tools needed to properly design and supervise the installation of an HVAC system to meet code as well as Energy Star® requirements.
- **Educational Program Instructor Certification (EPIC):** Residential EPIC is a master or expert level course that covers the residential design process in depth and requires the use of a Windows-based lap top computer. Material provided and covered includes the following: Manual J8® (load Calculations), Manual S® (Equipment Selection), Manual D® (Duct Design), Manual H® (Heat Pump Systems), Manual P® (Psychrometrics), Manual T® (Air Distribution Basics), Manual TT-102® Understanding the Friction Chart), and Manual 4® (Perimeter Heating and Cooling).

  Commercial EPIC parallels the residential EPIC course covering ACCA's commercial design materials: Manual CS® (Commercial Applications, Systems and Equipment), Manual N®

(Commercial Load Calculation), Manual H® (Heat Pump Systems), Manual P® (Psychrometrics), Manual T® (Air Distribution Basics), and Manual Q® (Commercial Low Pressure, Low Velocity, and Duct System Design)

- **Seminars at ACCA meetings, conferences, and councils:** ACCA's continues to evolve its seminar classroom opportunities that are made available in conjunction with various meetings and other events. These draw a large number of people where it is cost-effective to offer multiple learning modules:
  - ACCA Conference and IE3 Indoor Air EXPO.
  - Building Performance Forum (a two-day learning experience for contractors co-sponsored by ACCA and BPI).
  - National HVACR Service Managers Forum (a two-day learning experience exclusively for service managers in contracting businesses).
  - Commercial Contracting Roundtable (the leading educational and networking experience for commercial HVACR contractors).
  - Numerous sessions provided at monthly local ACCA chapter meetings.

INDIVIDUALIZED STUDY

Embracing what ACCA sees as an important part in the education of the future, ACCA has developed individualized training so it can be used when and where the user wants. Individualized study materials are available in several formats designed to meet individual needs: CDs, Videos, recorded webinars, and Manuals/Guides. ACCA's material provides high quality training and reusable training materials at an affordable price so contractors can train employees when it is convenient.

- **Quality Assurance Accreditation Programs:** ACCA now offers an online training course with testing that allow contractors to receive accreditation for the Energy Star New Homes program (QA), ACCA's Existing Homes – Residential Service & Installation (RSI), and the RSI Verifier Program.
- **Energy and Home Performance Programs:** ACCA offers online training courses with testing that allow contractors to become program members. The programs include the Quality Assured (QA) program and the Residential Service & Installation (RSI) program.
- **Webinars for ACCA Members:** ACCA provides members with access to the latest business practices and technology implementations through webinars. Webinars are seen as a hybrid methodology that allows those who want to participate to have access to very specific topics when it is more convenient for them.
- **qTech Online Training (CEU) Programs:** ACCA offers online 6 hour video QI and QH training courses with a pdf copy of the selected guide & workbook and online testing that allows a technician to receive a certificate that is recognized for CEUs by BPI, ESCO, NATE, RESNET, and RSES.

INDUSTRY TRAINING COLLABORATIONS

- **North America Technician Excellence (NATE):** ACCA is committed to NATE certification as a mark of distinction and a way for consumers and contractors to gain a true comfort level with the professionalism of HVAC technicians.
- **Instructor Workshops:** ACCA has been working with the Council of Air Conditioning and Refrigeration Educators (CARE), and to develop and disseminate the information HVACR instructors want and need.
- **Building Performance Forum:** ACCA forum for HVAC contractors and raters involved in the home performance industry held in conjunction with the Building Performance Institute, Inc. (BPI).

ACCA values collaborative partnerships with business entities and allied associations to advance the goal of quality education in a cost effective manner.

CONTRACTOR: *ACCA Training Offerings*

ACCA's Educational Offerings for an Evolving Marketplace

Updated 4 November 2015

Contractor To Contractor

For access to member benefits:
http://members.acca.org/home

- ACCA Conference
- Mixed Groups
- Code of Professional Conduct
- ACCA Blogs
  - Federal Affairs
  - State Affairs
  - Conference & Expo
  - Industry News & Opinion
  - Service Managers Forum
  - Building Performance

QA & RSI Training

Access to all contractors:
http://www.acca.org/qa/resources

- QA Contractor Elements
- Participation Requirements
- Outdoor Load Calculation Design Conditions
- QA Sample Policy Template
- ENERGY STAR Checklists
- RSI HVAC Verifiers

Free To Members Video Training

Watch: http://members.acca.org/acca/watch

1. Performance Reviews For Success
2. Stress in Service Contracting
3. 10 Easy Steps to Handling the Poor Performer

Plus, ACCA has an additional 133 additional Videos covering contracting management and employee relationship issues.

Safety Downloads

Risk Management Library:
http://www.acca.org/members/downloads

- A SIR Program – It's Just the Ticket!
- Who Are You Insuring?
- Who Pays for Errors?
- Conduct a "Safety" Interview
- Don't Risk a Lot to Save a Little
- Distracted Driving: At What Cost?
- First Impressions Work Both Ways
- Set Driving Expectations
- Workers' Compensation Fraud
- How Much Is a Good Name Worth?
- Two to Hire, Two to Fire!
- Preparing for a Flu Pandemic
- Concentrate On Safety
- Real Value or Paper Value?
  - Winter Driving Woes
  - Battling Mother Nature
  - Business Interruption
  - Add TLC to Workers' Comp
  - Back to Back Safety

Free Member Downloads

Keeping contractors up to date:
http://members.acca.org/home

- Residential HVAC Design for Quality Installation (Jack Rise Course)
- Technical Bulletins
- Customizable Brochures
- Comfor Tools (to be customized for distribution to customers)
- Q&A Section
- Forms and Templates
- ACCA Annual Report
- Hurricane Last Minute Essentials Guide
- Sample Emergency Management Plan
- Open for Business Planning Package

Contractor Focused CD's & DVDs

Training Library:
http://www.hvacessentials.com

- Contractor Soft Skills DVD
- Convert Phone Calls into More Sales DVD
- LEED, Follow or Get Out of the Way (Book and/or CD)

Forums & Annual Meeting

Live Training & Information:
http://members.acca.org/home

- ACCA Conference & IE3 Expo
- Service Manager Forum
- Building Performance Forum
- Radiant & Hydronic Forum

Free To Members Audio Training

Listen: http://members.acca.org/acca/listen/

- The Price Is Right! How To Properly Price Commercial Services
- The Next Generation of HVAC
- Private Label Products: Are They Worth It?

Plus, 30 Additional Audio Programs addressing business related issues.

Political Action Committee

Legislation Tracking, Grassroots Action Center and Federal affairs updates on the following items brings the latest information on in following areas of interest to contractors:
http://www.capwiz.com/acca/home/

- Tax Legislation
- Regional standards
- Copper & Metal Theft
- Healthcare
- Labor
- Commercial Energy Eff. Incentives
- Residential Energy Eff. Incentives
- Refrigerants
- Regional Standards
- Regulatory reform
- Small Business Capital Investment
- Transportation

Breaking News

IE3 Media: http://www.ie3media.com/

- IE3
- Insider Emails
- Special Interest Council News Letters:
  - Building Performance
  - Radiant and Hydronics

ACCA Town Hall

Town hall discussions and issues discussed.
http://www.acca.org/members/videos

Why Join ACCA?

To become part of the leading edge in the HVACR industry and grow your business. Learn what ACCA has to offer Contractors:
http://www.acca.org/join/

- Free Training
- Free Technical & Legal Support
- Free Downloads
- Connect with:
  - Customers
  - Contractors
  - Job Seekers

TECHNICIAN: *ACCA Training Offerings*

ACCA's Educational Offerings for an Evolving Marketplace

Updated 4 November 2015

Video and CD Training

ACCA on line store: **www.acca.org/store**

HVAC Essentials

- Understanding Manual J: Heat Gain & Heat Loss in the Real World
- Understanding Manual D: Airflow & Duct Design in the Real World
- Understanding Section 608: refrigerant Handling in the Real World
- Understanding Manual N: Commercial Load Calculation in the Real World
- Understanding Quality Installation
- Understanding Electricity
- Understanding Manual Q: Low Pressure, Low Velocity Duct Design in the Real World
- Understanding Manual Zr
- HVAC Essentials Understanding 608
- Tips for Residential HVAC Installation CD
- Control System Basics for HVAC Technicians CD
- Refrigeration and Air Conditioning 7th Edition CD set

Nate Training CDs

- Mastering Core Service CD
- Mastering Heat Pump Service CD
- Mastering Core Installation CD
- Mastering Air Conditioning Inst. CD
- NATE Air Conditioning and Heat Pumps CD
- NATE Air Distribution CD
- NATE Gas and Oil Heating CD
- NATE Hydronics CD

Mobile App

https://www.calcunow.com

Duct Wheel for iPad

Qtech Online Course CEU's

Available at: **http://www.acca.org**

- Quality Installation
- NATE Essentials
- Understanding Section 608
- Technician's Guide & Workbook for Quality installations
- Technician's Guide & Workbook for Home Performance Improvements

Training Books and Materials

ACCA on line store: **www.acca.org/store**

- Study Guide for EPA Section 608 (English, Spanish, and Italian)
- Training Manual for EPA Section 608 (English, and Spanish)
- Section 608 Refresher Manual (English, and Spanish)
- EPA 609 Certification and Training Manual
- Calculator/Pocket Card Set
- Careers In the HVAC Industry
- Control System Basics for HVAC Technicians
- Customer Service Handbook For HVACR Technicians
- Airflow In Ducts
- Blueprints and Plans For HVAC
- Commercial System Quick Reference (CSQR)

- Digital Controls for HVAC Technicians
- Duct Calculation Slide Rule
- Energy Efficiency Manual
- Fans and V-Belt Drives
- Geothermal HVAC: Green Heating and Cooling
- Good HVAC Practices for Residential and Commercial Buildings (ACCA)
- Green Guide
- HVAC Equations, Data, and Rules of thumb, 2nd Edition
- HVAC Licensing Study Guide
- HVAC Spanish
- Math for the Technician
- Refrigeration and Air Conditioning 7th
- Modern Refrigeration and Air Conditioning, 19th Edition
- Refrigeration for HVAC Technicians How Refrigeration Works
- Troubleshooting HVAC-R Equipment
- Building Science Principles Reference Guide
- Geothermal HP Training Manual
- Tech to Tech
- How Come?
- Modern Hydronic Heating
- Pumping Away, and other really cool piping options for hydronic system
- Residential Hydronic Heating, Installation and Design
- The Lost Art of Steam Heating
- Refrigeration for HVAC Technicians
- Bob's House
- Duct Diagnostics and Repair
- HVAC Installation Procedures Handbook
- HVAC Maintenance Procedures Handbook
- HVAC Service Procedures Handbook
- Layout for Duct Fittings
- Manual 4 Inst. Techniques for Perimeter heating and Cooling
- Tips for Residential HVAC Inst.
- HVAC Servicing Procedures Handbook
- HVAC Installation Procedures Handbook
- HVAC Maintenance Procedures Handbook
- Installing Residential Forced Air Furnaces
- Layout For Duct Fittings

NATE Training Manuals

ACCA on line store: **www.acca.org/store**

- NATE A/C & Heat Pumps Manual
- NATE Air Distribution
- NATE Essentials Manual
- NATE Gas and Oil Heating
- NATE Hydronics
- Mastering Air Distribution Service
- Mastering Hydronics – Gas Service
- Mastering Gas Furnace installation
- Mastering Gas Furnace Service
- NATE Core Essentials
- NATE Air Conditioning and Heat Pumps
- NATE Air Distribution
- NATE Gas and Oil Heating
- NATE Hydronics

Course Related Text and Work Books

ACCA online store: **www.acca.org/store**

- Technician's Guide & Workbook for QI
- Manual B Balancing and Testing Air and Hydronic Systems
- Manual H Heat Pump Systems and Applications
- Controls – Level 1 Fundamentals
- Life Cycle Costing for HVAC SYS.
- Principles of Mechanical Refrigeration

Consumer: *ACCA Training Offerings*

ACCA's Educational Offerings for an Evolving Marketplace

Updated 4 November, 2015

ACCA develops innovative consumer education materials for light commercial and residential customers. Tools are designed to help consumers locate and evaluate HVACR contractors. They help consumers recognize contractors who have differentiated themselves by offering standards-based quality installation services. Extensive web information on how to:

1. Find a contractor
2. Select a contractor
3. What questions to ask a contractor
4. What the QI is
5. Contractor proposal evaluation checklists
6. Commonly asked questions and answers
7. Texts that explain basic HVAC design and installation principles in non-technical language

Consumer Videos

Animated Videos:

- *Comfort Health Safety* **http://www.acca.org/homes/**
- *When Is The Best Time To Ask These Questions?* **http://www.acca.org/homes/**

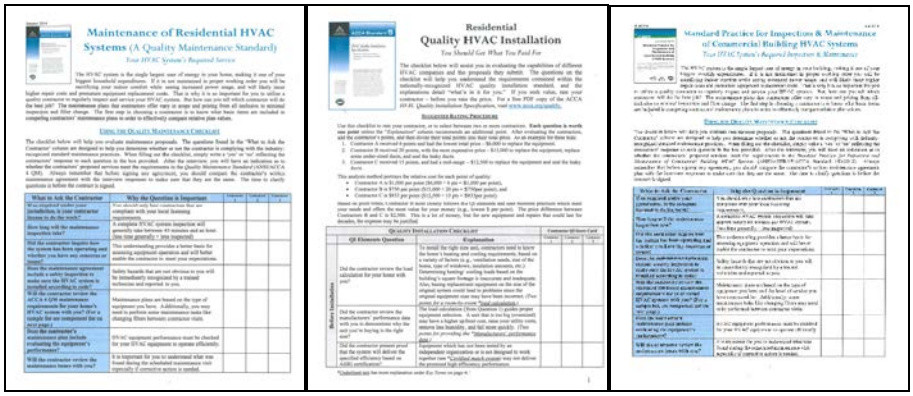
Videos:

- *A Guide For Home Heating and Air Conditioning* **http://www.acca.org/homes/**
- *A Guide For Business Heating AND Air Conditioning Services* **http://www.acca.org/buildings/**

Consumer Checklists

Quality Installation Checklist (*English & Spanish)* http://www.acca.org/homes/

Quality Maintenance Checklist (*Residential and Commercial Versions)* http://www.acca.org/homes/



Frequently Asked Questions & The Right Questions To Ask

Found at: **http://www.acca.org/homes/**

- **Are your technicians NATE certified?** NATE certification is the industry's standard for technician excellence. You should never accept anything less.
- **Do you offer continuing education to your employees?** This industry changes rapidly. Ask the contractor to describe their training program.
- **Can you provide local references?** Get the names of neighbors who have used the company's services, and then follow up with them.
- **Do you offer a service agreement plan?** Well-maintained equipment runs more efficiently and lasts longer.
- **Are you properly licensed?** Unfortunately, every state, city, or county could have different contractor licensing rules. Ask for proof!
- **Do you follow the industry standards?** Make sure your contractor knows what "Manual J" and "Quality Installation" are, just for a start. Scroll down on this page to find out what these standards are and why they are important to you!

Texts Designed For End Users

Found at: http://www.acca.org/store

Bob's House, a case study for understanding the residential HVAC design process and Manual RS-Comfort, Air Quality, & Efficiency by Design are designed to be used by those who want a basic understanding of HVAC design practices.

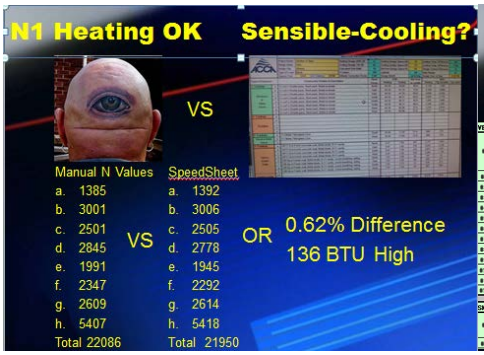
INSTRUCTOR: *ACCA Training Offerings*

ACCA's Educational Offerings for an Evolving Marketplace

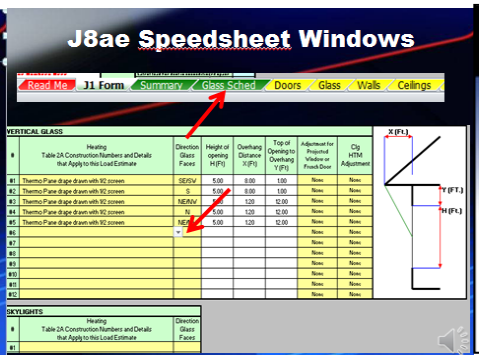
Updated 4 November 2015

ACCA participates in HVACR Instructor Work Shops and develops education materials for light commercial and residential training. ACCA helps instructors provide the training that contractors need today's technicians to have. The net result of using ACCA's HVACR training materials is to provide students with market place skills based on the HVACR industry's good practices and procedures.

Free Downloads From The ACCA Website



Manual N Speedsheet video



Manual Jae Speedsheet video

QI Standards

Speedsheet Videos available at: www.acca.org/speedsheet

Other Supporting Resource Materials Available as Free Downloads:

Standards available at: www.acca.org/standards/quality :

- HVAC Quality Installation Specification (English)
- HVAC Quality Installation Specification (Spanish)
- Home Performance Evaluation & Improvement
- HVAC Quality Installation Protocols
- Quality Maintenance of Residential HVAC Systems
- HVAC System Cleanliness & Restoration

ACCA Instructor's Lesson Plans

ACCA has lesson plans for Instructors available on the educator's page on the website. Lesson plans are available for:

- EDU 1-9/2015 Instructor's Lesson Plan for Manuals J, D, and S.
- EDU 2-9/2015 Instructor's Lesson Plan for *Technician's Guide & Workbook for Quality Installations*
- EDU 3-9/2015 Instructor's Lesson Plan for *Technician's Guide & Workbook for Home Performance Improvement*

North American Technical Excellence Instructor's CDs

NATE CDs available at: www.acca.org/store

- NATE A/C & Heat Pumps Manual
- NATE Air Distribution
- NATE Essentials Manual
- NATE Gas and Oil Heating
- NATE Hydronics

Instructor Power Point Presentations on CD's

Cd's developed for Instructor Use In the Classroom
Power points available at: www.acca.org/store

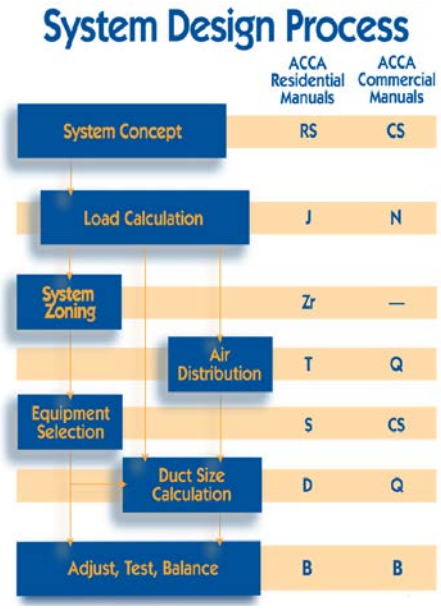
- Controls – Level 1 Fundamentals
- Life Cycle Costing for HVAC Systems
- Principles of Mechanical Refrigeration
- Simutech –Simuair- Air Conditioning Simulator Training System
- Water Piping and Heat Pumps- Instructor
- Residential Design Instructor Power point
- Commercial design Instructor Power Point
- 608 Certification Program (Refrigerant Transition and recovery Certification Instructor Manual includes lesson plans and *overhead* masters) Procter Sign Up: http://www.acca.org/for-contractors/
- Understanding Section 608

ACCA's Educational Program Instructor Certification (EPIC)

ACCA's Educational Program Instructor Certification (EPIC) is a 4 day course designed for those instructors with a master's level experience in HVAC systems. Participants must supply their own windows-based computer system. The following Manuals and materials are provided by ACCA:

Residential EPIC available at:
www.acca.org/education/epic/

- Manual D (Duct Design)
- Manual J (Load Calculation)
- Manual H (Heat Pump Systems)
- Manual P (Psychrometrics)
- Manual S (Equipment Selection)
- Manual T (Air Distribution Basics)
- Manual 4 (Perimeter Heating & Cooling)
- Manual TT-102 (Understanding the Friction Chart)



Apprenticeship Program

ACCA developed a training series of Manuals designed to teach what contractors need entry level technicians to know. Designed to be a two or four year program, the books are available with an Instructor's Guide CD. The following Courses are designed to build upon one another:

- HVACR 101 Book and Instructor's Guide on CD
- HVACR 201 Book and Instructor's Guide on CD
- HVACR 301 Book and Instructor's Guide on CD
- HVACR 401 Book and Instructor's Guide on CD

Available at: www.acca.org/store

Instructor's Training Certification Manual

ACCA has a Geothermal Heat Pump Training Certification Instructor Manual available for those who wish to teach the basics of Geothermal Heat Pump design and installations. Available at: www.acca.org/store

CODE OFFICIALS: *ACCA Training & Resources*

ACCA's Educational Offerings for an Evolving Marketplace

Updated 4 November, 2015

ACCA develops education materials for light commercial and residential Code Officials. Tools are designed to help them understand the basic requirements for HVACR designs. Additionally, ACCA is available as a trusted unbiased HVACR industry expert to answer Code Official's questions one on one when they call in.

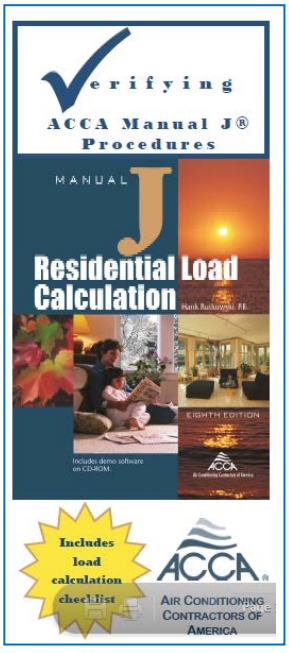
Building Code Requirements for ACCA Manuals

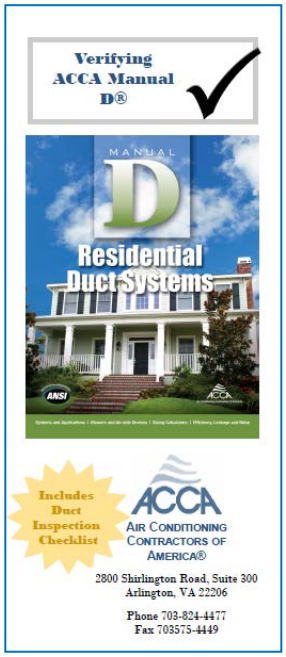
The following national codes make reference to specific ACCA procedures in order to comply. Jurisdictions that adopt these codes require the use of ACCA procedures as outlined in our technical manuals.

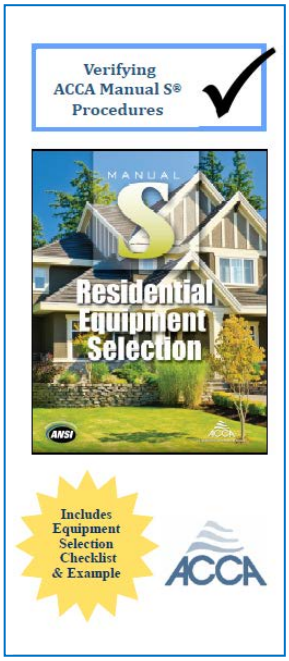
- The **IAPMO's Uniform Mechanical Code** requires the use of Manual J (Residential Load Calculation), Manual N (Commercial Load Calculation), Manual D (Residential Duct Systems), and Manual Q (Commercial Duct Systems).
- The **ICC's International Mechanical Code** requires the use of Manual D (Residential Duct Systems).
- The **ICC's International Residential Code** requires the use of Manual J (Residential Load Calculation) and Manual S (Residential Equipment Selection), Manual D (Residential Duct Systems).
- The **ICC's International Energy Conservation Code** requires the use of Manual J (Residential Load Calculation) and Manual S (Residential Equipment Selection).

Codes Verification Brochure's for Manuals J, D, and S

Available at: http://www.acca.org/standards/codes/

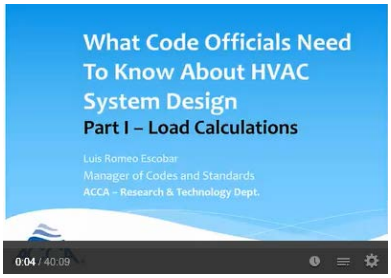


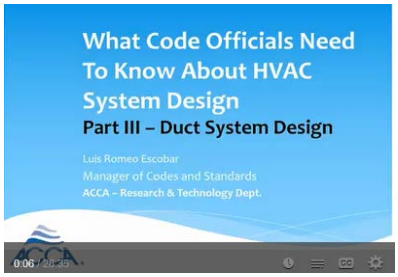




Videos for Code Officials

Available at: https://www.acca.org/standards/codes/





Residential System Design Review Forms

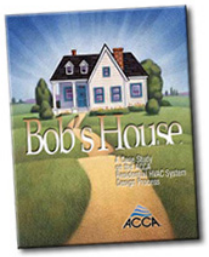
Available at: https://www.acca.org/standards/codes/

Illustrated examples and review form downloads are made available for free to Code Officials

- ICC Residential System Review Form
- UMC Residential System Review Form
- Understanding & Using the System Review Form

Bob's House

A Manual designed to walk Code Officials through the whole design process on a typical home.



Guidance on Approved Software Meeting Code Requirements

A brochure designed to provide guidance on approved software providers
http://www.acca.org/standards/software/