Quality Control Inspector Job Task Analysis

Jal Desai and Cory Chovanec

National Renewable Energy Laboratory

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Contract No. DE-AC36-08GO28308

Technical Report
NREL/TP-7A40-85789
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Suggested Citation
Desai, Jal and Cory Chovanec. 2023. *Quality Control Inspector Job Task Analysis*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-7A40-85789.
https://www.nrel.gov/docs/fy23osti/85789.pdf.

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NOTICE

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. Department of Energy Office of State and Community Energy Programs. The views expressed herein do not necessarily represent the views of the DOE or the U.S. Government.

Acknowledgments

The work described in this document is funded by the U.S. Department of Energy's (DOE) Weatherization Assistance Program (WAP) under the Guidelines for Home Energy Professionals project. The authors thank WAP, Professional Testing, Inc., and the home performance industry professionals who participated on the scheme committee and volunteered many hours of their time and expertise to validate and update the Quality Control Inspector (QCI) advanced Home Energy Professional (HEP) microcredential.

Energy Auditor (EA)-QCI Scheme Committee Members (2022–2026):

- Amy Vieira
- Thomas McIvor
- Peter Martin
- Fain Perrin
- Pamela Palmer
- Lance Gast
- Aubrey Myers
- Michael Swafford
- Chris Clay
- Kevin Grothe
- Charles Childers
- Andrew Woodruff
- Lara O'Brady
- Matt Turner
- Robert Parkhurst
- Bill Nickerson.

List of Acronyms

DOE	U.S. Department of Energy
EA	Energy Auditor
GHEP	Guidelines for Home Energy Professionals
HEP	home energy professional
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
JTA	job task analysis
NFPA	National Fire Protection Association
NREL	National Renewable Energy Laboratory
QCI	Quality Control Inspector
SWS	Standard Work Specifications
WAP	Weatherization Assistance Program

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1 Introduction

The National Renewable Energy Laboratory (NREL) is contracted by the U.S. Department of Energy's (DOE) Weatherization Assistance Program (WAP) to develop and maintain the resources under the Guidelines for Home Energy Professionals project (GHEP). The purpose of the GHEP project is to increase the quality of work conducted for residential energy retrofits in the United States through the WAP network and other residential retrofit programs. To meet the goal of "Establishing National Workforce Certifications and Training Standards," DOE tasked NREL with developing GHEP resources, including a set of advanced, competency-based home energy professional (HEP) personnel certifications. Since 2010, NREL has recruited volunteer subject matter experts from the WAP network and the home performance industry to serve on committees to develop and update certification schemes and their requisite job task analyses (JTA) as the foundation of standardized certification and training programs.

The HEP certifications support WAP and the broader residential home performance industry through the credentialing process and development of defined JTAs for Energy Auditors (EA) and Quality Control Inspectors (QCI). This report outlines the most recent updates (2022) to the QCI JTA.

2 Background

In 2013, NREL completed the development of four single-family, full-scope, International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC)-accredited HEP certifications[1] for QCI, EA, Crew Leader, and Retrofit Installer Technician.

Since the inception of the HEP certifications, significant changes to the structure of the certification programs were made to better reflect the needs of the industry and reduce redundancy among job roles where skills, abilities, and knowledge areas overlap. The first major change occurred in Fiscal Year 2018, when DOE, along with the relevant scheme committee, determined the Retrofit Installer Technician JTA could be eliminated and its tasks could be inserted in the Crew Leader JTA. The Retrofit Installer Technician tasks became the basis of the Retrofit Installer Badges,[2] which provide a flexible, customizable, and voluntary approach to training and skills recognition for industry professionals. The second major change was the transition of the full-scope QCI certification to a microcredential, of which the EA certification is the single prerequisite. The rationale behind this change is that a QCI must possess the knowledge, skills, and abilities of the EA and that a smaller subset of skills was needed for QCIs. Since 2019, the EA remains a full-scope certification accredited by the ANSI National Accreditation Board to ISO/IEC 17024.

As the owner of the certification scheme for the HEP QCI, NREL facilitates the development, maintenance, and validation of the certification schemes for use by organizations that certify individuals.

The QCI microcredential and full-scope ANSI Accreditation Board-accredited EA certification schemes are updated approximately on a 5-year cycle to ensure the knowledge, skills, and abilities outlined in each JTA reflect current and future needs of the broader retrofit industry. This report outlines the most recent updates (2022) to the QCI JTA.

On an ongoing basis, NREL brings industry practitioners and subject matter experts together to develop, review, revise, and maintain the certification schemes in accordance with the ISO/IEC 17024 standard, which was chosen by DOE for the quality and rigor of personnel certifications that the standard offers to the home performance industry. These schemes define the general requirements of each certification (e.g., prerequisites, exam structure, recertification requirements, etc.) and are based on JTAs developed by NREL in accordance with industry-recognized practices of workforce psychometrics.

The certification schemes are available to interested and qualified certifying bodies via a copyright license agreement. NREL is not directly engaged in the certification of any individual and only licenses the scheme to qualified certifying bodies.

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[1] The ISO/IEC 17024:2012 standard contains the general requirements for bodies operating certification of persons. The standard includes requirements for the development and maintenance of the certification scheme for persons upon which the certification is based: https://anab.ansi.org/accreds/personnel-certification-programs/.
[2] https://sws.nrel.gov/installerbadges.

Section 3 describes the process of revising the 2018 EA certification scheme and developing an improved 2022 QCI certification. Sections 5 and 6 provide the content of the revised 2022 QCI certification JTA.

3 QCI Certification Scheme Revision Process

The certification committee is a voluntary group comprised of subject matter experts with regional and industry diversity. A new combined EA and QCI committee was selected for a 5-year term and NREL held 21 virtual meetings with the QCI and EA scheme committee in 2022 to review, update, and validate the QCI and EA JTAs. The scheme committee completed a detailed crosswalk of the existing QCI and EA JTAs domains, tasks, and knowledge statements to identify necessary changes and updates. Because the QCI must inspect the work completed by the EA, the committee confirmed that the QCI's competencies included the competencies described in the EA JTA report, plus a smaller set of competencies specific to quality control work conducted by a QCI.

From March–October 2022, NREL assembled a panel of 16 subject matter experts. Professional Testing, Inc., a full-service provider of assessment, evaluation, and certification services facilitated each of the virtual scheme revision meetings to validate and update the QCI and EA JTAs and certification scheme components.

3.1 JTA Revision Process

The first step in developing the updated QCI JTA was to evaluate the major responsibilities or duties (i.e., performance domains) characterizing the practice of a QCI that were developed in the previous JTA study. As a group, committee members were asked to assess the currency and relevance of the existing domains and add, edit, or remove content as needed. Additionally, the panel was instructed to remove any items that were redundant with the EA JTA. Next, the panel reviewed and revised the task statements from the previous QCI JTA. The panel reworded, removed, or moved some tasks to more appropriate domains based on the domain revision.

In its final major undertaking, the panel identified knowledge and ability statements for each of the tasks. In some cases, a knowledge (or ability) statement was assigned to multiple tasks. In developing and assigning knowledge and skill statements, the panel made use of the knowledge and ability statements from the prior test specifications, and many previous statements were either reused without modification or modified slightly.

3.2 JTA Phase II: Validations Study

Professional Testing, Inc. designed an online JTA validation questionnaire and sent it to industry stakeholders to corroborate the work of the committee, many of whom held current EA and QCI certifications in 2022. Multiple models of rating scales are used in job analyses; however, for the purposes of these studies, the committee used two survey scales: task importance and frequency. Task frequency is simply how frequently each task is performed. Task importance, however, is defined as the potential for public harm if the task is performed incorrectly or not at all. The weighting of the tasks in the exam blueprint is the result of the validation process. The final task weighting from the validation process can be found in the exam blueprint in Section 6 of this report.

3.3 Results

During the QCI and EA scheme committee meetings, the members provided the necessary updates to the other certification scheme components. These included the prerequisite and

recertification requirements, minimal competencies, job scope and descriptions, and other relevant aspects of the QCI and EA certification schemes.

Through this work, the QCI and EA scheme committee determined that the EA competencies were required of QCIs, and that the EA would remain a prerequisite to the QCI certification. Because the QCI JTA defined a smaller subset of competencies, the QCI credential does not require a full-scope, ISO/IEC 17024:2012-accredited credential. The microcredential concept fits the QCI job requirements when the EA certification is used as a prerequisite to the QCI microcredential. As a result, the QCI microcredential should not be interpreted as a stand-alone credential.

The following sections of this report are the results of the scheme committees' updates of the 2018 QCI JTA, the foundation of the QCI microcredential. The following sections include the scope of certification; the JTA content outline; performance domains, tasks, abilities, and knowledge statements; and the exam blueprint, which provides the ideal percentage of exam questions that should be asked for each task.

4 QCI Job Scope and Description

A QCI is a residential energy efficiency expert who reviews, inspects, and verifies the appropriateness, quality, and completion of energy retrofit work by conducting site visits, performing diagnostic testing, and evaluating work practices and documentation to improve the indoor environment, safety, durability, comfort, and energy efficiency of the building for the client.

5 QCI JTA

A JTA is the foundation for a valid credentialing program and identifies the core knowledge areas, critical work functions, and/or skills typically found across a representative sampling of current practitioners. Empirical results from a JTA provide examinees and the public with a valid, reliable, fair, and realistic assessment that reflects the knowledge, skills, and abilities required to competently perform a job.

5.1 DOMAIN I: In-Process Evaluation

5.1.1 D1-Task 1: Verify worker compliance with safety regulations

Ability to:

- Evaluate that the work practices protect the health and safety of workers and building occupants (e.g., appropriate personal protective equipment being worn, monitoring air quality in workspaces, dust control, etc.)
- Evaluate the job site for compliance with safety regulations (e.g., proper lighting, safety and control in enclosed spaces, Safety Data Sheet, installation specifications)
- Document compliant, innovative, or deficient work practices
- Verify that crew members are using equipment to manufacturer's specifications and recommendations (e.g., safety switches are functional, ladder specifications, etc.).

Knowledge of:

- Energy retrofit techniques, terminology, materials
- Interpretation of manufacturer's specifications and recommendations
- Applicable codes and standards
- Safety regulations (e.g., Occupational Safety and Health Administration, U.S. Environmental Protection Agency)
- Information contained in a Safety Data Sheet.

5.1.2 D1-Task 2: Evaluate in-process work quality

Ability to:

- Compare the work performed to the work scope (e.g., appropriate R-value, square footage)
- Determine if correct materials and equipment are being installed (e.g., fire-rated used where needed, correct insulation type)
- Verify the condition and capacity of the tools and equipment (e.g., calibration dates, blowing machine pressure)
- Document compliant, innovative, or deficient installation practices (e.g., improper materials, good workmanship, poorly functioning tools and equipment)
- Determine if appropriate diagnostic testing is being performed, based on dwelling
- Document potential missed opportunities
- Evaluate job site management and scheduling (e.g., sequencing, material and equipment staging).

Knowledge of:

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differences, etc.).
- Applicable codes, standards, and program requirements (e.g., International Codes Council [ICC], National Fire Protection Association [NFPA], ASHRAE 62.2, Standard Work Specifications [SWS], etc.)
- Energy retrofit in-process best practices (e.g., dense packing sidewalls, duct sealing, fan installation, etc.)
- Appropriate testing protocols for the situation
- Documentation requirements for the in-progress work (e.g., QCI documentation [sampling], worker documentation [confined space, lead containment], etc.)
- Credentialing requirements for workers.

5.2 DOMAIN II: Postwork Evaluation

5.2.1 D2-Task 1: Compare work completed in relation to the initial assessment and work scope (Evaluate the work of the EA)

Ability to:

- Determine if appropriate diagnostic testing was performed (e.g., health and safety, air leakage)
- Confirm housing characteristics used for initial assessment (e.g., insulation levels, heating equipment, square footage, etc.)
- Identify potential missed opportunities
- Compare inspection results to work plan projections.

Knowledge of:

- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differentials, etc.).
- Applicable codes, standards, and program requirements (e.g., ICC, NFPA, ASHRAE 62.2, SWS, etc.)
- Typically installed measures and missed opportunities
- Appropriate/required measures for each situation
- Appropriate testing protocols for the situation.

5.2.2 D2-Task 2: Evaluate installed measures for compliance with standards and targets (Evaluate the work of the contractor[s] and/or crew[s])

Ability to:

- Identify additional investigation needed based on sensory inspection results (e.g., unusual sounds, smells, humidity, etc.)
- Visually inspect and document installed measures
- Determine code or program compliance of installed measures (e.g., insulation certificate, installation standards)
- Determine if installed measures meet job specifications
- Determine if a problem is a material problem or a work problem
- Compare inspection results to previous test data
- List actions necessary to bring installed measures up to compliance (e.g., punch list)
- Interpret diagnostic test results
- Verify pressure and thermal boundary alignment.

Knowledge of:

- Building science
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differentials, etc.).
- Applicable codes, standards, and program requirements (e.g., ICC, NFPA, ASHRAE 62.2, SWS, etc.)
- Energy retrofit best practices (e.g., dense packing sidewalls, duct sealing, fan installation, etc.)
- Interpreting/comparing test results.

5.3 DOMAIN III: Project Compliance and Completion

5.3.1 D3-Task 1: Confirm whether policy requirements have been satisfied

Ability to:

- Identify questionable costs (e.g., missing items, double billing, large variance between estimated costs and final costs, etc.)
- Determine accuracy and appropriateness of initial building evaluation (e.g., missing information, software modeling inputs, existing equipment, square footage matches documentation, etc.)
- Identify inappropriate measures in the work scope (e.g., not obtaining permits, measure skipping, misaligned thermal and pressure boundaries, etc.)
- Ensure that all measures have been completed to the applicable standards
- Complete inspection documentation (e.g., checklists, required reports, recommended training, etc.)

- Ensure needed client education was conducted (e.g., teaching client how to use digital thermostat, how to change filter, ASHRAE fan control, etc.).

Knowledge of:

- Policy/program requirements (e.g., Grantee's guidelines, contracted scope of work, etc.)
- Applicable codes and standards (e.g., ICC, NFPA, ASHRAE 62.2, SWS, etc.)
- Energy modeling and expected inputs and outputs
- Client education best practices
- Required inspection documentation
- Basic accounting (e.g., work orders, invoicing, etc.)
- Financial rules and regulations (e.g., DOE allowable costs, leveraged funds, etc.)
- Building science:
    - Heat transfer mechanisms (e.g., convection, conduction, radiation)
    - Moisture transfer mechanisms (e.g., water vapor, bulk moisture)
    - Air transfer mechanisms (e.g., stack effect, pressure differentials, etc.).

6 QCI Exam Blueprint

Table 1 outlines the percentage of domains/tasks that would comprise the written QCI exam developed by a certifying body based on the industry validation study.

Table 1. QCI Exam Domain/Task Percentages

Domain and Tasks	Final Percentages (Written Exam)
DOMAIN I: In-Process Evaluation	**20%**
Task 1: Verify worker compliance with safety regulations	10%
Task 2: Evaluate in-process work quality	10%
DOMAIN II: Postwork Evaluation	**68%**
Task 1: Compare work completed in relation to the initial assessment and work scope (Evaluate the work of the EA)	34%
Task 2: Evaluate installed measures for compliance with standards and targets (Evaluate the work of the contractor[s] and/or crews[s])	34%
DOMAIN III: Project Compliance and Completion	**12.0%**
Task 1: Confirm whether policy requirements have been satisfied	12.0%
	100.00%