



Raising the Bar

Two Utilities' Approach to Residential HVAC Contractor Education

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The Problem

Poor installation of high efficiency residential air conditioning degrades equipment energy performance, and the financial viability of DSM programming

Heat/Loss Summary (July Heat Load Calculations)

	Gross Area	Loss	Sensible Gain	Latent Gain
Walls	1128	6684	1162	0
Windows	163	7332	6305	0
Doors	21	322	116	0
Ceilings	1197	4282	2933	0
Skylights	0	0	0	0
Floors	1197	2155	575	0



The Question

Given limited utility DSM program resources, how do we move the contractor industry forward?

Trade Partners at a Glance



- 1500 companies
- 200 AC participating companies
- 230 Heating participating companies

AC Energy Savings – 2015



- Two different savings “buckets”
 - 51% is the average savings for equipment
 - 49% is the average savings for the Quality Install

Tiers	Total kWh	Equipment	Quality Install
13 – 14.99 SEER	385	0%	100%
15.0 SEER	571	42%	58%
16.0 SEER	650	52%	48%
17.0 SEER	718	59%	41%

Balancing Needs and Budget

- Total Resource Cost considerations
- Limited budget
- NATE certification required
- Annual Program class required



Specific educational needs



- Value proposition (high efficiency, matched systems, with furnace)
- Quality Installation
- NATE Certification
- Manual J and Manual S

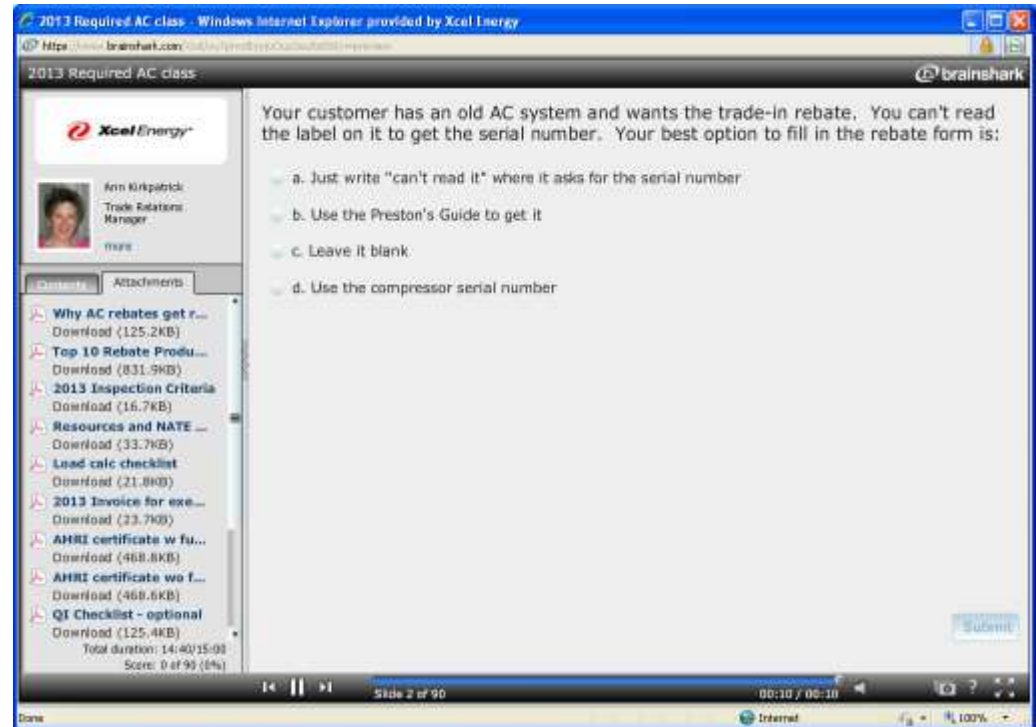


Tactics

Tactics



- NATE classes
- NATE scholarships
- Brainshark
 - Available 24/7
 - Built in test
 - Reporting
- Food



www.brainshark.com/xcel/2015ACclass

Carrots and sticks



- Rewards and recognition
- Calling out bad behaviors

Results



	Sizing	Airflow	Refrigerant Charge	Duct Leakage
2015 Pass Rate	91%	94%	66%	97%
2014 Pass Rate	78%	91%	66%	96%
2013 Pass Rate	84%	79%	69%	99%
2012 Pass Rate	84%	76%	69%	96%
2011 Pass Rate	46%	80%	48%	74%
2010 Pass Rate	62%	40%	24%	40%

Fort Collins Contractor Credentialing Approach

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- History of research on code effectiveness and programs for performance based residential efficiency
- **Approach**
 - **Develop separate residential programs for residential HVAC design and performance testing**
 - **Training plus proof of performance**
 - **Benefit is streamlined review of submittals and testing results by Fort Collins Building Service Department**
- Big picture: Fort Collins Climate Action Plan and Energy Policy
 - Outcomes are right sized equipment, quality and consistency of installations driving demand, energy and carbon reductions along with better building performance

Contractor Credentials

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- Replaced “Approved Agency” referenced in previous code
- New construction submittals from credentialed contractors
 - Streamlined HVAC review in plan check and for C.O.
- Credentials for individuals, not businesses
- Competency assessment and mentoring
- Separate credentials for:
 - Designers
 - Performance-testers
- Low cost for contractors that already do it right

Goals for Training: Performance Testing

- Step one towards earning Fort Collins Mechanical Systems Performance Tester Credential
- Learn the What, Why and How
- Get ready to demonstrate skills for assessment



Testing Form Sections

- Measuring Air Pressure + Flow
- Ventilation Airflow
- Duct Leakage
- Furnace / Air Handler
- Refrigerant Charge
- Room Airflow + Pressure Balance
- Combustion Safety
- Controls




Performance Tester Assessment

Competency Checklist:

- Checklist sections specific to form sections
- Demonstrate abilities for design values, measures, tests
- Demonstrate all skills for each section
- Credential awarded per section
- Mentoring

IBEW HVAC Performance Testing Checklist

HVAC Performance Testing Competency Checklist



Form Section	Competency
1. Local Exhaust Physical Installation	Measure Return and Outdoor Airflow using the approved method, then correct indicated airflow to indicated airflow using the ADOF for the airflow and air temperature indicated.
2. Airflow Measuring Unit Installation	Calculate and install minimum indicated airflow for indicated Design Indicated airflow and indicate Target Airflow Range. For single or dual zone (Return only) verification, measure total airflow from all returns, or use the sum of individual airflows, correct indicated to indicated airflow using the ADOF. Compare with target. For Supply verification, measure airflow in return (return to return) or a separate supply using a Pitot tube in flow inlet. Correct indicated to indicated airflow using ADOF and compare with target. For Return verification systems, measure Supply and Return airflows and compare using approved method. Use correct flow indicator to indicate airflow. Average the flow rate and compare with design value indicated on flow plate. For both standard form systems, verify design designed indicated return airflow and any other verification (if added) to total design indicated airflow. Calculate Target Airflow Ranges. Measure all airflows using approved method, correct from indicated to indicated airflow, and total. Compare the total and result of the calculations. Total and airflow indicated airflow with flow rate and flow velocity.
3. Duct Leakage	Demonstrate procedure for standard duct leakage (10% of flow rate) Demonstrate proper test instrument use: measure pressure and flow using manometer or other method, and measured indicated airflow to indicated airflow using the ADOF for pressure determination.
4. Heating and Cooling Equipment	Demonstrate proper installation and servicing of supply and return both pressure, pressure drop, static and total flow, and indication of flow direction. Use correct Install, adjust, measure and record ADOF Install, adjust, measure and record ADOF Install, adjust, measure and record ADOF Measure return gas (natural) pressure and compare with target indicated pressure. Measure return gas (natural) pressure and compare with target indicated pressure.
5. Refrigerant Charge	Demonstrate measuring compressor air delivery using 1/2 inch tube for non-TUV, discharge a suction line pressure, suction line pressure, and/or suction line pressure. Verify actual Refrigerant, Suction air, Suction air pressure in refrigerant to determine actual.
6. Proper Air Flow and Pressure Methods	Demonstrate correct use of standard or approved use of standard units based on form.
7. Electrical Safety	Demonstrate safety procedures for "lock out" electrical work including LOTO, pressure, voltage, test pressure, and COI determination in the gases.
8. System Controls	Verify electrical system controls for heating, cooling, hot water, and ventilation controls per design sheet.

After Review the Student completing this form has been awarded the following credential(s) based on the results:

Form Certification: Student Signature: _____ Date: _____

IBEW Local 1259

After Earning Credential

- Building Services: streamlines Performance Testing submittals
- Fort Collins Utilities: Quality control with random spot-checking of forms
- Contractor: maintain credential by keeping quality consistently high
 - Minor issues will be addressed with discussion or mentoring from Group 14
 - Repeat major problems: suspended credential
 - Can be re-earned with mentoring at \$500 per session

Test to Design Submittal Values

City of Fort Collins Residential Mechanical Systems Design Submittal

Updated 3/1/2014

For code references and training reminders/tips, see most current version of "Residential New Construction Mechanical Systems Design Submittal Guide."

Project Information

Builder: _____ Builder model: _____

Site-specific submittal Address: _____ Direction front of house faces: _____

Stock plan submittal City of Fort Collins stock plan #: _____

If the plan set shows options, what options affecting the thermal envelope are accounted for in this mechanical design?

Full basement Full crawl space Basement + crawl Walkout basement Other foundation: _____

Bonus room Other significant floor area change: _____

Window area changes > 20 sf: _____

Other significant options: _____

Other notes regarding house configuration: _____

Source of information for energy specs (R-values, windows, etc.): _____

Designer

Designer's name: _____ Company: _____

Signature: _____ Date: _____

Local Exhaust -- Bath Fans

Exhaust Pickup Location (1)	Code-required?	Operation (2) + Minimum Airflow Requirement (CFM 5000)	Control and Other Notes (Does any fan also provide whole-house ventilation?) (Specify location of any remote fans)
__ Y __ N	__ I (50 cfm) __ C (20 cfm)		
__ Y __ N	__ I (50 cfm) __ C (20 cfm)		
__ Y __ N	__ I (50 cfm) __ C (20 cfm)		
__ Y __ N	__ I (50 cfm) __ C (20 cfm)		
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__ Y __ N	__ I (50 cfm) __ C (20 cfm)		
__ Y __ N	__ I (50 cfm) __ C (20 cfm)		
__ Y __ N	__ I (50 cfm) __ C (20 cfm)		

(1) Match room names on plans

(2) I = Intermittent C = Continuous

City of Fort Collins Residential Mechanical Systems Performance Report

Updated 3/1/2014

This form is a record of testing targets and results, with Pass/Fail outcomes. For information on measurement tools and testing techniques, see the "Residential New Construction Mechanical Systems Testing Guide." The guide and this form may be periodically updated; check the Building Services web site for the current version.

This form must be completed and signed by an "Approved Agency," and submitted to Building Services as a requirement for receiving a C.O.

Color key	Target or limit	Measured value to compare with target or limit	Pass	Fail	Caution	Other data	ADCF	ADCF = Air Density Correction Factor, based on tool, altitude (5000'), air temperature through tool
	Volumetric flow (CFM 5000') = ADCF x Indicated flow (CFM)							

1. House Data

Address		Date of "Residential Mechanical Systems Design Submittal" information referenced by testing technicians
Builder		
HVAC contractor		

Performance Testing Form

City of Fort Collins Residential Mechanical Systems Performance Report

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Color key	Target or limit	Measured value to compare with target or limit	Pass	Fail	Caution	Other data	ADCF

1. House Data

Address		Date of "Residential Mechanical Systems Design Submittal" information referenced	
Builder			

Signatures

Technician #1 performing inspection and testing documented on this report (Approved Agency)

I certify that the tests referenced above, in sections bearing my initials, were performed in accordance with protocols specified by the City of Fort Collins Building Services Department, and that the reported results are accurate to the best of my knowledge.

Name (print)	
Title	
Company	



Program Outcomes

- 23 Performance testing credentials
 - Spot checks by Utility and Group 14 found mechanical designs and testing that did not meet code.
 - Grossly over-sized furnace and AC designs discovered
 - Complying systems were redesigned & installed to code
 - Problem mechanical ventilation
 - Supply ventilation into attic furnace (48 degree return air temps air compromising HX and frozen condensate lines)
- Non-complying submittals by non-credentialed contractors not checked: credential lost credibility
- Next step: continue spot checks and code change to require HVAC Credential to design and test



Questions and Answers

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