



ACCA Standard 9

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HVAC Quality Installation Verification Protocols

Establishes Minimum Requirements for Verifying That Residential and Light Commercial HVAC Systems Meet the ANSI/ACCA 5 QI - 2007 (*HVAC Quality Installation Specification*) Standard.

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FORWARD

[The Forward is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard]

Verification activities associated with the ANSI/ACCA 5 QI – 2007 (*HVAC Quality Installation Specification*), the QI Standard, involve validating that an HVAC installation adheres to the standard's requirements. Verification participants (Contractors, Verifiers, and Administrators) that follow this document's protocols will meet the minimum requirements for ensuring that outcome.

Verification participants will benefit from a complete understanding of the requirements in the QI Standard. All are encouraged to address ancillary operational and business issues such as, but not limited to:

- Entry and training requirements
- Installation requirements to the ACCA/ANSI QI Standard
- Documentation processing, retention, and information confidentiality
- Sampling and verification requirements that ensure credibility
- Conflict resolution process
- Customer service policies/procedures
- Quality control/quality assurance plan
- Applicable licensing and/or certifications

A strong, objective HVAC Quality Installation verification effort follows consistent, transparent, and standardized procedures. The ACCA QI Verification Protocols are for those who intend to protect the value and integrity of the QI Standard through qualified and objective examination of submitted HVAC system installations.

It is recognized that a verification effort which conducts a thorough inspection of every HVAC system installation for compliance to the QI Standard provides the greatest confidence. However, this level of verification effort requires substantial resources and coordination activities; proving costly and cumbersome. The intent of these protocols is to provide an approach to effectively evaluate HVAC system installations while optimizing resources in terms of manpower and expenses.

NOTE: Verification participants using the QI Standard should be aware of the following:

- No one may construe, claim or imply that their participation in ACCA/ANSI QI Verification constitutes ACCA's approval, acceptance, or endorsement. ACCA currently offers no endorsement of such parties or services.
- Everyone shall understand that the activities they undertake in connection with the ACCA/ANSI Quality Installation Standard are voluntary.
- ACCA reserves the right to actively pursue resolution of noncompliance related to the use of the ACCA and ACCA/ANSI Quality Installation marks.

INTRODUCTION

[The Introduction is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard]

This document details the requirements, roles, and obligations for the participants in an organized effort which ensures that HVAC installations comply with the ANSI/ACCA 5 QI – 2007 (*HVAC Quality Installation Specification*) QI Standard. Those HVAC systems which comply with the QI Standard provide several benefits to building owners including: increased comfort, improved indoor air quality and proper equipment operation.

Part I of the QI Verification Protocols addresses the purpose, scope, definitions, and an overview of the verification process for an HVAC system according to sampling and evaluation protocols. These steps involve the review of an HVAC system installation file and an in-field verification of measurements taken during the installation. A Verifier evaluates the installation file containing the system design elements, documentation pertinent to the installation, and customer education elements. The Verifier also coordinates the in-field verification, measures the different aspects of the HVAC system installation, records the findings, and verifies that the installation meets the requirements in the QI Standard.

Part II of the QI Verification Protocols provides the general requirements for the primary participants. The Contractor installs the HVAC system, the Verifier evaluates the HVAC system for conformity to the QI Standard, and the Administrator provides oversight to the verification effort.

The appendices provide samples and recommendations for a verification effort. Appendix A offers sample illustrations of forms, reports and other documentation. Appendix B outlines possible fee considerations and Appendix C offers sample documentation which demonstrates a Verifier's skill sets.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS i

FORWARD iii

INTRODUCTION iv

PART 1: VERIFICATION PROTOCOLS 1

1.0 PURPOSE AND SCOPE 1

2.0 DEFINITIONS: 1

3.0 PROCESS OVERVIEW: 2

4.0 SAMPLING PROTOCOLS 4

5.0 EVALUATION PROTOCOLS 6

PART 2: PARTICIPANT’S ROLES AND RESPONSIBILITIES 17

6.0 CONTRACTOR’S RESPONSIBILITIES 17

7.0 VERIFIER’S RESPONSIBILITIES 18

8.0 ADMINISTRATOR’S RESPONSIBILITIES 22

TABLE OF APPENDICES AND FIGURES 23

APPENDIX A | SAMPLE FORMS AND REPORTS 24

APPENDIX B | SAMPLE FEE AND INCENTIVE GUIDANCE FOR VERIFICATION EFFORTS 39

APPENDIX C | SAMPLE DOCUMENTATION THAT DEMONSTRATE VERIFIER COMPETENCY 40

PART 1: VERIFICATION PROTOCOLS

1.0 PURPOSE AND SCOPE

- 1.1 Purpose: This document specifies the protocols to verify the installation of HVAC systems in accordance with the ANSI/ACCA 5 QI-2007 *HVAC Quality Installation Specification*, the quality installation (QI) Standard.
- 1.2 Scope: The protocols provide guidance to a Contractor, Verifier, and Administrator who participate in verification efforts which use independent, objective, and qualified third parties to ensure that an HVAC installation meets the requirements in the QI Standard.

2.0 DEFINITIONS:

ACCA: Air Conditioning Contractors of America

AHRI: Air Conditioning, Heating, and Refrigeration Institute, formed when ARI and GAMA merged in January 2008. The ARI and GAMA proprietary rating programs, along with the Hydronics Institute, will continue into the near future.

Administrator: The entity that provides control over the verification process and ensures that HVAC installations comply with the QI Standard. Examples of entities that may serve as Administrators are: utilities, municipalities, industry associations, OEM preferred dealer programs, and groups of contractors.

ANSI/ACCA 5 QI -2007, HVAC Quality Installation Specification: The American National Standard that details the minimum requirements for the installation of unitary HVAC systems in residential and light commercial buildings.

Appeal: Request by a building owner or contractor for reconsideration of any adverse decision¹ made by the Administrator or Verifier related to the verification of an HVAC installation.

Building owner: The person or entity responsible for purchasing an HVAC system; either for a new building or to replace an existing system. The building owner may be the designated operator or manager of a commercial building, or the landlord of a rental property. The building owner shall be the prime point of contact for the building.

CEE: Consortium for Energy Efficiency

Complaint: Expression of dissatisfaction, other than appeal, where a response is not required.

Contractor: The entity responsible for the installation of HVAC systems.

Deficiency: A fault or omission found during the QI verification that the Verifier allowed the contractor to readily resolve.

Expert System: A software system that uses a previously assembled knowledge base and internal procedures to assess the values of multiple HVAC system data points and evaluate them for compliance with the QI Standard.

Installation file: A portfolio of documentation pertinent to the HVAC system installation. Examples include but are not limited to the pertinent items listed in §6.0 of the QI Standard. Installation files shall exclude job cost information, financing information, and any other type of personal², competitive, or financial information.

¹ Examples of adverse decisions include:

- refusal to accept an application,
- refusal to proceed with a verification,
- verification results.

² The Administrator may require some personal information; this may include name, address and phone number in order to manage the verification process. Other personal information shall be excluded.

Matched System: A set of two compatible HVAC units (i.e., combinations of evaporators, condensers, fan-coils, or heat pumps) that have been rated by AHRI or are in the CEE directory, or are certified by the OEM to deliver the specified capacity under the design conditions.

Nonconformity: A fault or omission found during the QI verification that prevents the HVAC system from meeting the QI Standard.

Original equipment manufacturer (OEM): The entity responsible for the design, manufacturer, and rating of HVAC equipment or components and provides support for its installation, use, and operation.

Positive control: Transfer of information that ensures receipt of all information to the intended party.

Quality Installation (QI) Standard: See: ANSI/ACCA 5 QI - 2007, *HVAC Quality Installation Specification*.

Verification review: An evaluation performed by a Verifier to ensure a specific HVAC system complies with the installation requirements in the QI Standard.

Verifier: The entity responsible for verifying that a specific HVAC installation system complies with the QI Standard. Verifiers may be one person or an organization, which provide an unbiased review and testing of specific HVAC system's installation.

3.0 PROCESS OVERVIEW:

3.1 Verification process: The process involves the review of an HVAC system installation file and an in-field verification of measurements taken during the installation (see Figure 1).

3.1.1 The Contractor submits an installation file for every HVAC system that is intended to be verified to the requirements in the QI Standard. The Verifier evaluates the system design elements, system documentation, and customer education elements submitted in the installation file.

3.1.2 The Verifier also coordinates the in-field site visit, measures the different aspects of the HVAC system installation, records the findings, and verifies that the installation meets the requirements in the QI Standard.

3.2 Use of archived information: The personal recorded information gathered from this activity shall be considered confidential and shall only be used in the effective administration of the verification effort. For all other purposes, recorded personal information shall only be disclosed with the written consent of all participating parties: building owner, Contractor, and Administrator (Section 8.5.3).

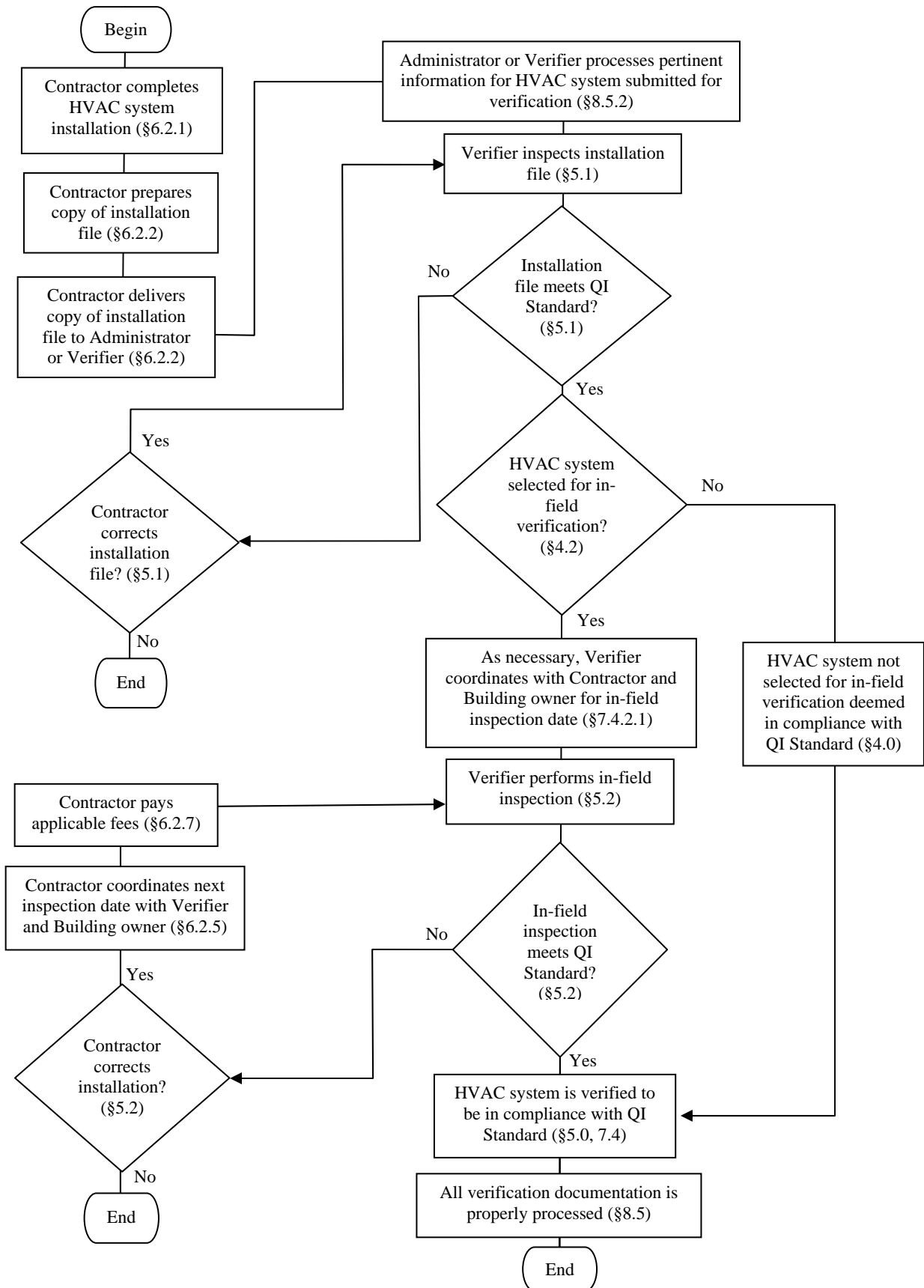


Figure 1: Illustration of Process Overview

4.0 SAMPLING PROTOCOLS

Recognizing that verifying every HVAC system would be resource intensive; these sampling protocols provide the minimum requirements for installation file reviews and in-field verifications.

4.1 Sampling Participation: The Administrator shall have the discretion to employ these sampling protocols.

4.2 Sampling Criteria: HVAC systems shall be selected for installation file review or in-field verification in an independent manner which:

4.2.1 Seeks a representative sample of the submitted HVAC systems.

4.2.2 Considers input from the Verifier's review of the installation file or in-field verification.

4.3 Sampling Strategy: Contractors may be advanced or demoted from level to level based on the results of their cumulative performance.

4.3.1 Level 1 Verification:

4.3.1.1 100% of installation files shall be reviewed for compliance to the QI Standard.

4.3.1.2 Each submitted installation shall receive in-field verification.

4.3.2 Level 2 Verification:

4.3.2.1 100% of installation files shall be reviewed for compliance to the QI Standard.

4.3.2.2 HVAC systems shall receive in-field verification at the following rate, the greater of either:

a. 10% of submitted installations, or

b. One of every ten (1-10) submitted installations, or

c. One submitted installation per quarter.

4.3.3 Level 3 Verification:

4.3.3.1 100% of installation files shall be reviewed for compliance to the QI Standard.

4.3.3.2 HVAC systems shall receive in-field verification at the following rate, the greater of either:

a. 3% of submitted installations, or

b. One of every thirty (1-30) submitted installations, or

c. One submitted installation per year.

Table 1: Sampling Protocol Summary (as allowed by Administrator)			
Increasing Proficiency Level			
Sampling Levels	Level 1	Level 2	Level 3
Installation file reviews	100%	100%	100%
In-field verifications	100%	One-in-ten (1-10)	One-in-thirty (1-30)
Decreasing Proficiency Level			
	From Level 2 to Level 1	From Level 3 to Level 2	
Installation file reviews	Fail three consecutive installation file reviews	Fail three consecutive installation file reviews	
In-field verifications	Fail a 1-10 in-field verification AND either of the two follow-up verifications	Fail a 1-30 in-field verification AND either of the two follow-up verifications	

- 4.4 Advancing Proficiency Level: The Administrator shall have the discretion to advance the Contractor to subsequent sampling level (if the administrator supports such levels):
 - 4.4.1 From Level 1 to Level 2: After a minimum of three consecutive installations have been verified to meet the QI Standard.
 - 4.4.2 From Level 2 to Level 3: The Administrator shall set the policy for advancing to this level.
- 4.5 Decreasing Proficiency Level: Contractors shall be reduced to the next lower sampling level using the following protocols.
 - 4.5.1 Installation file reviews: If the Contractor fails three consecutive installation file reviews.
 - 4.5.1.1 An installation file withdrawn from inspection because it does not meet the QI Standard shall count against the consecutive review file count.
 - 4.5.1.2 An installation file that has deficiencies, and is corrected shall not count against the consecutive review file count.
 - 4.5.2 In-field verification: If the Contractor fails an in-field verification, then two additional verifications shall be coordinated (see 4.6). If either of those two in-field verifications fails, then the Contractor shall return to the next lower level.
- 4.6 Subsequent testing of HVAC systems:
 - 4.6.1 Testing for an anomaly: If an HVAC system fails an in-field verification, then another HVAC system shall be selected to determine if the failed verification was an anomaly. If either of the subsequent HVAC systems fails the in-field verification then the other HVAC systems associated with that sampling group of installations (e.g., the other 27 of 30 HVAC systems) shall be deemed to have failed as well.
 - 4.6.2 Associated failures in a sampling group: HVAC systems associated with a failed sampling group, and those which have no in-field verification, must pass the in-field verification to achieve QI status.
 - 4.6.3 Evaluation expenses: An Administrator is not obligated to authorize, or bear the cost of evaluation for associated HVAC systems. Re-evaluation fees may also be assessed for failed installation file or in-field verifications (see Appendix B).
- 4.7 Expert Systems

The Administrator shall have the discretion to use other sampling strategies which include expert systems, given that the expert system can adequately evaluate the relationship of multiple data points, to ensure the applicable installation elements of the QI Standard are met.

 - 4.7.1 Use of expert systems: The Administrator shall have the discretion to use expert systems to supplement in-field verifications but shall not reduce the minimum required in-field verifications.
 - 4.7.2 Requirements for expert systems: Expert systems shall evaluate the relationship between the following applicable factors and correlate compliance to the QI Standard:
 - 4.7.2.1 Operating conditions inside and outside,
 - 4.7.2.2 Equipment capacity at those conditions,
 - 4.7.2.3 Refrigerant charge,
 - 4.7.2.4 On-rate tests,
 - 4.7.2.5 Airflow across the heat exchanger,
 - 4.7.2.6 Supply and return air volume (from Test and Balance report), and
 - 4.7.2.7 Duct leakage.

5.0 EVALUATION PROTOCOLS

HVAC systems shall be evaluated on two criteria: installation file review and in-field verification. An HVAC system that passes both portions of the verification review shall be in compliance with the QI Standard. One criterion shall not prevent the evaluation of the other. After the evaluation, the Verifier shall notify the Administrator of the verification's final disposition.

5.1 Installation file review:

A complete installation file must be submitted by the Contractor to the Verifier for each HVAC system installation to meet the QI Standard. The Verifier shall review the installation file to ensure it conforms to the QI Standard and shall notify the Contractor if the installation file passes or fails its review. The Contractor shall provide the necessary documentation to correct the non-conformities or withdraw the installation for verification.

5.1.1 Installation file requirement: The installation file must pass the Verifier's review in order to meet the requirements of these protocols.

5.1.2 Installation file completeness: The Verifier shall review the documentation within the HVAC system installation file and ensure that the pertinent information is present.

5.1.3 Installation file accuracy: The Verifier shall review the installation file to ensure the correctness of the following items: load calculation, correct equipment selection, and system matching.

5.1.3.1 Load calculation (Reference §3.1 of the QI Standard): The Verifier shall review the load calculation and determine if it is a reasonable approximation of the building's load. The Verifier will document the following information (see the Load Calculation section of Table 2: Required Information Reported by the Verifier):

- a. Design temperatures: In accordance with the load calculation's design weather data, or other approved design weather data by the authority having jurisdiction.
- b. Occupants: For residential load calculations, the number of occupants equals the number of bedrooms plus one³. For commercial load calculations, refer to the occupancy schedule.
- c. Infiltration: Verify use of blower door or other test data. Verify the load calculation procedure was followed to estimate the infiltration if infiltration is unknown.
- d. Ventilation: Rate is in accordance with codes, standards, and load calculation procedure or equivalent. Adjust the load calculation for heat or enthalpy recovery or ventilating dehumidifier.
- e. Building orientation: Building component's exposure on plans or drawings matches those used in the procedure.
- f. Altitude: Value used is within 500 feet of the altitude for the city selected for weather data or actual survey data.
- g. Latitude: Value used is the same as the city selected for weather data or actual survey data.

³ Abnormal occupancy requirements (e.g., those differing from 5.1.3.1.b.) will be documented and justified in the installation file.

- h. Duct loads: Ensure load calculation procedure includes the system loads associated with the duct distribution system.
 - i. Total heating load: Sum the different heating component loads and ensure that the value equals the design load calculation.
 - j. Total cooling load: Sum the different sensible, latent, and total cooling component loads and ensure that the value equals the design load calculation.
 - k. Building components: The Verifier shall, as a minimum, randomly select one (1) room or three (3) to five (5) building components from the load calculation worksheet (e.g., one window, one door, one wall or partition, one floor, and one ceiling) for verification. The Verifier shall calculate, record, and compare their results with the Contractor's results. For example:
 - Select one window, and evaluate the correctness of selecting that component for the procedure observed,
 - Ensure the correct heating and cooling factors were selected,
 - Ensure the area (size) of the building component is correct,
 - If applicable, as with a window, ensure the orientation, overhang, and internal shading are correct, and
 - Validate the mathematical calculation's correctness for the component's load.
 - Excessive deviations in the random selections shall be the basis to inspect more load components until the Verifier can determine if the load estimate does or does not approximate the expected building load. An inaccurate load estimate (see Table 4: Examples of Deficiencies and Nonconformities) shall negate the load calculation and fail the HVAC installation.
- 5.1.3.2 Equipment Capacity Selection (Reference §3.2 of the QI Standard): The Verifier shall review the equipment selection reference(s) and document the necessary information (see the Equipment Selection section of Table 2: Required Information Reported by the Verifier).
- a. Verify that the manufacturer's performance data meets the load calculation and design conditions in accordance with ACCA *Manual S*, *Manual CS* or other approved procedure by the authority having jurisdiction.
 - b. Verify that the equipment is sized within the tolerance specified in the QI Standard.
- 5.1.3.3 System Matching (Reference §3.3 of the QI Standard): The Verifier shall ensure the equipment has an AHRI or CEE directory certificate or is matched in accordance with OEM performance data. The Verifier shall document the necessary information (see the Matched Systems section of Table 2: Required Information Reported by the Verifier).
- 5.1.3.4 System documentation to owner: (Reference §6.1 of the QI Standard) The Verifier shall review the installation file for information pertinent to the

HVAC system installation (see the System Documentation section of Table 2: Required Information Reported by the Verifier):

- a. Drawings
- b. Installation performance measurements
- c. Warranty (Equipment and any Contractor warranty)
- d. Equipment submittals or sales literature
- e. Equipment model and serial numbers
- f. Test and balance reports
- g. Duct sealing test results⁴
- h. Building owner briefing checklist
- i. OEM venting instructions

5.1.3.5 Owner education (Reference §6.2 of the QI Standard): The Verifier shall review documentation that the building owner received the following information (see the Owner Education section of Table 2: Required Information Reported by the Verifier):

- a. Maintenance information:
 - Owner's tasks
 - Professional HVAC Contractor's tasks
 - Contractor contact information for maintenance
- b. Warranty information:
 - Warranty items and level of coverage
 - Process for warranty claims
 - Contact information for warranty claims.

5.1.4 Identifying HVAC systems for potential in-field verification: The Verifier shall have the discretion to identify HVAC systems for in-field verification based on irregularities found during the review the installation file's QI measurements. The in-field verifications shall be conducted in accordance with the §4.0 (Sampling protocols) and the Administrator's guidance.

5.2 In-field verification (installation file in hand):

The Verifier shall verify the in-field installation of the HVAC system. The Verifier shall record the results of the verification measurements and evaluate same for conformance to the QI Standard. The Verifier shall notify the Contractor if the in-field verification passes or fails. The Contractor shall correct the non-conformities or withdraw the installation for verification. In-field verification requirements: HVAC systems must "Pass" all requirements in order to be in compliance with the QI Standard.

5.2.1 Installation file requirements: The Verifier shall have the discretion to conduct an in-field verification before all of the installation file components are available⁵.

⁴ If building owner opts out of doing duct sealing (§5.1.3.d, QI Standard) the measured leakage rate will be recorded/documented in the installation file.

⁵ In-field verification of retrofit HVAC installations may occur nearly simultaneously with the completion of an HVAC system installation. An installation file may be incomplete at that time however; in-field verification measurements may be recorded. Information pertaining to a later installation file review shall be recorded, e.g., load calculation factors, equipment information, etc.

- 5.2.2 Mechanical failure: HVAC systems which suffer mechanical failure shall be retested after completion of repairs.
- 5.2.3 Load calculation (Reference §3.1 of the QI Standard): The load calculation data shall be reviewed against the building on which it was performed to confirm the applicability of the load calculation.
- 5.2.4 Equipment sizing (Reference §3.2 of the QI Standard): Record the make, model and serial number. Ensure equipment installed matches the equipment listed in the installation file.
- 5.2.5 System Matching (Reference §3.3 of the QI Standard): Verify the installed equipment matches the AHRI, or CEE directory certificate, or OEM performance data.
- 5.2.6 Required records of measurements: Measure and record the following using one of the approved methods (see the applicable section of Table 2: Required Information Reported by the Verifier):
 - 5.2.6.1 Airflow over the heat exchanger (Reference §4.1 of the QI Standard)
 - 5.2.6.2 Refrigerant Charge (Reference §4.2 of the QI Standard)
 - 5.2.6.3 Electrical Requirements (Reference §4.3 of the QI Standard)
 - 5.2.6.4 On-Rate for fuel-fired equipment (Reference §4.4 of the QI Standard)
 - 5.2.6.5 Combustion venting system (Reference §4.5 of the QI Standard)
 - 5.2.6.6 System controls (Reference §4.6 of the QI Standard)
 - 5.2.6.7 Duct leakage (Reference §5.1 of the QI Standard)
 - 5.2.6.8 Airflow balance (Reference §5.2 of the QI Standard)

Table 2 Required Information Reported by the Verifier			
QI Standard Element	Approved Procedure	Reported Information	
Design Elements (§3.0 QI Standard)	Load calculation (§3.1 QI Standard)	Manual J or Manual N forms and worksheets (or approved equivalent by authority having jurisdiction)	✓ Verify design conditions (measured and estimated):
			<ul style="list-style-type: none"> ○ Outdoor temps ○ Grains diff ○ Orientation ○ Occupants ○ Ventilation
			<ul style="list-style-type: none"> ○ Indoor temps ○ Latitude ○ Altitude ○ Infiltration ○ Duct load
			✓ For selected opaque building components (wall, doors, floors, etc)
			<ul style="list-style-type: none"> ○ Area of component ○ HTM of component
			✓ For windows
			<ul style="list-style-type: none"> ○ Area ○ Heating U value ○ Orientation
<ul style="list-style-type: none"> ○ Adjusted HTM ○ SHGF ○ Overhang dimensions 			
✓ Calculated loads			
<ul style="list-style-type: none"> ○ Total heating ○ Total cooling 			
<ul style="list-style-type: none"> ○ Sensible cooling ○ Latent cooling 			

Table 2 Required Information Reported by the Verifier (continued)

QI Standard Element	Approved Procedure	Reported Information
Design Elements (§3.0 QI Standard)	Equipment capacity selection (§3.2 QI Standard)	<ul style="list-style-type: none"> ✓ Equipment model ✓ Outdoor ambient dry-bulb ✓ Indoor entering wet-bulb ✓ Indoor entering dry-bulb ✓ Airflow across the heat exchanger ✓ Equipment Sensible Capacity ✓ Equipment Latent Capacity
	Heat Pump (from OEM performance data)	<ul style="list-style-type: none"> ✓ Equipment model ✓ Outdoor ambient dry-bulb ✓ Indoor entering wet-bulb ✓ Indoor entering dry-bulb ✓ Airflow across the heat exchanger ✓ Equipment Sensible Capacity ✓ Equipment Latent Capacity
	Furnace (from OEM performance data)	<ul style="list-style-type: none"> ✓ Equipment model ✓ Output Btu/H
	Boiler (from OEM performance data)	<ul style="list-style-type: none"> ✓ Equipment model ✓ Output Btu/H
	Electric Heater (from OEM performance data)	<ul style="list-style-type: none"> ✓ Equipment model ✓ Output Btu/H at: ✓ Rated kW ✓ Electric power (1Ø or 3Ø)
Matched systems (§3.3 QI Standard)	<ul style="list-style-type: none"> ✓ AHRI Directory Certificate, or ✓ CEE Directory Certificate, or ✓ OEM Catalog Performance Data 	
Airflow over the heat exchanger (§4.1 QI Standard)	Pressure matching method: At return air grille	<ul style="list-style-type: none"> ✓ Number of return air terminal devices ✓ Volume of measured duct leakage ✓ Location of calibrated fan ✓ Filter condition ✓ Location of pressure reading ✓ Calibrated fan pressure ✓ Design airflow ✓ Measured airflow (Calibrated fan flow at corresponding pressure)
	OR	<ul style="list-style-type: none"> ✓ Supply duct static pressure, unit fan only ✓ Location of pressure reading ✓ Calibrated fan pressure at supply static pressure ✓ Design airflow ✓ Measured airflow (Calibrated fan flow at corresponding pressure)
	Duct system traverse	<ul style="list-style-type: none"> ✓ Duct's inside dimensions ✓ Number of readings taken ✓ Average velocity ✓ Are ducts lined or internally insulated? ✓ Location of traverse test site ✓ Design airflow ✓ Measured airflow

Table 2 Required Information Reported by the Verifier (continued)			
QI Standard Element	Approved Procedure	Reported Information	
Equipment Elements (§4.0 QI Standard)	Airflow over the heat exchanger (§4.1 QI Standard)	Flow grid measurement	<ul style="list-style-type: none"> ✓ Flow grid test site (e.g., unit filter rack, etc) ✓ Altitude adjustment ✓ Air temperature adjustment ✓ Average air velocity ✓ Flow grid area ✓ Design airflow ✓ Measured airflow
		OR	
		Pressure Drop Total External Static Pressure	<ul style="list-style-type: none"> ✓ Equipment fan speed setting ✓ Supply side SP ✓ Return side SP ✓ Design airflow ✓ Measured airflow (Fan flow based on measured ESP, voltage, and fan speed)
		OR	
		Temperature rise method (electric heat only)	<ul style="list-style-type: none"> ✓ Measured temperature rise (supply - return air temp) ✓ Measured volts (at electrical disconnect) ✓ Measured amps (at electrical disconnect) ✓ Annotate Single Ø or Three Ø heater ✓ Design airflow ✓ Measured airflow
OR			
Temperature rise method (gas heat only)	<ul style="list-style-type: none"> ✓ Measured temperature rise (supply air - return air) ✓ Measured manifold pressure ✓ OEM specified manifold pressure ✓ Measured gas flow (time for one revolution of meter) ✓ Fuel gas heating value (from the gas company) ✓ Steady state heating efficiency ✓ Design airflow ✓ Measured airflow 		
OR			
Temperature rise method (oil heat only)	<ul style="list-style-type: none"> ✓ Measured temperature rise (supply air - return air) ✓ Nozzle size ✓ Nozzle flow rate ✓ Measured pump pressure ✓ Fuel oil heating value (from the oil company) ✓ Steady state heating efficiency ✓ Design airflow ✓ Measured airflow 		
Refrigerant charge (§4.2 QI Standard)	Superheat	<ul style="list-style-type: none"> ✓ Airflow over evaporator coil ✓ Refrigerant type ✓ Suction line pressure (at OEM specified location) ✓ Suction line temperature (at OEM specified location) ✓ Entering air temperature and humidity (at steady state, about 15 minutes) ✓ Outdoor weather conditions (invalid below 60°F, unless specified by OEM) ✓ Expansion device type ✓ OEM-recommended superheat ✓ Measured superheat 	

Table 2 Required Information Reported by the Verifier (continued)			
QI Standard Element	Approved Procedure	Reported Information	
Equipment Elements (§4.0 QI Standard)	Refrigerant charge (§4.2 QI Standard)	Sub-cooling	<ul style="list-style-type: none"> ✓ Airflow over evaporator coil ✓ Refrigerant type ✓ Liquid line pressure (at OEM specified location) ✓ Liquid line temperature (at OEM specified location) ✓ Entering air temperature and humidity (at steady state, about 15 minutes) ✓ Outdoor weather conditions (invalid below 60°F, unless specified by OEM) ✓ Expansion device type ✓ OEM-recommended sub-cooling ✓ Measured sub-cooling
		OR	
		OEM specified method	<ul style="list-style-type: none"> ✓ List all applicable measurements taken and provide documentation substantiating this procedure for the HVAC system
	Electrical requirements (§4.3 QI Standard)		<ul style="list-style-type: none"> ✓ Measured & name-plate line voltage for each component ✓ Measured and listed control voltage ✓ Measured & name-plate line amperage for each component ✓ Measured and listed control amperage ✓ Ensure the equipment is properly grounded ✓ List line wire size and type ✓ List control wire size and type
On-Rate for fuel-fired equipment (§4.4 QI Standard)	Gas-fired equipment	<ul style="list-style-type: none"> ✓ Nameplate heating input ✓ Nameplate temperature rise ✓ Fuel gas heating value (from the gas company) ✓ Measured gas flow rate ✓ Measured temperature rise (supply air - return air) 	
	Oil-fired equipment (Combustion testing)	<ul style="list-style-type: none"> ✓ Nozzle size and flow rate ✓ Measured temperature rise (supply air - return air) ✓ Nameplate temperature rise ✓ Measured CO level (at high, medium & low fire) ✓ Fuel pressure at burner (at high, medium & low fire) ✓ Draft above draft hood or barometric pressure (at high, medium & low fire) ✓ Steam pressure or water temperature entering and leaving boiler, steam generator, or process heater ✓ Unit rate if meter is available 	
Combustion venting system (§4.5 QI Standard)	Category I per OEM instructions or NFGC	<ul style="list-style-type: none"> ✓ Number and venting type (natural or fan assisted) of appliances in the venting system ✓ Number and type of offsets in venting system ✓ Altitude of installation (if de-rated for altitude) ✓ Total vent height (in feet) ✓ Total vent lateral length (in feet) 	
	OR		
	Category I per OEM instructions or IFGC	<ul style="list-style-type: none"> ✓ Number and venting type (natural or fan assisted) of appliances in the venting system ✓ Number and type of offsets in venting system ✓ Altitude of installation (if de-rated for altitude) ✓ Total vent height (in feet) ✓ Total vent lateral length (in feet) 	

Table 2 Required Information Reported by the Verifier (continued)				
QI Standard Element	Approved Procedure	Reported Information		
Equipment Elements (§4.0 QI Standard)	Combustion venting system (§4.5 QI Standard)	Category II, III, or IV per OEM instructions OR Category II, III, or IV per local code	✓ Attach OEM instructions and list required measurements (typical measurements are similar to those for Category I vent system). ✓ Attach local code and list required measurements (typical measurements are similar to those for Category I vent system).	
	System controls (§4.6 QI Standard)	Equipment controls	✓ Type of HVAC system ✓ Type of control ✓ Sequence of operation tested (heat, cool, fan, re-set controls, etc.)	
		Safety controls	✓ Type of safety control (e.g., condensate overflow switch) ✓ Method of test (e.g., lifted float, or filled pan with water) ✓ Result of test (e.g., system stopped, compressor stopped)	
	Duct Distribution Elements (§4.0 QI Standard)	Duct leakage (§5.1 QI Standard)	Duct pressurization test	✓ Qualitative assessment of outdoor wind conditions ✓ Calibrated fan connection point ✓ Duct pressure with reference to outside ✓ Orifice size and associated pressure table (if orifice is used) ✓ Pressure difference across the orifice (if orifice is used) ✓ Calibrated fan pressure ✓ Calibrated fan flow at reported pressure ✓ Duct leakage tolerance ✓ Measured duct leakage
OR			✓ Total measured supply CFM ✓ Total measured return CFM ✓ Airflow across the heat exchanger ✓ Duct leakage tolerance ✓ Measured duct leakage	
Flow hood method (Commercial only)			✓ Total measured supply CFM ✓ Total measured return CFM ✓ Airflow across the heat exchanger ✓ Duct leakage tolerance ✓ Measured duct leakage	
		OR	Blower door subtraction method	✓ Qualitative assessment of outdoor wind conditions ✓ House pressure with reference to outside (grilles covered) ✓ Calibrated fan pressure (grilles covered) ✓ Calibrated fan flow at reported pressure (grilles covered) ✓ Pressure in house WRT ⁶ ducts (house pressurized) ✓ Corresponding Subtraction Correction Factor ✓ House pressure with reference to outside (grilles open) ✓ Calibrated fan pressure (grilles open) ✓ Duct leakage tolerance ✓ Measured duct leakage (Calibrated fan flow at reported pressure - grilles open)

⁶ WRT is an acronym for With Reference To, it specifies the two areas across which a pressure difference is measured.

Table 2 Required Information Reported by the Verifier (continued)

	QI Standard Element	Approved Procedure	Reported Information	
Duct Distribution Elements (§4.0 QI Standard)	Duct leakage (§5.1 QI Standard)	Hybrid duct pressurization (At tested conditions)	<ul style="list-style-type: none"> ✓ Qualitative assessment of outdoor wind conditions ✓ House pressure with reference to outside ✓ House calibrated fan pressure ✓ House calibrated fan flow at reported pressure ✓ Duct calibrated fan pressure ✓ Duct leakage tolerance ✓ Measured duct leakage (Duct calibrated fan flow at reported pressure) 	
	Airflow balance (§5.2 QI Standard)	Flow hood measurements	<ul style="list-style-type: none"> ✓ Design airflow (for each duct terminal) ✓ Measured airflow (for each duct terminal) 	
		OR	Hot-wire or Rotary anemometer	<ul style="list-style-type: none"> ✓ Terminal devices' air velocity ✓ Report terminal devices' Ak factor ✓ Terminal devices' air velocity ✓ Report terminal devices' Ak factor ✓ Design airflow (for each duct terminal) ✓ Measured airflow (for each duct terminal)
		OR	Pitot tube	<ul style="list-style-type: none"> ✓ Duct's inside dimensions ✓ Number of readings taken ✓ Average velocity ✓ Location of traverse test site ✓ Design airflow (for each duct terminal) ✓ Measured airflow (for each duct terminal)

Table 3: QI Verification Elements Independent of Other Elements													
Element with Non-conformities	Element(s) That Subsequently Can be Verified												
	Load Calc	Equip Sel.	Sys Match	Air-flow	Ref Chg	Elect	On Rate	Vent	Controls	Duct Leak	Air Bal	Sys Doc	B.O. Ed
Load Calculation (§3.1 of QI Standard)			✓			✓			✓				✓
Equipment Selection (§3.2 of QI Standard)	✓												✓
System Matching (§3.3 of QI Standard)	✓	✓							✓	✓	✓		✓
Airflow (Heat Exchanger) (§4.1 of QI Standard)	✓	✓	✓			✓			✓				✓
Refrigerant Charge (§4.2 of QI Standard)	✓	✓	✓	✓		✓	*	*	✓	✓	✓		✓
Electrical ⁷ (§4.3 of QI Standard)	✓		✓					✓					✓
On Rate (§4.4 of QI Standard)	✓	✓	✓	✓	*	✓			✓	✓	✓		✓
Venting (§4.5 of QI Standard)	✓	✓	✓	✓	*	✓	✓		✓	✓	✓		✓
Controls (§4.6 of QI Standard)	✓	✓	✓										✓
Duct Leakage (§5.1 of QI Standard)	✓	✓	✓		✓	✓	✓	✓	✓				✓
Air Balance (§5.2 of QI Standard)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
System Documentation (§6.1 of QI Standard)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Building Owner Education (§6.2 of QI Standard)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

* As applicable; as when an HVAC system uses a fossil fuel heating appliance with forced air cooling then these items shall be verified.

5.3 Independent aspects of the QI Standard: If a deficiency or nonconformity is found, then the verification shall continue for the other unrelated elements of the HVAC installation. Table 3 (QI Verification Elements Independent of Other Elements) provides the independent element(s) that subsequently shall be verified at the discretion of the Verifier.

5.4 Deficiencies and Nonconformities:

Two different types of faults may be identified during the verification: deficiencies and non-conformities⁸. Table 4 (Examples of Deficiencies and Nonconformities) provides samples of quantified boundaries and descriptions of different faults and omissions.

5.4.1 Non-standard faults and deficiencies: Faults found that do not match the samples in Table 4:

5.4.1.1 Shall be compared with the listed deficiencies and nonconformities and then evaluated to determine the severity of the fault.

5.4.1.2 Faults evaluated to be nonconformities shall fail the HVAC installation.

5.4.1.3 Faults evaluated to be deficiencies shall not fail the HVAC installation.

⁷ The extent and nature of the electrical deficiency will determine the effect on the subsequent testing. The Verifier will decide which, if any, additional items to inspect.

⁸ Deficiencies will allow an HVAC system to meet the QI Standard, a non-conformity will cause the HVAC system to fail.

Table 4: Examples of Deficiencies and Nonconformities		
QI Element	Deficiencies	Nonconformities
Load calculation (§3.1 QI Standard)	<ul style="list-style-type: none"> Load calculation not initially in installation file; restored during onsite visit Error that does not affect equipment size 	<ul style="list-style-type: none"> No load calculation performed Block load performed in lieu of room-by-room (if needed per §3.1 QI Standard) Error that affects equipment size by more than the tolerances cited in the QI Standard Gross misrepresentation between the building and the load calculation performed, that result in a difference of 0.5 tons in equipment selection.
Equipment sizing (§3.2 QI Standard)	NA	<ul style="list-style-type: none"> Heating capacity of selected equipment is insufficient to meet the design heat loss or exceeds the tolerances set in the QI Standard. Cooling capacity exceeds the tolerances set in the QI Standard.
Equipment matching (§3.3 QI Standard)	<ul style="list-style-type: none"> Missing information restored to installation file during onsite inspection 	<ul style="list-style-type: none"> Improper equipment match (e.g., no AHRI certificate, no CEE directory listing, no OEM performance data, etc.)
Airflow (heat exchanger) (§4.1 QI Standard)	NA	<ul style="list-style-type: none"> Airflow exceeds the tolerances set in the QI Standard
Refrigerant charge (§4.2 QI Standard)	NA	<ul style="list-style-type: none"> Charge exceeds the tolerances set in the QI Standard
Electrical (§4.3 QI Standard)	<ul style="list-style-type: none"> Immediately correctable installation mistakes (e.g., bare wire, loose grounding, etc.) 	<ul style="list-style-type: none"> Incorrect wire size Incorrect grounding Line voltage out of OEM specifications Component amp draw out of OEM specifications
On-Rate (§4.4 QI Standard)	NA	<ul style="list-style-type: none"> Firing rate exceeds the tolerances set in the QI Standard Temperature rise exceeds the tolerances set in the QI Standard Oil nozzle flow rate exceeds the tolerances set in the QI Standard Oil pump pressure exceeds the tolerances set in the QI Standard
Venting (§4.5 QI Standard)	<ul style="list-style-type: none"> Immediately correctable strapping and support 	<ul style="list-style-type: none"> Wrong vent size. Wrong vent pipe material or classification Signs of condensate on vent system Improper condensate drains
System controls (§4.6 QI Standard)	NA	<ul style="list-style-type: none"> Controls do not control all modes of operation Safety controls do not function as specified
Duct leakage (§5.1 QI Standard)	<ul style="list-style-type: none"> Duct installation is incorrect but repaired. Filter door seal is corrected. 	<ul style="list-style-type: none"> New or existing construction, duct leakage exceeds the tolerances set in the QI Standard
Air balancing (§5.2 QI Standard)	NA	<ul style="list-style-type: none"> New or existing construction, residential or commercial, airflow exceeds the tolerances set in the QI Standard
System documentation (§6.1 QI Standard)	<ul style="list-style-type: none"> Any missing items restored to installation file 	<p>Missing copies of:</p> <ul style="list-style-type: none"> Load calculation forms and applicable worksheets Supporting drawings or architectural plans Manufacturer's performance data Equipment matching Airflow across the heat exchanger measurement or method of test Refrigerant charge measurement and method of test On Rate measurements and noted method of test Duct leakage measurement and method of test Air balance measurements and method of test
Building owner education (§6.2 QI Standard)	<ul style="list-style-type: none"> Any missing items restored to installation file 	<p>Missing copies of:</p> <ul style="list-style-type: none"> Briefing on sequence of operation Maintenance requirements, owner's maintenance tasks, maintenance contact information Warranty coverage, owner's requirements, warranty contact information.

PART 2: PARTICIPANT'S ROLES AND RESPONSIBILITIES

This section specifies the roles of the participants in a verification effort to establish that HVAC system installations meet the QI Standard. The administrative details in this section are meant to clarify the responsibilities of each participant.

6.0 CONTRACTOR'S RESPONSIBILITIES

6.1 Requirements for participation:

- 6.1.1 **Occupational Responsibilities:** The contractor is responsible for complying with all applicable jurisdictional requirements for licenses, insurance, and bonds.
- 6.1.2 **Liability:** The contractor is responsible for the installation of the HVAC system throughout the verification process. The Contractor shall maintain at least the minimum levels of insurance and bonding as required by the authority having jurisdiction.
- 6.1.3 **Tools and instrumentation:**
 - 6.1.3.1 **Calibration:** Use accurate measuring instruments and equipment. Maintain current calibration reports (Appendix A – Sample Forms and Reports) for applicable tools.
 - 6.1.3.2 **Training:** Contractors shall ensure technicians and installers use and are trained on the pertinent installation, diagnostic, and measurement instruments and equipment.

6.2 General obligations:

- 6.2.1 **Installation Responsibilities:** Contractor shall install HVAC systems in accordance with the QI Standard and other applicable installation guidance: OEM instructions, building codes, and all pertinent regulations for the state, county, or municipality in which they operate.
- 6.2.2 **Installation file submissions:** In a timely manner, submit an installation file, which contains the required information from §5.0, to the Administrator or Verifier for each HVAC installation that is intended for verification to the QI Standard
- 6.2.3 **Cooperation:**
 - 6.2.3.1 Provide the Verifier with the names and contact information for the primary and secondary points of contact for the business.
 - 6.2.3.2 Afford such accommodation and cooperation as is necessary to enable the Verifier to assess the HVAC system for the verification.
- 6.2.4 **In-Field verification attendance:** The Contractor shall attend the in-field verification at their discretion.
- 6.2.5 **In-Field verification re-inspection:** The Contractor shall coordinate testing for anomalies or re-testing of any HVAC systems.
- 6.2.6 **Complaints and appeals:** Comply with the Administrator's rules for complaints and appeals.
- 6.2.7 **Fees:** Pay fees as determined by the Administrator.

7.0 VERIFIER’S RESPONSIBILITIES

7.1 Requirements for participation

- 7.1.1 Occupational Responsibilities: The Verifier shall obtain and maintain appropriate licensing, insurance, and bonding.
- 7.1.2 Verification Responsibilities: Ensure the installed HVAC system meets the requirements specified in the QI Standard.
- 7.1.3 Liability: The Verifier shall have the applicable insurance and bonding at the appropriate levels for potential liabilities arising from its activities.
- 7.1.4 Licensing and Experience: Verifiers shall possess the necessary skill sets (See Table 5: Verifiers Skill Sets) and required licenses (by the authority having jurisdiction) for the measurements required by the QI Standard. See Appendix C for samples of documentation demonstrating these skill sets.

Table 5: Verifiers Skill Sets	
Applicable QI Section	Skill Set
	Basic Skills
	Basic math <ul style="list-style-type: none"> • Add • Subtract • Multiply • Divide <ul style="list-style-type: none"> • Calculate area • Read a tape measure • Apply figures to algebraic formulas and perform functions to achieve answer
	Problem solving skills <ul style="list-style-type: none"> • Ability to read and understand written instructions • Ability to reason logically <ul style="list-style-type: none"> • Ability to read and understand OEM installation instructions
	Equipment operation <ul style="list-style-type: none"> • Operate emergency disconnects <ul style="list-style-type: none"> • Cycle equipment through all phases of operation (heat, cool, fan only, auxiliary heat only)
	Mobility <ul style="list-style-type: none"> • Climb 10’ step ladder, hold a capture-hood, and record data • Able to lift 30 pounds <ul style="list-style-type: none"> • Crawl in a 3’ tall, 20’ long crawlspace dragging a tool bag
	Interpersonal skills <ul style="list-style-type: none"> • Relates well to others <ul style="list-style-type: none"> • Can present information clearly
	§3.1 Load Calculations
Understands principles of heat transfer <ul style="list-style-type: none"> • Hot – cold • Temperature difference • U Value / heat conductance <ul style="list-style-type: none"> • R Value / insulation / heat resistance • Sensible & latent heat 	
Understands building blueprints/plans <ul style="list-style-type: none"> • Images • Diagrams • Orientation <ul style="list-style-type: none"> • Illustrations • Legends 	

Table 5: Verifiers Skill Sets (continued)	
Applicable QI Section	Skill Set
§3.2 Equipment Selection	Understands OEM performance data: <ul style="list-style-type: none"> • Operating conditions • Basic equipment nomenclature • Equipment capacity at field conditions
	Understands QI sizing guidance: <ul style="list-style-type: none"> • AC, heat pump, furnace, boiler • Heating dominated climate • Cooling dominated climate
§3.3 Matched Systems	Can identify a matched set in the AHRI database
	Can identify a matched set in the CEE directory
	Can identify a matched set using OEM performance data
	Can identify equipment to ensure what is specified is what is installed
4.1 Airflow (heat exchanger)	Knowledge of: <ul style="list-style-type: none"> • Airflow dynamics • Fan laws
	Knowledge of airflow tools: <ul style="list-style-type: none"> • Calibrated fan • Manometer • Static pressure probe • Thermometer • Anemometer (hotwire or vane/rotary style) • Flow grid • Pitot tube • Use a multi-meter
	Knowledge of airflow procedures: <ul style="list-style-type: none"> • Section a duct for a traverse • Pressure matching • “Clock” a gas meter • Blower curve data
§4.2 Refrigerant Charge	Possess EPA 608 Certification (Type II, III, or Universal)
	Ability to convert a temperature to a pressure or vice versa for a given refrigerant (Knowledge of pressure temperature chart)
	Ability to select the correct manifold gauge set for the refrigerant tested
	Ability to read pressure on a manifold gauge set for the refrigerant tested
	Ability to connect refrigerant hoses to a Schrader valve
	Ability to read a thermometer
§4.3 Electrical	Knowledge of electrical components
	Knowledge of electrical measurement instruments
	Knowledge of electrical measurements: <ul style="list-style-type: none"> • Volts • Amps
	Knowledge of electrical codes: <ul style="list-style-type: none"> • Fuses • Wire sizing
§4.4 On-rate	Knowledge of: <ul style="list-style-type: none"> • Gas pressure • Fuel nozzle sizes • Nozzle orientation • Manifold pressure • Fuel pump pressure • Measure temperatures
§4.5 Combustion Venting	Knowledge of pertinent information relating to: <ul style="list-style-type: none"> • National Fuel Gas Code venting tables • OEM instructions for Type I, II, III, and IV appliances • Vent connections • Vent strapping and supporting • International Fuel Gas Code venting tables • Local codes for Type I, II, III, and IV appliances • Different types of vent pipe/materials

Table 5: Verifiers Skill Sets (continued)	
Applicable QI Section	Skill Set
§4.6 System Controls	Equipment operation: <ul style="list-style-type: none"> • Cycle equipment through all phases of operation (heat, cool, fan only, auxiliary heat only) • Cycle zone controls for each controlled zone
§5.1 Duct Leakage	Knowledge of air leakage measurement procedures: <ul style="list-style-type: none"> • Pressure testing • Hybrid pressurization / blower door subtraction • Total supply and return compared to airflow at the heat exchanger • Blower door subtraction method
	Knowledge of air leakage measurement instruments: <ul style="list-style-type: none"> • Calibrated fans • Capture hoods • Blower doors
§5.2 Airflow Balance	Knowledge of: <ul style="list-style-type: none"> • Airflow dynamics • Fan laws
	Knowledge of airflow measurement instruments: <ul style="list-style-type: none"> • Anemometer (hotwire) • Capture hood • Manometer • Pitot tube
	Knowledge of airflow procedures (e.g., AABC, ACCA, ASHRAE, NBI, NEBB, SMACNA, and TABB):

7.1.5 Tools and instrumentation:

7.1.5.1 Calibration: Use accurate measuring instruments and equipment. Maintain current calibration reports (Appendix A – Sample Forms and Reports) for applicable tools.

7.1.5.2 Training: Verifiers shall ensure all in-field verification personnel use and are trained on pertinent installation, diagnostic, and measurements instrumentation and equipment.

7.1.5.3 Documentation: Verifiers will maintain documentation demonstrating conformance to calibration requirements

7.2 Prevention of conflict of interest: Verifiers, who are HVAC contractors, will use other Verifiers to review installation files and conduct in-field verification on their own HVAC system installations.

7.3 General obligations:

7.3.1 Verifications: Provide objective and un-biased evaluations of HVAC systems.

7.3.2 Documentation: Accurately record and review the results of the verifications with the Contractor and the Administrator.

7.3.3 Complaints and Appeals: Address complaints and appeals to the Administrator in accordance with the Administrator's established procedures.

7.3.4 Releasing Verifications Results: Relay to the Contractor's identified primary and secondary points of contact the results of the verification.

7.3.5 Information Control: As instructed by the Administrator, release information about an HVAC system's verification. The Contractor shall receive the first notification of deficiencies and nonconformities to allow for their resolution.

- 7.4 Verification protocols: The Verifier shall verify an HVAC system installation in two stages: review of the installation file and the in-field verification.
 - 7.4.1 Installation file review: The Verifier shall review the HVAC system installation file and verify that the necessary information is present and correct (see Section 5.1).
 - 7.4.2 In-field verification:
 - 7.4.2.1 Coordination: The Verifier shall coordinate the verification of an HVAC system with the contractor and the building owner. The Verifier shall call the Contractor for target dates and then coordinate with the building owner for one of the target dates.
 - 7.4.2.2 Records and measurements: Record the results of measurements, tests, and observations of the HVAC system and ensure they meet the QI Standard.
 - 7.4.3 Verification or disapproval of an HVAC system to meet the QI Standard:
 - 7.4.3.1 If the HVAC installation passes all applicable portions of the verification, then the Verifier provides the Administrator with the documentation confirming the HVAC system complies with the QI Standard.
 - 7.4.3.2 If the HVAC installation fails the verification, then the Verifier shall review the nonconformities that caused the denial with the Contractor's primary or secondary point of contact and provide necessary information to the Administrator.
- 7.5 Resolution of Safety Faults identified by Verifier: If a Verifier observes an obvious and imminent safety issue that would cause harm to the building owner, occupant, or installing contractor, then they shall immediately take the following action:
 - 7.5.1 If applicable, call 911.
 - 7.5.2 In the absence of any other responsible party, initiate steps to resolve the immediate safety issue (e.g., turn off power or fuel supply).
 - 7.5.3 Alert the following parties of actions taken:
 - 7.5.3.1 Installing Contractor
 - 7.5.3.2 Building owner (or designated point of contact)
 - 7.5.3.3 Fuel (gas or oil) company, if applicable
 - 7.5.3.4 Administrator
 - 7.5.4 Document actions taken, person(s) notified, date, time, etc.
- 7.6 Document control and records management: The Verifier shall follow the Administrator's requirements for document control and records management.
- 7.7 Internal audits: Perform internal audits, at least annually to identify and incorporate good practices and to correct inadequacies.

8.0 ADMINISTRATOR'S RESPONSIBILITIES

8.1 Requirements for participation:

- 8.1.1 **Legal identity:** Shall be a registered legal entity. Shall have a description of its legal status, including the names of its owners if applicable and, if different, the names of the organization(s) or person(s) who control it.
- 8.1.2 **Financial Security:** Shall have sufficient financial resources and insurance to satisfy expenses and liabilities arising from a QI verification effort.
- 8.1.3 **Organization:** Shall establish a verification effort which provides confidence, and safeguards the objectivity and impartiality of its activities.
- 8.1.4 **Oversight:** Provide supervision of a verification effort in accordance with the QI Standard and the ACCA verification protocols.

8.2 General obligations:

- 8.2.1 **Verification standard compliance:** Shall document, implement, and maintain procedures in accordance with the ACCA verification protocols.
- 8.2.2 **Application processing:** The Administrator shall establish requirements for Contractors and Verifiers who participate in the QI verification activity:
- 8.2.3 **HVAC system verification:**
 - 8.2.3.1 Ensure objective and appropriately proficient Verifiers are used to verify HVAC system installations.
 - 8.2.3.2 Provide HVAC system sampling criteria which are independent, seek a representative sample, and consider Verifier's input.

8.3 **Complaints and Appeals:** The Administrator shall develop and implement a process for the management and resolution of complaints in an expedient manner.

8.4 **QI Brand Protection:** The Administrator shall establish policies and procedures to protect the use of the logos and certificates which represent that HVAC system meets the requirements for the QI Standard.

8.5 **Administrative requirements:** The Administrator shall develop and implement the management procedures for:

- 8.5.1 Creation of documents, forms, and applications
- 8.5.2 Control of records and information flow throughout the verification effort
- 8.5.3 Protection of records confidentiality
- 8.5.4 Maintenance of records after completion of the verification process

TABLE OF APPENDICES AND FIGURES

[These appendices are not part of the standard. They are merely informative and do not contain requirements necessary for conformance to the standard]

Appendix A

Figure A1: Sample Contractor’s Installation File Summary	25
Figure A2: EPA EnergyStar Commissioning Report (Page 1)	26
Figure A3: EPA EnergyStar Commissioning Report (Page 2)	27
Figure A4: Sample Test And Balance Report.....	28
Figure A5: HVAC System QI Checklist (Page 1).....	29
Figure A6: HVAC System QI Checklist (Page 2).....	30
Figure A7: Light Commercial Load Calculation Sample N1 Form	31
Figure A8: Residential Load Calculation Sample J1 Form.....	32
Figure A9: Residential Load Calculation Sample J1ae.....	33
Figure A10: Equipment Performance Data Sample	34
Figure A11: Test Instrument/Gauge Calibration Report.....	34
Figure A12: Matched Systems – AHRI Certificate Sample.....	35
Figure A13: Matched Systems – CEE Directory Printout Sample.....	36
Figure A14: Example of Matched System from OEM Performance Data.....	37
Figure A15: Administrator Survey of Contractor: Verifier.....	37
Figure A16: Administrator Survey of Building Owner: Verifier.....	38
Figure A17: Administrator Survey of Building Owner: Contractor	38

Appendix B

Figure B1: Sample Fee Structures.....	39
Figure B2: Sample Incentives	39

Appendix C

Figure C1: Acceptable Documentation Demonstrating a Verifier Skill Set	40
Figure C2: Acceptable Documentation Demonstrating a Verifier Skill Set (continued)	41

APPENDIX A | SAMPLE FORMS AND REPORTS

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard]

The samples forms illustrated here may be used by Contractors and Verifiers. These forms are not required for compliance to the QI Specification, they are offered as a way to document the necessary information. The questionnaires are offered for use in a telephone survey.

Sample Contractor’s Installation File Summary										
Customer Information										
Address					Phone Number					
Design Information (QI Standard §3.0)										
Heating load					Equipment Capacity					
					Auxiliary Heat (if applicable)					
Equipment Type ¹										
Equipment Model					Equipment Serial Number					
Total Cooling load					Equipment Capacity					
Sensible Cooling load					Equipment Capacity					
Latent Cooling load					Equipment Capacity					
Equipment Type ¹										
Equipment Model					Equipment Serial Number					
Equipment Type ¹										
Equipment Model					Equipment Serial Number					
Matched System (Circle one)			AHRI Certificate		CEE Directory Certificate		OEM Catalog Data			
Equipment Installation (QI Standard §4.0)										
Measured Airflow					Measured Refrigerant Charge Deviation ²					
Component				Name plate Volts				Measured Volts		
				Name plate Amps				Measured Amps		
Component				Name plate Volts				Measured Volts		
				Name plate Amps				Measured Amps		
Component				Name plate Volts				Measured Volts		
				Name plate Amps				Measured Amps		
Component				Name plate Volts				Measured Volts		
				Name plate Amps				Measured Amps		
Control ³				Name plate Volts				Measured Volts		
				Name plate Amps				Measured Amps		
Grounding					Line wire size					
Control wire size					Combustion: Gas pressure					
Combustion: Manifold					Combustion: Oil pump					
Venting per ⁴ :				Yes or	Combustion: Oil nozzle / spray					
Duct Distribution Installation (QI Standard §5.0)										
Measured Duct Leakage					Balance Report Attached			Yes or No		
System Documentation and Owner Education Aspects (QI Standard §6.0)										
System Documentation	Architectural Drawings			Operation instructions			Balance reports			
	Survey data			As-built drawings			Equip. model / serial			
	OEM performance data			Equipment submittals			Sales literature			
Owner Education		Owner ed. – Maintenance			Owner ed. – Warranty			Sequence of operation		
¹ Furnace, Boiler, Air Conditioner Condenser, Air Conditioner Coil, Heat Pump Condenser, Fan Coil ² Difference from ideal for procedure performed, e.g., Superheat +2°F, or Sub cooling -1°F ³ List the model thermostat, humidistat, de-humidistat, zone system, economizer control, etc. ⁴ List if IFGC, NFGC, OEM Instructions, or code requirements										

Figure A1: Sample Contractor’s Installation file Summary

ENERGY STAR			
Installation Pilot Commissioning Report			
Date: _____		Time: _____	
Site Information			
Address 1: _____			
Address 2: _____			
City: _____		State: _____	Zip: _____
Design			
Heat Gain Method: <input type="checkbox"/> Manual J v7 <input type="checkbox"/> Manual J v8 <input type="checkbox"/> None <input type="checkbox"/> Other (specify): _____			
Duct Design Method: <input type="checkbox"/> Manual D <input type="checkbox"/> None <input type="checkbox"/> Other (specify): _____			
Equipment Specification method: <input type="checkbox"/> Manual S <input type="checkbox"/> OEM Recommendation <input type="checkbox"/> Other (specify): _____			
Latent Heat Gain: _____ BTUh		Sensible Heat Gain: _____ BTUh	
Total Heat Gain: _____ BTUh		Design Airflow: _____ CFM	
Duct Design Static Pressure: _____ IWC			
Type of Installation: <input type="checkbox"/> Replacement <input type="checkbox"/> New System - Existing Home <input type="checkbox"/> New System - New Home			
Square Feet of Zone: _____ sqft			
Equipment			
Condenser:		Manufacturer: _____	Model: _____
Serial Number: _____			
Evaporator:		Manufacturer: _____	Model: _____
Serial Number: _____			
System			
Metering Device: <input type="checkbox"/> TXV <input type="checkbox"/> Fixed Orifice <input type="checkbox"/> Other (specify): _____			
Refrigerant: <input type="checkbox"/> R-22 <input type="checkbox"/> R-410a <input type="checkbox"/> Other (specify): _____			
Refrigerant Charge Goal (for TXV): _____ Subcooling		Approach (for Lennox only)	
Fan Motor Type: <input type="checkbox"/> Fixed Speed (e.g. PSC) <input type="checkbox"/> Variable (e.g. GE - ECM)			
Latent Capacity: _____ BTUh		Sensible Capacity: _____ BTUh	
Total Capacity: _____ BTUh			
ARI EER/SEER: _____ (14 or higher)		ARI Ref #: _____	
Air Flow Tests			
Static Pressure: Return Static _____ IWC Supply Static _____ IWC			
Measured Air Volume @ evaporator: _____ CFM			
Volume Measurement Method Used: <input type="checkbox"/> TrueFlow <input type="checkbox"/> Anemometer <input type="checkbox"/> Pressure Matching (w/ Duct Blaster) <input type="checkbox"/> Other:			
Evaporator/Air Handler Fan Power: Pre: _____ Amps _____ volts _____ watts			
Post: _____ Amps _____ volts _____ watts			
Condenser Fan Power: Pre: _____ Amps _____ volts _____ watts			
Post: _____ Amps _____ volts _____ watts			
Compressor Power: Pre: _____ Amps _____ volts _____ watts			
Post: _____ Amps _____ volts _____ watts			
Speed Setting: Fixed: <input type="checkbox"/> Low <input type="checkbox"/> Med-Low <input type="checkbox"/> Med <input type="checkbox"/> Med-High <input type="checkbox"/> High CFM (for setting): _____			
>>> OR <<<			
Speed Setting: Variable: Fan set for: _____ CFM			

Figure A2: EPA EnergyStar Commissioning Report (Page 1)

Installation Pilot Commissioning Report (Page 2)	
Refrigerant Tests	
Test Conditions:	
Return Air _____ F DB	Return Air _____ F WB
Supply Air _____ F DB	Supply Air _____ F WB
<i>Above air temperatures are taken in ducts near evaporator - not in conditioned building space.</i>	
Outdoor Ambient (at condenser): _____ F DB	
Liquid Line Pressure: _____ psi	Liquid Line Temp.: _____ F
Suction Line Pressure: _____ psi	Suction Line Temp.: _____ F
Refrigerant Calculations	
Condensing Temp (from liq. press) _____	
Evaporating Temp (from suction press) _____	
For TXV:	
Subcooling: (Condensing Temp - Liquid Line Temp) _____	
Subcooling Deviation: (Subcooling - Subcooling Goal) _____ (must be +/- 3 degrees F of goal)	
For Fixed Orifice:	
Superheat: (Suction Line Temp - Evaporating Temp) _____	
Superheat Goal: _____ From Superheat lookup tables - based on Outdoor ambient and return air wet bulb temp	
Superheat Deviation: (Superheat Goal - Superheat) _____ (must be +/- 5 degrees F of goal)	
For Lennox TXV:	
Approach: (Liquid Line Temp - Outdoor Ambient) _____	
Approach Deviation: (Approach Goal - Approach) _____ (must be +/- 1 degrees F of goal)	
Electrical Requirements	
Meets ACCA QI 4.3? <input type="checkbox"/> Yes <input type="checkbox"/> No	
System Controls	
Meets ACCA QI 4.6? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Duct Leakage	
Existing system Duct Leakage: _____ CFM	Leakage % Reduction (Existing - Post / [Existing]): _____
Post Installation Duct Leakage: _____ CFM	% Total Leakage (Post Leakage/Design CFM): _____
Test Method Used: <input type="checkbox"/> Duct Blaster <input type="checkbox"/> Blower Door Subtraction <input type="checkbox"/> Other (specify): _____	
System Documentation	Owner Education
Copies of this report and OEM manuals left with owner? <input type="checkbox"/> Yes <input type="checkbox"/> No	Demonstrated system for owner? <input type="checkbox"/> Yes <input type="checkbox"/> No
Contractor/ Technician Information	
Technician Name: _____	
Company: _____	
Address 1: _____	
Address 2: _____	
City: _____	State: _____ Zip: _____
Technician Signature: _____	

Figure A3: EPA EnergyStar Commissioning Report (Page 2)

Sample Test and Balance Report

Date: _____ Time: _____

Site Information

Address 1: _____
Address 2: _____
City: _____
State: _____ Zip: _____

Construction Type New or Existing Commercial or Residential

Testing Technician _____

Testing Method Flow Hood Traverse (Anemometer) Traverse (Pitot tube) Velocity / Grille Ak

Test Instrument (Make and Model) _____ Calibration Date _____

Test Instrument (Serial number) _____ Air Temperature _____ Altitude _____

Room / Duct Terminal Location	Design Airflow	Test 1 / Final	Test 2 / Final	Test 3 / Final	% Design
Total Design Airflow		Final Airflow			% of Design

Figure A4: Sample Test and Balance Report

<h1 style="background-color: black; color: white; padding: 5px;">HVAC System QI Checklist</h1>		† Building: <input type="radio"/> EC <input type="radio"/> NC <input type="radio"/> ER <input type="radio"/> NR
Customer Name: _____	Building Plan ID: _____	
Building Address: _____	Zone Name: _____	
<h2 style="background-color: black; color: white; padding: 5px;">Equipment Information</h2>		
<input type="checkbox"/> Furnace _____ <input type="checkbox"/> Unit Model # <input type="checkbox"/> Boiler _____ <input type="checkbox"/> Fan Coil _____ <input type="checkbox"/> Unit Serial #	<input type="checkbox"/> Coil _____ <input type="checkbox"/> Unit Model # <input type="checkbox"/> Elect Htr _____ <input type="checkbox"/> Other _____ <input type="checkbox"/> Unit Serial #	<input type="checkbox"/> A/C Cond _____ <input type="checkbox"/> Unit Model # <input type="checkbox"/> H/P Cond _____ <input type="checkbox"/> Other _____ <input type="checkbox"/> Unit Serial #
<input type="checkbox"/> Equipment specified in the installation file matches the equipment found during in-field verification		
<h2 style="background-color: black; color: white; padding: 5px;">Installation File Verification</h2>		
Equipment Matching <input type="checkbox"/> Pass <input type="checkbox"/> AHRI <input type="checkbox"/> CEE Directory <input type="checkbox"/> OEM Catalog Data	Equipment Sizing: <input type="checkbox"/> Pass Equipment meets load and design conditions: <input type="radio"/> Yes <input type="radio"/> No Equipment within size requirements: <input type="radio"/> Yes <input type="radio"/> No	
Load Calculation <input type="checkbox"/> Pass Winter OD Temp: _____ ID Temp: _____ Summer OD Temp: _____ ID Temp: _____ Design Grains: _____ @ Rh: _____ Latitude: _____ Altitude: _____ Building orientation: _____ # Occupants: _____ Ventilation rate: _____ Infiltration estimate: _____ Ducts (correct duct table used?): <input type="radio"/> Yes <input type="radio"/> No Math: Heating: _____ Math: Cooling: _____ Random Comp. Load 1: _____ Random Comp. Load 2: _____ Random Comp. Load 3: _____ Random Comp. Load 4: _____ Random Comp. Load 5: _____	System Documentation: <input type="checkbox"/> Pass Drawings: <input type="radio"/> Yes <input type="radio"/> No Equipment performance info: <input type="radio"/> Yes <input type="radio"/> No Equipment submittals or sales literature: <input type="radio"/> Yes <input type="radio"/> No Equipment model and serial numbers: <input type="radio"/> Yes <input type="radio"/> No Test and balance reports: <input type="radio"/> Yes <input type="radio"/> No Duct sealing test results: <input type="radio"/> Yes <input type="radio"/> No Owner education: Sequence of operation: <input type="radio"/> Yes <input type="radio"/> No Maintenance: <input type="radio"/> Yes <input type="radio"/> No Requirements: <input type="radio"/> Yes <input type="radio"/> No Owner's tasks: <input type="radio"/> Yes <input type="radio"/> No Contact info: <input type="radio"/> Yes <input type="radio"/> No Warranty: Coverage: <input type="radio"/> Yes <input type="radio"/> No Owner's requirements: <input type="radio"/> Yes <input type="radio"/> No Contact info: <input type="radio"/> Yes <input type="radio"/> No	
<h2 style="background-color: black; color: white; padding: 5px;">In-field Verification</h2>		
Airflow (across indoor heat exchanger): <input type="checkbox"/> Pass Meas. Airflow: _____ Design Airflow: _____ *MOT: _____ † Meas. 1: _____ ‡ Meas. 2: _____ ‡ Meas. 3: _____ ‡ Meas. 4: _____ ‡ Meas. 5: _____ ‡ Meas. 6: _____ ‡ Meas. 7: _____	On-Rate: <input type="checkbox"/> Pass SAT: _____ RAT: _____ Ent. H2O Temp: _____ Lv. H2O Temp: _____ Draft above hood: _____ Unit Rate: _____ On-Rate - Gas specific measurements: Gas Press: _____ Manifold Press: _____ OEM Spec Manifold Press: _____ On Rate - Oil specific measurements: Pump Pressure: _____ Nozzle Size: _____ Nozzle Flow Rate: _____ SAT: _____ RAT: _____ CO Level: _____ Fuel Press @ Burner: _____	
Refrigerant Charge: <input type="checkbox"/> Pass Refr Line Temp: _____ Refr. Pressure: _____ EA Wet Bulb: _____ OD Dry Bulb: _____ *MOT: _____		
† Building: NC – New Commercial, EC – Existing Commercial, NR – New Residential, ER – Existing Residential * MOT: Method of Test (e.g., Superheat or Subcooling, Pressure Matching or Static Pressure, etc.) ‡ Approved methods require different measurements. Measurements will correlate to MOT and QIVP Table 2: Required Information Reported by the Verifier		

Figure A5: HVAC System QI Checklist (Page 1)

In-field Verification cont.	
<div style="border: 1px solid black; padding: 2px;"> Electrical <input type="checkbox"/> Pass Item: _____ Volts: _____ Nameplate: _____ Amps: _____ Nameplate: _____ Item: _____ Volts: _____ Nameplate: _____ Amps: _____ Nameplate: _____ Item: _____ Volts: _____ Nameplate: _____ Amps: _____ Nameplate: _____ Item: _____ Volts: _____ Nameplate: _____ Amps: _____ Nameplate: _____ Item: _____ Volts: _____ Nameplate: _____ Amps: _____ Nameplate: _____ Grounding: <input type="checkbox"/> Pass <input type="checkbox"/> Fail Wire Size(s) - Line: _____ Wire Size - Control: _____ </div>	<div style="border: 1px solid black; padding: 2px;"> Airflow Balance: <input type="checkbox"/> Pass *MOT: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ Room name: _____ Design: _____ Measured: _____ </div>
<div style="border: 1px solid black; padding: 2px;"> System Controls: <input type="checkbox"/> Pass Model _____ <input type="checkbox"/> Heating <input type="checkbox"/> Cooling <input type="checkbox"/> Fan Only <input type="checkbox"/> Emer. / Aux Heat <input type="checkbox"/> Zone # _____ </div>	
<div style="border: 1px solid black; padding: 2px;"> Combustion Venting: <input type="checkbox"/> Pass # Appliances: _____ Altitude: _____ Venting type(s): _____ Vent height: _____ Vent length: _____ </div>	
<div style="border: 1px solid black; padding: 2px;"> Duct Leakage: <input type="checkbox"/> Pass Leakage Rate: _____ Design Airflow: _____ *MOT: _____ † Meas. 1: _____ † Meas. 2: _____ † Meas. 3: _____ † Meas. 4: _____ † Meas. 5: _____ † Meas. 6: _____ † Meas. 7: _____ </div>	
<div style="border: 1px solid black; padding: 2px;"> Notes: _____ _____ _____ _____ _____ </div>	
<div style="border: 1px solid black; padding: 2px; height: 30px;"> Installer Signature </div>	<div style="border: 1px solid black; padding: 2px; height: 30px;"> Installer Print and Date </div>
<div style="border: 1px solid black; padding: 2px; height: 30px;"> Verifier Signature </div>	<div style="border: 1px solid black; padding: 2px; height: 30px;"> Verifier Print and Date </div>
<small>† Building: NC – New Commercial, EC – Existing Commercial, NR – New Residential, ER – Existing Residential * MOT: Method of Test (e.g., Superheat or Subcooling, Pressure Matching or Static Pressure, etc.) ‡ Approved methods require different measurements. Measurements will correlate to MOT and QIVP Table 2: Required Information Reported by the Verifier</small>	

Figure A6: HVAC System QI Checklist (Page 2)

1	Name of Room												
2	Running Feet of Exposed Wall												
3	Ceiling Height (Ft) and Gross Wall Area (SqFt)												
4	Room Dimensions (Ft) and Floor Plan Area (SqFt)												
5	Ceiling Slope (Deg.) and Gross Ceiling Area (SqFt)												
	Type of Exposure	Const. Number	Panel Faces	HTM		Area or Length	Btuh			Area or Length	Btuh		
				Htg.	Clg.		Heating	S-Clg.	L-Clg.		Heating	S-Clg.	L-Clg.
6a	Windows and Glass Doors	a											
		b											
		c											
		d											
		e											
		f											
		g											
		h											
6b	Skylights	a											
		b											
		c											
		d											
7	Wood and Metal Doors	a											
		b											
		c											
8	Above Grade Walls and Partitions	a											
		b											
		c											
		d											
9	Below Grade Walls	a											
		b											
		c											
10	Ceilings	a											
		b											
		c											
11	Floors	a											
		b											
		c											
12	Internal	a	Lighting Fixtures										
		b	Occupants and Plants										
		c	Office Equipment										
		d	Food Service Equipment										
		e	DT-fan, Motor, Pipe, Hot/Wet Surface, Steam, Hygros										
		f	Regain for Cold Storage or Pipe (negative cooling load)										
13	Infiltration	Total sensible load for Lines 6 thru 12	NACH			Heating Btuh				WAR			
						Sensible Btuh							
						Latent Btuh							
14	Envelope Subtotals: Sum lines 6 through 13												
a	Supply Duct Load	EHLF & ESGF				x Line 14							
	Space Load Totals (Line 14 subtotal + Line 14a)												
15	Return Duct Load on Equipment	EHLF and ESGF				x Line 14							
		ELG											
		Return Air Plenum Load (Btuh)											
16	Ventilation Loads	Vent Cfm											
17	Winter Humidification load	Gal / Day											
18	Hot Water, Steam and Chilled Water Piping Load												
19	BT-Fan, RA-Fan and Chilled Water Pump Load												
20	Latent Moisture Migration Load												
21	Total Load	Sum lines 14b > 20											

Figure A7: Light Commercial Load Calculation Sample N1 Form

Worksheet A Location and Design Conditions														
State:		City:		Elevation =			Latitude =							
Indoor Conditions, Heating: DB =				RH =		Indoor Conditions, Cooling: DB =				RH =				
Table 1 Conditions		99% DB =		1% DB =		Grains Difference =			Daily Range =					
Design Temperature Differences				HTD =			CTD =							
1	Name of Room			Entire House										
2	Running Feet of Exposed Wall													
3	Ceiling Height (Ft) and Gross Wall Area (SqFt)													
4	Room Dimensions (Ft) and Floor Plan Area (SqFt)													
5	Ceiling Slope (Deg.) and Gross Ceiling Area (SqFt)													
	Type of Exposure		Const. Number	Panel Faces	HTM		Area or Length	Btuh			Area or Length	Btuh		
					Htg.	Cig.		Heating	S-Cig.	L-Cig.		Heating	S-Cig.	L-Cig.
6a	Windows and Glass Doors	a												
		b												
		c												
		d												
		e												
		f												
		g												
		h												
		i												
		j												
6b	Skylights	a												
		b												
		c												
7	Wood and Metal Doors	a												
		b												
		c												
8	Above Grade Walls and Partitions	a												
		b												
		c												
		d												
		e												
		f												
		g												
9	Below Grade Walls	a												
		b												
		c												
10	Ceilings	a												
		b												
		c												
11	Floors	a												
		b												
		c												
		d												
12	Infiltration	Heating Load (Btuh)		Efect. ACH	WAR 1.00					WAR				
		Sensible Load (Btuh)												
		Latent Load (Btuh)												
13	Internal	a Occupants at 230 and 200 Btuh												
		b Scenario Number												
		c Default Adjustments												
		d Custom Appliances												
		e Plants												
14	Subtotals		Sum lines 5 through 12											
15	Duct Loads	EHLF & ESG												
		ELG												
16	Ventilation Loads		Vent Cfm		E Cfm									
17	Winter Humidification load			Gal / Day										
18	Piping Load													
19	Blower Heat													
20	AED Excursion & Latent Moisture Migration Load													
21	Total Load		Sum Lines 13 Through 19											

Form J1

Figure A8: Residential Load Calculation Sample J1 Form



WORKSHEET: FORM J1AE
ABRIDGED EDITION OF MANUAL J, 8TH EDITION

Project:		Location:			1) Room		Block Load / Room Summation		
ACCA		Indoor db Heating	Latitude	DR	L, H & W in decimal feet and gross SqFt areas		Length	Height or Width	Gross Area
		Indoor db Cooling	99% db	HTD	2) Exposed Wall				
		Indoor RH Cooling	1% db	CTD	3) Partition				
		Elevation	Grains	ACF	4) Floor				
		Construction Number			Heating	Cooling	Net Area	Btuh Heating	Btuh Cooling
		Direction & Details			HTM	HTM			
6A	Windows & Glass Doors Total Area (SqFt) =	a							
		b							
		c							
		d							
		e							
		f							
		g							
		h							
		i							
		j							
		k							
6B	Skylights Total Area (SqFt) =	a							
		b							
		c							
		d							
7	Wood & Metal Doors Total Area (SqFt) =	a							
		b							
		c							
		d							
8	Above Grade Walls Total Area (SqFt) =	a							
		b							
		c							
		d							
		e							
		f							
	Partition Walls Total Area (SqFt) =	g							
9	Below Grade Walls Total Area (SqFt) =	a							
		b							
10	Ceilings Total Area (SqFt) =	a							
		b							
		c							
	Partition Ceilings Total Area (SqFt) =	d							
		e							
11A	Passive Floors Total Area (SqFt) =	a							
		b							
	Use feet of exposed edge for slab	c							
	Partition Floors Total Area (SqFt) =	d							
		e							
12	Infiltration Gross exposed wall area for WAR	a	Envelope Leakage		Infiltration Cfms for Heating				
		b	No of Fireplaces		Infiltration Cfms for Cooling				
13	Internal Gains One occupant = 230 sensible Btuh	a	Number of bedrooms		# Occupants >				
		b	Appliances (1200 Btuh or 2400 Btuh)						
14	Sub Totals (sum lines 6A through 13)								
15	Duct Loss / Gain:				Factors >				
16	Ventilation	Maximum ventilation Cfms for MJ8ae is 50			Cfms for this job >				
19	Blower Heat Gain	Manufacturer's performance data has blower heat discount (1,707 if no, 0 if yes)							
20	Total Sensible Loss or Gain (sum lines 14 through 20)								
21	A) Latent Infiltration Gain (Btuh)								
	B) Latent for Occupants (One occupant = 200 Btuh)								
	C) Latent for Plants (Small = 10, Med = 20, Large = 30)								
	D) Latent for Duct in Unconditioned Space								
	E) Latent Ventilation Gain								
	F) Total Latent Gain (Btuh)								

Figure A9: Residential Load Calculation Sample J1AE

ABC Performance Data						
Model 030 with Coil AC030 and Furnace FU060-36 @ 1,000 CFM						
OD Dry Bulb (F)	Indoor Entering Wet Bulb (F)	Total Capacity	Sensible Capacity at Entering Dry Bulb Temperature (F)			
			72	75	78	80
85	59	28,400	22,600	25,300	27,800	29,400
	63	29,900	18,800	21,600	24,300	26,100
	67	32,100	15,100	17,900	20,700	22,600
	71	34,700	11,400	14,200	17,000	18,900
95	59	27,300	22,200	24,900	27,400	28,300
	63	28,700	18,500	21,200	23,900	25,700
	67	30,800	14,700	17,500	20,400	22,200
	71	33,300	11,000	13,700	16,600	18,500
105	59	26,200	21,900	24,500	27,100	27,200
	63	27,600	18,100	20,900	23,600	25,400
	67	29,700	14,300	17,200	20,000	21,800
	71	32,100	10,600	13,300	16,200	18,100

OD Dry Bulb – Outdoor Dry Bulb, the outdoor temperature.

Correction Factors for other Airflows			
	Airflow	Total Capacity	Sensible Capacity
Low	875	0.98	0.93
High	1125	1.02	1.06

Multiply rated capacity data by factor.

Figure A10: Equipment Performance Data Sample

Test Instrument/Gauge Calibration Report				
Test Instrument/Gauge	Manufacturer Model	Manufacturer's Calibration Requirements	Last Calibration Date	Calibration Company, Phone number
Flow hood	ABC Co, M# Flow 123	Annually	Jan 2008	Ace Calibration, 800-555-1212
Electric Multi-meter	XYZ Co, M#: Digi 9876	3 years	Jan 08	Ace Calibration, 800-555-1212

Figure A11: Test Instrument/Gauge Calibration Report

Certificate of ARI-Certified Performance

The following

Single Phase, Split System: Air-Cooled Condensing Unit, Coil with Blower

Outdoor Unit Model Number: 24ABA436A30

combined with

Indoor Unit Model Number: CAP**3621A**+58MVB080-20

manufactured by: CARRIER AIR CONDITIONING

under the Trade/Brand Name: Base 14 Puron AC

has been rated in accordance with


ARI Standard 210/240-2005 for UNITARY AIR-CONDITIONING AND AIR-SOURCE HEAT PUMP EQUIPMENT


and is certified by the Air-Conditioning and Refrigeration Institute to meet

the following product performance ratings:

Cooling Capacity (Btuh):	35000
SEER Rating (Cooling):	15.00

* Voluntarily revised, unless accompanied with a WAS in which case the change is involuntary.





ARI Reference #: 737995

Today's Date: 04 / 05 /06

Status: Active

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Figure A12: Matched Systems – AHRI Certificate Sample

Certificate of ARI-Certified Performance

The following
 Single-Package Heat Pump Air-Source
 Model Number: RQPM-A024JK
 Manufactured by: RHEEM MANUFACTURING COMPANY
 under the Trade/Brand name: RHEEM RQPM SERIES
 has been rated in accordance with
 ARI Standard 210/240-2006 for UNITARY AIR-CONDITIONING AND AIR-SOURCE HEAT PUMP EQUIPMENT
 and is certified by the Air-Conditioning and Refrigeration Institute to meet
 the following product performance ratings:

Cooling Capacity (Btuh): 23600
 EER Rating (Cooling): 12.00
 SEER Rating (Cooling): 14.00
 Heating Capacity(Btuh) @ 47 F: 23200
 Region IV HSPF Rating (Heating) 8.00
 Heating Capacity(Btuh) @ 17 F: 13200

A * following a rating indicates a voluntary rerate of previously published data, unless accompanied with a WAS which indicates an involuntary



ARI Reference #: 931964
 Today's Date: 5/29/2008
 Status: Active
 CEE Tier: CEE Tier 2

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Figure A13: Matched Systems – CEE Directory Printout Sample

ABC Performance Data						
Model 030 with Coil AC030 and Burnace FU060-36 @ 1,000 CFM						
OD Dry Bulb (F)	Indoor Entering Wet Bulb (F)	Total Capacity	Sensible Capacity at Entering Dry Bulb Temperature (F)			
			72	75	78	80
85	59	28,400	22,600	25,300	27,800	29,400
	63	29,900	18,800	21,600	24,300	26,100
	67	32,100	15,100	17,900	20,700	22,600
	71	34,700	11,400	14,200	17,000	18,900
95	59	27,300	22,200	24,900	27,400	28,300
	63	28,700	18,500	21,200	23,900	25,700
	67	30,800	14,700	17,500	20,400	22,200
	71	33,300	11,000	13,700	16,600	18,500
105	59	26,200	21,900	24,500	27,100	27,200
	63	27,600	18,100	20,900	23,600	25,400
	67	29,700	14,300	17,200	20,000	21,800
	71	32,100	10,600	13,300	16,200	18,100

OD Dry Bulb – Outdoor Dry Bulb, the outdoor temperature.

Correction Factors for other Airflows			
	Airflow	Total Capacity	Sensible Capacity
Low	875	0.98	0.93
High	1125	1.02	1.06
Multiply rated capacity data by factor.			

Figure A14: Example of Matched System from OEM Performance Data

Contractor Survey: Verifier

Contractors are encouraged to answer the following questions about the certification field inspection with regards to the Verifier:

1. Did the Verifier properly coordinate the field inspection with you? Yes or No
2. Was the Verifier on time? Yes or No
3. What is the name and position of the company representative who accompanied the Verifier during the field inspection? _____
4. Was the Verifier professional? Yes or No

Explain:

Figure A15: Administrator Survey of Contractor: Verifier

Building Owner Survey: Verifier

Building owners are encouraged to answer the following questions about the certification field inspection:

- | | |
|---|-----------|
| 1. Was the inspection done on time? | Yes or No |
| 2. Was the inspection done in a timely manner? | Yes or No |
| 3. Was the inspection team courteous? | Yes or No |
| 4. Did the inspection team leave the premises as they found them? | Yes or No |
| 5. Were the results of the inspection explained to your satisfaction? | Yes or No |

Figure A16: Administrator Survey of Building Owner: Verifier

Building Owner Survey: Contractor

The Administrator will introduce themselves and ask only the following questions:

- | | |
|---|-----------|
| 1. Do you have a few moments to answer 8 more questions? | Yes or No |
| 2. Were you in the building when the contractor completed the installation? If no, skip to question 10. | Yes or No |
| 3. Did the installing contractor explain how to use the system? | Yes or No |
| 4. Did the installing contractor explain the maintenance requirements? | Yes or No |
| 5. Were your maintenance responsibilities explained to you? | Yes or No |
| 6. Did the installing contractor explain the equipment warranty? | Yes or No |
| 7. Did the installing contractor explain where your system's documentation is? | Yes or No |
| 8. Who are you to call for a warranty claim? | Yes or No |
| 9. Are you satisfied with the HVAC system installation? | Yes or No |

Figure A17: Administrator Survey of Building Owner: Contractor

APPENDIX B | SAMPLE FEE AND INCENTIVE GUIDANCE FOR VERIFICATION EFFORTS

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard]

Administrators may wish to implement a fee structure to defray costs associated with HVAC system submissions. The fees charged could offset all or a portion of the verification costs for HVAC installations that do not meet the QI Standard’s requirements.

Service	Fee	Qualification for Fee Refund
Review of Installation file information	Cost for time spent in review an installation file.	Installation file appears complete and information passes review
Onsite visit of HVAC installation	Cost of sending a verifier or verifier team to a job site to perform an in-field verification	Installation file information verified and HVAC installation passes review
Expert System HVAC installation data review	Cost of submitting the information	Installation file information and measurements pass review
Contractor Visit to review Installation files	Cost of sending a verifier or verifier team to perform the Contractor verification	
Duplication of a Lost Installation file	Cost of local printer for size of file plus delivery expenses	

Figure B1: Sample Fee Structures

Objective	Paid To:	Incentive
Successful access to premises for HVAC Installation Verification	Building/Home Owner, when they must miss work or other obligations to provide verifier access to the building/home.	Estimated cost of missing ½ day of work.
Successful completion of Installation file review	Contractor	¼ of estimated cost to implement QI
Successful completion of in-field verification	Contractor	¾ of estimated cost to implement QI

Figure B2: Sample Incentives

APPENDIX C | SAMPLE DOCUMENTATION THAT DEMONSTRATE VERIFIER COMPETENCY

[This Appendix is not part of the standard. It is merely informative and does not contain requirements necessary for conformance to the standard]

The credibility of a verification effort depends on the Verifiers ability to confidently and professionally interact with Contractors and building owners. Figures C1 and C2 offer examples of certificates which demonstrate knowledge in the skills needed to verify HVAC system installations. Administrators may accept these examples as an indication of a Verifier’s proficiency in each of the following aspects of the QI Standard. These forms of acceptable documentation are not required; this list is neither exhaustive nor comprehensive.

The accreditation of any education program providing documentation should be evaluated to ensure it is valid, reliable, and defensible. Documentation is preferred from organizations or education programs that meet or are in the process of meeting ISO 17024. ISO 1724 demonstrates an approved level of accreditation.

Applicable QI Section	Acceptable Documentation
I	<u>Basic Skills</u> High School diploma or equivalency Demonstrated ability to perform physical requirements: climb, lift, etc.
QI §3.1 Load Calculations	ACCA HVAC Fundamentals Certification, or ASHRAE Certificate, or Documentation from an accredited HVAC technical school or program ⁹ , or Education Program for Instructor Certification (EPIC) certificate, or TABB certificate, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §3.2 Equipment Selection	ACCA HVAC Fundamentals certificate, or Documentation from an accredited HVAC technical school or program ⁹ , or Education Program for Instructor Certification (EPIC) certificate, or Manufacturer’s training, or TABB certificate, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §3.3 Matched Systems	ACCA HVAC Fundamentals certificate Documentation from an accredited HVAC technical school or program ⁹ , or Education Program for Instructor Certification (EPIC) certificate, Manufacturer’s training, TABB certificate, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §4.1 Airflow (heat exchanger)	Documentation from an accredited HVAC technical school or program ⁹ , or AABC certification, or NBI certification, or NEBB certification, or NATE Air Distribution service level certification, or TABB certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .

Figure C1: Acceptable Documentation Demonstrating a Verifier Skill Set

⁹ Documentation or supplemental information (e.g., course syllabus) should demonstrate knowledge was tested for this element of the QI Standard.

Applicable QI Section	Acceptable Documentation
QI §4.2 Refrigerant Charge	EPA 608 certification and one of the following: Documentation from an accredited HVAC technical school or program ⁹ , or NATE AC or HEAT Pump Service certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §4.3 Electrical	Contractor's license (if required by authority having jurisdiction), or Documentation from an accredited HVAC technical school or program ⁹ , or Any NATE service level certification, or TABB certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §4.4 On-rate	NATE service level Gas or Oil certification, or Documentation from an accredited HVAC technical school or program ⁹ , or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §4.5 Combustion Venting	Documentation from an accredited HVAC technical school or program ⁹ , or NATE Gas or Oil service level certification, or National Fuel Gas Code certification, or TABB certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §4.6 System Controls	Any NATE service level certification, Documentation from an accredited HVAC technical school or program ⁹ , or OEM certification, or TABB certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §5.1 Duct Leakage	Documentation from an accredited HVAC technical school or program ⁹ , or AABC certification, or NBI certification, or NEBB certification, or NATE Air Distribution service level certification, or TABB certification, or HERS certification, or BPI Heating Specialist certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .
QI §5.2 Airflow Balance	Documentation from an accredited HVAC technical school or program ⁹ , or AABC certification, or NBI certification, or NEBB certification, or NATE Air Distribution service level certification, or TABB certification, or State or Municipal-recognized Journeyman or higher HVAC Mechanic or equivalent certification ⁹ .

Figure C1: Acceptable Documentation Demonstrating a Verifier Skill Set (continued)

⁹ Documentation or supplemental information (e.g., course syllabus) should demonstrate knowledge was tested for this element of the QI Standard.

NOTES