

Comments of the Air Conditioning Contractors of America to the California Energy Commission:
Comprehensive Energy Efficiency Program for Existing Buildings – Scoping Report

The Air Conditioning Contractors of America (ACCA) submits these comments on the California Energy Commission Comprehensive Energy Efficiency Program for Existing Buildings – Scoping Report. As the only nationwide association representing the technical, educational, and policy interests of small and large businesses that design, install, and maintain indoor environmental systems, ACCA is ready to work with the California Energy Commission on its plans to improve the energy efficiency of existing buildings so that the state can meet its goals to reduce energy use.

Defining Quality Standards for Energy Efficiency Work

For 50 years, ACCA has provided technical guidance so that industry practitioners can achieve effective HVAC designs for residential and commercial applications: load calculations (ANSI/ACCA 2 Manual J), duct sizing (ANSI/ACCA 1 Manual D), equipment selection (ANSI/ACCA 3 Manual S), and other manuals and guides. These heating and cooling system standards have been the industry cornerstone for decades. However, it was recognized that subpar installation and maintenance practices have been depriving building owners of comfort. Additionally, such field practices may create an unhealthy or unsafe environment for occupants.

Starting in the early 2000's, ACCA worked with a growing coalition of interested stakeholders to address the problems associated with subpar field practices in equipment installation / service as well as whole home performance improvement. ACCA spearheaded the development of consensus standards that establish the minimum core capabilities and competencies required of indoor environment and energy efficiency professionals. These standards are aimed at fulfilling the needs of homeowners and occupants for whole-house performance: comfortable, healthy, safe, energy-efficient indoor environments. ACCA makes its Quality Standards available to interested parties as free PDF downloads from www.acca.org/quality. Printed copies are also available for purchase through the ACCA bookstore.

Quality Homes (QH)

The **ANSI/ACCA 12 QH – 2011 Standard (*Existing Home Evaluation and Performance Improvement*)** establishes the minimum criteria by which deficiencies in existing residential buildings are identified, improvement opportunities are assessed, scopes of work are finalized, work is performed, post-work verification is undertaken, and improvement objectives are met. Supporting Appendices detail building auditing procedures, supplemental tasks that enhance the audit, and identify related industry resources.

The standard applies to existing site-constructed or manufactured one- and two-family dwellings and townhouses not more than three stories above grade in height. In ensuring safe and healthy operation, ACCA 12 QH invokes pertinent installation requirements (see ACCA 5 QI and ACCA 9 QIvp), maintenance requirements (see ACCA 4 QM), identifies and recommends corrections to shell / envelope difficulties, and places health and safety as preeminent.

Quality Installation Specification (QI)

The **ANSI/ACCA 5 QI – 2010 Standard (*HVAC Quality Installation Specification*)** incorporates OEM instructions, applicable building and energy codes, documentation of system commissioning elements, and customer education. For each QI attribute, specific metrics, tolerances, approved test/measurement procedures, and acceptable documentation are identified for ensuring that unitary HVAC equipment is properly designed and installed for residential and light commercial applications:

Design Aspects:

- Ventilation
- Building heat gain/loss load calculations
- Proper equipment capacity selection

- Geothermal Ground Loop Design
- Matched systems (splits only)

Distribution Aspects:

- Duct leakage
- Airflow balance
- Hydronic balance

Equipment Installation Aspects:

- Airflow across the indoor coil
- Water flow through heat exchangers
- Refrigerant charge
- Electrical requirements
- On-rate for gas-fired equipment
- Combustion venting system
- System controls

System Documentation & Owner Education Aspects:

- Proper system documentation to the owner
- Owner/operator education

Quality Installation Verification Protocols (QIvp)

The **ANSI/ACCA 9 QIvp – 2011 Standard (*Quality Installation Verification Protocols*)** establishes the requirements to objectively verify that an HVAC system meets the QI Specification. The verification protocols, along with the QI Specification, provide the framework for program administrators (e.g., trade associations, utilities, OEMs, etc.) to implement a verification program with appropriate field verifications. The document details the requirements, roles, and obligations for participants in an organized effort to ensure that HVAC installations comply with the underlying QI Standard:

Quality Maintenance (QM)

Two separate, but similarly-constructed, standards detail the requirements for quality maintenance for HVAC systems in the installed base:

Residential: The **ANSI/ACCA 4 QM – 2007 Standard (*Maintenance of Residential HVAC Systems*)** establishes the minimum inspection requirements for the maintenance of HVAC equipment found in one- and two-family dwellings of three stories or less. It provides checklists for the inspection of typical residential HVAC systems to meet maintenance requirements. These equipment checklists are divided by equipment type and detail minimum visual inspections, performance tests, and measurements. The recommended corrective actions provide adjustments and component cleaning that should return the equipment to good working order.

Commercial: The **ANSI/ACCA/ASHRAE 180 – 2012 Standard (*Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems*)** establishes the minimum HVAC inspection and maintenance requirements that preserve a system’s ability to achieve acceptable thermal comfort, energy efficiency, and indoor air quality in commercial buildings.

Conducting regularly scheduled inspections, maintenance, and cleaning of HVAC systems prolongs equipment efficiency, promotes healthy clean air, supports lower utility costs, guards against unexpected failures, corrects unsafe operating conditions, and prolongs equipment life. Occupants and the environment benefit.

Quality Restoration (QR)

The **ANSI/ACCA 6 QR – 2007 Standard (*Restoring the Cleanliness of HVAC Systems*)** recognizes that a lack of routine maintenance or catastrophic natural disaster such as flooding may cause excessive soiling and air-side fouling of the HVAC system. In such cases, the HVAC system will require restorative activities beyond those performed in normal

HVAC mechanical maintenance and servicing. This standard details procedures to significantly improve the cleanliness of an HVAC system and return it to a serviceable condition, although not necessarily an “as new” condition.

Exhibit A: Letter of Support from EnergyStar™ Quality Installation Program
Manager



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
October 26, 2009

OFFICE OF AIR AND RADIATION

Climate Protection Partnership Division
U.S. EPA 6202J
Washington, DC 20460

IECC Technical Committee:

ENERGY STAR[®] is a voluntary partnership program that promotes energy efficiency in products, homes, and buildings in an effort to reduce carbon dioxide emissions. When earned, the ENERGY STAR label signifies superior energy efficiency over standard performance. The ENERGY STAR program also strives to improve energy performance in buildings and existing homes that may never achieve the label, but can still realize considerable energy savings. The program is managed by the U.S. Environmental Protection Agency (EPA).

EPA has been labeling high efficiency heating and cooling equipment since 1995. Unfortunately, studies show that more than half of all air conditioners in U.S. homes do not perform to their rated efficiency as a result of poor installation practices¹. Improper installation of even high efficiency equipment can reduce performance by as much as 30 percent. This affects not only the homeowner's utility bills, but can also result in a variety of comfort problems, including insufficient dehumidification, and poor air distribution.

To address this problem, ENERGY STAR has developed a strategy for encouraging proper installation of residential heating, ventilation and air conditioning (HVAC) systems called the ENERGY STAR HVAC Quality Installation (QI) Program. This program helps public utilities, state energy offices and other stakeholders go beyond high efficiency product incentives to deliver additional KW and kWh savings by improving installation procedures. The program defines a quality installation using the Air Conditioning Contractors of America's (ACCA), ANSI recognized, HVAC Quality Installation Standard. EPA uses the Standard because it sets performance tolerances and establishes the minimum requirements for system design, equipment and duct installation. It also outlines minimum documentation requirements for demonstrating compliance, allowing for system verification and better quality assurance.

EPA is also investigating the use of the ACCA QI Standard as a requirement for the ENERGY STAR New Homes program and for its retrofit program, Home Performance with ENERGY STAR.

Regards,

A handwritten signature in blue ink that reads "Ted Leopkey".

Ted Leopkey
ENERGY STAR HVAC QI National Program Manager

1. Source: C. Neme, J. Proctor, S. Nadel, *National Energy Savings Potential from Addressing Residential HVAC Installation Problems*, 1999

Exhibit B: EnergyStar™ for Qualified New Homes Quality Installation Checklist

Home Address: _____		City: _____		State: _____	
1. Whole-Building Mechanical Ventilation Design²					
1.1	Ventilation system designed to meet ASHRAE 62.2-2007 requirements ³	<input type="checkbox"/> Contractor Approved			
1.2	Ventilation system does not utilize an intake duct to the return side of the HVAC system unless coupled with a motorized damper and control system	<input type="checkbox"/> Contractor Approved			
1.3	Documentation is attached with ventilation system type, location and design rate	<input type="checkbox"/> Contractor Approved			
1.4	If present, continuously-operating ventilation and exhaust fans designed to operate during all occupiable hours	<input type="checkbox"/> Contractor Approved	<input type="checkbox"/> N/A		
1.5	If present, intermittently-operating whole-house ventilation system designed to automatically operate at least once per day and at least 10% of every 24 hours	<input type="checkbox"/> Contractor Approved	<input type="checkbox"/> N/A		
2. Heating & Cooling System Design^{3,4} - The following design parameters shall be used in the design calculations:					
A. Outdoor design temps. comply with procedure being used ⁵		D. Insulation levels and window U-values/SHGC's match rated home			
B. Indoor temp. setpoints = 70°F for heating; 75°F for cooling		E. Airflow accounts for MERV 6 air filter			
C. Infiltration rate = "Tight", or equivalent rate		F. ASHRAE 62.2 ventilation load accounted for			
2.1	Heat Loss / Gain Method:	<input type="checkbox"/> Manual J v8	<input type="checkbox"/> ASHRAE 2005	<input type="checkbox"/> Other: _____	
2.2	Duct Design Method:	<input type="checkbox"/> Manual D	<input type="checkbox"/> Other: _____		
2.3	Equipment Selection Method:	<input type="checkbox"/> Manual S	<input type="checkbox"/> OEM Recommended	<input type="checkbox"/> Other: _____	
2.4	Outdoor Design Temperatures Used:	1%: _____ °F	99%: _____ °F		
2.5	Design Latent Heat Gain:	_____ BTUh			
2.6	Design Sensible Heat Gain:	_____ BTUh			
2.7	Design Total Heat Gain:	_____ BTUh			
2.8	Design Sensible Heat Ratio (SHR):	_____ (Value 2.6 ÷ Value 2.7)			
2.9	Design Total Heat Loss:	_____ BTUh			
2.10	Design Airflow:	_____ CFM			
2.11	Design Duct Static Pressure:	_____ IWC			
2.12	Copy of load calculations attached?	<input type="checkbox"/> Contractor Approved			
3. Selected Cooling Equipment, If Cooling Equipment to be Installed					
3.1	Condenser Manufacturer & Model:	_____			
3.2	Condenser Serial #:	_____			
3.3	Evaporator Manufacturer & Model:	_____			
3.4	Evaporator Serial #:	_____			
3.5	AHRI Reference #: ⁶	<input type="checkbox"/> N/A			
3.6	Listed Efficiency:	EER: _____	SEER: _____		
3.7	Metering Device Type:	<input type="checkbox"/> TXV	<input type="checkbox"/> Fixed orifice	<input type="checkbox"/> Other: _____	
3.8	Refrigerant Type:	<input type="checkbox"/> R-22	<input type="checkbox"/> R-410a	<input type="checkbox"/> Other: _____	
3.9	Fan Speed Type: ⁷	<input type="checkbox"/> Fixed	<input type="checkbox"/> Variable (ECM/ICM)	<input type="checkbox"/> Other: _____	
3.10	Selected Latent Capacity at Design Cond.:	_____ BTUh			
3.11	Selected Sensible Capacity at Design Cond.:	_____ BTUh			
3.12	Selected Total Capacity at Design Cond.:	_____ BTUh			
3.13	Selected Sensible Heat Ratio (SHR):	_____ (Value 3.11 ÷ Value 3.12)			
3.14	Selected SHR (Value 3.13) < Design SHR (Value 2.8)	<input type="checkbox"/> Contractor Approved <input type="checkbox"/> No			
3.15	If No, ENERGY STAR qualified dehumidifier installed?	<input type="checkbox"/> Contractor Approved <input type="checkbox"/> N/A			
3.16	Capacity (Value 3.12) is 95-115% of Design Heat Gain (Value 2.7) or next nom. size Or for Heat Pumps in Climate Zones 4-8, 95-125% or next nominal size	<input type="checkbox"/> Contractor Approved <input type="checkbox"/> N/A			
3.17	AHRI Certificate Attached? ⁸	<input type="checkbox"/> Contractor Approved			
4. Selected Heat Pump Equipment, If Heatpump to be Installed					
4.1	AHRI Listed Efficiency:	_____ HSPF			
4.2	Performance at 17°F:	Capacity: _____	BTUh	Efficiency: _____	COP
4.3	Performance at 47°F:	Capacity: _____	BTUh	Efficiency: _____	COP
5. Selected Furnace, If Furnace to be Installed					
5.1	Furnace Manufacturer & Model:	_____			
5.2	Furnace Serial #:	_____			
5.3	Listed Efficiency:	_____ AFUE			
5.4	Selected Gross Capacity:	_____ BTUh			
5.5	Gross capacity (Value 5.4) is 100-140% of design heat loss (Value 2.9) or next nom. size	<input type="checkbox"/> Contractor Approved			



ENERGY STAR Qualified Homes HVAC System Quality Installation Contractor Notes

1. The HVAC System Quality Installation Contractor Checklist is designed to align with the requirements of ASHRAE 62.2-2007 and published addenda and ANSI / ACCA's 5 QI-2007 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, or HVAC problems; for instance those caused by a lack of maintenance by the occupants. Therefore, this checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

This checklist applies to ventilation systems, split air conditioners, unitary air conditioners, air-source/water-source heat pumps up to 65,000 Btu/h and furnaces up to 225,000 Btu/h. All other equipment is exempt.

This checklist shall be provided by the Rater to the HVAC contractor who shall complete one checklist for each system. Upon completion, the HVAC contractor shall return the checklist(s) to the Rater.

This checklist with supporting documents may also be used to demonstrate compliance with Indoor airPLUS specifications 4.1, 4.2, 4.5, 4.6, and 7.1.

Exhibit C: Prerequisite in LEED For Homes Rating System (25 May 2010 draft – pending Public Comment)

EA PREREQUISITE 1 PERFORMANCE OF ENERGY STAR FOR HOMES

Intent

Improve the overall energy performance of a home to lower the building's greenhouse gas emissions.

Requirements

SINGLE FAMILY & MULTI-FAMILY LOWRISE

Option 1: Performance Pathway

Meet all of the following requirements:

1. Meet the performance requirements of ENERGY STAR for Homes version 3, including all of the following:
 - Successful completion of the thermal enclosure system rater checklist, **the HVAC system quality installation rater and contractor checklists**, and the water management system builder and rater checklists:
 - Achieve a HERS Index below the ENERGY STAR for Homes version 3 HERS Index Target
2. At least one of the following appliances must be ENERGY STAR qualified and installed in each dwelling unit:
 - Refrigerator
 - Dishwasher
 - Clothes Washer

Note: For buildings that do not have in-unit kitchens or laundry rooms, projects must install ENERGY STAR qualified appliances for all of their refrigerators, dishwashers, or clothes washers in their central kitchen or laundry room.

OR

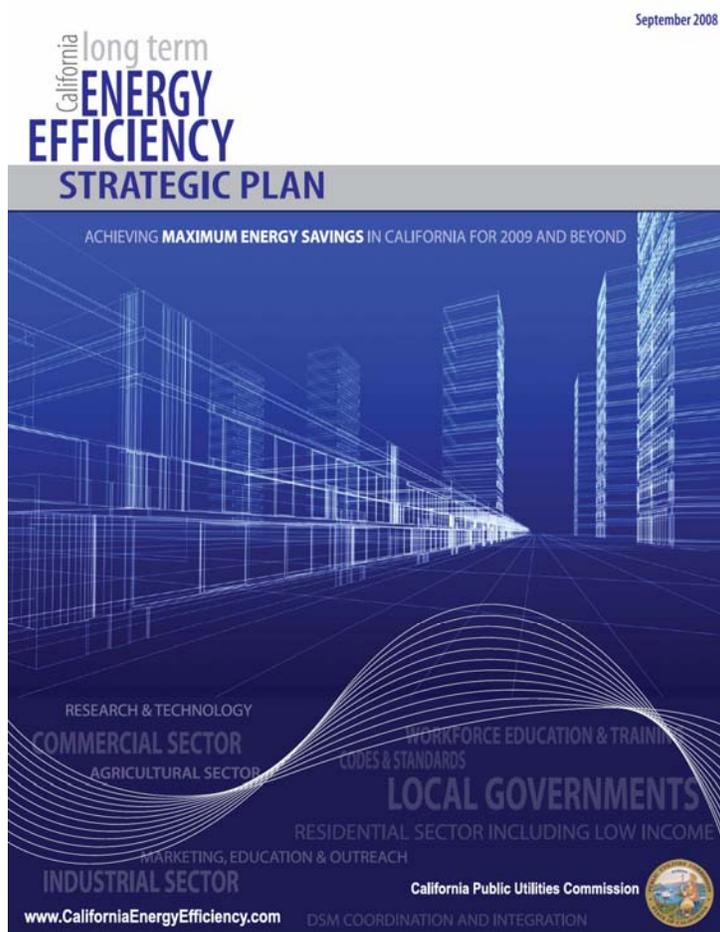
Option 2: Prescriptive Pathway

Meet all of the following requirements:

1. Meet the prescriptive requirements of ENERGY STAR for Homes version 3, including all of the following:

- Successful completion of the thermal enclosure system rater checklist, **the HVAC system quality installation rater and contractor checklists**, and the water management system builder and rater checklists;
- Meet the requirements of the ENERGY STAR for Homes version 3 Prescriptive Pathway, which includes meeting or exceeding all components of the ENERGY STAR Reference Design.

Exhibit D: Implementation Plan and Timeline from California Long Term Energy Efficiency Strategic Plan



From page 61

Goal 1: Improve Code Compliance

Implementation Plan and Timeline				
Strategies	Non-CPUC Partners	Near Term 2009 – 2011	Mid Term 2012 – 2015	Long Term 2016 – 2020
1-1: Develop streamlined local government HVAC permitting systems, including on-line HVAC replacement permitting.	Local Governments CALBO Utilities Distributors Contractors	<ul style="list-style-type: none"> Convene an industry/local government stakeholder group; develop proposed new system; pilot test with local governments. 	<ul style="list-style-type: none"> Revise pilots and expand to other cities; develop framework for statewide program. 	<ul style="list-style-type: none"> Expand statewide.
1-2: Streamline process for obtaining and overseeing contractor business licenses.	Local Governments CALBO Calif. Contractor State License Board	<ul style="list-style-type: none"> Pilot test streamlined process with local building departments. Explore possible common business licenses for multiple jurisdictions. 	<ul style="list-style-type: none"> Revise pilot and expand pilot testing to other cities; develop framework for statewide program. 	<ul style="list-style-type: none"> Expand statewide.
1-3: Replace Title 24's current optional quality control requirements with mandatory requirements (ACC/AANSI QI/QM specification).	Energy Commission ACCA/ANSI Utilities Contractors	<ul style="list-style-type: none"> Adopt ANSI standards into Title 24; integrate into existing utility program designs. 	<ul style="list-style-type: none"> Explore steadily higher QI/QM standards as baseline becomes commonplace. 	<ul style="list-style-type: none"> Ongoing
1-4: Develop amendments to Title 24 to address...

Exhibit E: Extract from an Equipment Manufacturer’s 2010 Sales Plan, Dealer Responsibilities



Sales Plan

TITLE:

Program
Addendum 2 – Performance Guarantee

DATE: **January 1, 2010** NO: **SP1029.2**

DEPARTMENT: Channel Marketing

FILE NO: 2.1.09

I. EFFECTIVE PERIOD:

January 1, 2010 through December 31, 2010

II. PURPOSE: Heating and air conditioning products must be applied and installed properly in order to perform as designed by the manufacturer. In essence, the independent dealer is completing the manufacturing process when they install equipment in their customer's home. The Commissioning Checklist (Exhibit A) described in this sales plan is in fact the final quality control test for the system. The following process is designed to provide the consumer with an additional level of confidence that the system and installing dealer will address their comfort needs and deliver the factory rated performance of the HVAC system. This sales plan addendum will detail the elements of **100% Performance Guarantee** offered by independent dealers to homeowners purchasing new complete system(s) for their home.

III. ELIGIBLE PARTICIPANTS:

2010 independent dealers (referred to as "dealers" throughout this sales plan)

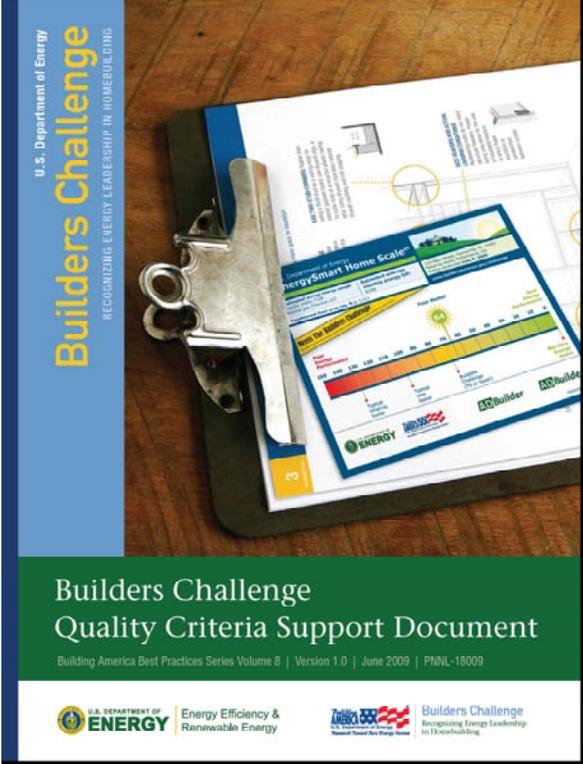
B. [REDACTED] Dealer Responsibilities

- The dealer must perform a heat gain / heat loss calculation for every system they install and be able to provide evidence that the selected equipment will satisfy the house sensible and latent load requirement at outdoor design temperatures.
- The dealer must also inspect and evaluate the existing ductwork and discuss any deficiencies that could cause comfort issues with the homeowner and **note them on the proposal.**

- After the [REDACTED] system has been installed, the dealer **must complete the designated commissioning check list**, which is based on the HVAC Quality Installation Specification (ANSI / ACCA Standard 5-2007) (Exhibit C) in either the heating or cooling mode based on the ambient conditions at the time of installation.

- The checklist can be completed in one of two ways
 - Electronically with the performance Excel spreadsheet

Exhibit F: Extract from Department of Energy Builders Challenge Program



Space-Conditioning System Installation

BUILDERS CHALLENGE QUALITY CRITERIA	BUILDER DOCUMENTATION & VERIFICATION REQUIREMENTS	THIRD-PARTY VERIFICATION REQUIREMENTS
<p>8. Space-Conditioning System Installation – Recommended: Space-conditioning system installation meets ACCA Quality Installation Specification.</p>		

The Air Conditioning Contractors of America's Quality Installation Specification is available at www.acca.org/quality/. This ANSI-approved standard provides precise steps for a quality HVAC installation. According to ACCA, proper installation includes correct selection of equipment and controls and following all the steps for correct installation. In this specification, five core areas are characterized: equipment design, equipment installation, duct distribution, system documentation, and owner education.



Figure 8.1. Space-conditioning systems should meet the ACCA Quality Installation Specification

Want to Learn More?

Designing and Building Interior Duct Systems, FSEC-PF-365-01. Available from the Florida Solar Energy Center at http://securedb.fsec.ucl.edu/pub/pub_show_detail?y_pub_id=4013

Better Duct Systems for Home Heating and Cooling, NREL/BR-550-30506; DOE/GO-102004-1606. Available from Building America at www.buildingamerica.gov

Thermal Energy Distribution Website at <http://ducts.lbl.gov>

Related Standards & Procedures

Air Conditioning Contractors of America, 2007. *ACCA Standard 5, HVAC Quality Installation Specification*, ANSI/ACCA 5 DI-2007. Air Conditioning Contractors of America, 2800 Shirlington Road, Suite 300, Arlington, Virginia. Available at www.acca.org

Building America Best Practices

The U.S. Department of Energy has produced a series of *builders guides* that provide instructions for construction "best practices" that can help builders achieve high-performance homes. These guides can be found at www.eere.energy.gov/buildings/building_america/

As you may be aware, ACCA's Quality Assured (QA) program is an accreditation program for professional HVAC contracting businesses. QA participants satisfy the requirements for the EPA ENERGY STAR Qualified New Homes Program (Version 3).

The QA Program relies upon three elements to promote quality HVAC installations. First, QA participants have written policies and procedures as identified in the ACCA 5 QI Standard to effect quality on a consistent basis in the field. Second, QA participants complete a detailed HVAC system installation checklist as required by the ENERGY STAR Qualified New Homes Program (Version 3). Finally, qualified 3rd party raters validate specific elements of the installation for compliance to the ENERGY STAR Qualified New Homes Program (Version 3) requirements.

Existing Homes Evaluation and Performance Improvement

Building on the successful implementation of the Energy Star New Homes Accreditation program, in the first quarter of 2013 ACCA will be expanding its Quality Assured (QA) Contractor Accreditation program to include the existing home market.

The principal elements will be that HVAC contractors are vetted, system will be installed are per the ANSI/ACCA 12 QH-2011 standard and subject to third party verification, and an ACCA certificate on the installation will be provided.

Permit Compliance

One Need identified in Chapter 7, Compliance and Enforcement, is to "Increase Permit Participation for Alternations Involving Energy Efficiency (HVAC Change-out, Reroofs, Water Heaters, and Window Replacements)" as a method to increase the compliance rate of permit-required projects. One option suggested by the Staff Report would be to "track HVAC equipment serial numbers from the manufacturer or distribution points to actual permit addresses." The report further posits that "this could be accomplished by a cooperative effort of equipment manufacturers, distributors, and enforcement agencies developing the process and database to track and monitor the equipment."

ACCA would caution against proposing to track and report HVAC equipment serial numbers along with permit addresses. The administrative burdens on the small business HVAC contractors, along with the potential exposure of confidential business information, will cause many unintended harms to contractors. If the goal is to simplify the compliance process the solution is unlikely to be found by adding recordkeeping and information collection requirements.

HVAC equipment serial number tracking would be a complex undertaking with tremendous potential for "no match" errors. Many factors would have to be considered, including the method contractors would use to provide this information (electronic or paper), whether new software might be required to fulfill the requirements, the frequency that contractors would have to report the information (weekly, monthly, semi-annually), the amount and type of information beyond serial number (customer name and address, make and model number), and how this information would be protected from disclosure. A customer list that shows jobs by address, or even the number of jobs performed in a year, is confidential

business information to an HVAC contractor and represents the bulk of their goodwill. This information is valuable and should not be exposed to disclosure, whether by accident or due to a security breach.

Before the state implements an HVAC equipment serial number tracking program it must consider these issues very carefully.