Request for Certification as
Performance Tested Duct System Trainers, and Certification System Operators for New and Existing Site-Built and Manufactured/Modular Homes in Washington State

Washington State University Energy Program

BACKGROUND

The Washington State University Energy Program (WSU) began working with duct efficiency in site-built housing in 1994, during the RCDP (Residential Construction Demonstration Program) duct efficiency project. During that period, WSU acquired its first Duct Blaster, trained staff in testing and remediation, and worked with builders to incorporate efficient duct practices into new construction.

WSU has applied performance testing to research projects in the intervening years, including evaluations of duct leakage in homes built to the Washington State Energy Code and manufactured homes built under the U. S. Department of Energy's Building America Program. WSU began working with duct efficiency in manufactured homes in 1989 with the Super Good Cents Manufactured Home Program (SGC). WSU, together with the Idaho Energy Division (IED), the Montana Department of Environmental Quality, and the Oregon Department of Energy, pioneered specifications for making crossover connections structurally sound and sealed. Research and trouble-shooting on over 100,000 energy efficient manufactured homes built since 1989 has resulted in better duct performance.

WSU and the other state partners provide technical assistance to the manufactured housing industry, performing duct leakage testing in-plant for quality assurance, and on-site for problem home diagnostics.

In 1990's, WSU staff participated in the development and implementation of the Performance Tested Comfort Systems standards (PTCS). WSU staff member David Hales is on the board of Climate Crafters; he has been the lead trainer for PTCS throughout the Northwest region.

To date, WSU has certified over 250 ENERGY STAR homes in Washington prior to implementation of the Northwest Builder Option Package. These homes met PTCS requirements for duct tightness.

WSU is the State Certifying Organization for the Energy Star Homes Northwest (ESHNW) program in Washington State. As part of the ESHNW Quality Assurance process, WSU staff are performing leakage tests on ductwork.

WSU provides in-plant quality assurance, and on-site problem home resolution for the Super Good Cents in Washington State; both processes involve routine duct performance testing.

PURPOSE

The purpose of this proposal is to integrate Performance Tested duct systems (PT) with the ENERGY STAR Homes Northwest and Super Good Cents programs in Washington State. WSU is already operating as the certifying and quality assurance organization for ESHNW in Washington State, and the in-plant quality assurance agent for Super Good Cents homes built and sited in Washington State.

Great economies can be obtained by combining the PT testing and quality assurance with the on-site testing and quality assurance required for ESHNW. Rather than having a separate tester travel to the site and perform tests, the same tester can perform all tests at the same time, thus maximizing the operational efficiency of testing and Quality Assurance activities.

In addition, WSU proposes to act as the PT provider for any retrofit program for site built and manufactured homes in Washington State. Through the SGC program, WSU provides performance testing during the problem home resolution process. As such, WSU has substantial recent field experience with existing housing as well as new homes.

STRATEGY

WSU trains, certifies, and maintains agreements with each PT contractor. Each PT contractor is an independent contractor. The agreement provides for:

- Standards of Conduct and Ethics
- Quality assurance for work done. Quality assurance is performed by WSU staff using performance testing protocols for duct sealing and depressurization tests.
- Suspension and de-certification based on negative quality assurance findings and/or unwillingness to correct issues.
- Maintenance of records of certified homes including owner, location, contractor, test results and other required data.

For new PT contractors, WSU will:

- Certify PT contractors to administer PT duct leakage and house depressurization tests during a two-day training session.
- Perform initial follow-up field visits per the RTF specifications.

For existing contractors, working under the auspices of RTF approved performance testing programs, WSU will:

- Recognize all certified contractors that have met the training, testing and QA requirements for their given program. If the contractors have met all requirements

except for QA, WSU will be able to provide QA so that these requirements may be fulfilled. The cost for these QA visits will be paid by the contractor.

For the Energy Star Homes Northwest program, WSU will:

- Perform Quality Assurance on a sample of certified ESHNW homes. Homes will be selected for QA in accordance with the ESHNW Quality Assurance plan.

For the Super Good Cents program, WSU will:

- Perform Quality Assurance on a quarterly basis in each Washington-based manufactured housing plant. Quality Assurance will be administered per the Super Good Cents in-plant inspection protocol.
- Performance test duct systems as appropriate during problem home inspections. Tests will be applied per the Super Good Cents problem home protocol.

TRAINING

Trainer Qualifications

Trainers of PTCS Duct Systems shall at a minimum meet the following minimum standards. Certification of new trainers shall be through a training process, which shall include the following provisions:

Minimum Trainer Standards:

1. Minimum two (2) years experience in duct system testing and remediation and combustion zone depressurization testing, or conducting quality assurance inspections for duct tightness programs using these tests.
2. Minimum two (2) years experience teaching building science concepts to energy professionals, trades people, or design professionals.

Proposed Lead Trainer, QA staff and Qualifications

David Hales will be the Lead Trainer. David Hales, Gary Nordeen, Erin Hamernyik and Andrew Gordon will be QA specialists. The qualifications and experience of these team members are identified below in Attachment A.

Training Curriculum

The training agenda is shown as Attachment B. The Curriculum is shown in the Handbook and materials that will be circulated at the RTF meeting when this application is reviewed.

CERTIFICATION

PT contractors will receive certification when they have:

- Actively participated in the PT training
- Proven competency in PT performance tests in the field
- Passed the PT competency test with a minimum score of 70%
- Entered into an agreement with WSU that provides for Quality Assurance, Code of Conduct, and de-certification.

Certification Tests

Field Demonstrated

Technician shall perform accurate measurements, adhere to PT protocols, accurately record measurements on accepted forms, and evaluate whether PT specifications have been met in a field location for the following PT tests:

- Total duct leakage
- Duct leakage to outside
- Combustion appliance zone (CAZ) depressurization test

Written exam:

PT contractor shall score at least 70% on a written test that covers the following:

- Basic understanding of air leaks and air pressure dynamics
- PT test standards
- PT materials and installation standards
- Combustion safety
- PT quality assurance program
- Proper paperwork and reporting requirements

De-certification

Technicians will be decertified for any of the following:

- Quality doesn't improve after receiving notice (see 9.C. below)
- Technician falsifies reported data
- 15% or more of their certified systems fail QA or QC on first review

Quality Assurance Reviews

Reviews include:

- File/data review, for complete and accurate information
- Site review, to confirm performance test results, and inspect sealing materials/techniques

File/Data Review

Incoming data will be screened for reasonableness and data will be tracked to assess whether data is reliable.

Site review

A technician will fail a review when:

- Submitted data is incomplete or shows misrepresentation of participation or results
- Duct leakage test differs by more than the larger of 15% or 10 CFM50
  Exception: when either review or certification test was conducted during difficult weather conditions
- CAZ net depressurization exceeds -3 Pascals WRT outdoors
  Exception: when either review or certification test was conducted during difficult weather conditions
- Duct sealing materials or methods do not meet PTCS specifications

DATA MANAGEMENT

WSU will maintain a central file of all PT contractor certifications, and the results of quality assurance tests.

For the ESHNW program, performance testing data is collected in the field by third party verifiers; this data is then registered in a central regional database. WSU will review this data for reasonableness and accuracy before ESHNW certification is given to any home.

For all other programs, WSU will maintain a central file of all PT certified contractors, labeled systems, and QA results.

The Data Manager will be Andrew Gordon, who provides data analysis support to the Super Good Cents and Building America Industrialized Housing programs. Mr. Gordon has been managing data for WSU since 1996.

Experience

WSU has provided data analysis support for the Super Good Cents Manufactured Home project since 2001, including reporting of homes to the national ENERGY STAR and Building America Industrialized Housing programs.

Certification Data

WSU reviews PT certification data submitted by ESHNW verifiers on the ESHNW website; this review is provided before any ESHNW home is certified.

Quality Assurance Data

Quality assurance data is produced during the entire QA process. This process begins when a verifier enters a home into the ESHNW database. The first three homes inspected by any verifier receive QA. These homes receive a complete battery of performance testing, including duct and CAZ testing. In the case of heat pumps, the certifying agency for the commissioning technician is notified[AG1].

Data Sharing

WSU will follow regional protocols for testing and data collection; all data collected under the ESHNW program will be reported back to the Northwest Energy Efficiency Alliance, and will be available to the RTF to facilitate consistent regional application of the PT standards.

Attachment A

STAFF QUALIFICATIONS

Lead Trainer/QA Specialist: David Hales

Twenty-four years experience in building science and construction providing skills training, curriculum development, field research, and technical support. Broad range of expertise in

- Residential Energy Codes
- HVAC system design and distribution efficiency
- Duct leakage diagnostics and sealing
- Ground source heat pump system design and installation
- Moisture problems, mold, radon, and other indoor air quality issues
- Building envelope air leakage control
- Combustion appliance back drafting and safety
- Building weatherization
- Sustainable construction

WSU Energy Program Role

Building Systems Specialist, Washington State University Extension Energy Program, 1996-Present

- Perform field research, quality assurance inspections/problem home diagnostics for programs such as Super Good Cents, Energy Star and Washington State Energy Code
- Provide technical assistance, curriculum development, training and demonstrations for utilities and construction industry supporting energy efficient design/construction
- Implement U.S. Environmental Protection Agency's tools for schools/tribes programs
- Teach energy and mechanical systems module for Interdisciplinary Design Institute
- Resource for building science, indoor air quality, heat pumps/EnergyIdeas Clearinghouse

Professional Experience

Energy Specialist, Washington State Energy Office, 1990-1996

- Provided technical assistance/training for implementation of Washington State Energy Code
- Developed training curricula and presentations for code officials, builders, sub-contractors, material suppliers, vocational technology/apprenticeship programs, and utility staff
- Performed Super Good Cents training for utilities and K-12 classroom/teacher presentations
- Served as residential hotline expert
- Wrote copy for weekly column on energy issues
- Led Residential Technology Training and Assistance Program, K-12 education and progressive and exemplary code grants

Managing Partner, Sun Construction, 1983-1990

- Designed/constructed energy efficient residential and commercial buildings
- Completed over 3.5 million dollars of construction
- Handled bidding, contracts, procurement, hiring, sub-contractors, and over 20 employees

Education

Bachelor of Science, University of Chicago (Physics)

Awards and Honors

Special Achievement Award, U.S. EPA; Certified Trainer, International Ground Source Heat Pump Association; Certified Instructor, Energy & Environmental Building Association; Recipient, U.S. EPA Refrigerant Certificate; Board Member, Performance Tested Comfort Systems; Member, Regional Technical Forum; Presenter, National/Regional Conferences

QA Specialist – Gary Nordeen

Over 20 years experience in public sector developing, implementing and enforcing building codes and standards. Extensive expertise with energy and indoor air quality codes. Highly skilled educator conducts classes in local, regional and national settings

WSU Energy Program Role

Energy Specialist, Washington State University Extension Energy Program, 2004-Present

- Conduct classes on wide variety of energy and indoor air quality topics
- Provide technical assistance to local jurisdictions/general public on energy issues
- Assist Washington State Building Code Council in code development process
- Offer technical assistance/performance testing to manufactured home industry to determine compliance with Super Good Cents and Energy Star requirements
- Develop and disseminate fact sheets, manuals and newsletters

Professional Experience

Building Official, City of Centralia, 1993-2004

- Ran operation of building division – inspectors, plans examiners/permit technician staff
- Managed annual federal grant programs through Bonneville Power Administration and Federal Emergency Management Agency totaling $4.4 million
- Crafted home elevation program for structures prone to flooding – used by Federal Emergency Management Agency as national model
- Acted as Staff Manager for Planning Commission and Board of Adjustment
- Managed Historic Preservation Commission
- Developed/implemented municipal building zoning/abatement ordinances
- Served as Conservation Manager for Centralia City Light

Energy Specialist, Washington State Energy Office, 1986-1993

- Represented organization during development/implementation of 1991 Washington State Energy and Ventilation Codes
- Managed hotline that provided technical assistance to building departments
- Served as an educator for energy and ventilation code. Conducted numerous energy and ventilation code trainings for thousands of attendees
- Developed energy/ventilation code training and technical support documents, including first edition of *Washington State Energy Code Builders Field Guide*

Building Inspector, City of Bremerton, 1984-1986

- Conducted field inspections and plan checks for building department
- Worked with planning department to enforce zoning requirements

Project Manager/Carpenter, Baugh Construction, 1974-1984

- Participated in construction of numerous large commercial buildings
- Served as Project Manager for large-scale tenant improvement projects in Seattle

Other Experience

- Certified, International Code Conference, Building/Mechanical/Plumbing Inspector
- Certified, Bonneville Power Administration, Energy Auditor and Inspector

- Board Member, International Code Conference, Rainer Chapter
- Member, Washington Association of Building Officials

QA Specialist – Erin Hamernyik

Over six years in building indoor air quality and energy analysis and improvement, program management and training development

WSU Energy Program Role

Energy Specialist, Washington State University Energy Program, 2004 – Present[AG2]

- Develop indoor air quality training programs and proposals
- Conduct indoor air quality problem diagnosis audits and recommend remediation strategies
- Conduct quality assurance audits of new site and factory built construction
- Conduct energy efficiency research audits
- Provide technical and programmatic support for Energy Ideas Clearinghouse

Professional Experience

Program Manager, Healthy Homes Program, 2001-2004

- Managed program designed to reduce asthma in the home child care and residential setting for low income children.
- Conducted Indoor Air Quality and Weatherization Inspections
- Designed and developed databases, publications and press releases.
- Liaison with 4 county personnel, presentation design and presenter at related conferences.
- Coordination with over 40 personnel.

Indoor Air Quality assistant, 1999 – 2001 (part time)

- Assistant for school and residential indoor air quality walk-throughs and asbestos permitting inspection.

Building Operator Certification Technical Editor and Site Coordinator, Resource Management Asssociates, June 1999 – 2000

- Editor for Building Operator Manuals Level 2 for Northwest Energy Efficiency Council.
- Site coordinator of Mt. Vernon, Everett, BOC classes
- Assistant with Building Commissioning Association creation.

Energy and Building Characteristics Auditor and Analyst, RLW Analytics, 1998–1999

- Recorded and analyzed new commercial building data, including HVAC, fenestration, lighting, and energy output.
- Utilized DOEII software to model commercial buildings.

Other Experience

- Personal research on height code for City of Bellingham, land use code for the Chuckanut area.
- Two Field Seasons in Mojave Desert at Ft. Erwin, CA. Collected and organized data of faulted alluvial fans.

- Volunteer at ReSources, Bellingham, WA. Research and evaluation of discharge permits for wood treatment facilities, oil refineries, paper mills and fish hatcheries.
- Explored physical and cultural impacts of oil exploitation in the Upper Napo River, Ecuador.

Education

- Certificate in Project Management, Bellingham Technical College.
- Graduate Level Certificate in Energy Management and Design
- Bachelor of Science, Environmental Engineering and Geology, Western Washington University.

QA Specialist/Data Manager – Andrew Gordon

Over 15 years experience providing high quality implementation and management services to site-built and manufactured housing industries. Accomplished writer and collaborator on numerous technical papers, articles and reports. Committed team member in residential sector research efforts

WSU Energy Program Role

Energy Specialist, Washington State University Extension Energy Program, 1996-Present

- Manage state Energy Star Homes Northwest Program
- Collaborate with regional Energy Star team to develop certification, verification and quality assurance protocols
- Participate in development of technical specifications
- Implement quality assurance efforts for Energy Star Homes Northwest and Northwest Energy Efficient Manufactured Housing Programs
- Provide data analysis and research support for Building America Industrialized Housing Program
- Develop and monitor contracts for residential programs
- Offer writing, editing and database management expertise to Building Science and Standards Program
- Work with manufactured housing industry to support progressive manufactured housing standards

Professional Experience

Energy Specialist, Washington State Energy Office, 1989-1996

- Authored and edited residential articles, reports and other technical documents
- Assessed appliance efficiency standards with utilities, state and federal agencies, conservation groups and manufacturers
- Developed and maintained databases for residential programs
- Delivered technical assistance to the *EnergyIdeas* and Western Area Power Administration Clearinghouses
- Provided technical assistance on residential energy code
- Conducted marketing outreach to the manufactured housing retail sector, focusing on the marketing benefits of energy efficiency
- Supported Residential Construction Demonstration Program technical activities

Attachment B

TRAINING AGENDA, NEW CONSTRUCTION

Target Audience

- New construction residential duct system installers.
- Candidates to become to certified PTCS new system duct testers.

Learning Objectives

- Learn duct sealing methodology to consistently install new duct systems that meet or exceed the Performance Tested Comfort System (PTCS) new construction duct tightness standard.
- Gain proficiency in performing total duct system tightness test using (PTCS) testing protocol.
- Demonstrate an understanding of the PTCS duct system standard required to obtain an Energy Star rating for new Northwest homes.

Resource Materials

- *Duct System Diagnostic Field Guide*
- *New Construction Energy Star Duct Sealing Guide*
    - Hard copy flip version for field presentations
    - PowerPoint version for classroom presentations
- Product information on mastics

Course Approach

The material may be presented in a classroom environment for larger audiences but is primarily designed for hands-on instruction at the job site with small groups (<10).

Materials Needed On Site

- Approved mastic
- Panduit gun and straps
- Mesh tape
- Brushes
- Latex gloves

- Caulk gun
- UL181A tape
- Duct tester
- Digital manometer
- Material to seal registers (for duct testing)

Performance Testing Training
(Two day training for new construction PTCS certification)

Agenda

Day 1 Classroom

8:00 AM Introductions

Topics:

Why We Seal Ducts.
Basic Building Science
House as a System
Energy Star New Construction Program Requirements

Noon (Break for Lunch)

1:00 PM Performance Testing

Topics:

Equipment
Testing Protocols
Testing Demonstrations
Reporting Requirements

Day 2 In the Field

Each Candidate for certification as a Performance Testing Technician must demonstrate proficiency in the following:

Blower Door Test
Total Duct Leakage Test
Duct Leakage to Exterior Test
Combustion Appliance Zone Safety Test
Data Reporting

Final Exam (written)

Testing

To become a certified PTCS duct tester candidates must pass a written exam on the PTCS duct testing protocol and the PTCS standard as applied to new Energy Star homes. They must also successfully set-up and conduct a total leakage, leakage to exterior duct, and CAZ test in the field environment.

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