BUILDING PERFORMANCE INSTITUTE, INC.

TECHNICAL STANDARDS
FOR THE
MANUFACTURED HOUSING PROFESSIONAL

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ACKNOWLEDGEMENTS

The following standards were developed for the Building Performance Institute, Inc. (BPI) with assistance from an expert panel, the BPI Technical Advisory Council, and the BPI Technical Committee. These groups include industry stake-holders including: contractors, licensing and code officials, weatherization agencies, program administrators, equipment manufacturers, researchers, and trainers. This document, released in 2003, is the result of their efforts. For additional information, contact BPI.

BPI MOBILE HOMES EXPERT PANEL PARTICIPANTS:

Robert deKieffer, *Boulder Design Alliance*
Robert DeSoto, *U.S. Department of Energy*
Cal Steiner, *Community Action Program*
Barry York, *Mid-Iowa Community Action*

Additional thanks goes to the New York State Energy Research and Development Authority (NYSERDA) for providing necessary funding to support this project.

USE AND DISTRIBUTION OF BPI STANDARDS

This document was prepared by BPI to provide a guiding set of technical performance standards for use by BPI certified technicians. The certification process ensures technicians utilizing these standards have demonstrated competency at both the skill and knowledge required to apply the techniques and applications referenced herein. BPI makes no claim as to the competency of any persons engaging in any application of these standards without holding current, valid BPI certification in the relevant discipline.

	Module	Category	Standard	Method or Technique	Special Materials or Equipment
1	**Health and Safety**				
1.1.1	Health and Safety	Personal	All technicians performing diagnostic tests, inspections, or installations, must have access to all necessary personal safety equipment required by OSHA.	Occupational Safety and Health Administration	Hard hats, safety glasses, gloves, dust masks and/or respirators, harnesses, as required
1.1.2	Health and Safety	Personal	Technicians must be trained in proper use and applications of all personal safety devices and must adhere to OSHA regulations when on the job site	Occupational Safety and Health Administration	OSHA standards
1.1.3	Health and Safety	Personal	Ambient CO MUST be monitored throughout all combustion safety tests. Testing shall be aborted if ambient levels exceed 35ppm. Testing may resume only after repairs have been made and ambient CO levels are below 35 ppm.	Occupational Safety and Health Administration	OSHA standards, BPI BA-I standards
1.1.4	Health and Safety	Personal	Respirators with proper cartridges must be worn when working in areas where exposure to airborne mold, asbestos, lead, fiberglass, cellulose, or formaldehyde is at risk	Occupational Safety and Health Administration	OSHA standards
1.2.1	Health and Safety	Personal / Occupant	A copy of the MSDS for ALL materials on the job or installed in the home, must be kept on each crew vehicle, at the main office, and made available to all workers and clients upon request	Occupational Safety and Health Administration	OSHA standards, manufacturer's Material Safety Data Sheets

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
1.2.2	Health and Safety	Personal / Occupant	Where the presence of asbestos, lead, mold, and/or other potentially hazardous material is known or suspected, all relevant state and federal guidelines must be followed**. Blower door depressurization tests may NOT be performed where there is a risk of asbestos becoming airborne or where other hazardous materials could be drawn into the dwelling**	State / Federal guidelines	State / Federal guidelines
1.2.3	Health and Safety	Personal / Occupant	The building occupants must be informed of the likelihood of airborne contaminants (asbestos, fiberglass, mold, etc.) in the home during and after inspection and improvement of airflow to the AC or heating system.	NA	NA
1.2.4	Health and Safety	Personal / Occupant	A minimum of one UL-2034 compliant CO detector must be installed in each home. Smoke and CO detectors must be installed per manufacturer's instructions.	Per Manufacturers Instructions	BPI BA-I Standards
1.3.1	Health and Safety	Electrical	Electrical power must be shut off before working on mechanical equipment.	Shut off switch or circuit breaker	NA
1.3.2	Health and Safety	Electrical	Wiring must be checked for the presence of aluminum wire. If found, a qualified electrician must do a full load test and verify safe	Certified/Licensed Electrician	NA

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
			installation before ANY work is done.		
1.3.3	Health and Safety	Electrical	Any wiring hit by drills, etc. should be fixed properly and immediately	Shut off switch or circuit breaker	NA
1.3.4	Health and Safety	Electrical	Pre and Post electrical circuit inspections should be completed to check for proper ground and polarity of each circuit when installing enclosed cavity insulation.	Test with electronic GFI/Circuit Tester	GFI/Circuit Tester
1.3.5	Health and Safety	Electrical	Lighting fixtures installed in the ceiling must be checked for proper operation before any roof insulation is installed.	NA	NA
1.4.1	Health and Safety	Solid Fuel Appliances	Solid fuel appliances are not allowable in mobile homes. Work may not proceed where solid fuel appliances are present in the mobile home.	NA	NA
1.4.2	Health and Safety	Moisture and Plumbing leaks	All plumbing leaks and moisture problems must be addressed prior to work commencing on the mobile home.	See section 9 of these standards	NA

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
2	**Ducts**				
2.1.1	Duct System	Inspection	A thorough inspection of the duct system must be completed prior to treatment of the home to identify blockages, disconnects, or other catastrophic leaks.	See BPI Best Practices	Flashlight, inspection mirror
2.2.1	Duct System	Testing	The Pressure Pan shall be used to identify the location and estimate the magnitude of the duct leaks	See BPI Best Practices	Blower Door, Pressure Pan, digital manometer
2.2.2	Duct System	Testing	Room-to-room pressures shall be measured in all rooms with doors. The work scope shall include strategies to mitigate pressure which exceed 3 Pascals between rooms.	See BPI Best Practices	Digital manometer
2.3.1	Duct System	Repair	Mastic and mechanical fasteners must be used to seal ducts and ensure that they are attached to the structure. Caulk is an acceptable material only for sealing register boots to the floor • Ducts should be cleaned before applying mastics	Se BPI Best Practices	Duct Mastic (UL-181), mesh tape, metal straps, self-tapping metal screws, electric drill, solvent for cleaning
2.3.2	Duct System	Repair	Remove, eliminate, and seal all cold air return systems in the belly and attic and provide alternate return air grill	N/A	Sheet metal, Duct Mastic (UL-181)
2.3.3	Duct System	Repair	The end caps of all duct runs must be examined and sealed if the end of the duct is determined to be leaking.	N/A	Duct Mastic (UL-181), mesh tape

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
2.3.4	Duct System	Repair	Repair, seal, and support all crossover ducts. • Must be insulated to R-11 minimum • Must be securely fastened • Must be off the ground	N/A	Duct Mastic (UL-181), mesh tape, metal straps, self-tapping metal screws, electric drill, solvent for cleaning, insulation
2.3.5	Duct System	Repair	Clean and seal connections between the furnace and duct plenums using appropriate duct sealing materials.	N/A	Duct Mastic (UL-181) with mesh tape, or UL-181 compliant duct sealing tape (NOT STANDARD DUCT TAPE), solvent for cleaning

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
3	**Belly**				
3.1.1	Belly	Inspection	Conduct thorough inspection of the **entire belly**. • Condition of the belly board / rodent barrier • Construction techniques including the direction of the joists and blocking • Location of all plumbing and ducts	N/A	Flashlight, personal protective gear
3.1.2	Belly	Inspection	Measure the existing insulation levels in the belly if any. Take note at this time of amount of room for insulation in the wings and center	N/A	Flashlight, personal protective gear, measuring tape, probe, knife
3.1.3	Belly	Inspection	De-rate insulation to reflect actual performance	Use chart provided by BPI	BPI BA-I standards
3.2.1	Belly	Repair / Soft Patch	All holes average fist size or larger must be patched • Soft patch shall be done on all soft bellies using mechanical fasteners and adhesive	N/A	Stitch stapler, utility knife, caulk or adhesive, belly patching material, metal building insulation
3.2.2	Belly	Repair / Hard Patch	Hard patches <u>less than 1”</u>, can be made with materials that are not mechanically fastened if you are insulating the belly Hard patches <u>larger than 1”</u> must be mechanically fastened to the belly	N/A	Screws, nail gun, screw gun, rigid insulation, old paneling, 1x2’s, metal or plastic washers, buffalo board, rigid patches of various materials

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
3.2.3	Belly	Repair	Repair all holes from the interior, particularly in ductwork, prior to insulating, so that belly insulation will not be blown into the home or ductwork	N/A	N/A
3.3.1	Belly	Insulation	Belly insulation shall be installed at the following densities: 1.5-2.0 lbs/f^3 in the wings, and 1.0-1.5 lbs/f^3 in the center. • Blow tube should be not be more than 1 foot from desired insulation area • Calculate and verify bag count as you insulate to ensure proper density	N/A	½" drill with a clutch, 2-9/16" wood bit
3.4.1	Belly	Skirting	**Insulated skirting is ONLY recommended if the belly is totally inaccessible and unrepairable**	N/A	N/A

	Module	Category	Standard	Method or Technique	Special Materials or Equipment
4	**Wall Insulation**				
4.1.1	Wall Insulation	Inspection	Inspect at least one full wall cavity or more by physical inspection Physically remove a piece of insulation to inspect • Define the construction type • Define the depth of cavity • Evaluate the interior and exterior cavities for defects • De-rate insulation materials to reflect actual performance	Use chart provided by BPI	BPI BA-I standards
4.2.1	Wall Insulation	Installation	Wall Insulation should be installed when cost-effective. It can be blown, stuffed, or a combination. Techniques used shall be in accordance with BPI Best Practices.	See BPI Best Practices	See BPI Best Practices
4.2.2	Wall Insulation	Installation	After insulation is installed, siding shall be replaced without bulging or damage to the siding or paneling.	NA	NA

	Module	Category	Standard	Method or Technique	Special Materials or Equipment
5	**Roof Insulation**				
5.1.1	Roof Insulation	Inspection	Physically inspect the ceiling cavity by drilling a viewing hole. • Define the depth of cavity • Define construction techniques and type and depth of insulation • De-rate insulation materials for actual performance	Use chart provided by BPI	BPI BA-I Standards
5.1.2	Roof Insulation	Inspection	Inspect both interior and exterior surfaces for structural integrity before proceeding with installation of insulation	N/A	N/A
5.1.3	Roof Insulation	Inspection	Exhaust fan vents must be fully ducted and vented outside. Exhaust ducts in unheated space must be insulated.	N/A	Flashlight
5.2.1	Roof Insulation	Installation	Wherever roof access is made, ensure a weatherproof seal after insulation by closing the opening and installing latex elastomeric roof coating on all seams and penetrations	See BPI Best Practices	
5.2.2	Roof Insulation	Installation	Flues must be properly blocked to provide adequate clearance to combustible materials when installing insulation	NFPA 54 HUD	Rigid material for damming around flues
5.2.3	Roof Insulation	Installation	Peal-and-seal must be installed over the seams of building penetrations (swamp coolers, flues, vents). Finish with latex elastomeric roof coating	See BPI Best Practices	Peal-and-seal, torch, white wash brush, latex elastomeric roof coating

	Module	Category	Standard	Method or Technique	Special Materials or Equipment
6	**Infiltration**				
6.1.1	Infiltration	Testing	Pre-installation blower door tests are required. Post blower door tests are required when measures are installed which may affect the airflow characteristics of the building envelope.	N/A	BPI BA-I Standards, blower door
6.2.1	Infiltration	Insulation	Prepare home for insulation measures by repairing large holes where insulation may enter the living space	N/A	N/A
6.3.1	Infiltration	Insulation / Air Sealing	Install insulation measures before any additional air sealing measures are conducted	N/A	N/A
6.3.2	Infiltration	Air Sealing	**Do not conduct additional air sealing measures until insulation is completed. Do not seal the home if below 1500 CFM_{50}**	N/A	N/A
6.4.1	Infiltration	Mechanical Ventilation	**If home is below 800 CFM50, make sure kitchen and bath fans must operate correctly and exhausting air outside, or install a balanced mechanical ventilation system to provide ventilation in accordance with ASHRAE 62-89.**	See BPI Best Practices	Digital manometer

	Module	Category	Standard	Method or Technique	Special Materials or Equipment
7	**Mechanical Systems**				
7.1.1	Mechanical Systems	Inspection	Perform a visual inspection of the venting system to ensure compliance with NFPA standards.	NFPA 54	N/A
7.1.2	Mechanical Systems	Inspection	Floor in the water heater closet must be checked for structural integrity • The water heater must be level and adequately supported.	N/A	N/A
7.2.1	Mechanical Systems	Testing	Check for visual signs of spillage prior to testing	N/A	N/A
7.2.2	Mechanical Systems	Testing	Furnaces and water heaters should be tested for CO with the door to the furnace/water heater closet closed. CO measured after 5 minutes of operation may not exceed 100 ppm. Units producing CO in excess of 100 ppm must be repaired or replaced.	See BPI Best Practices	Digital CO meter
7.3.1	Mechanical Systems	Heating System	Isolate the water heater closet from the rest of the home through air sealing • Water heater closets should be sealed from any communication with the furnace closet	See BPI Best Practices	Air sealing materials
7.3.2	Mechanical Systems	Heating System	Non-sealed combustion heating systems must be replaced with sealed combustion units or units	Installed per manufacturers instructions	N/A

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
			approved for use in mobile homes. Combustion air must come from outside the mobile home and not the door.		
7.3.3	Mechanical Systems	Heating System	For all sealed combustion systems you must locate the source of combustion air and verify proper operation	Manufacturer's specifications	N/A
7.4.1	Mechanical Systems	Water Heater	Any water heater accessible from the interior of the home must be sealed combustion. Make up air should come from under the mobile home.	See BPI Best Practices, Manufacturer's specifications	N/A
7.4.2	Mechanical Systems	Water Heater	All water heaters must be approved for use in mobile homes	Manufacturer's specifications	N/A
7.4.3	Mechanical Systems	Water Heater	Water heaters without switchable gas valves must be replaced with mobile home approved water heaters	N/A	N/A
7.4.4	Mechanical Systems	Water Heater	The water heater closet should be air sealed from the rest of the home and any communication with the furnace closet • Insulate tank and pipes when cost-effective based on climate based SIR	See BPI Best Practices	Air sealing materials, pipe insulation, tank wrap
7.5.1	Mechanical Systems	Unvented Appliances	Unvented space heaters, appliances, etc. are NOT permitted and work must cease until the such units are removed from the home. (Gas ovens are an exception and must be	N/A	BPI BA-I Standards

MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
		tested according to BPI standards for ovens.)		

	MODULE	CATEGORY	STANDARD	METHOD OR TECHNIQUE	SPECIAL MATERIALS OR EQUIPMENT
8	**Windows and Doors**				
8.1.1	Windows	Inspection	• Inspect all windows for proper fit and operation • Assess all windows for operation and effectiveness	N/A	N/A
8.1.2	Doors	Inspection	Inspect doors for integrity, operation and efficiency • Replace door if nonfunctional	N/A	N/A

	Module	Category	Standard	Method or Technique	Special Materials or Equipment
	Plumbing and Moisture				
9.1.1	Plumbing	Inspection	All leaks on the water supply system must be repaired before work begins	N/A	N/A
9.1.2	Plumbing	Inspection	All leaks on the water drain system must be repaired before work begins	N/A	N/A
9.1.3	Plumbing	Inspection	Sewage leaks must be fixed and isolated before any work is done.	N/A	N/A
9.1.4	Moisture	Inspection/Source Control	Review all potential moisture problems and correct prior to installing measures which may affect the air infiltration properties of the building envelope.	N/A	BPI BA-I Standards
9.2.1	Moisture	Source Control	Where a moisture source is present, ground vapor barriers must be installed to control moisture migration into the building.	See BPI Best Practices	6-mil polyethelene
9.2.2	Moisture	Source Control	Penetrations between the living space and cavities or areas where moisture is present must be sealed.	N/A	Caulk, foam, rigid baffles, as needed
9.3.1	Moisture	Mechanical Ventilation	Mechanical ventilation must be added if moisture source cannot be removed	N/A	N/A