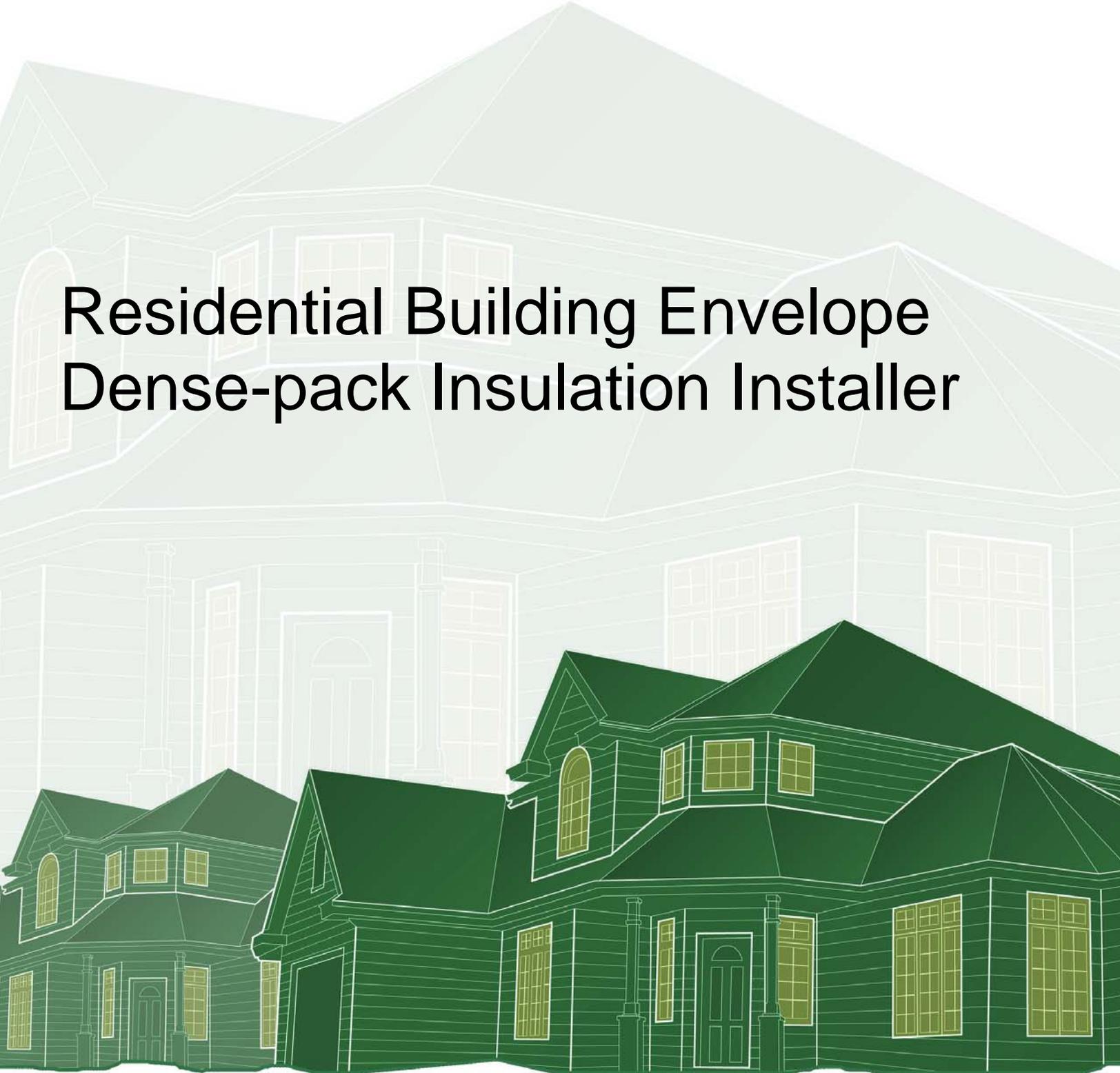




Building Performance Institute, Inc.
BPI Installer Certification

Residential Building Envelope Dense-pack Insulation Installer



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1. Scope¹

This certification scheme outlines the knowledge, skills and abilities for densepack insulation installers.

The installer candidates shall demonstrate their abilities to reduce uncontrolled air movement by safely installing blown insulation materials at a density tested to be air semi-permeable into cavities inaccessible to standard air sealing.

The scope of this certification scheme includes:

- Preparation of attic spaces and crawlspaces including confirmation of air sealing completeness before the installation of loose fill, blanket, or rigid board insulation
- Locating all closed cavities in a safe manner, and ensuring that they are safe to insulate
- Installation of dense-pack cavity insulation in a specific section of wall or floor in a step by step method and to a specific density confirmed by the weight change in a known volume
- The scope of this certification scheme is limited to existing buildings, which are not greater than three stories and does not include all skills required to complete all types of insulation in all types of residential construction

Note: *The scope of this certification scheme is in addition to and does not replace: general requirements and regulations governing installers engaged in construction work on existing buildings; skill certifications, requirements or accepted practices of trades, including carpentry, roofing, siding, plastering & drywall, and standard insulation; nor requirements of licensed specialty trades or advanced installation techniques requiring instrumented diagnostic testing or analysis. This is not an installation standard or construction specification for work.*

¹ Does not include:

- Work scope development or alteration, health and safety analysis including mechanical ventilation, combustion system analysis or alteration
- Installation of loose fill insulation (mineral fiber, fiber glass, cellulose)
- Installation of batt or blanket insulation in open walls, attics, or floors
- Installation of rigid board insulation
- Installation of spray applied foam insulation
- Installation of damp spray, wet spray, or insulation blown behind net
- Installation of membranes, such as belly wrap under mobile homes or water resistive barriers behind siding mobile home cavities
- Interior and exterior finish details and more complex housing types
- Siding removal and replacement, plaster or gypsum repair or finishing
- Roof vent and gable vent installation or replacement
- Access techniques to key framing junctures and limited clearance areas
- Commercial construction air sealing skills or certification requirements

2. Determination of Pre-qualifications

- a. Successfully completed basic air leakage control installer certification A.
- b. Follow all applicable federal, state, and local regulations, including required training and certifications. Confirmation of compliance is to be made by others.
- c. Demonstrate basic safety knowledge, including, but not limited to: inspecting and donning proper PPE. Demonstrate basic carpentry skills, safe and proper use of hand and power tools including hammer and pry bar, caulk gun, stapler, utility knife, sheet metal snips, electric screwdriver, ½” electric drill with side handle, self-feed bits and holesaws, circular saw, reciprocating saw. Demonstrate knowledge of ladder safety, electrical safety; demonstrate proper materials-handling techniques, and knowledge of basic building science component of weatherization training. Confirmation of compliance is to be made by others.

3. Review of Existing Standards

None exists for certification on these specific topics.

Related and referenced standards and documents:

ASTM C1015-06 Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation

ASTM C 764-07 Standard Specification for Mineral Fiber Loose Fill Thermal Insulation

ASTM C 1320-05 (09) Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction

ASTM E 2178-03 Standard Test Method for Air Permeance of Building Materials

ASTM C 522-03 Standard Test Method for Airflow Resistance of Acoustical Materials

ASTM C 1574-04 Standard Guide for Determining Blown Density of Pneumatically Applied Loose-Fill Mineral Fiber Thermal Insulation

CAN/ULC-S702.2-01 Standard for Thermal Insulation Mineral Fiber-Part 2: Installation Guidelines

ICC-ES Evaluation Reports of the International Code Council

ICC-ES AC 12 Acceptance Criteria for Foam Plastic Insulation

ICC-ES AC 377 Acceptance Criteria for Spray-Applied Foam Plastic Insulation

WX Regional Technical Field Guides

EEBA-BSC Builder's guides

Assumed standard: Demonstrate the ability to locate, open, and pack all building cavities in a specified section, full without voids, with semi-permeable blown insulation installed at a density tested to limit airflow.

All materials shall be used within their listing for temperature and exposure and installed in conformance to all applicable codes and to manufacturer's recommendations, except where these requirements exceed manufacturer's recommendations. Where the performance requirements of this scheme require higher densities and result in lower coverage than insulation manufacturer's recommendations, these requirements govern. Cavity fill shall not show visible airflow at a pressure difference of 50 Pascals as indicated by chemical smoke at specified openings or infrared imaging of specified cavity areas, including framing connections.

4. Functions and Tasks

K = Knowledge, shown on written or verbal test

S = Skill, shown on written test, diagram, or interactive tool

A = Ability, demonstrated on prop or in house

#		Description	Reason	K	S	A
1		General				
	a	Understand fires occur when a burnable material, such as a wood product, paper facing, rubber caulk or plastic foam contacts a heat source like a chimney; or any insulation traps heat over a non-IC recessed light or improper wiring.	Improper installation of insulation can cause fires. You may get no immediate indication anything is wrong. The fires may take a long time to start or occur later during different use.	x		
	b	Recognize from photos, drawings, props or real examples: <ul style="list-style-type: none"> recessed lights from attic side, and interior where to look for IC label on fixture knob and tube wiring, open junction boxes, unsupported connections outside of boxes, and other wiring hazards 	Installers are required to maintain clearance around certain fixtures and wiring types. Contact with open connections and improper wiring can injure workers.		x	
	c	Recognize a heat source-chimney vent or fireplace in wall.	Standard practice ² does not allow insulation in air spaces surrounding metal flues, chimneys or fireplaces. Specific clearances are required by code.		x	

#		Description	Reason	K	S	A
2		Set up				
	a	Understand that crew leader must issue OK to proceed with job and no stop work conditions are present before beginning. ³	Prep and install requirements may change. Hazards noted before work may still be in place.	x		

² ASTM C 1015-06 Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation.

³ See D. Dense-pack Insulation Crew Leader Certification for specific checks before installation.

#		Description	Reason	K	S	A
2		Set up				
	b	*Show where to set up poly sheeting, damp spray, or other required prep for wall access.	Protect site and occupants.		x	
	c	*Find and mark or block: heat sources in wall (e.g. chimneys, radiant heaters) to maintain required 3" or greater clearance.	Avoid fire. Do not blow combustible insulation next to heat source.		x	
	d	*Mark wall cavities used as returns before drilling and blowing.	No evidence from outside. Densepack is not an approved duct sealing method. Avoid mess and potential damage to the system, including dust throughout the house. Don't close off part of the duct system without permission and a plan. Big improvement possible if ducts are relocated inside and all walls completed properly.		x	
	e	*Understand at least two reasons to block between floor duct cavities and exterior wall cavities before blowing.	Preparation reduces cleanup. Standard work requires installers to block all openings for insulation to escape from cavities. Ducts can fill with insulation, affecting or stopping HVAC operation. Efficient work-quicker completion of insulation job with less material used. It keeps you on the ladder longer if you are filling back to the furnace.		x	
	f.	*Locate outlets and wiring fixture locations in walls from diagram or inside inspection. Choose placement of access openings to reduce contact with wiring.	Pick access locations for least interference with house systems and smoothest path to completion. Avoid damage, electric shock, extra delays and repairs		x	

#		Description	Reason	K	S	A
2		Set up				
	g	Distinguish interior finish material and standard wall cavity details that will support normal blowing from others requiring some alteration. Confirm there is an interior finish behind built-ins and cabinets before blowing. Continuous ½” gypsum board or equal, lath and attached plaster 3/8” or better. Confirm wall cavity is 2x4 or more and empty.	Prevent wall blowouts and slowdowns. Recognize damaged areas and report for repair before further work in those areas. Techniques for work with less durable interior finish materials, shallow cavities, and re-blows of partial fills are for later – beyond this scope.		x	
	h	Understand where to look to block all openings in ceilings, floors, and sidewalls through which it is possible for the insulating material to escape.	Better to learn before it happens. Prevent surprise messes in interior.		x	
	i	Recognize wall cavities that open into a basement or crawl space need to be blocked before wall insulation is installed.	Cellulose can wick moisture up into floor and walls if blown onto moist crawlspace. Prevent mess in basement.		x	
		*On diagram, prop or on site: written, verbal, or by showing actual setup.				

#		Description	Reason	K	S	A
3		Attic air seal and prep				
	a	Distinguish between properly completed and incomplete air sealing of one selected detail presented in a diagram, or question.	Confirm knowledge.	x		
	b	For incomplete air sealing on a detail - Provide acceptable material, 2 or 3 primary action steps, and self check to properly complete air sealing.	Confirm skill and air sealing steps.		x	
3.1		Clearance dam at heat source.	Chimney or gas vent.			
	a.	Select the right roll or piece of sheet metal to fashion a chimney clearance dam at least 16 inches tall, that wraps all around to an overlap, is closed at the top and fastened at the bottom for a 5” B-vent.	Take enough material to complete the work.		x	

#		Description	Reason	K	S	A
3		Attic air seal and prep				
	b	Fold metal in Z shape with top 2" in toward chimney and bottom 1" out for fastening	Prevent filling clearance space with insulation.			x
	c	Install metal clearance dam. Fasten down bottom, fold in top, and fasten lap.	Keep combustibles away from heat source. Maintain clearance required by code and listing of combustion vent.			x
3.2		Roof wall joint preparation.	Use roof wall prop.			
	a	Demonstrate install soffit vent chute and foam or stuff under chute at outside edge of top plate. Maintain at least 1" open between chute and roof deck. Seal top air leak and reduce wind penetration as access permits. (Set prop to high slope 8:12 to 12:12 for access.)	Direct airflow from vent up along roof. Prevent wind wash at edges. Top plate sealing is important for performance but often not yet completed.			x
	b	Pack tight or stuff edge over top plate to roof in an area without soffit vents. Demonstrate a backup method where access is limited, but still possible (set prop low 4:12, 2:12).	Stop wind and get most R-value at edge. Much better than leaving it open and exposed.			x
3.3		Duct insulation.				
	a	Apply R8 faced duct wrap with joints taped over uninsulated duct section that has been confirmed sealed.	Stop sweating on AC ducts in summer with vb. facing and drips inside in winter with insulation. Half of attic duct losses are conduction.			x
	b	Alternate: Spray 2-part kit foam 1" thick or greater on exterior ductwork and wrap in 1.5" thick mineral fiber insulation or other prescribed ignition barrier.	Air seal and insulate.	x		
3.4		Access insulation, dams for blown insulation.				
	a	Show sample of dam for blown insulation at attic access, level change, or border between floored and loose fill attic insulation to full depth of insulation and with wood, plywood or OSB.	Allow full insulation depth to dam. Prevent spills.		x	

#		Description	Reason	K	S	A
3		Attic air seal and prep				
	b	Show insulation on access door or hatch, fastened; show R value as close to adjacent building section as practical.	No voids in insulation, Keep R value even.		x	
		*On diagram, prop or on site: written, verbal, or by showing sample installation on short section.				

#		Description	Reason	K	S	A
4		Dense-pack wall insulation skills⁴				
	a	Understand that crew leader directs setup of equipment to manufacturers' instructions and contractors' policies, checks power supply and machine operating pressure and all house preparations are complete, including blower door for cavity smoke test.	Follow regulations, standard work process.	x		
	b	Understand siding removal and replacement, lead safe protection for interior drilling or other wall access method is performed with minimum damage following all regulations, contractors' policies and scope of work, with access holes plugged after filling, including a basecoat patch at any gypsum openings and water resistive barrier repaired to restore original function where opened.	Protect property, workers and occupants.	x		
	c	In specified section of house wall or on prop, drill holes ⁵ for insertion tube to access all cavities. Create step by step grid that creates access to 100% of surface with drill, probe, and tube.	Densepack air leakage reduction requires 100% of hidden cavities packed. Leave no hidden escape paths for air and no voids. Irregular and open framing is common.		x	
	d	Choose location for first hole, likely to	Check so no vertical			x

⁴ Allowance withdrawn for floor cavity alternate, floor densepack is a related additional application.

⁵ Whenever drilling, control drill spin and depth as per training. Brace side handle to control torque if bit locks up; and reduce push as bit clears sheathing to limit depth to avoid unexpected wiring or breaking through interior finish. Confirm wall materials, cavity depth and atypical details before drilling. Do not continue drilling in solid framing once past sheathing on props or elsewhere.

#		Description	Reason	K	S	A
4		Dense-pack wall insulation skills⁴				
		be away from corner framing at a height convenient for inserting tube. Test back and forward with probe, both ways side to side, and open a hole just past the next stud and repeat to access all stud cavities over 1" wide, even if framing isn't irregular. Re-check with probe to confirm no missing spaces.	cavities are missed. Existing wall framing is often irregular and each cavity must be confirmed. This tube is for basics, thin cavities and other methods are for later.			
	e	Insert sidewall tube into first hole. Check that tube reaches full height up and down, repeat on each stud space and make openings needed to access the other side of each horizontal blocker. Drill an additional hole beyond each horizontal blocker if insert tube won't go all the way to the end of each cavity, until you are sure the whole section is open.	Check so fill is full height with no voids. Check length of tube inserted against distance to end of cavity.			x
	f	Blow density test box and measure weight change. ⁶ Readjust blower settings and repeat until required density is met or exceeded in test box.	Confirm blower adjustment.			x
	g	Insert tube and completely pack 1 cavity.	Demonstrate proper installation.			x
	h	Stop and check first cavity with smoke before proceeding to remainder, house at 75 pa. ⁷ Turn fan or blower door to 75 pa house pressure. Smoke check in undisturbed material away from installation hole. ⁸	Smoke test shows cavity airflow until it is stopped. Confirm installation before proceeding.			x
	i	Demonstrate airflow through adjacent empty cavity with smoke to show walls leak. And confirm conditions for the test are	So candidate recognizes air movement through cavities before their			x

⁶ 2 cubic foot test box-DI mockup 1A: 45"x 17.5" 4.375"ID weigh empty box, pack, weigh full box
3.5 lbs/ft³ requires 7 lbs or more cellulose or rock wool above empty weight
2.2 lbs/ft³ requires 4.4 lbs or more tested fiber glass blowing wool above empty weight

⁷ Turn fan or blower door to 75 pa house pressure. Test empty hole to confirm active airflow in cavities.

⁸ Pull plug from duplicate hole and test with smoke in undisturbed part of first cavity before packing the second and third. Change installation technique, re-adjust blower, clear hose with air and repack first cavity until no smoke movement is observed.

#		Description	Reason	K	S	A
4		Dense-pack wall insulation skills⁴				
		in place.	work. Show target airflow.			
	j	Pack 3 or more wall cavities full, ⁹ with insertion tube to provide consistent pack in whole cavity (test fan off). Check all 3 cavities with smoke at 75 pa at undisturbed holes.	Confirm complete fill.			x
	k	Compare selected area completed with first bag blown to confirm installed density. ¹⁰ 1- 30 lb bag fills approx. 30 sq feet at 3.5lbs/ft ³ or 10 lbs/8' 2x4 wall cavity. 2- 1-30 lb bag fills 48 -50 sq feet at 2.2lbs/ft ³ or 6 lbs/8' 2x4 wall cavity.	Confirm material use matches coverage requirement. Alerts you to blowout or incomplete fill.			x

5. How to document

- 5.1 An evaluator authorized by BPI shall observe and record each candidate's performance and provide the results to BPI. Decisions on certification of the candidate are made by BPI.
- 5.2 The evaluator can suspend the evaluation if at any time he feels one or more of the following conditions exist:
- health and safety of anyone is being jeopardized
 - the structure or fixtures are being damaged or put at risk of fire
 - the candidate is suspected of being under the influence of alcohol or drugs
 - the candidate or crew leader will not cooperate with instructions / requests of the evaluator
- 5.3 Written test questions developed by BPI for this scheme may be delivered verbally. English language is not required. The candidate is required to demonstrate each skill listed. Completion of single examples of each skill in a specified section is required. Completion of an entire work scope is not required here. Mockups of sample details shall be allowed to show competence. Separate wall mockups shall be allowed to show adequate material density, smoke test at 50 pa, completeness of opening, and material use per sq ft. Demonstration of sealing sample details in specified sections of homes shall be allowed to show competence. A combination of in-house details and props are allowed to complete the evaluation. Once a skill is shown in an acceptable manner on one detail, it does not need to be repeated on another application of the same skill. More than one house visit is allowed if not all required details are present.

⁹ Pack from one end, let it run until cell stops, then pull out 12-18" to get flow, pack and move again.

¹⁰ **Note:** DI mockup 3C: fill prop is 27 sq ft net, 3-5/8" thick for 8.1 cu ft and 28.7# at 3.5 pcf at required density and within 4% of 30# target. Weigh bags added if recycled cellulose used. Weigh bags before if partial bag added and keep initial fill as close to 30# for cell and 18# for fiberglass (0.6 bag) as possible.

5.4 Evaluator Instructions: Indicate pass or fail for each of the following skills. If an individual fails to demonstrate a skill successfully, he or she may repeat the attempt two additional times. Field guides including step-by-step photo guides are allowed. No coaching by evaluator is allowed. A recommendation for approval will be granted upon successful demonstration of all skills.

5.5 Competence demonstration required:

Pass	Fail	Sec 5 #	
		3.1bcd	Cut and fold metal clearance dam 2" at chimney heat source.
		3.2a	Soffit vent channel-chute; wind baffle foam/stuff under chute (steep).
		3.2b	Pack top plate edge where there is no soffit vent (low slope).
		3.3	R-8 duct insulation.
		4d,e	Drill to open, check side to side for studs, up and down for blockers open 100%.
		4f	Blow test box to target density to initial blower adjustment.
		4g	Densepack one cavity.
		4h	Check packed opening with chemical smoke @ 75 pa (reset blower and redo until no smoke enters or leaves test hole).
		4i	Smoke test at open cavity.
		4j	Pack 3-5 cavities, check all with smoke.
		4k	Confirm installed density: visual check on bag use, # of material added to hopper, less remainder. Match lbs/sq ft of area completed with coverage required to meet density target.

6. Materials

6.1 In the context of this certification scheme, the purpose of air sealing is to assemble an air barrier in an existing accessible attic, side attic, crawlspace or other buffer zone, between inside and outside. The goal is a single pressure boundary where it is most practical to establish. Typically, several different materials are used to bridge gaps between solid sections of existing construction. The materials, sealants, connections and attachments used in this effort must be: continuous on all edges and across all gaps, strong enough to support expected loads, durable enough to maintain airtightness over time, and impermeable to airflow-typically 0.004 cfm/sq ft @75 pa for barriers and sealants. In addition, materials that bridge the clearance distance to heat sources must be non-combustible. Where the air barrier material is not warmed by insulation, it must also be permeable to moisture movement.

6.2 Contractor is responsible to follow applicable codes and consult specific ICC ES reports to determine additional conditions for use for specific products. Supplies of rigid barrier materials, noncombustible barriers, foams, sealants, tools and fasteners shall be on hand for evaluation.

6.3 Sample Materials Include:

- a. Cellulose loose fill insulation meeting ASTM C739, 16 CFR 1209, 1404
Specific Cellulose ICC ES reports required for fire rated details (e.g. ESR-1996 US Greenfiber, ESR-2217 NuWool)
Mineral fiber batt and blanket insulation meeting ASTM 665
Mineral fiber loose fill insulation meeting ASTM C764
Fiberglass wool engineered for air resistance tested to draft BPI standard using {ASTM E2178, C522 (e.g. JM Spider, Knauf Perimeter Plus) and showing under 3 cfm 50} per square foot leakage
- b. Rigid closed cell foam boards meeting ASTM C578, ICC ES AC12
Specific foam board ICC ES reports required for uncovered use (e.g. NER-681 Thermax, ESR 2142 Dow XPS)
Rigid Fiberglass faced insulation meeting ASTM C553, C612, and C 1136 for facing
- c. Rigid fiber glass duct board with Flame spread 25 facing
Gypsum board
Plywood
Oriented strand board (OSB)
"Hardie" board
Flame spread 25 faced batts and duct insulation when supported
- d. Non combustible barriers
Galvanized sheet metal
Aluminum flashing on roll
Aluminum coil
Cement board
- e. Non-combustible sealants
Furnace cement
Fireblock sealant meeting ASTM E 136 (all chimneys)
For gas vents only: 600F RTV silicone
- f. Duct mastic and sealants
Water based duct sealant UL 181A-M, UL 181B-M
Acrylic sealant meeting ASTM C-834
Silicone, urethane caulk meeting ASTM C-920
- g. Foam sealants that meet ICC ES 377 and ASTM C1642-07
One component foam
Two component sealant foam (kit)
- h. Air impermeable Insulating foam (bulk, truck mounted)
Two component open cell foam listed for uncovered use in attics and crawlspaces
e.g. ESR 2668 Certaspray open; ESR1826 Icynene
Two component closed cell foam listed for uncovered use in attics and crawlspaces
e.g. ESR 2669 Certaspray closed;
With spray or prescriptive ignition barrier ESR-2642 BASF wall spray