

ENERGY STAR[®]

HVAC Quality Installation

Sponsor Guide



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1. Introduction

The ENERGY STAR® HVAC Quality Installation (ESQI) program seeks to improve heating, ventilation and air conditioning (HVAC) installation practices to increase energy efficiency in home heating and cooling. Although HVAC product standards have increased over the years, studies show that many systems are operating inefficiently due to improper sizing or installation. Savings potential from quality installations are estimated, based on a November 2005 EPA study, to be 18-36% for air conditioners and heat pumps and 11-18% for furnaces. Some factors that decrease efficiency can also adversely affect comfort, such as decreased heating and cooling capacity, insufficient dehumidification, dust from leaking return ducts and poor air distribution. By adding ESQI to an existing energy efficiency program portfolio, partners can provide homeowners with cost-effective energy efficient heating and cooling systems that also improve the comfort of their homes.

A local or regional program partner is crucial to the implementation and operation of an ESQI program. The partner is responsible for overseeing the program's implementation, including the performance of participating contractors and verifiers, to ensure that quality standards are met. Utilities or state energy agencies typically act as program partners because they usually have an existing portfolio of programs, understand local market conditions, can recruit qualified HVAC contractors, can provide third-party oversight and can protect the integrity of the ENERGY STAR brand. While the basic requirements for participating in the program are outlined in this document, EPA gives program partners the flexibility to develop a program to best fit their management structure and regional setting.

A program partner is responsible for:

1. Developing program standards, policies and procedures, within EPA guidelines
2. Managing the program
3. Recruiting and training qualified contractors
4. Promoting and marketing the program
5. Ensuring that installations completed meet program standards
6. Issuing ESQI certificates to homeowners
7. Tracking and evaluating program success
8. Reporting data to EPA

This guide will help program partners to understand ESQI program requirements and develop a successful program. Each section highlights important considerations and options for developing an ESQI program.

For more information on ESQI, visit www.energystar.gov/hvacqi or contact:

Ted Leopkey
EPA ENERGY STAR Program, National Program Manager for HVAC QI
(202) 343-9659
leopkey.ted@epa.gov

2. Program Elements

ESQI partners must ensure that their programs meet all of the requirements of the participation agreement, shown in Appendix A. EPA realizes there are alternate ways to operate a program and will accept on a case-by-case basis alternate program designs that differ slightly from these requirements.

2.1. Eligibility

The basic ESQI program requirements for eligibility are as follows:

- Residential installations of
 - Central air conditioner
 - Air-source heat pump
 - Geothermal heat pump
 - Furnace
 - Boiler
- Single-family houses or multifamily buildings in which each unit has its own self-contained HVAC system.
- A sponsor may choose to include new construction and/or existing homes. Some program requirements are more stringent for new construction and for systems with new or modified ductwork.
- If the home has multiple HVAC systems, each system must be verified as a separate unit.

Although the ESQI program does not require contractors to install ENERGY STAR qualified equipment, we strongly encourage program partners to promote ENERGY STAR equipment in tandem with quality installation.

2.2. Installation Requirements

The installation requirements are based on *ACCA Standard 5: HVAC Quality Installation Specification*, published by the Air Conditioning Contractors of America. This document is available for free download on the ENERGY STAR website at www.energystar.gov/ia/home_improvement/home_contractors/qispec.pdf

The four main components for a quality installation are:

- Proper sizing of equipment and component matching
- Correct refrigerant charge
- Adequate airflow to match refrigerant capacity
- Properly sealed ducts to minimize leaks

Following is a summary of installation requirements, which are further detailed in the ACCA standard:

Equipment Sizing and Selection

- Heat gain/loss load calculations must be performed using Manual J or the equivalent and must include latent, sensible and total load.
- Sizing calculations using Manual S or the equivalent

- The design temperature used in the sizing calculations must be within ± 2 degrees of the prescribed design temperature. (Contractors should submit a reason for using design temperatures that are greater than the prescribed design temperature.)
- System capacity must be:
 - Between 95% and 115% of calculated total cooling load for air conditioners and heat pumps.
 - Between 95% and 125% of calculated cooling load for heat pumps with heating dominated requirements.
 - Between 100% and 140% of calculated load for furnaces.
 - Between 100% and 115% of calculated load for boilers.
 - Or the next nominal size piece of equipment.
- Contractors must use a matched coil set and provide a copy of the AHRI or CEE-AHRI record/certificate or OEM-provided catalog indicating acceptable combination selection for selected equipment.

Airflow

- Airflow must be measured using one of these approved methods:
 - Pressure matching
 - Flow grid measurement
 - Traversing using a manometer and probe or an anemometer
 - OEM CFM/static pressure drop coil table
 - Temperature rise – for furnaces only
- Airflow across the coil, at fan design speed and full operating load must be within 15% of the airflow required per system design, and within the range recommended by the OEM product data.
- In new construction and if ductwork has been modified: measured external static pressure (ESP) must be no more than 25% or 0.10 iwc (whichever is greater) over the calculated ESP used to design the duct system and within OEM-specified acceptable range

Refrigerant

- Refrigerant charge must be checked using the subcooling or superheat method (subcooling for TXV systems, superheat for fixed orifice systems, or the method required by OEM), and the results must be:
 - Subcooling within $\pm 3^{\circ}\text{F}$
 - Or superheat within $\pm 5^{\circ}\text{F}$ of goal
- The contractor must follow a testing method approved and documented by the OEM and perform the test under the required outdoor conditions. Typically the outdoor ambient temperature must be at least 55°F drybulb for superheat testing and 60°F for subcooling testing.

Duct Leakage

- Leakage must be measured using one of these approved methods:
 - Duct pressurization test, at 25 Pa or reference pressure set by local authority
 - Hybrid blower door/airflow measuring device subtraction
- For existing construction, leakage must be no more than 20% of total duct leakage, or at least a 50% improvement over existing conditions.

- For new construction, leakage must meet one of the following requirements:
 - Ducts located inside the thermal envelope may have no more than 10% total duct leakage.
 - Ducts located outside the thermal envelope may have no more than 6% total duct leakage
- In regions where current programs are based on the Performance Tested Comfort Systems (PTCS) standard, partners may use the PTCS criteria for duct leakage with prior approval from the EPA Program Manager.
 - For existing homes, check to ensure that duct leakage (in CFM) at 50 Pa does not exceed 10% of the floor area (in square feet), or at least a 50% reduction in leakage to the outside.
 - For new ducts in existing homes, check that duct leakage (in CFM) at 50 Pa does not exceed 10% of the floor area (in square feet) or 75 CFM, whichever is greater.
 - For new construction, check that duct leakage (in CFM) at 50 Pa does not exceed 6% of the floor area (in square feet) or 75 CFM, whichever is greater.
 - Note that both supply and return sides must be measured for the PTCS standard to be recognized for ESQI.

Combustion Safety

- EPA encourages partners to require combustion venting as specified in the ACCA standard and to require testing according to the Building Performance Institute (BPI) or Residential Energy Services Network (RESNET) combustion safety test procedures, though neither is currently a requirement of the ESQI program.

2.3. Implementation

The participation of qualified contractors is essential to having a successful quality installation program. Utilities can achieve this in part by offering training and mentoring to help develop a local network of qualified professionals

Contractor Eligibility and Recruitment

All eligible systems must be installed in accordance with ESQI guidelines by a technician working as or for a state licensed contractor, where the state has an applicable license.

Utility partners may choose to have additional eligibility requirements for participating contractors. For example, some utilities require that companies be National American Technician Excellence Inc. (NATE) HVACR contractors, a status earned when at least half of the technicians at a company have earned certification by NATE, an independent, third-party certification organization for HVAC and refrigeration technicians.

Partners have successfully recruited contractors through existing relationships from other efficiency programs, trade shows and outreach to local distributors and local chapters of trade organizations.

Contractor Training

The partner must offer introductory training to participating contractors. This training should include a clear explanation of program requirements including both process and technical components. EPA strongly urges that training be offered on an ongoing basis.

All companies participating in the program must attend the training. Companies do not have the option of testing out or providing evidence of qualified knowledge allowing them to opt out of the training. EPA encourages partners to make appropriate training available to sales staff, technicians, managers, and company owners.

Training should cover all elements of a quality installation and best practices for efficient delivery, including:

- Equipment eligibility requirements
- Program incentives
- Requirements and expectations for participating contractors
- Documentation and reporting requirements
- Load calculations using Manual J or the equivalent
- Equipment sizing and selection using Manual S or the equivalent
- Testing airflow
- Ensuring correct refrigerant charge
- Measuring duct leakage
- Importance of keeping tools calibrated

EPA recommends offering training during the winter or early spring, when business is typically slower so contractors are more available and more receptive to new opportunities.

Classroom training should be supplemented with field mentoring so program partners can provide hands-on demonstrations, determine in-field obstacles and gather data on the additional time and cost of executing program elements.

EPA assists partners with developing their training programs by providing guidance and presentation materials.

To supplement training offered by partners and to introduce new contractors to the concepts of quality installation, EPA is offering free online contractor training sessions. These sessions last approximately one hour each and introduce participants to a variety of topics related to quality installation. Free recordings of past online training sessions can be accessed at www.energystar.gov/hvacqi under *For Contractors*.

Contractor Participation Agreement

Participation in the program provides benefits and privileges to contractors and in turn requires a commitment from the contractor to follow program requirements. The expectations of both parties must be documented in a participation agreement, which will specify the contractor's commitment to follow program requirements and the program partner's obligations to the participating contractors. In addition, the agreement may also set forth the terms and conditions

for contractors to be considered active in the program and the process for removal when appropriate. EPA recommends that the contractor participation agreement be renewed annually to confirm each firm's commitment and document any program changes.

EPA recommends that these commitments be included in the contractor participation agreement:

- Follow program-specified standards for all work performed
- Follow program quality assurance procedures
- Comply with local business license and permitting requirements
- Maintain coverage for general liability and workers compensation insurance
- Follow program-specified homeowner complaint/dispute resolution procedures when necessary
- Train staff to respond to customer inquiries about ESQI
- Follow the ENERGY STAR logo use guidelines
- Complete and report a minimum number of jobs annually to continue partnership

Documentation Requirements

The contractor must complete the program's commissioning report and provide copies to the homeowner for their records and to the program partner or their representative for verification. This document must be filled out in its entirety. Incomplete commissioning reports may result in return visits to the homeowner to gather required data, delays in verification or failure of the quality installation due to lack of information.

EPA has developed a Commissioning Report form, shown in Appendix B. Partners may choose to use the ENERGY STAR commissioning and verification reports as is, customize for any additional requirements specific to their program, create their own form or online system to collect the data, or integrate the commissioning data requirements into their existing data collection efforts. Customized forms must include, at a minimum, all of the inputs on the ENERGY STAR forms.

The program partner will provide an additional level of quality assurance by reviewing commissioning reports and performing in-field verification on sampled installations. See the following section for more information on verification.

EPA recommends that the contractor submit the commissioning report and supporting documentation to the program partner within one week of system start up in order to minimize data loss and increase the probability of success.

The minimum documentation requirements of the program are:

Attached to (or near) the installation:

- Manufacturer's performance data or AHRI certificate of matched components
- Copy of the Manual J calculations
- Copy of the commissioning report

Submitted to the partner or verifier:

- Manufacturer's performance data or AHRI certificate of matched components
- Copy of the Manual J calculations
- Copy of the commissioning report

Kept on record at the contractor's place of business for a minimum of one year:

- The original Manual J calculations
- The original commissioning report
- Sales documentation
- Any other documentation from the verifier or partner relevant to the installation (i.e., the verification report and other correspondence)

2.4. Verification

Quality assurance is a required component of the program and reassures homeowners that participating contractors will be held accountable for the work they perform. To maintain the credibility of the program and ensure that program goals are achieved, it is essential to verify that contractors are meeting the quality installation standards. Verifiers will use the commissioning reports as the basis for verifications and complete a verification report for each installation.

Verification Provider Qualifications

Verification should be performed by the program partner or a neutral third party. The qualifications of verifiers are left up to the discretion of the partners, but it is recommended they be able to demonstrate the knowledge and ability to verify each element of the ESQI Guidelines. Guidelines on the required skills for verifiers are provided in *ACCA Standard 9: HVAC Quality Installation Verification Protocols*. This document is available for free download on the ENERGY STAR website at www.energystar.gov/ia/home_improvement/home_contractors/QI_Verification_Protocols.pdf

Verification Protocol

Contractors are encouraged to attend the verification of their installations and must be given that opportunity, within reason, by the verifier.

The job of the verifier is to collect data which verifies that the installation meets the program guidelines, not to provide a subjective evaluation of the contractor's work. A verification report form should be used to ensure that the verifier collects all necessary information. EPA has developed a Verification Report form, shown in Appendix C. Partners may choose to use the ENERGY STAR reporting forms as is, customize for any additional requirements specific to their program, create their own form or online system to collect the data, or integrate the verification data requirements into their existing data collection efforts.

All of the installations submitted to the partner under the program must be verified using the sampling rates presented in the following section. There are two levels of verification: file verification is a review of the sizing calculations and the Commissioning Report, and field verification is an in-field verification of the system installation. Each level is described in detail below.

File Verification

File verification must include at a minimum:

Sizing

- Check that heat gain/loss load calculations were performed using Manual J (or the equivalent) and that latent, sensible, and total load are provided.
- Check that the design temperature used in the sizing calculations is within ± 2 degrees of the prescribed design temperature. (Contractor's should submit a reason for using design temperatures that are greater than the prescribed design temperature.)
- Track the square footage per ton of installations over time from each contractor. Check the Manual J calculations of contractors who are unusually consistent or have square footage per ton ratios less than 450 square feet per ton.

Equipment Selection

- Check that the AHRI number is present and matches the selected equipment.
- Check that the system capacity meets program requirements.

Airflow

- Check that the airflow was measured (not calculated) using an approved method and that the results meet program requirements.

Refrigerant

- Check to make sure that the superheat or subcooling method was used and produced an appropriate deviation.
- Check that the outdoor ambient temperature and weather was within requirements at time of test.

Duct Leakage

- Check that duct leakage was measured using an approved method and that the results meet program requirements.

Field Verification

Field verification must include at a minimum:

Sizing

- Check dimensions and sketches, if any, for general agreement with the site.
- Verify orientation of building (i.e., south elevation).
- Verify attic and wall insulation levels if practical (no cutting of structure).
- Check assumed duct leakage levels.

Equipment Selection

- Check that model numbers on commissioning report match numbers on equipment nameplates.

Airflow

- Check the airflow across the coil using the pressure matching method, flow grid measurement method or anemometer traverse, and verify that the result is within 15% of design, or within the range recommended by the OEM product data.

Refrigerant charge

- Check refrigerant charge using the superheat or subcooling method, and verify that the results meet program requirements.

Duct sealing

- Check for evidence of duct sealing (such as boot/cabinet sealing, tape/mastic near joints) for systems where a duct leakage reduction was reported.

After receiving the commissioning report, EPA recommends that file verification be completed with one week and in-field verification be completed within two weeks.

Failed Verifications

In some cases, a contractor may be able to correct and resubmit installations that do not pass verification. A properly completed verification report will inform contractors and program staff as to whether an installation can be reevaluated after corrective action by the contractor or if the issue cannot be remedied (for example, the installed equipment does not meet program requirements). Any installation that fails the file verification must be field verified, unless it is confirmed that the installation will not be able to be corrected to meet program requirements.

If an installation submitted by the participating contractor fails the verification process, the contractor must be notified by the program partner and given the opportunity to take corrective action, when possible. Contractors who fail numerous reviews may be removed from the program at the partner's discretion.

For more information on the program process see the verification flowchart in Appendix G.

Verification Selection Protocol

File verification must be completed for all jobs submitted. EPA requires that in-field verification be performed for the majority of installations when contractors are new to the program, then as contractors gain experience the required frequency of verification decreases.

The program requires all program partners to meet, at a minimum, the following sampling rates for in-field verification, or offer an alternate verification schedule for EPA approval:

- Phase 1 In-field verification on three of the first five jobs completed by a contracting firm who is new to the program.
- Phase 2 After the first five jobs have been completed, 5% of the subsequent installations by each contracting firm require on-site verification.

Program sponsors may require a higher sampling rate, and they may perform additional verification for selected contractors if necessary to ensure that installations are meeting the QI standard. A firm is not eligible to move into the second phase until it has shown it is consistently meeting all program requirement and technical standards.

It is up to the discretion of the program partner whether a participating contractor has met the criteria to move to the next phase. EPA recommends that contractors who fail file verifications should not progress to the next phase. Contractors who fail in-field verifications but are able to remediate the installation to meet program standards and do not show a consistent pattern of failure should be considered for the next phase when they become eligible.

EPA recommends that the verifier randomly pre-select jobs for in-field verification. Additional verification beyond the required sample may be necessary to resolve any customer complaints.

2.5. Certificates

Once the installation has passed the verification process, the program partner should issue an ESQI certificate to the homeowner. EPA strongly encourages partners to issue certificates and inform the contractors within one month of successfully completing the verification process. A sample certificate is shown in Appendix D. Partners may add their own logo to the certificate template provided by EPA.

2.6. ENERGY STAR Branding & Logo Use

Partners

Program partners may use the ENERGY STAR Partner logo, and must comply with current ENERGY STAR Identity Guidelines at www.energystar.gov/ia/partners/logos/downloads/BrandBook_Partnership.pdf, which describe how the ENERGY STAR logos, marketing graphics and name may be used. Partners are responsible for adhering to these guidelines and for ensuring that their authorized representatives, such as advertising agencies, dealers, distributors and contractors are in compliance. Prior to use, partners must submit marketing materials to EPA for review to ensure accuracy of ENERGY STAR logo use and consistency of the ENERGY STAR message.

Contractors

Contractors approved by a program sponsor to participate in the program may use the following terminology:

- Participating contractor in the ENERGY STAR HVAC Quality Installation program
- Installation performed according to ENERGY STAR Quality Installation guidelines
- We follow ENERGY STAR guidelines for HVAC Quality Installation

They may not use terminology such as:

- EPA/ENERGY STAR partner
- EPA/ENERGY STAR approved/certified contractor
- Endorsed by EPA/ENERGY STAR.

Participating contractors may use the “Ask about ENERGY STAR” or “We Sell ENERGY STAR” logos (known as linkage phrase marks) for marketing purposes and must comply with the Guidelines at www.energystar.gov/ia/partners/logos/downloads/BrandBook_Linkage.pdf. Contractors may write to hvacqi@energystar.gov to get logo files, get approval for materials using the ENERGY STAR logo, or ask questions about how to identify themselves as program participants. Prior to use, contractors must submit marketing materials to EPA for review to ensure accuracy of ENERGY STAR logo use and consistency of the ENERGY STAR message.

2.7. Marketing

Many homeowners are unaware of the benefits of a quality installation and do not know that comfort problems and energy inefficiency can result from improper installation. Program partners use a variety of marketing and media activities to overcome this barrier including websites, bill inserts, advertising and events. Effective marketing can help educate homeowners about the benefits of quality installation, the qualifications of participating contractors and any consumer incentives.

The program website is at www.energystar.gov/hvacqi. The main page is targeted to consumers, with links to pages for sponsors and contractors.

The ENERGY STAR brochure, shown in Appendix E, is available for use in customer education and program marketing. EPA offers customized co-branded versions of this brochure to partners and their contractors. To take advantage of this opportunity, partners and contractors can contact EPA. Only contractors who actively participate in the program should have access to the program’s marketing support.

EPA is writing case studies to highlight successful installations, as shown in Appendix F. Program sponsors are encouraged to notify the EPA team of customers who might be willing to participate in a case study.

2.8. Feedback and Conflict Resolution

EPA recommends that a customer survey be developed to determine:

- Reasons for participating
- Reaction to ENERGY STAR or utility materials
- Satisfaction with the program offering and installation experience

Surveys provide partners with an opportunity to receive feedback from the customers and to answer any questions or concerns the customers may have. EPA suggests that the survey be sent out to the homeowner at the same time as the ESQI certificate.

EPA also requires program partners to have a process to resolve any conflicts that might arise between program participants (customer, contractor and/or verifier).

Interventions may be necessary if a contractor fails to meet the program's standards, such as:

- Frequent verification failures
- Frequent customer complaints
- Health or safety violations
- Failure to follow program requirements
- Misuse of the ENERGY STAR logo

Depending on the issue, the homeowner involved may be contacted for comment. A meeting will then be held with the contractor to provide guidance and clarification regarding the violation. In case of health or safety violations, the contractor's involvement in the program may be suspended pending investigation. Other repercussions may include additional training or an adjustment to the contractor's verification sampling phase. Repeated interventions should result in removal from the program.

3. Program Cost and Benefits

3.1. Cost and Incentives

Potential program partners should understand that operating an ESQI program requires a substantial investment for program administration, contractor mentoring and oversight, system verification and incentives (if offered).

Incentives may be paid to the customer, contractor, or a combination of the two. In existing programs, the total incentive available for ESQI ranges from \$300 to approximately \$1,500. Some partners offer additional separate incentives for high-efficiency equipment. Other partners do not offer an equipment incentive outside of the quality installation program but may factor in equipment efficiency by varying the ESQI incentive amount based on efficiency levels.

Partners may also consider offering small incentives for specific elements of quality installation with a bonus for completing all elements and earning an ESQI certificate, especially in the early stages of a program when many contractors are learning the process of quality installation. In this case, EPA recommends that the incentive levels be carefully considered to encourage contractors to aim for a full quality installation.

In addition to financial incentives for each installation, some programs have offered contractors discounts on required equipment or rebates toward equipment purchases when a contractor reaches certain numbers of installations.

3.2. Benefits

ESQI programs can provide a number of benefits including improved comfort and performance for the customer, increased sales for the contractor and energy savings for the utility sponsor. Savings from improved installations will vary widely depending on a number of factors including the current practices in a region, the type of equipment, the condition of ducts and whether or not equipment is located in a conditioned space.

The following table presents approximate energy savings potential based on a November 2005 EPA study (“Energy Savings Impact of Improving the Installation of Residential Central Air Conditioners”, November 2005). The analysis included a survey of existing studies and a bin analysis of a large sample of units in the field.

Program Element	Energy Savings	
	Cooling	Heating
Refrigerant Charge	2-6%	-
Airflow	2-5%	-
Sizing	3-7%	-
Duct sealing	11-18%	11-18%
Total	18-36%	11-18%

EPA expects that many program partners will have to develop more detailed regional savings and cost-effectiveness values.

4. Summary of Requirements for Program Partners

Required Elements:


- Ensure contractor qualifications by:
 - Using an EPA-approved participation agreement
 - Requiring that lead technicians attend program-specific training
 - Verifying that technicians work as/for state licensed contractors
- Verify that installations meet the ESQI guidelines by:
 - Requiring that installations are documented in accordance with Section 3.2 of this report
 - Performing file verification on all submitted installations
 - Meeting or exceeding the in-field verification frequency described in Section 3.3 of this document.
 - Notifying contractors when an installation fails verification and giving them the opportunity to remedy the issue, when possible
- Issue ESQI certificates to participating homeowners
- Comply with current ENERGY STAR Identity Guidelines
- Manage program quality by establishing a conflict-resolution process and performing customer feedback surveys

Recommended Elements:

- Offer incentives for qualifying installations
- Introduce program in off-peak months
- Use ENERGY STAR marketing materials
- Offer contractor training on an ongoing basis
- Invite contractors to attend verification on their installations
- Perform file verification within one week of receiving the commissioning report and field verification within two weeks.
- Issue certificates and incentives within one month of successfully completing verification

See more detail on program planning and key program design elements in Appendix H.

APPENDIX A: ENERGY STAR Partnership Agreement

HVAC QI	8/31/2011	
ENERGY STAR® Partnership Agreement For ENERGY STAR HVAC Quality Installation (QI) Program Partners		
Mail this form to: ENERGY STAR HVAC QI Program Manager US EPA (Mail Code 6202J) 1200 Pennsylvania Ave, NW Washington, DC 20460	Or	Fax this form to: 202-343-2200
		
<hr/>		
Organization		
Name: _____		
Address: _____		City/State/Zip: _____
Telephone: _____	Fax: _____	Web Site: _____
Major Area(s) Served: _____		
Authorized Company/Organization Representative (printed name): _____		
Title: _____		E-mail: _____
Signature: _____		Date: _____
<hr/>		
To be completed by U.S. EPA:		
EPA Representative; ENERGY STAR Residential Branch, Climate Partnership Program Division		
Signature: _____		Date: _____
<hr/>		
ENERGY STAR HVAC QI Program Goals		
ENERGY STAR helps consumers, businesses, and public organizations protect the environment through superior energy efficiency. The ENERGY STAR HVAC QI program seeks to improve HVAC installation practices to deliver greater energy efficiency and comfort to consumers and to provide a new energy efficiency program strategy to utilities.		
Notes:		
<ul style="list-style-type: none">- The ENERGY STAR HVAC QI Program is applicable to residential installations of central air conditioning, furnace, air-source heat pump, geothermal heat pump and boiler systems. Installations may be in single-family houses or in multifamily buildings in which each unit has its own self-contained HVAC system.- Program sponsors may choose to include systems in existing homes and/or new construction. Requirements are more stringent for new construction and for existing homes with new or modified ductwork.- If a home has multiple zones with separate HVAC systems, each system must be verified as a separate unit.- Although the ENERGY STAR HVAC QI Program does not require contractors to install ENERGY STAR qualified equipment we strongly encourage program partners to promote ENERGY STAR qualified equipment in tandem with quality installation.		
<hr/>		
ENERGY STAR Commitments to Partners		
<ol style="list-style-type: none">1. Increase awareness of the ENERGY STAR HVAC Quality Installation Program by distributing key messages on the benefits of proper installation practices and verification.2. Provide current ENERGY STAR news, information, and reference documents (via the ENERGY STAR Web site, Hotline, e-mail or other means).3. Provide ENERGY STAR partners with public recognition for their involvement in ENERGY STAR.4. Respond swiftly to any partner request for information or clarification on ENERGY STAR policies.		
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Definitions:

For the purpose of this agreement the following terms are defined as follows:

ANSI

The American National Standards Institute (ANSI) facilitates the development of American National Standards by accrediting the procedures of standards developing organizations. Accreditation by ANSI signifies that the procedures used by the standards body in connection with the development of American National Standards meet the Institute's essential requirements for openness, balance, consensus and due process.

ENERGY STAR HVAC QI Guidelines

Requirements for installations under the program must meet Air Conditioning Contractors of America (ACCA) Standard 5: HVAC Quality Installation Specification or equivalent standard approved by EPA.

File Verification

File verification is a data review of load calculations, equipment selection and the commissioning report. This review includes confirming that all required installation elements were performed using an approved method and checking for data inconsistencies.

Field Verification

Field verification is an in-field verification of the installation that follows established protocols.

Terms of the Agreement:

The following are the terms of the ENERGY STAR Partnership Agreement as it pertains to ENERGY STAR HVAC Quality Installation (QI) Program Partners. The ENERGY STAR Partner under HVAC QI is defined as a program sponsor who agrees to the following commitments, and is legally independent from contractors performing installations and third-party verifiers verifying installations under this program.

The ENERGY STAR Partner may issue an ENERGY STAR Quality Installation Certificate for a residential central air conditioning, furnace, air-source heat pump, geothermal heat pump or boiler system if the following criteria are met:

- 1) The participating contractor has signed a participation agreement with the ENERGY STAR Partner implementing the program.
 - a) The participation agreement between the contractor and the ENERGY STAR partner must include at a minimum:
 - i) Entry and training requirements
 - ii) Installation requirements
 - iii) Documentation requirements
 - iv) Sampling and verification requirements
 - v) A conflict resolution process
 - vi) A process for dismissal from the program if the terms of the participation agreement are not adhered to
- 2) The system is installed by a technician working as or for a state licensed contractor, where a license is required.
- 3) The system is verified to meet the ENERGY STAR HVAC QI Guidelines by an eligible and qualified third party verifier.
 - a) The criteria for meeting the ENERGY STAR HVAC QI Guidelines are established by:
 - i) ACCA Standard 5 or comparable ANSI-recognized, HVAC specification related to the proper installation of residential and commercial heating, ventilation, and air conditioning
 - b) To be considered eligible under the program the third party verifier must:
 - i) Be an autonomous organization/individual with no financial or ownership connections to the contractors participating in the program
 - ii) Demonstrate knowledge and ability to verify each element of the ENERGY STAR HVAC QI Guidelines

Terms of the Agreement (continued):

- 4) Sampling Rates and Verification Protocols.
 - a) A file verification must be performed on each installation.
 - b) The program requires that all Partners meet, at a minimum, the following sampling rates on field verifications, or offer an alternate verification schedule for EPA approval:
 - i) Phase 1 – Field verification will be conducted on 3 of the first 5 installations submitted by a new contractor participant.
 - ii) Phase 2 – After successful completion of Phase 1, the Partner must perform field verification on at least 5% of installations by each contractor.
 - c) A contractor is not eligible to move to the next phase, or lower sampling rate, until they can demonstrate to the Program Partner that they are consistently meeting all program requirement and technical standards.
 - d) All Installation must be verified using the verification protocols outlined in the ENERGY STAR HVAC QI Sponsor Guide document.
- 5) The Partner has submitted a detailed implementation plan to EPA describing how they will implement sections 1 through 4 of this agreement. The Partner may not proceed with the program until this plan has been approved by EPA.

Other Partner requirements under this agreement:

- Provide EPA, on a quarterly basis, market indicators to assist in determining the effects of the program in promoting quality HVAC installations. EPA will only use the data for program evaluation purposes. The following data should be submitted in electronic format:
 - Number of participating contractors
 - Number of installations performed
 - Number of installations inspected
 - Number of installations failing verification
 - Number of certificates issued
 - Reasons for installation failures and the action that was taken to resolve the problem
- Adhere to the ENERGY STAR Identity Guidelines (available at www.energystar.gov/marks) and ensure that authorized representatives, such as advertising agencies also comply.
- Prior to use, submit all marketing materials developed for Partner's ENERGY STAR promotions to ENERGY STAR for review to ensure accuracy of ENERGY STAR logo use and consistency of the ENERGY STAR message. Partner will allow a minimum of five full working days for ENERGY STAR to review and approve ENERGY STAR aspects of the marketing materials.
- Notify EPA of a change in the designated responsible party or contacts within 30 days.

General Terms and Disclaimers

1. The partner will not construe, claim or imply that its participation in ENERGY STAR constitutes federal government approval, acceptance, or endorsement of anything other than the partner's commitment to ENERGY STAR. Partnership does not constitute federal government endorsement of the partner or its services.
2. The partner understands that the activities it undertakes in connection with ENERGY STAR are voluntary and not intended to provide services to the federal government. As such, the partner will not submit a claim for compensation to any federal agency.
3. The partner and ENERGY STAR will assume good faith as a general principle for resolving conflict and will seek to resolve all matters informally, so as to preserve maximum public confidence in ENERGY STAR.
4. This agreement is voluntary and can be terminated by either party at any time or any reason, with no penalty.
5. Failure to comply with any of the terms of this partnership agreement can result in its termination and cessation of access to the benefits of ENERGY STAR, including use of the marks.
6. ENERGY STAR will actively pursue resolution of noncompliance related to the use of the ENERGY STAR marks.

APPENDIX B: ENERGY STAR Commissioning Report

ENERGY STAR in Cooperation with ABC Electric Company Installation Commissioning Report for Central AC and Furnace	
Site Information	
Customer name (name on utility bill): _____ Customer utility account number: _____ Address: _____ City: _____ State: _____ Zip: _____	
Design	
Type of installation: <input type="checkbox"/> Replacement <input type="checkbox"/> New system - existing home <input type="checkbox"/> New system - new home <input type="checkbox"/> AC only <input type="checkbox"/> Heat only <input type="checkbox"/> AC & heat	
Area of zone served by unit: _____ sq ft # of units in home: _____	
Heat gain method: <input type="checkbox"/> Manual J v7 <input type="checkbox"/> Manual J v8 <input type="checkbox"/> None <input type="checkbox"/> Other: _____	
Duct design method: <input type="checkbox"/> Manual D <input type="checkbox"/> None <input type="checkbox"/> Other: _____	
Equipment specification method: <input type="checkbox"/> Manual S <input type="checkbox"/> OEM recommendation <input type="checkbox"/> Other: _____	
Latent Heat Gain: _____ BTUh Sensible Heat Gain: _____ BTUh	
Total Heat Gain: _____ BTUh Design Airflow: _____ CFM	
Duct Design Static Pressure: _____ IWC Design heat loss: _____ BTUh	
Equipment - AC	
Condenser	Manufacturer: _____ Model: _____ Serial number: _____
Evaporator	Manufacturer: _____ Model: _____ Serial number: _____
System	Type: <input type="checkbox"/> Packaged unit <input type="checkbox"/> Split system <input type="checkbox"/> Other: _____ Metering device: <input type="checkbox"/> TXV <input type="checkbox"/> Fixed orifice <input type="checkbox"/> Other: _____ Refrigerant: <input type="checkbox"/> R-22 <input type="checkbox"/> R-410a <input type="checkbox"/> Other: _____
Fan Motor Type:	<input type="checkbox"/> Fixed speed (e.g. PSC) <input type="checkbox"/> Variable (e.g. ECM/ICM) <input type="checkbox"/> Other: _____
Speed setting	<u><i>If fixed</i></u> <input type="checkbox"/> Low <input type="checkbox"/> Med-Low <input type="checkbox"/> Med <input type="checkbox"/> Med-High <input type="checkbox"/> High CFM (at 0.5 IWC): _____ <u><i>If variable</i></u> Fan set for _____ CFM
	AHRI equipment rating System capacity (Manual S)
Latent capacity (BTUh)	_____
Sensible capacity (BTUh)	_____
Total capacity (BTUh)	_____
EER/SEER	_____
Reference #	_____
<u><i>Previous equipment - for replacements only</i></u>	
Total capacity: _____ Btuh	AHRI EER/SEER: _____
Does Manual S capacity meet requirement of 95-115% of calculated load or the next nominal size? <input type="checkbox"/> Yes <input type="checkbox"/> No	

AC & Furnace Installation Commissioning Report (Page 2 of 4)

Equipment - Furnace

Manufacturer: _____ Model: _____
 Serial number: _____ AFUE: _____
 Gross capacity: _____ Btuh Net capacity: _____ Btuh
Previous equipment - for replacements only
 Gross capacity: _____ Btuh Net capacity: _____ Btuh
 Fuel type: ☐ Gas ☐ Oil ☐ Propane ☐ Other: _____
 Sealed combustion? ☐ Yes ☐ No
 Fan Motor Type: ☐ Fixed speed (e.g. PSC) ☐ Variable (e.g. ECM/ICM) ☐ Other: _____
 Speed Setting If fixed ☐ Low ☐ Med-Low ☐ Med ☐ Med-High ☐ High CFM (at 0.5 IWC): _____
If variable Fan set for _____ CFM

Does capacity meet requirement of 100-140% of calculated load or the next nominal size? ☐ Yes ☐ No

Refrigerant Tests - run system for 15 minutes before testing

Date: _____ Outdoor ambient temp. (at condenser): _____ °F DB
 Time of test: _____ Outdoor relative humidity - optional: _____
 Barometric pressure - optional: _____

Air temperatures measured in duct near evaporator (not in conditioned building space):

Cooling Mode	<u>Return</u>	_____ °F DB	_____ °F WB
	<u>Supply</u>	_____ °F DB	_____ °F WB
Liquid line pressure:	_____ psi	Liquid line temp.:	_____ °F DB
Suction line pressure:	_____ psi	Suction line temp.:	_____ °F DB
Refrigerant Calculations	Condenser sat. temp. (from liquid pressure):	_____ °F DB	
	Evaporator sat. temp. (from suction pressure):	_____ °F DB	
Subcooling (condensing temp. - liquid line temp.):	_____ °F DB		
Superheat (suction line temp. - evaporating temp.):	_____ °F DB		

For Fixed Orifice

Superheat goal (from superheat lookup tables, based on outdoor ambient and return air wet bulb temps.): _____ °F DB
 Superheat deviation (superheat goal - superheat): _____ °F DB

For TXV

OEM subcooling goal: _____ °F DB
 Goal for: ☐ Specific temperature: _____ °F
☐ Single point specified by OEM
☐ Average over range of outdoor temperatures
For packaged units Goal calculated using: ☐ Discharge pressure ☐ Liquid line pressure
 Subcooling deviation (subcooling - subcooling goal): _____ °F DB

Does system meet both of the following requirements:

- ☐ Subcooling within ±3°F or superheat within ±5°F of goal?
☐ Superheat between 5°F and 25°F?

AC & Furnace Installation Commissioning Report (Page 3 of 4)

Electrical Measurements - taken at time of refrigerant tests

	amps	x	volts	x	power factor *	=	watts
Air handler/evaporator fan:	_____		_____		_____		_____
Condenser fan:	_____		_____		_____		_____
Compressor:	_____		_____		_____		_____
					Total power:		_____

* If unable to measure power factor, use 0.98 for standard motors and 0.68 for ECM motors

Electrical Requirements

Does system meet requirements of ACCA QI 4.3? ☐ Yes ☐ No

Air Flow Tests

Date: _____ Outdoor ambient temp. (at condenser): _____ °F DB
 Time of test: _____ Outdoor relative humidity - optional: _____
 Barometric pressure - optional: _____

Measured air volume at evaporator: _____ CFM

Test performed in heating or cooling mode? ☐ Heating ☐ Cooling

Fan speed setting used in testing: If fixed ☐ Low ☐ Med-Low ☐ Med ☐ Med-High ☐ High
If variable Fan set for _____ CFM

Static pressure Return Static: _____ IWC Measurement location: _____
Supply Static: _____ IWC Measurement location: _____

Measurement method used: ☐ TrueFlow ☐ Pressure matching (with Duct Blaster) ☐ Anemometer
☐ Fan Curve ☐ Temperature split (heating only) ☐ Other: _____

Does air flow meet both of the following requirements:

- ☐ Within ±15% of design
☐ Within range required by OEM for safety and efficiency

Duct Leakage

Initial Test Date: _____ Time: _____
Final Test Date: _____ Time: _____

Test method used: ☐ Duct Blaster ☐ Blower Door Subtraction ☐ Other: _____

Existing system duct leakage: _____ CFM

Post Installation duct leakage: _____ CFM Leakage % reduction ((existing-post) ÷ existing): _____

Total % leakage (post leakage ÷ design flow): _____ OR (post leakage ÷ measured flow): _____

Does duct leakage meet one of the following requirements:

- existing homes: ☐ No more than 20% of total air flow
☐ A reduction of 50% or more from the initial measurement
- new construction: ☐ Leakage from ducts inside the thermal envelope is no more than 10% of total air flow
☐ No more than 6% of total air flow from ducts outside the thermal envelope
☐ Less than 4 CFM leakage to outdoors per 100 square feet of conditioned floor area

AC & Furnace Installation Commissioning Report (Page 4 of 4)**Gas Combustion Test**

Altitude derating factor (from site elevation): _____

Return air: _____ °F DB Supply air: _____ °F DB

Orifice size: _____ Manifold pressure: _____ psi

Gas meter test dial size: _____

Gas meter seconds for one revolution of meter: Low: _____ High: _____

Gas combustion test calculations

Gas rate (from meter lookup tables):	Low speed: _____	High speed: _____
Actual firing rate:	Low speed: _____	High speed: _____
	Percent: _____	Percent: _____
Temperature rise:	Low speed: _____ °F	High speed: _____ °F

Combustion Analyzer - required for oil systems, optional for other fuels

O₂: _____ Stack temperature: _____ °F Efficiency: _____

CO: _____ Draft pressure: _____ psi

System Controls

Does system meet requirements of ACCA QI 4.6? ☐ Yes ☐ No

System Documentation & Owner Education

Copies of this report and OEM manuals left with owner? ☐ Yes ☐ No

Demonstrated system for owner? ☐ Yes ☐ No

Contractor/Technician Information

Technician name: _____

Company: _____

Address 1: _____

Address 2: _____

City: _____ State: _____ Zip: _____

Phone/Email: _____

Technician signature: _____

*Please send completed forms to: **System Implementer, 123 Main St, Town, ST, 01234, FAX 555-123-4567***

ENERGY STAR in Cooperation with ABC Electric Company
Installation Commissioning Report for Central AC and Heat Pump

Site Information

Customer name (name on utility bill): _____
 Customer utility account number: _____
 Address: _____
 City: _____ State: _____ Zip: _____

Design

Type of installation: ☐ Replacement ☐ New system - existing home ☐ New system - new home
☐ AC only ☐ Heat only ☐ AC & heat
 Area of zone served by unit: _____ sq ft # of units in home: _____
 Is the unit self-contained, or is fan/airflow provided by external device (furnace)? _____
 Heat gain method: ☐ Manual J v7 ☐ Manual J v8 ☐ None ☐ Other: _____
 Duct design method: ☐ Manual D ☐ None ☐ Other: _____
 Equipment specification method: ☐ Manual S ☐ OEM recommendation ☐ Other: _____
 Latent heat gain: _____ BTUh Sensible heat gain: _____ BTUh
 Total heat gain: _____ BTUh Design airflow: _____ CFM
 Duct design static pressure: _____ IWC Design heat loss: _____ BTUh

Equipment

Condenser Manufacturer: _____ Model: _____
 Serial number: _____
 Evaporator Manufacturer: _____ Model: _____
 Serial number: _____
 System Type: ☐ Packaged unit ☐ Split system ☐ Other: _____
 Metering device: ☐ TXV ☐ Fixed orifice ☐ Other: _____
 Refrigerant: ☐ R-22 ☐ R-410a ☐ Other: _____
 Fan Motor Type: ☐ Fixed speed (e.g. PSC) ☐ Variable (e.g. ECM/ICM) ☐ Other: _____
 Speed Setting If fixed ☐ Low ☐ Med-Low ☐ Med ☐ Med-High ☐ High CFM (at 0.5 IWC): _____
If variable Fan set for _____ CFM/ton
 Cooling AHRI equipment rating System capacity (Manual S)
 Latent capacity (BTUh) _____
 Sensible capacity (BTUh) _____
 Total capacity (BTUh) _____
 EER/SEER _____
 Reference # _____
 Heating HSPF: _____
 At 17°F Capacity: _____ BTUh COP: _____
 At 47°F Capacity: _____ BTUh COP: _____

AC & Heat Pump Installation Commissioning Report (Page 2 of 4)

Equipment - continued

Previous equipment - for replacements only

Cooling	Total capacity: _____ Btuh	AHRI EER/SEER: _____
Heating	HSPF: _____	
	At 17°F Capacity: _____ BTUh	COP: _____
	At 47°F Capacity: _____ BTUh	COP: _____

Does capacity meet requirement of 95-115% (or up to 125% for heat pumps with heat dominated requirements) of calculated load or the next nominal size? ☐ Yes ☐ No

Refrigerant Tests - run system for 15 minutes before testing

Date: _____ Outdoor ambient temp. (at condenser): _____ °F DB
 Time of test: _____ Outdoor relative humidity - optional: _____
 Barometric pressure - optional: _____

Air temperatures measured in duct near evaporator (not in conditioned building space):

Cooling Mode	<u>Return</u>	_____ °F DB	_____ °F WB
	<u>Supply</u>	_____ °F DB	_____ °F WB
Heating Mode	<u>Return</u>	_____ °F DB	
	<u>Supply</u>	_____ °F DB	

Liquid line pressure: _____ psi Liquid line temp.: _____ °F DB

Suction line pressure: _____ psi Suction line temp.: _____ °F DB

Refrigerant Calculations Condenser sat. temp. (from liquid pressure): _____ °F DB

Evaporator sat. temp. (from suction pressure): _____ °F DB

Subcooling (condensing temp. - liquid line temp.): _____ °F DB

Superheat (suction line temp. - evaporating temp.): _____ °F DB

For Fixed Orifice

Superheat goal (from superheat lookup tables, based on outdoor ambient and return air wet bulb temps.): _____ °F DB

Superheat deviation (superheat goal - superheat): _____ °F DB

For TXV

OEM subcooling goal: _____ °F DB

Goal for: ☐ Specific temperature: _____ °F

☐ Single point specified by OEM

☐ Average over range of outdoor temperatures

For packaged units Goal calculated using: ☐ Discharge pressure ☐ Liquid line pressure

Subcooling deviation (subcooling - subcooling goal): _____ °F DB

Does system meet both of the following requirements:

☐ Subcooling within ±3°F or superheat within ±5°F of goal?

☐ Superheat between 5°F and 25°F?

AC & Heat Pump Installation Commissioning Report (Page 3 of 4)

Electrical Measurements - taken at time of refrigerant tests

	amps	x	volts	x	power factor *	=	watts
Air handler/evaporator fan:	_____		_____		_____		_____
Condenser fan:	_____		_____		_____		_____
Compressor:	_____		_____		_____		_____
Total power:							_____

* If unable to measure power factor, use 0.98 for standard motors and 0.68 for ECM motors

Electrical Requirements

Does system meet requirements of ACCA QI 4.3? ☐ Yes ☐ No

Air Flow Tests

Date: _____ Outdoor ambient temp. (at condenser): _____ °F DB
 Time of test: _____ Outdoor relative humidity - optional: _____
 Barometric pressure - optional: _____

Measured air volume at evaporator: _____ CFM

Test performed in heating or cooling mode? ☐ Heating ☐ Cooling

Fan speed setting used in testing: If fixed ☐ Low ☐ Med-Low ☐ Med ☐ Med-High ☐ High
If variable Fan set for _____ CFM

Static pressure Return Static: _____ IWC Measurement location: _____
Supply Static: _____ IWC Measurement location: _____

Measurement method used: ☐ TrueFlow ☐ Pressure matching (with Duct Blaster) ☐ Anemometer
☐ Fan Curve ☐ Temperature split (heating only) ☐ Other: _____

Does air flow meet both of the following requirements:

- ☐ Within ±15% of design
- ☐ Within range required by OEM for safety and efficiency

Duct Leakage

Initial Test Date: _____ Time: _____
Final Test Date: _____ Time: _____

Test method used: ☐ Duct Blaster ☐ Blower Door Subtraction ☐ Other: _____

Existing system duct leakage: _____ CFM

Post Installation duct leakage: _____ CFM Leakage % reduction ((existing-post) ÷ existing): _____

Total % leakage (post leakage ÷ design flow): _____ OR (post leakage ÷ measured flow): _____

Does duct leakage meet one of the following requirements:

- existing homes: ☐ No more than 20% of total air flow
- ☐ A reduction of 50% or more from the initial measurement
- new construction: ☐ Leakage from ducts inside the thermal envelope is no more than 10% of total air flow
- ☐ No more than 6% of total air flow from ducts outside the thermal envelope
- ☐ Less than 4 CFM leakage to outdoors per 100 square feet of conditioned floor area

AC & Heat Pump Installation Commissioning Report (Page 4 of 4)

System Controls

Does system meets requirements of ACCA QI 4.6? ☐ Yes ☐ No

System Documentation & Owner Education

Copies of this report and OEM manuals left with owner? ☐ Yes ☐ No

Demonstrated system for owner? ☐ Yes ☐ No

Contractor/Technician Information

Technician name: _____

Company: _____

Address 1: _____

Address 2: _____

City: _____ State: _____ Zip: _____

Phone/Email: _____

Technician signature: _____

*Please send completed forms to: **System Implementer, 123 Main St, Town, ST, 01234, FAX 555-123-4567***

APPENDIX C: ENERGY STAR Verification Report

ENERGY STAR in Cooperation with ABC Electric Company Quality Installation Verification Report	
Site Information	
Customer name (name on utility bill): _____ Customer utility account number: _____ Address: _____ City: _____ State: _____ Zip: _____	
Instructions	
<p>The verifier shall review the technician's file to ensure the correctness of the load calculation, equipment selection, system matching and the airflow, refrigerant and duct leakage measurements. If any of the following boxes are checked "No", the verifier must either make a recommendation for remediation or provide justification on why the installation will not be able to meet the Program standards.</p> <p>This form must be completed in its entirety. Any calculations made by the verifier to determine if a measure meets the standard should be attached to this verification form. These calculations may be needed if a conflict between the technician and the verifier arises due to this process.</p>	
Equipment	
Type of installation: <input type="checkbox"/> Replacement <input type="checkbox"/> New system - existing home <input type="checkbox"/> New system - new home (check all that apply) <input type="checkbox"/> AC <input type="checkbox"/> Heat pump <input type="checkbox"/> Furnace – Fuel Type: <input type="checkbox"/> Gas <input type="checkbox"/> Oil <input type="checkbox"/> Propane <input type="checkbox"/> Other: _____	
Load Calculations and Equipment Selection Review	
Design Conditions Are all measures listed below reasonably approximated for determining the house's load? <input type="checkbox"/> Yes <input type="checkbox"/> No - Outdoor temps - Latitude - Infiltration - Occupants - Indoor temps - Altitude - Ventilation - Grains diff. - Orientation - Duct load	
Opaque Components Are all measures listed below reasonably approximated for determining the house's load? <input type="checkbox"/> Yes <input type="checkbox"/> No - Area of components - Heat Transfer Multiplier (HTM) of components	
Windows Are all measures listed below reasonably approximated for determining the house's load? <input type="checkbox"/> Yes <input type="checkbox"/> No - Area - Adjusted HTM - Orientation - SHGF - Heated U value - Overhang dimensions	
Calculated Loads Are all measures listed below reasonably approximated for determining the house's load? <input type="checkbox"/> Yes <input type="checkbox"/> No - Total heating - Total cooling - Sensible cooling - Latent cooling Calculated load (Btu per square foot) Heating: _____ Cooling: _____	
Equipment Selection Does the manufacturer's performance data meet the load calculation and design conditions in accordance with ACCA Manual S? <input type="checkbox"/> Yes <input type="checkbox"/> No Is the equipment sized within the tolerance specified by the ACCA QI Standard? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Matched System Is one of the following provided for evidence of a matched system <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> AHRI certificate <input type="checkbox"/> CEE directory certificate <input type="checkbox"/> OEM performance data	
If no to any of the above, what action is recommended? _____ _____	

ENERGY STAR Quality Installation Verification Report (Page 2 of 3)

Refrigerant Test Review

Does system meet **one** of the following requirements? ☐ Yes ☐ No

☐ Subcooling within $\pm 3^{\circ}\text{F}$ of goal?

☐ Superheat within $\pm 5^{\circ}\text{F}$ of goal?

If no, what action is recommended? _____

Air Flow Test Review

Does air flow meet **both** of the following requirements? ☐ Yes ☐ No

1. Within $\pm 15\%$ of design

2. Within range required by OEM for safety and efficiency

If no, what action is recommended? _____

Duct Leakage Review

Does duct leakage meet **one** of the following requirements? ☐ Yes ☐ No

existing ☐ No more than 20% of total air flow

homes: ☐ A reduction of 50% or more from the initial measurement

new ☐ Leakage from ducts inside the thermal envelope is no more than 10% of total air flow

construction ☐ No more than 6% of total air flow from ducts outside the thermal envelope

: ☐ Less than 4 CFM leakage to outdoors per 100 square feet of conditioned floor area

If no, what action is recommended? _____

File Verification Result

Does this system pass file verification? ☐ Yes ☐ No ☐ Reevaluate after corrective action

Notes: _____

File Verifier Information

Verifier name: _____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

Verifier signature: _____

Next page required only for systems that have been sampled for field verification

ENERGY STAR Quality Installation Verification Report (Page 3 of 3)
Required only for systems that have been sampled for field verification

Field Verification

Do all model and serial numbers match those submitted on commissioning form? ☐ Yes ☐ No

Refrigerant Charge Testing

Using **one** of these methods, verify that refrigerant charge meets QI requirements:

Subcooling method

Measurement: _____ °F DB OEM goal: _____ °F DB Deviation: _____ °F DB

Superheat method

Measurement: _____ °F DB OEM goal: _____ °F DB Deviation: _____ °F DB

Measurement method:

☐ Observed contractor measurements OR ☐ Independent measurements made by verifier

Air Flow Testing

Using **one** of these methods, verify that air flow meets QI requirements:

☐ TrueFlow ☐ Pressure matching (with Duct Blaster) ☐ Anemometer
☐ Fan Curve ☐ Temperature split (heating only) ☐ Other: _____

Measured air volume at evaporator: _____ CFM

Measurement method:

☐ Observed contractor measurements OR ☐ Independent measurements made by verifier

Duct Leakage Testing

Using **one** of these methods, verify that duct leakage is consistent with entries on commissioning report:

☐ Duct Blaster ☐ Blower door subtraction ☐ Other: _____

Post Installation duct leakage: _____ CFM

Measurement method:

☐ Observed contractor measurements OR ☐ Independent measurements made by verifier

Field Verification Result

Does this system pass field verification? ☐ Yes ☐ No ☐ Reevaluate after corrective action

Notes: _____

Field Verifier Information

Verifier name: _____

Company: _____


Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

Verifier signature: _____

APPENDIX D: Sample ENERGY STAR Certificate

 LEARN MORE AT energystar.gov	<h3>ENERGY STAR® Quality Installation</h3> <p>Congratulations! The installation of your new central heating or air conditioning system meets ENERGY STAR Quality Installation Guidelines and will save energy, money, and help protect the environment.</p> <p>Presented to:</p> <p>A. Customer <u>123 Main Street</u> Town, State</p> <p><u>Verified in April 2010.</u></p> <p>(signed) _____ Utility Program Manager</p>
--	--

APPENDIX E: ENERGY STAR Marketing Materials

Brochure

Side 1


WHAT IS ENERGY STAR?

ENERGY STAR is the government-backed program that helps us all to save money and protect our environment with energy-efficient products and practices. Whether you are looking to replace old appliances, remodel your home, or buy a new house, ENERGY STAR can help.

More than 50 kinds of products, including lighting, appliances, televisions, computers, heating and cooling equipment, and even new homes, can earn the ENERGY STAR label.


ENERGY STAR also offers best practice solutions, like HVAC quality installation and home sealing, that can make your home more comfortable and reduce your energy costs.


For more information
CALL 888-STAR-YES



LEARN MORE AT
energystar.gov

ENERGY STAR® QUALITY INSTALLATION: CENTRAL HEATING & COOLING





U.S. Environmental Protection Agency
and U.S. Department of Energy

The middle panel is left blank so EPA can customize the brochure for program partners with their logo and contact information. Participating contractor information can be added below the sponsor information.

ENERGY STAR Quality Installation

You may be familiar with the ENERGY STAR label to help you select efficient heating and cooling equipment. The new ENERGY STAR Quality Installation guidelines help ensure that your equipment is properly installed to deliver comfort, dependability and efficiency.

These guidelines, based on industry best practices, help ensure that new equipment is:

- Correctly sized to meet your needs
- Installed with the proper amount of refrigerant
- Operating with sufficient airflow in the system
- Connected to a well-sealed duct system

If your local utility company offers the ENERGY STAR Quality Installation program, you may be eligible for:

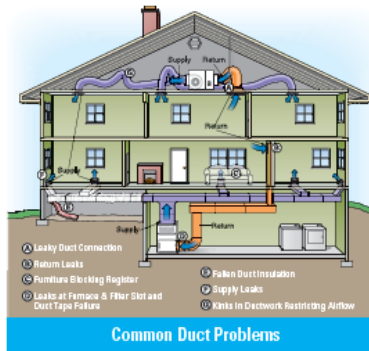
- Incentives toward your installation cost
- Independent verification that your system was installed correctly
- An ENERGY STAR certificate

GET COMFORT

When your heating and cooling equipment is installed to meet ENERGY STAR Quality Installation guidelines, you avoid common comfort problems caused by poor quality installations. The guidelines specify that heating and cooling equipment is properly sized using standard industry methods and ensure that its duct system is properly sealed.

Many believe that bigger is better when buying new heating and cooling equipment, but your system should be a custom fit for your home. A properly sized system will keep you comfortable and operate efficiently.

Poorly installed duct systems can also cause comfort problems. Holes and gaps in air ducts and disconnected duct connections will reduce the amount of air delivered to each room. Sealing air leaks and balancing air flows between rooms can help ensure your heating or cooling system delivers comfort throughout your home.



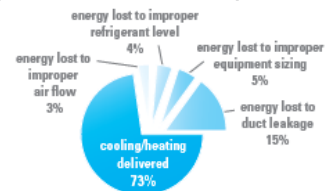
GET DEPENDABILITY

When your equipment is installed to meet ENERGY STAR Quality Installation guidelines, you avoid installation problems that could reduce the life of your equipment. Modern furnaces, heat pumps and air conditioners are designed to deliver years of service, but incorrect sizing or installation can put stress on system components and shorten equipment life.

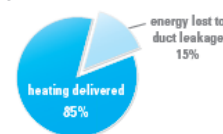
GET ENERGY EFFICIENCY

When your system is installed correctly, you avoid common problems that can reduce the operating efficiency of your equipment. The charts below show typical losses in systems that aren't installed to ENERGY STAR guidelines.

Typical Air Conditioner or Heat Pump Installation



Typical Furnace Installation



Quality installations help deliver the equipment's full potential.

Bid Comparison Checklist

Heating & Air Conditioning Installation Bid Comparison Checklist

When you purchase a new heating or cooling system, you expect high performance. Unfortunately, more than half of new systems in U.S. homes do not perform to their rated efficiency as a result of improper installation. In fact, improper installation can reduce performance by as much as 30%. This not only affects your utility bills, but can lead to a variety of comfort problems, including insufficient dehumidification, dust from leaking ductwork, and poor air distribution.

Ask the contractors bidding for your business if they follow ENERGY STAR[®] Quality Installation Guidelines (www.energystar.gov/qispec) to ensure that you are not buying just a piece of equipment but a properly installed heating and cooling system that provides comfort and efficiency. Ask the following questions to each contractor:

Contractor A: _____ Contractor B: _____ Contractor C: _____

Contact: _____ Contact: _____ Contact: _____

Phone: _____ Phone: _____ Phone: _____

EQUIPMENT	A	B	C
Do you offer ENERGY STAR qualified equipment?			
Will you measure my home and calculate the correct size for my equipment using Manual J? ¹			
Will you install a properly matched indoor coil and outdoor unit? ² (AC & heat pump only)			
Will you test to determine the maximum system size that can be installed with my existing ductwork?			
Will you install new refrigerant lines rather than reusing existing lines?			
Will you install and help me to set up an ENERGY STAR qualified programmable thermostat(s) (if not already in use)?			
Will you consider if zoning, with separate temperature controls for different areas, would be appropriate for my home?			
Will you provide me with information on any local rebate programs for which I might be eligible?			

DUCT WORK			
Will you check for damage to existing ductwork and duct insulation, and make repairs if necessary?			
If insulating ducts, will you seal all duct seams first?			
Will you test to confirm that duct leakage does not exceed recommended levels? ³			

VERIFICATION & MAINTENANCE			
Will you show me how to replace the air filter(s) in my new system?			
After installation, will you leave all manuals with me and provide documentation of installation procedures, including Manual J calculations, AHRI certificate, and records of any measurements or testing?			
Do you offer third-party verification that my system was properly installed and set up?			
Will you confirm proper levels of refrigerant and airflow across the coil? (AC & heat pump only)			

NOTES

¹ Proper equipment size is vital for maximizing efficiency and comfort. To size your new system, the contractor should calculate your home's heating and cooling loads using the Air Conditioning Contractors of America (ACCA) Manual J or equivalent.

² Your contractor should provide an Air Conditioning, Heating and Refrigeration Institute (AHRI) certificate to document that your system was properly matched.

³ Duct sealing is essential to the operation of your heating and cooling system. In most cases, it is recommended that total duct leakage be no more than 20%.

ENERGY STAR is sponsored by the U.S. Environmental Protection Agency and the U.S. Department of Energy. For more information, visit www.energystar.gov.



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APPENDIX F: Sample Case Studies



CASE STUDY

ENERGY STAR® HVAC Quality Installation

Finally Finding Comfort

Moreno Valley, CA

Soon after Linda and her family bought their new house 25 years ago they found that two rooms were consistently either too cold or too hot. A few years ago, they upgraded to new double-paned windows, with the hopes that it would solve their comfort problems. But they found that the improvement was minor. Those rooms were "driving us nuts," said Linda.

Last year, the family decided to upgrade the home's furnace and air conditioner. Linda looked to her electric utility company, Southern California Edison (SCE), to help find a quality contractor. SCE offers an ENERGY STAR Quality Installation program to provide maximum efficiency and comfort in heating, ventilation and air conditioning (HVAC) systems. On the utility's website, www.ac-quality.com, customers can see a list of participating contractors who have been trained to offer this specialized service. Linda called several contractors from the list and also checked with the Better Business Bureau. Ultimately, she selected JBS Mechanical, based in San Bernardino, CA.

JBS Mechanical staff began by conducting a comprehensive assessment of Linda's home and the existing HVAC system. This assessment included collecting information about the home to determine the appropriate equipment size and measuring air flow and leakage in the duct system.

In Linda's home, JBS technicians found that the air conditioner was oversized and the ductwork was undersized and leaking 30% of the air into the attic. As a result, conditioned air was not being well distributed throughout the entire house. So, in addition to replacing the old air conditioner and furnace with new, properly

sized, high efficiency models, they also redesigned and replaced ductwork to provide adequate air flow throughout the house and reduce leakage. During installation, the technicians also made sure that the system refrigerant was properly charged and air flow in the system was correct. "It now works great! Changing the ductwork made a big difference," Linda said. JBS submitted the installation file to SCE and Linda earned a rebate toward the cost of her new installation.

After the system was installed, SCE conducted independent testing to verify that the system passed the ENERGY STAR Quality Installation requirements. "With the ENERGY STAR program, we felt we had back up people with us to make sure the system that was installed correctly. We had the program on our side," said Linda.

Now, Linda and her family are comfortable in their entire home all year round. Linda highly recommends the Quality Installation program, "It's just great. It's not just the rebate money. It's the confidence it gives you in the company putting the system in."

The ENERGY STAR Quality Installation program is offered by EPA in partnership with utility companies in several states. Benefits of the program include:

- Up to 30% savings on heating and cooling costs
- Increased comfort throughout the home
- Improved system efficiency and air distribution

To find out more about HVAC Quality Installation, visit www.energystar.gov/HVACQI



CASE STUDY

ENERGY STAR® HVAC Quality Installation

Getting the Right Fit with Quality Installation

Southampton, MA

Ned and Nancy Polan contacted several contractors after deciding to install central air conditioning in their house. Wilson Services, based in Northampton, MA, set themselves apart by taking measurements of each room in the house and doing calculations to determine the appropriate equipment. The Polans received a range of equipment recommendations and price proposals, including one for significantly larger and more expensive air conditioning equipment, but they had more confidence in the system recommended by Wilson Services because of their thorough approach. "Of four contractors, only one did any kind of measurements," Ned said. Wilson Services explained that for optimal performance a system should be designed and sized properly for the home, and that bigger equipment is not always better.

The Polans wanted an efficient system, so they asked about ENERGY STAR equipment. Their contractor told them that in addition to selecting equipment with a high efficiency rating, he could ensure that the whole system would operate more efficiently by performing an ENERGY STAR Quality Installation. The ENERGY STAR Quality Installation program is offered by Western Massachusetts Electric Company through the COOL SMART program. Wilson Services is one of the contractors trained to offer this specialized service to provide maximum efficiency and comfort in heating, ventilation and air conditioning (HVAC) systems.

The measurements and sizing calculations performed by Wilson Services were the first steps for ENERGY STAR Quality Installation. Then during installation, the contractor sealed the ductwork to minimize leakage of cooled air and

tested to make sure that the new system had proper levels of air flow and refrigerant.

After the installation, COOL SMART staff conducted independent testing to verify that the system passed the ENERGY STAR Quality Installation requirements. The Polans valued the testing done by the COOL SMART technician. "He was super. It was great to have someone independent checking to make sure things were done right." Then Wilson Services submitted the installation file to COOL SMART and the Polans earned rebates toward the cost of their equipment and installation.

A year later, after a hot, humid summer, the Polans are very happy with their new air conditioning system. When asked if they would recommend the ENERGY STAR Quality Installation program and their contractor, Ned said "Absolutely, and I already have!"

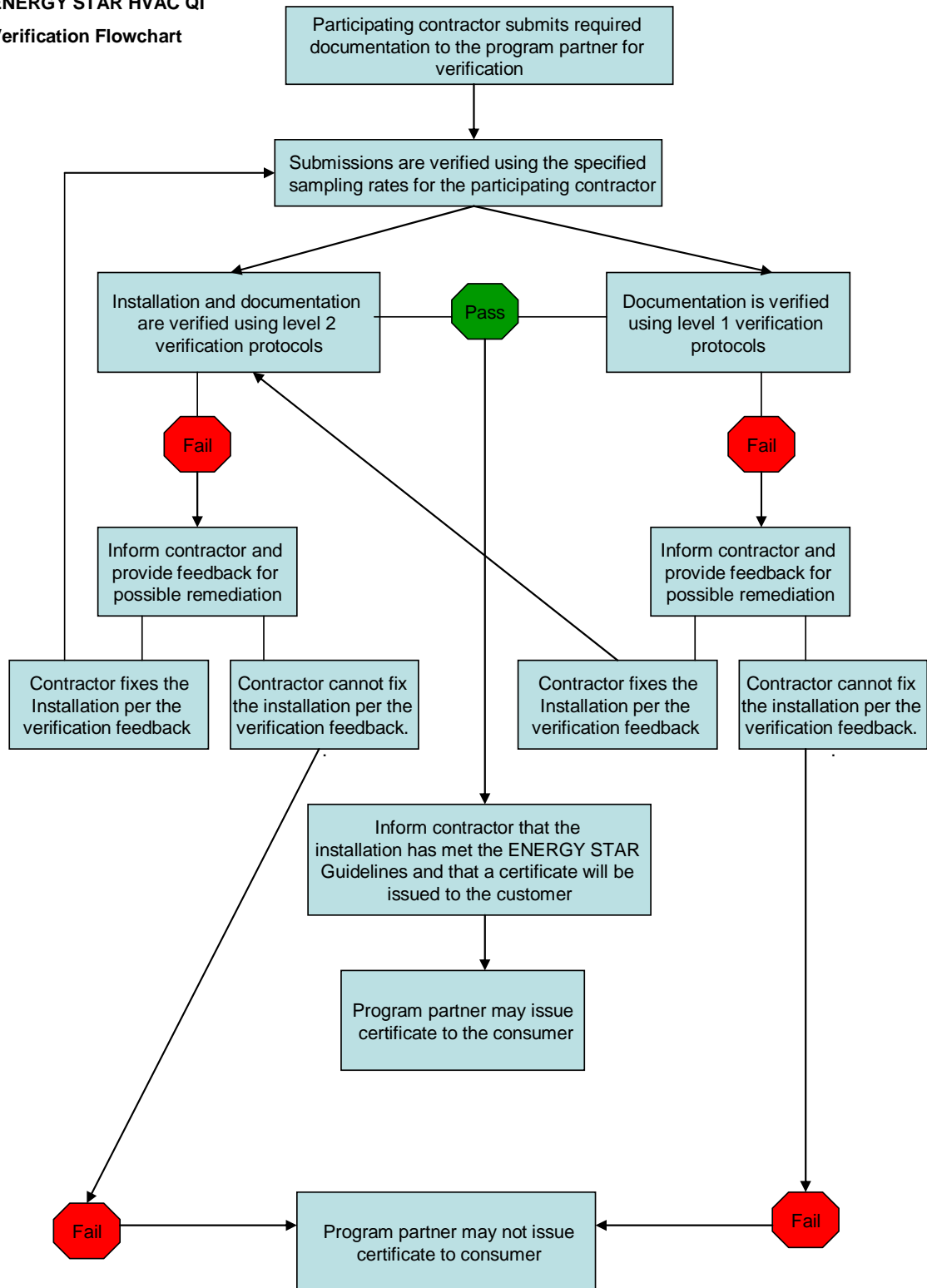
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To find out more about HVAC Quality Installation, visit www.energystar.gov/HVACQI

APPENDIX G: Verification Process

ENERGY STAR HVAC QI
Verification Flowchart



APPENDIX H: Program Plan Outline and Key Design Elements

This resource is designed to assist potential and current ESQI program partners in developing and refining program plans for their local markets. Each section highlights important considerations and questions that partners need to address in their program plans. Refer to the ESQI Partnership Agreement for specific areas that must be included in the program plan submission to EPA.

Introduction	Program Partner Information <ul style="list-style-type: none"> Type of organization (e.g. non-profit, utility, state energy office, etc) Overall goals and objectives for the program
Program Framework	Approach to delivering ESQI in your target market(s) <ul style="list-style-type: none"> Describe related programs and/or pre-existing infrastructure (e.g. trade organizations, training centers, and other residential energy efficiency programs) Program co-branding or coordination with any other pre-existing or future programs (e.g. utility/state programs) Describe what program functions will be delivered by the partner, 3rd party administrator/implementer, and other organizations Identify and assess market barriers to delivering the program. Address how to overcome these barriers and the benefits associated.
Target Market	Program Delivery <ul style="list-style-type: none"> Territory, metropolitan area, or service area Electricity rates, housing and population demographics, etc. Identify market influencers, trade allies, and stakeholders.
Estimated Budget	Program timetable for delivering ESQI to the target market(s)? <ul style="list-style-type: none"> Key dates Timeline for delivery of essential activities and deliverables (e.g. program launch, contractor recruiting, contractor training, marketing kickoff) Program Budget <ul style="list-style-type: none"> Source and duration of program funding Budget expenditures breakdown (Note: this is not required in the plan submitted to EPA) <ul style="list-style-type: none"> Program design Program administration and management Quality assurance Program development Marketing Incentives (contractor and/or homeowner incentives) Monitoring and evaluation Tracking and reporting
Goals and Savings Target	

<p>Marketing Strategy</p> <p>Incentive Strategy</p>	<p>What are the marketing strategies and methods for building program recognition among both contractors and homeowners?</p> <ul style="list-style-type: none"> • Describe how ESQI program will be communicated in sales and marketing materials and Web sites • Consider what materials will be developed and/or used by contractors to deliver information to homeowners about the program • What other sales and marketing strategies will be used to recruit contractors and attract homeowners to the program? <p>What incentives are being offered through the program? (Note: this is not required in the implementation plan submitted to EPA.)</p> <ul style="list-style-type: none"> • Consider contractor incentives for participation, training, completed jobs, and/or reporting • Consider rebates, special financing or buy-downs of home improvement loans for consumers
<p>Program Evaluation</p>	<p>How will program success be evaluated each year?</p> <ul style="list-style-type: none"> • Required cost-effectiveness tests (If so, describe the tests) • Performance against established program goals/metrics (participation, jobs, savings) • Accounting for non-energy savings related benefits