Standard Work Specifications 2017 – Single Family Housing

Disclaimer

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Note: In the specification tables below, the farthest right column (no header) containing a numerical reference should be ignored.

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Glossary

AAMA	American Architectural Manufacturers Association, www.aamanet.org
AARST	American Association of Radon Scientists and Technologists, www.aarst.org
AB	Air barrier
ACCA	Air Conditioning Contractors of America, www.acca.org
ACM	Asbestos-containing material
ADA	Americans with Disabilities Act
ADC	Air Diffusion Council, www.flexibleduct.org
AFUE	Annual fuel utilization efficiency
AGA	American Gas Association, www.aga.org
AHJ	Authority having jurisdiction
AHRI	Air Conditioning, Heating, and Refrigeration Institute, www.ahrinet.org
Air barrier	The separation between the interior and exterior environments of a building that slows air flow to the point that no smoke movement is visible at 50 pascals of pressure difference across the boundary
AL	Action level
ANSI	American National Standards Institute, www.ansi.org
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, www.ashrae.org
ASTM	ASTM International, www.astm.org
Backdraft damper	A damper that allows air to flow in only one direction
Beaded collar	A round fitting with a ridge or lip part way down its length that prevents a flexible duct mechanically attached with a draw band from sliding off
Bonus room	A livable room that is often over a garage or in an attic area; the room commonly contains slanted ceilings and knee walls
BPI	Building Performance Institute, www.bpi.org
BTU	British thermal unit

Can light	A light fixture (or can) that is recessed into the ceiling
Cathedral ceiling	A condition in which the ceiling has the same slope as the roof
Cathedralized attic	An attic that contains insulation located at the roof deck rather than the attic floor, bringing the attic space into the thermal boundary of the house
CAZ	Combustion appliance zone
CFL	Compact fluorescent lamp
CFM	Cubic feet per minute
CGSB	Canadian General Standard Board
Closed crawl space	A foundation without wall vents that uses air-sealed walls, ground and foundation moisture control, and mechanical drying methods to control crawl space moisture. Insulation may be located at the conditioned floor level or on the exterior walls. Return pathways are not allowed from the crawl space to the living space
CO	Carbon monoxide
Conditioned basement	A below- or partially below-grade livable space with concrete or finished floor that is intentionally heated or cooled
Conditioned crawl space	A foundation without wall vents that encloses an intentionally heated and/or cooled space. Insulation is located on the exterior walls
CPSC	Consumer Product Safety Commission
CSA	Canadian Standards Association
DACUM	Developing a curriculum
dBA	A-weighted decibels
Dense pack	The process of installing loose-fill insulation to reduce air flow and perform to a stated R-value
DHW	Domestic hot water
Dielectric union	A plumbing connection that separates two different materials and does not allow them to chemically react and break down
Draft regulator	A device that functions to maintain a desired draft in the appliance by automatically reducing the draft to the desired value. Source: National Fire Protection Association 54, 2012
Dual-Cooling Up-Duct	Piece of duct located between the living space and attic to allow air flow in pressurized homes having evaporative coolers

Efflorescence	Deposits of crystals or salts left attached to masonry materials after moisture has evaporated off of the surface
Egress window	A window that people can escape through in an emergency
EIFS	Exterior insulation and finish systems
EIMA	EIFS Industry Members Association
Energy factor	Measure of overall efficiency for a variety of appliances. For water heaters, the energy factor is based on three factors: 1) the recovery efficiency, or how efficiently the heat from the energy source is transferred to the water; 2) stand-by losses, or the percentage of heat lost per hour from the stored water compared to the content of the water: and 3) cycling losses. For dishwashers, the energy factor is defined as the number of cycles per kWh of input power. For clothes washers, the energy factor is defined as the cubic foot capacity per kWh of input power per cycle. For clothes dryers, the energy factor is defined as the number of pounds of clothes dried per kWh of power consumed.
Envelope	The separation between the interior and exterior environments of a building that includes a combination of air and thermal barrier
EPA	U.S. Environmental Protection Agency, www.epa.gov
ERV	Energy recovery ventilator
ESP	External static pressure
Exfiltration	The uncontrolled passage of inside air out of a building through unintended leaks in the building envelope
Exterior storm window	An additional window assembly installed on the exterior of the main window
Finished attic	An attic space that has been converted into an additional living space of the house
GFCI	Ground-fault circuit interrupter
GPM	Gallons per minute
Hi-limit switch	A protective electronic switch that keeps a burner from continuing to operate and damage the appliance
HRV	Heat recovery ventilator
HVAC	Heating, ventilation, and air conditioning
HVI	Home Ventilation Institute
Hydrophobic	Lacking affinity for water; tending to repel and not absorb water; tending not to dissolve in, mix with, or be wetted by water

I-P	Inch-pound
IAQ	Indoor air quality
IBC	International Building Code
IBR	Institute of Boiler and Radiator Manufacturers
IC	Insulation contact
ICC	International Code Council
IECC	International Energy Conservation Code
IFGC	International Fuel Gas Code
Ignition barrier	Any layer of material that protects another from catching fire due to heat or spark
IMC	International Mechanical Code
Infiltration	The uncontrolled passage of outside air into a building through unintended leaks in the building envelope
Interior storm window	An additional window assembly installed on the interior of the main window
IPM	Integrated Pest Management
IRC	International Residential Code
IWC	Inches of water column
JTA	Job task analysis
Knee wall	Any wall between the conditioned space and the attic
KSA	Knowledge, skills, and abilities
LED	Light-emitting diode
MERV	Minimum efficiency reporting value
Modulating systems	Heating systems with the ability to adjust the heating capacity and output based on the heating demand
MSDS	Material Safety Data Sheet

NAHB	National Association of Home Builders, www.nahb.com
NAIMA	North American Insulation Manufacturers Association, www.naima.org
NATE	North American Technician Excellence, www.natex.org
NEBB	National Environmental Balancing Bureau, www.nebb.org
NEC	National Electrical Code
NFPA	National Fire Protection Association, www.nfpa.org
NIOSH	National Institute for Occupational Safety and Health, www.cdc.gov/niosh
Orphaned equipment	Condition when one smaller combustion appliance exists after being commonly vented with a larger appliance. What remains is a larger exhaust flue or chimney than is necessary for the remaining smaller appliance
Orphaned water heater	Condition when one smaller combustion appliance (e.g., water heater) exists after being commonly vented with a larger appliance. What remains is a larger exhaust flue or chimney than is necessary for the water heater
OSHA	U.S. Occupational Safety and Health Administration, www.osha.gov
PEL	Permissible exposure limit
Perm rating	The measurement of a material's ability to allow the transfer of water vapor through the material
PPE	Personal protective equipment
Programmable thermostat	A thermostat designed to adjust the temperature according to a series of programmed settings that take effect at different times of the day
Psi	Pounds per square inch
Psig	Pound per square inch gauge
Reverse or upslope lapping technique	Upper course laps under a lower course to keep the moisture under the barrier
Rigid material	Drywall, oriented strand board, duct board, cardboard, or any other stiff product that may support the load of insulation while serving as a durable air barrier
RPA	Radiant Professional Alliance
RRP	Renovation, repair, and painting
SDS	Safety Data Sheet

Sealant foam	One- or two-component polyurethane foam typically applied as a bead and used to control air leakage as part of an air barrier system within the building envelope
Service switch	An electrical switch that controls the complete flow of electricity to a mechanical device
SHGC	Solar heat gain coefficient
SI	Système International
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association, www.smacna.org
SPF	Spray polyurethane foam
SPFA	Spray Polyurethane Foam Alliance
SSE	Steady state efficiency
Standby loss	Heat loss through the outer part of a water heater. Energy that is used even when a device is turned off
Storm door	An additional door assembly that is installed on the exterior of the main door
Strip heat	A function of a heat pump that uses energy-intensive resistance heat to warm conditioned space when the heat pump is unable to satisfy the heating demand; also provides emergency heat backup for heat pumps
Support material	Typically, wooden strips that provide support over holes greater than 24" in size for less rigid air barrier materials
T&TA	Training and Technical Assistance
TABB	Testing and Balancing Bureau, www.tabbcertified.org
TDC	Transverse duct connector
TDF	Transverse duct flange
Thermal boundary	The separation between the interior and exterior environments of a building that slows heat flow
Thermal resistance	The insulation or other building material that offers the primary barrier to thermal transmittance. R-value is a measurement of thermal resistance
Tie band	A strap, often made of nylon, that mechanically squeezes a flexible duct to a fitting. Must have a minimum performance temperature rating of 165° (per UL 181A-type test) and a minimum tensile strength rating of 50 pounds
UL	Underwriters Laboratories
Unconditioned basement	A below- or partially below-grade livable space with concrete or finished floor without intentional heating or cooling

UV	Ultraviolet
Vapor barrier	A material that retards the passage of water vapor and contains a perm rating of less than 1
Vapor retarder	A material that slows the passage of water vapor and contains a perm rating above 1
Vaulted ceiling	A condition where a non-horizontal ceiling has a different slope than the roof
Vented crawl space	A foundation that uses wall vents as a primary means to control moisture. Insulation is located at the conditioned floor level above the crawl space
VOC	Volatile organic compound
WAP	DOE Weatherization Assistance Program
WDMA	Window and Door Manufacturers Association, www.wdma.com
Wg	Water gauge
Wind intrusion	A condition where air from outside of a structure can pass through insulation and reduce its performance
Wood/materials shrinkage	A loss of dimension and weight as a result of drying the structure and operating the building at lower relative humidity

Section 2: Health and Safety

2.0100.1 Global Worker Safety

Topic: Safe Work Practices

Subtopic: Safe Work Practices

Desired Outcome: Work completed safely without injury or hazardous exposure

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0100.1a Prevention through design	Design will be incorporated to eliminate or minimize hazards (e.g., material selection, access to equipment for installation and maintenance, placement of equipment, ductwork and condensate lines)	Prevent worker injuries Reduce risk exposure to toxic substances and physical hazards		1691
2.0100.1b Hand protection	Durable and wrist-protecting gloves will be worn that can withstand work activity	Minimize skin contact with contaminants Protect hands from hazards		1692
2.0100.1c Respiratory protection	If the risk of airborne contaminants cannot be prevented, proper respiratory protection will be provided and worn (e.g., N-95 or equivalent face mask) When applying low pressure 2-component spray polyurethane foam, air purifying masks with an organic vapor cartridge and P-100 particulate filter will be used When applying high-pressure SPF insulation, supplied air respirators (SARs) will be used Consult SDS for respiratory protection requirements OSHA 1910.134 shall be followed for the implementation of a respiratory protection program	Minimize exposure to airborne contaminants (e.g., insulation materials, mold spores, feces, bacteria, chemicals)		1693
2.0100.1d Electrical safety	An electrical safety assessment will be performed All electric tools will be protected by ground-fault circuit interrupters (GFCI) Three-wire type extension cords will be used with portable electric tools Worn or frayed electrical cords will not be used Water sources (e.g., condensate pans) and electrical sources will be kept separate Metal ladders will be avoided	Avoid electrical shock and arc flash hazards		1694

	Special precautions will be taken if knob and tube wiring is present Aluminum foil products will be kept away from live wires For arc flash hazards, NFPA 70E will be consulted			
2.0100.1e Carbon monoxide (CO)	All homes will have a carbon monoxide alarm Ambient CO will be monitored during combustion testing and testing will be discontinued if ambient CO level inside the home or work space exceeds 35 parts per million (ppm)	Protect worker and occupant health		1695
2.0100.1f Personal Protective Equipment	SDS and OSHA regulations will be consulted for equipment and protective clothing would be worn if contaminants are present(e.g., insulation materials) Eye protection will always be worn (e.g., safety glasses, goggles if not using full-face respirator)	Protect worker from skin contact with contaminants Minimize spread of contaminants Provide eye protection		1696
2.0100.1g Confined space safety	Spaces with limited ingress and egress and restricted work area will be considered confined space Access and egress points will be located before beginning work Inspection will be conducted for hazards, such as damaged or exposed electrical conductors, mold, sewage effluent, friable asbestos or fiberglass, pests, and other potential hazards Adequate ventilation will be provided Use of toxic material will be reduced	Prevent build-up of toxic or flammable contaminants Reduce risk to the workers in the confined space Provide adequate access and egress points Prevent electrical shock		1697
2.0100.1h Power tool safety	Power tools will be inspected and used in accordance with manufacturer specifications and OSHA regulations to eliminate hazards such as those associated with missing ground prongs, ungrounded circuits, misuse of power tools, noise, and improper or defective cords or extension cords.All tools must be maintained in proper operating condition with all guards securely in place All devices used will be verified as GFCI protected or double insulated Exhaust gases from compressors and generators will be prevented from entering interior space	Prevent power tool injuries Prevent buildup of toxic or flammable contaminants		1698
2.0100.1i Chemical safety	Hazardous materials will be handled in accordance with manufacturer specifications, SDS and OSHA standards to eliminate hazards associated with volatile organic compounds (VOCs), sealants, insulation, contaminated drywall, dust, foams, asbestos, lead, mercury, and fibers Appropriate personal protective equipment (PPE) will be provided Workers will be trained on how to use PPE	Prevent worker exposure to toxic substances		1699

	Workers will be expected to always use appropriate PPE during work			
2.0100.1j Ergonomic safety	Appropriate PPE will be used (e.g., knee pads, bump caps, additional padding) Proper equipment will be used for work Proper lifting techniques will be used	Prevent injuries from awkward postures, repetitive motions, and improper lifting		1700
2.0100.1k Hand tool safety	Hand tools will be maintained in safe working order and used for intended purpose	Prevent injuries		1701
2.0100.1l Slips, trips, and falls	Caution will be used around power cords, hoses, tarps, and plastic sheeting Precautions will be taken when ladders are used, when working at heights, or when balancing on joists Walk boards will be used when practical When scaffolding is used, manufacturer set-up procedures will be followed Appropriate footwear and clothing will be worn	Prevent injuries due to slips, trips, and falls		1702
2.0100.1m Thermal stress	Ensure staff is aware of risks during extreme weather including the symptoms of heat stroke, heat exhaustion, and hypothermia Appropriate ventilation, hydration, rest breaks, and cooling equipment will be provided 911 will be dialed when necessary	Prevent heat stroke, heat stress, and cold stress related injuries		1703
2.0100.1n Fire safety	Ignition sources will be identified and eliminated (e.g., turn off pilot lights and fuel supply) Use of flammable material will be reduced and fire-rated materials will be used	Prevent a fire hazard		1704
2.0100.1o Asbestos-containing materials (ACM)	Assess potential asbestos hazard; if unsure whether material contains asbestos, contact a qualified asbestos professional to assess the material and to sample and test as needed If suspected ACM is in good condition, do not disturb If suspected ACM is damaged (e.g., unraveling, frayed, breaking apart), immediately isolate the area(s) For suspected ACM that is damaged or that must be disturbed as part of the retrofit activity, contact an asbestos professional for abatement or repair in accordance with federal, state, and local requirements; only a licensed or trained professional may abate, repair, or remove ACM When working around ACM, do not: Dust, sweep, or vacuum ACM debris Saw, sand, scrape, or drill holes in the material Use abrasive pads or brushes to strip materials Asbestos abatement or repair work should be completed prior to blower door testing; exercise appropriate caution when conducting blower door	Protect workers and occupants from potential asbestos hazards		1705

	testing where friable asbestos or vermiculite attic insulation is present to avoid drawing asbestos fibers into the living space (i.e., use positively pressurized blower door testing) unless the material has been tested and found not to contain asbestos			
2.0100.1p Lead paint assessment	Presence of lead based paint in pre-1978 homes will be assumed unless testing confirms otherwise The Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards	Protect workers and occupants from potential lead hazards		1706
2.0100.1q Site security	Work site will be secured to prevent unauthorized entry Temporarily disconnected eqipment will be locked up and tagged out All loose or unbagged trash and unused materials will be removed from work site daily	Protect the occupant from exposure to potential hazards		6906
2.0100.1r Crawl space safety	The source of all contaminants (e.g., sewage,dead animals,needles) will be corrected,repaired,or removed before performing inspections that require complete access to the crawl space If appropriate, the contaminant will be neutralized and/or a protective barrier will be installed in the area	Ensure work safety Prevent worker exposure to hazards		6907

2.0101.1 Air Sealing Worker Safety

Topic: Safe Work Practices

Subtopic: Air Sealing

Desired Outcome: Work completed safely without injury or hazardous exposure

For supporting material, see Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0101.1a Worker safety	Worker safety specifications will be in accordance with SWS Global Worker Safety Complete safety action plan based on hazard; plan will be in place for each job site	Prevent injury Minimize exposure to health and safety hazards		4312
2.0101.1b Moisture	Exposed earth will be covered with a continuous, durable, and sealed class I	Ensure durability of repairs		4313

precautions for crawl spaces and basements	vapor retarder that is suitable for ground contact exposure to normal service traffic Causes of air dew points greater than 55°F will be identified and eliminated in crawl spaces connected to conditioned spaces Seasonal dehumidification (e.g., dehumidified or conditioned with air conditioner supply) will be recommended where humidity sources, including outdoor air incursion, cannot be eliminated Undesigned penetrations between the crawl space or basement and the outdoors will be sealed Holes between the crawl space or basement and the living space will be sealed Open sumps and intentional slab or vapor barrier penetrations will be sealed or capped to control moisture and radon levels	Reduce potential for occupant exposure to mold and other moisture-related hazards Reduce potential for occupant exposure to radon and other soil gases		
2.0101.1c Moisture precautions: living space	Moisture sources in the building will be identified and reduced or removed Where local ventilation will be installed, (e.g., baths, kitchens), exhaust units will be vented to the outdoors in accordance with ASHRAE 62.2 Unvented heaters will be removed except when used as a secondary heat source and when it can be confirmed that the unit is listed to ANSI Z21.11.2 Unvented gas or propane cooking stoves will be tested for carbon monoxide (CO) per BPI Standard and corrected as required before air sealing work begins If replacing air conditioning system, new system will be sized to optimize dehumidification Properly sized dehumidifier will be installed to satisfy latent and sensible loads, when necessary ANSI/ACCA 2 Manual J-2011 (Residential Load Calculation) will be used to size replacement AC and heat pumps Enhanced dehumidification will be installed in the Gulf Coast region areas on the Gulf side of the warm humid line on the International Energy Conservation Code map	Ensure durability of building components and repairs Reduce potential for occupant exposure to mold and other moisture-related hazards Reduce potential occupant exposure to CO		4314
2.0101.1d Moisture precautions for exterior water	Before air sealing and insulating building components, exterior water management will be addressed Before insulating basement or crawl space walls near wet areas, surface water pooling	Reduce potential for occupant exposure to mold and other moisture-related hazards		4315

	near the foundation will be addressed by repairing, modifying, or replacing gutters and downspouts Grading and subsurface drainage at critical locations (e.g., localized drain and grading beneath valleys) will be in accordance with EPA Indoor airPLUS Construction Specifications Section 1.1			

2.0102.1 Insulation Worker Safety

Topic: Safe Work Practices

Subtopic: Insulation

Desired Outcome: Work is completed safely without injury or hazardous exposure

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0102.1a Worker safety	Worker safety specifications will be followed in accordance with SWS 2.0100 Global Worker Safety	Prevent injury Minimize exposure to health and safety hazards		6913
2.0102.1b Asbestos containing materials (ACM)	OSHA asbestos abatement protocol 29 CFR 1926.1101 will be followed if vermiculite insulation is present Assess potential asbestos hazard; if unsure whether material contains asbestos, contact a qualified asbestos professional to assess the material, and to sample and test as needed If suspected ACM is in good condition, do not disturb If suspected ACM is damaged (e.g., unraveling, frayed, breaking apart), immediately isolate the area(s) For suspected ACM that is damaged or that must be disturbed as part of the retrofit activity, contact an asbestos professional for abatement or repair, in accordance with federal, state, and local requirements; only a licensed or trained professional may abate, repair, or remove ACM When working around ACM, do not: Dust, sweep, or vacuum ACM debris Saw, sand, scrape, or drill holes in the material Use abrasive pads or brushes to strip materials Asbestos abatement or repair work should be completed prior to blower door testing; exercise appropriate caution when conducting blower door testing where friable asbestos or vermiculite attic insulation is present to avoid drawing asbestos fibers into the living space (i.e., use positively pressurized blower door testing) unless the material has been tested and found not to contain asbestos	Protect workers and occupants from potential asbestos hazards		6914
2.0102.1c Materials	All materials will be handled in accordance with manufacturer specifications or safety data sheets (SDS) standards	Eliminate hazards associated with incorrect, defective,		6916

		or improperly used or installed materials		
2.0102.1d Lead paint assessment	Presence of lead based paint in pre-1978 homes will be assumed unless testing confirms otherwise The Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rule making or any more stringent state or federal standards	Protect worker and occupant from potential lead hazards		6917

2.0103.1 Combustion Worker Safety

Topic: Safe Work Practices

Subtopic: Heating and Cooling Equipment

Desired Outcome: Work completed safely without injury or hazardous exposure

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0103.1a Worker safety	All worker safety specifications in Global Worker Safety section will be followed	Prevent injury Minimize exposure to health and safety hazards		1712
2.0103.1b Carbon monoxide (CO)	Ambient CO will be monitored during combustion testing and testing will be discontinued if ambient CO level inside the home or work space exceeds 35 parts per million (ppm)	Protect worker and occupant health		1713
2.0103.1c Raw fuel	Raw fuel leaks will be monitored for before entering building spaces If leaks are found, testing will be discontinued and condition reported to occupant immediately	Protect worker and occupant health		1714

2.0103.2 Heating and Cooling Worker Safety

Topic: Safe Work Practices

Subtopic: Heating and Cooling Equipment

Desired Outcome: Work completed safely without injury or hazardous exposure

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

2.0103.2a Worker safety	Follow all worker safety specifications in SWS 2.0100 Global Worker Safety section	Prevent injury Minimize exposure to health and safety hazards		3928
2.0103.2b Mercury	When replacing existing thermostats, identify and dispose of any mercury containing thermostats in accordance with Environmental Protection Agency (EPA) guidance	Protect worker and occupant from mercury exposure		3930
2.0103.2c Asbestos	Suspected asbestos hazards will be identified in furnaces (e.g., gaskets), wood stoves, zonal heating devices, electrical wiring insulation, boilers, and pipe insulation and corrected in accordance with EPA guidance Workers will take precautionary measures to avoid exposure	Protect worker and occupant from asbestos exposure		3932
2.0103.2d Personal protective equipment (PPE)	Workers will wear personal protective equipment (PPE) as needed to protect themselves against exposure to hazards (e.g., pests, sewage, flooded duct work, mold, chemicals, scat, viruses) Long sleeves and long pants should be worn as additional protection from liquid nitrogen and other hazardous materials	Protect worker from exposure to hazards Protect worker from skin contact with liquid nitrogen		3934
2.0103.2e Combustible gas detection	Worker will check for presence of combustible gas leaks before work begins Leaks will be repaired before work is performed	Protect worker and occupant from exposure to hazards		3936
2.0103.2f Carbon monoxide (CO)	Workers will check for presence of ambient CO before and during work CO issues will be addressed before work is performed or continued	Protect worker and occupant from exposure to hazards		3938
2.0103.2g Sealant	Pipes will be sealed by a certified professional with an approved fastening process and sealant in accordance with manufacturer specifications (International Fuel Gas Code) Gas lines will be leak free when tested with an electronic combustible gas leak detector and verified with bubble solution OR Gas lines will be leak free when tested by a standing pressure test that meets the approval of the local code	Install gas lines with no leaks		3940

2.0103.2h Safety devices	A secondary LP safety detector system (valve, exhaust fan, alarm light) will be installed by a certified professional for propane piping installed below grade When installing new equipment, a shut off valves will be installed by a certified professional at each gas appliance (ANSI Z21.15)	Detect accumulation of dangerous levels of propane in below-grade areas Isolate appliances from the rest of the system for emergencies, removal, or repairs		3942

2.0104.1 Ventilation Worker Safety

Topic: Safe Work Practices

Subtopic: Ventilation Equipment

Desired Outcome: Work completed safely without injury or hazardous exposure

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0104.1a Worker safety	Follow all worker safety specifications in SWS 2.0100 Global Worker Safety section	Prevent injury Minimize exposure to health and safety hazards		1719

2.0105.1 Baseload Worker Safety

Topic: Safe Work Practices

Subtopic: Baseload

Desired Outcome: Work is completed safely without injury or hazardous exposure

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0105.1a Worker safety	All worker safety specifications in SWS 2.0100 Global Worker Safety section will be followed	Prevent injury Minimize exposure to health and safety hazards		1720

2.0106.1 Material Selection, Labeling, and Material Safety Data Sheets (MSDSs)

Topic: Safe Work Practices

Subtopic: Material Safety

For supporting material, see Building America Solution Center.

Desired Outcome: Occupant and worker risk from hazardous materials minimized

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

2.0106.1a Material selection	Materials that do not create long-term health risks for occupants and workers will be used	Improve indoor air quality in the living space		1721
2.0106.1b Material labels	Manufacturer specifications will be followed	Reduce risk of exposure to harmful substances Follow safety procedures		1722
2.0106.1c Material Safety Data Sheets (MSDSs)	MSDSs will be provided onsite and available during all work	Assess exposure risk Prepare a response in case of emergency		1723

2.0107.1 Basements and Crawl Spaces Worker Safety

Topic: Safe Work Practices

Subtopic: Basements and Crawl Spaces

Desired Outcome: Work completed safely without injury or hazardous exposure

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0107.1a Worker safety	All worker safety specifications in SWS 2.0100 Global Worker Safety section will be followed	Prevent injury Minimize exposure to health and safety hazards		1724

2.0107.2 Basements and Crawl Spaces—Pre-Work Qualifications

Topic: Safe Work Practices

Subtopic: Basements and Crawl Spaces

Desired Outcome: Site properly prepared for upgrade

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0107.2a Fuel leaks	Fuel leaks will be repaired and inspected in accordance with the IRC	Ensure site is safe and ready for upgrade		1725
2.0107.2b Electrical hazards	Electrical hazards will be eliminated and inspected in accordance with NFPA 70 National Electric Code	Ensure site is safe and ready for upgrade		1726
2.0107.2c Mold	Appropriate remediation will be completed before upgrade	Ensure site is safe and ready for upgrade		1727
2.0107.2d Plumbing and water leaks	Plumbing leaks will be repaired before crawl space upgrade in accordance with the IRC	Prepare site for upgrade		1728
2.0107.2e Pest and termite work	Pest and termite treatment will be completed before crawl space	Prepare site for upgrade		1729

	upgrade and inspected in accordance with the IRC			
2.0107.2f Structural repairs, modifications	Structural repairs and modifications will be inspected and completed before crawl space upgrade in accordance with the IRC	Prepare site for upgrade		1730
2.0107.2g Appliance and heating, ventilation, and air conditioning (HVAC) system repairs and change outs	Crawl space upgrades (e.g., sealing and insulation) are to be undertaken after appliance and HVAC system work has been completed and inspected	Prepare site for upgrade		1731
2.0107.2h Correctable standing water	Passive drains or sump pumps will be used to remove standing water	Prepare site for upgrade		1732
2.0107.2i Non-correctable standing water	Spaces with non-correctable standing water will not be considered for a closed crawl space	Prevent possible damage to house		1733

2.0107.3 Basements and Crawl Spaces—Debris Removal

Topic: Safe Work Practices

Subtopic: Basements and Crawl Spaces

Desired Outcome: Clean, safe, and easily accessible crawl space created

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0107.3a Debris removal	Under-floor grade will be removed of all vegetation and organic material Debris that can cause injury or puncture ground covers (e.g., nails, glass, sheet metal screws, etc.) will be removed from the crawl space	Minimize punctures in ground liner Minimize habitat for pests (Integrated Pest Management—IPM) and contaminant sources		1734
2.0107.3b Debris disposal	Debris will be properly disposed of according to type and jurisdiction	Protect environment from damage		1735

2.0107.4 Negative Pressure Contamination Control

Topic: Safe Work Practices

Subtopic: Basements and Crawl Spaces

Desired Outcome: Contaminants prevented from entering house during work process

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0107.4a Pressure	A negative pressure will be maintained in the crawl space with reference to the house while work is being performed in the crawl space	Prevent contaminants from entering house		1738

2.0201.1 Combustion Appliance Zone (CAZ) Testing

Topic: Combustion Safety

Subtopic: Combustion Safety General

Desired Outcome: Accurate information about appliance safe operation is gathered

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0201.1a Assessment	Emergency problems (e.g., ambient gas levels greater than 10% Lower Explosion Limit (LEL), ambient CO levels that exceed 70 ppm) will be communicated clearly and immediately to the customer, the home shall be evacuated, and appropriate personnel (e.g.: HVAC technician, utility, emergency services) shall be contacted. ; Significant problems (e.g., gas leak less than 10% LEL, ambient CO levels that exceed 35 ppm but less than 70 ppm) will be communicated clearly and immediately to the customer and appropriate solutions will be suggested Examine appliance for signs of damage, misuse, improper repairs, and lack of maintenance	Ensure system does not have potentially fatal problems		1739
2.0201.1b Fuel leak detection	Inspect and test for gas or oil leakage at connections of natural gas, propane piping, or oil systems	Detect fuel gas leaks Determine and report need for repair		1740

	If leaks are found, immediate action will be taken to notify occupant to help ensure leaks are repaired The report will specify repair for leaks and replacement for hazardous or damaged gas or oil connectors and pipes			
2.0201.1c Venting	For oil systems that require a draft regulator, the presence and operability of it (that draft regulator) will be verified and tested Combustion venting systems will be inspected for damage, leaks, disconnections, inadequate slope, and other safety hazards	Determine if a regulator is present and working Determine whether vent system is in good condition and installed properly		1741
2.0201.1d Base pressure test	Baseline pressure for naturally drafting vented appliances will be measured in Combustion Appliance Zone with reference to outdoors	Measure pressure difference between combustion zone and the outside under natural conditions		1742
2.0201.1e Depressurization test	CAZ depressurization testing will be administered for all atmospherically vented appliances located inside the pressure boundary. Depressurization test will include exhaust fans, interior door closure, or duct leakage, or a combination thereof; the test will be done to determine the largest negative pressure per BPI Standard 1200.	Determine worst-case depressurization in combustion zone due mechanical system fans		1743

2.0201.2 Combustion Safety - Make-up Air

Topic: Combustion Safety

Subtopic: Combustion Safety General

Desired Outcome: Buildup of dangerous combustion byproducts in the living space prevented

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

2.0201.2a Outside combustion make-up air	Where applicable, combustion air will be provided from the outside and installed in accordance with the IRC for the type of appliance installed	Prevent combustion byproducts from entering the house		1747
2.0201.2b New appliances	If replacing appliances, a sealed-combustion, direct-vent appliance will be installed if possible. New appliances will be installed in accordance with manufacturer specifications, the IRC and additional applicable codes	Prevent combustion byproducts from entering the house		1748
2.0201.2d Gas ovens	Gas ovens will be tested for CO A clean and tune will be conducted if measured CO in the undiluted flue gases of the oven vent at steady state exceeds 225 ppm as measured	Ensure clean burn of gas ovens		1750
2.0201.2e Gas range burners	Specify clean and tune if the flame has any discoloration, flame impingement, an irregular pattern, or if burners are visibly dirty, corroded, or bent	Ensure clean burn and operation of gas range burners		1751
2.0201.2f Solid fuel burning appliances	If the solid fuel burning appliance is the primary heat source and has signs of structural failure replace solid fuel burning appliance with UL-listed and EPA - certified appliances if the existing appliance is not UL-listed	Ensure safe operations of solid fuel burning appliances		1752

2.0201.3 Vented Combustion Appliance Safety Testing

Topic: Combustion Safety

Subtopic: Combustion Safety General

Desired Outcome: Accurate information about appliance safe operation is gathered

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0201.3a Spillage Test	In conditions with largest negative pressure as determined from Detail 2.0201.1e: If spillage in a combustion appliance with a warm vent exceeds two minutes during pressure testing, specify measures to mitigate If spillage in a combustion appliance with a cold vent exceeds five minutes	Detect excessive spillage of combustion gases		3974

	during pressure testing, specify measures to mitigate			
2.0201.3b Carbon monoxide (CO) test in appliance vent	CO will be tested for in undiluted flue gases of combustion appliances In conditions with largest negative pressure as determined from Detail 2.0201.1e: If CO levels exceed 400 ppm air-free measurement in furnaces, service will be provided to reduce CO to below these levels (unless CO measurement is within manufacturer specifications) If CO levels exceed 200 ppm air-free measurement in water heaters or room heaters, service will be provided to reduce CO to below these levels (unless CO measurement is within manufacturer specifications)	Measure CO and report excessive levels		3975
2.0201.3c Final test out	Final combustion testing will be conducted at project completion to ensure compliance with the above specifications	Ensure safe operation of combustion appliance within the whole house system after any repair project		3976

2.0202.1 Unvented Space Heaters: Propane, Natural Gas, and Kerosene Heaters

Topic: Combustion Safety

Subtopic: Unvented Space Heaters

Desired Outcome: Elimination of combustion byproducts

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0202.1a Removal	With the occupant's permission, unvented heaters will be removed, except when used as a secondary heat source and when it can be confirmed that the unit is listed to ANSI Z21.11.2 Units that are not being operated in compliance with ANSI Z21.11.2 should be removed before the retrofit but may remain until a replacement heating system is in place Failure to remove unvented space heaters serving as primary heat	Eliminate sources of combustion byproduct within a living space		1753

	sources has the potential to create hazardous conditions and thus any further weatherization services will be re-evaluated in the context of potential indoor air quality risks			
2.0202.1b Occupant education	Occupant will be educated on potential hazards of unvented combustion appliances (primary or secondary) within a living space	Inform occupant about possible hazards associated with combustion byproducts and moisture		1754

2.0203.1 Combustion Air for Natural Draft Appliances

Topic: Combustion Safety

Subtopic: Vented Gas Appliances

Desired Outcome: Sufficient air provided in the Combustion Appliance Zone (CAZ)

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0203.1a Required combustion air	The required volume of indoor air will be determined in accordance with IRC and authority having jurisdiction, except that where the air infiltration rate is known to be less than 0.40 air changes per hour (ACH), IRC will be used Exception: Existing appliances that have passed combustion safety testing per BPI 1200 are deemed to have sufficient combustion air	Determine if existing conditions meet the combustion air calculation		1755
2.0203.1b Additional combustion air (if action is required)	Additional combustion air will be provided in accordance with IRC and authority having jurisdiction when necessary to solve spillage problems	Ensure adequate combustion air for operation of the appliance		1756
2.0203.1c Spillage testing	If spillage in a combustion appliance with a warm vent exceeds two minutes during pressure testing, specify measures to mitigate If spillage in a combustion appliance with a cold vent exceeds five minutes during pressure testing, specify measures to mitigate	Detect excessive spillage of combustion gases		6968

2.0203.2 Combustion Flue Gas—Orphaned Water Heaters

Topic: Combustion Safety

Subtopic: Vented Gas Appliances

Desired Outcome: Flue gasses successfully removed from the house

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0203.2a Spillage testing	If spillage in a combustion appliance with a warm vent exceeds two minutes during pressure testing, specify measures to mitigate If spillage in a combustion appliance with a cold vent exceeds five minutes during pressure testing, specify measures to mitigate	Detect excessive spillage of combustion gases		1757
2.0203.2b Flue gas removal (chimney liner or approved methods)	A chimney liner will be installed in accordance with the IRC or applicable NFPA standard	Allow water heater to vent properly Prevent damage to the chimney		1758
2.0203.2c Retesting spillage	If a combustion appliance spillage exceeds two minutes during pressure testing, specify measures to mitigate	Ensure appliance is not spilling longer than two minutes with a warm vent		1759
2.0203.2d Required combustion air	The minimum required volume will be 50 cubic feet per 1,000 Btu /h in accordance with IRC and authority having jurisdiction. Exception: Existing appliances that have passed combustion safety testing per BPI 1200 are deemed to have sufficient combustion air.	Determine if existing conditions meet the combustion air calculation		1760
2.0203.2e Additional combustion air (if action is required)	Additional combustion air will be provided in accordance with IRC or other authority having jurisdiction	Ensure adequate combustion air for operation of the appliance		1761

2.0203.4 Occupant Education

Topic: Combustion Safety

Subtopic: Vented Gas Appliances

Desired Outcome: Ensure persistence of resident safety

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0203.4a Occupant health and safety	All homes will have a functioning CO alarm If CO levels in interior living spaces exceed outdoor levels, potential sources will be investigated and appropriate action taken to reduce them (e.g., have a qualified professional tune, repair, or replace improperly operating combustion appliances; apply weather stripping or conduct air sealing between the garage or crawl space and the home)	Ensure occupant health and safety Ensure indoor CO levels do not exceed outdoor CO levels		3989
2.0203.4b Occupant education	Occupants will be educated on the operation and maintenance of the CO alarm Completed work on combustion appliances and recommended maintenance will be reviewed with occupant Occupant will be provided information regarding the health effects and risk of high CO concentrations; EPA provides possible expanded actions and offers client education information in an appendix to the protocols	Ensure occupant can operate and maintain installations Inform occupant regarding possible CO hazards		3990

2.0301.1 Smoke Alarm

Topic: Safety Devices

Subtopic: Combustion Safety Devices

Desired Outcome: Properly installed smoke alarms

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0301.1a Smoke alarm (hardwired)	When installing hardwired smoke alarms, it will be listed and labeled in accordance with UL 217 and installed in accordance with the IRC or as required by the authority having jurisdiction	Ensure proper installation		4013

2.0301.1b Smoke alarm (battery operated)	When installing battery operated smoke alarms, it will be installed in accordance with manufacturer specifications	Ensure proper installation		4014

2.0301.2 Carbon Monoxide Alarm or Monitor

Topic: Safety Devices

Subtopic: Combustion Safety Devices

Desired Outcome: Properly installed CO alarms or monitors

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0301.2a CO detection and warning equipment (hardwired)	Hardwired CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 or as required by the authority having jurisdiction Installation will be accomplished by a licensed electrician when required by the authority having jurisdiction	Ensure proper installation		4015
2.0301.2b CO detection and warning equipment (battery operated)	Battery-operated CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 and manufacturer specifications as required by the authority having jurisdiction	Ensure proper installation		4016

2.0401.1 Air Sealing Moisture Precautions

Topic: Moisture

Subtopic: Air Sealing

Desired Outcome: Ensure durability of repairs and reduce potential for occupant exposure to mold and other moisture-related hazards

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0401.1a Moisture precautions for attics	Roof leaks will be repaired before performing attic air sealing or insulation Moisture sources in the house that can generate moisture into the attic will be identified and removed or reduced Where possible, water resistant sealants and/or closed cell foams will be used in cold climates. Plastic, foil, or any other Class 1 vapor barrier will not be used in hot humid climates In marine climates, vapor permeable materials will be used to block and seal penetrations in attic	Ensure durability of repairs Reduce potential for occupant exposure to mold and other moisture-related hazards Prevent moisture from communicating from within the conditioned space into unconditioned attic space. Increase durability of seal Avoid moisture-related damage to the home		1782
2.0401.1b Moisture precautions for crawl spaces	Exposed earth will be covered with a continuous, durable, sealed Class 1 vapor retarder a minimum of 6 mils in thickness Any vapor retarder shall not encapsulate wood building materials or spray foam Holes between the crawl space and the living space will be sealed	Ensure durability of repairs Reduce potential for occupant exposure to mold and other moisture-related hazards		1783
2.0401.1c Moisture precautions for the living space	Moisture sources in the home will be identified and removed or reduced Local ventilation will be installed where appropriate (e.g., baths, kitchens) and vented to outside according to ASHRAE 62.2 Unvented combustion appliances that are not listed to ANSI Z21.11.2 will be removed	Ensure durability of repairs Reduce potential for occupant exposure to mold and other moisture-related hazards		1784
2.0401.1d Moisture precautions for exterior water	Before air sealing basement or crawl space walls near wet areas, surface water pooling near the foundation will be addressed by: Repairing, modifying or replacing gutters and downspouts Grading and subsurface drainage at critical locations (e.g., localized drain and grading beneath valleys) in accordance with Environmental Protection Agency (EPA) Indoor airPLUS Construction Specifications Section 1.1	Reduce potential for occupant exposure to mold and other moisture-related hazards		1785

	Possible mitigation by waterproofing or installing draining plane with construction adhesive			

2.0401.2 Vented Crawl Space—Venting

Topic: Moisture

Subtopic: Air Sealing

Desired Outcome: Pollutants effectively vented

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0401.2a Venting	Venting will be performed in accordance with the IRC or the authority having jurisdiction	Provide ventilation for pollutant sources (e.g., moisture, radon, soil gases)		1786

2.0402.1 Drainage

Topic: Moisture

Subtopic: Drainage

For supporting material, see Building America Solution Center.

Desired Outcome: Move water away from home

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0402.1a Work Assessment	Installer prework assessment will be conducted to determine: Exterior grading Roof drainage Exterior waterproofing Interior grading Interior drainage	Verify scope of work Ensure that work space is ready for work		6933
2.0402.1b Corrective Action	Ground will be sloped away from the house at a rate of 6" of fall within 10' If downspouts are present (e.g., gutters, overhangs, French drain), they will be drained a minimum of 6' away from the house Foundation walls will be waterproof. Exterior foundation drains will be installed Interior grading will be sloped to one or more collection points, if possible	Drain water away from the foundation wall Prevent roof water from leaking into the crawl space or basement Prevent water from leaking into the crawl space or basement Collect interior water for removal Remove interior water from the crawl space or basement		6934

	One or more drains or sump pumps will be installed			
2.0402.1c Occupant Education	Occupant will be educated on the benefit of trees and shrubs to reduce heat gain and provide wind breaks in high wind locations Occupant will be educated on the need to maintain positive drainage (e.g., gutters, down spouts, grading), exterior waterproofing and interior drainage	Maintain durability Ensure water is moved out, down and away from home		6935

2.0403.1 Vented Crawl Spaces—Ground Moisture Barrier

Topic: Moisture

Subtopic: Vapor Barriers

Desired Outcome: Durable, effective ground moisture barrier provides long-lasting access and minimizes ground vapor

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0403.1a Material Integrity	Care will be taken to prevent punctures during installation	Protect ground moisture barrier from damage during other crawl space work		1792
2.0403.1b Coverage	A ground moisture barrier that covers the exposed crawl space floor will be installed	Reduce ground moisture entering the crawl space		1793
2.0403.1c Material specification	A ground moisture barrier with a rating of no more than 0.1 perm will be used A ground moisture barrier will be used that meets tear and puncture resistance standard ASTM E1745 Homeowner will be advised that all plastic is biodegradable and will have a life span much shorter than the home (5 years), and it will need replacing to remain effective	Ensure crawl space is accessible for service and maintenance without damaging the integrity of the ground moisture barrier		1794
2.0403.1d Overlap seams	When seams exist, they will be overlapped a minimum of 12" using reverse or upslope lapping technique	Keep water under the liner Reduce the likelihood of damage at seams		1795
2.0403.1e Fastening	When ground moisture barrier is installed on sloping ground, may be exposed to wind, or accessed for routine maintenance or storage it will	Prevent movement of the ground moisture barrier		1796

	be fastened to ground with durable fasteners or ballast(s)			

2.0403.2 Closed Crawl Spaces—Ground Moisture Barriers

Topic: Moisture

Subtopic: Vapor Barriers

Desired Outcome: Durable, effective air barrier and ground moisture barrier provide ongoing access and minimize ground vapor

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0403.2a Material Integrity	Care will be taken to prevent punctures during installation	Protect ground moisture barrier from damage during other crawl space work		1797
2.0403.2b Coverage	An air barrier and ground moisture barrier, covering the exposed crawl space floor, will be installed and sealed to the wall's air and moisture barrier in accordance with ASTM E1643 and manufacturer's recommendations Ground moisture barrier will be fastened to ground in accordance with manufacturer's recommendations and extend a minimum of 6 inches up the foundation wall	Reduce ground moisture entering the crawl space Create a continuous and durable connection between the wall and ground air and moisture barriers		1798
2.0403.2c Material specification	A ground moisture barrier with a rating of no more than 0.1 perm will be used A ground moisture barrier will be used that meets tear and puncture resistance standard ASTM E1745 Homeowner will be advised that all plastic is biodegradable and will have a life span much shorter than the home, and it will need replacing to remain effective	Reduce ground vapor entering the crawl space Ensure crawl space is accessible for service and maintenance without destroying the integrity of the moisture barrier		1799
2.0403.2d Overlap seams	When seams exist, they will be overlapped a minimum of 12" with reverse or upslope lapping technique For wall to floor connection, the wall moisture barrier will be installed under the ground moisture barrier	Keep water under the liner		1800

2.0403.2e Fastening	When ground moisture barrier is installed on sloping ground, or accessed for routine maintenance or storage it will be fastened to ground with durable fasteners or ballast(s)	Prevent movement and uplift of the air barrier and ground moisture barrier		1801
2.0403.2f Sealing seams	A durable sealant compatible with the air barrier and ground moisture barrier will be used	Maintain continuous air barrier and ground moisture barrier		1802
2.0403.2g Air barrier, ground moisture barrier penetrations, including fastener penetrations	A durable sealant, compatible with the air barrier and ground moisture barrier, will be used Physical attachments will be provided where practical (e.g., masonry columns, footings)	Maintain continuous air barrier and ground moisture barrier		1803
2.0403.2h Drainage	The air barrier and ground moisture barrier will not interfere with the established drainage pattern	Ensure proper drainage		1804
2.0403.2i Drainage points	Interior drainage collection points will be accessible from above and below the air barrier and ground moisture barrier	Remove water above and below the air barrier and ground moisture barrier		1805

2.0403.3 Closed Crawl Spaces—Vapor Retarders on Walls

Topic: Moisture

Subtopic: Vapor Barriers

Desired Outcome: Durable, effective vapor retarder minimizes leakage from ground and air

For supporting material, see Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0403.3a Air barrier and vapor retarder	An air barrier and vapor retarder will be installed on the interior side of the exterior wall in accordance with IRC	Prevent air and moisture penetration		1806
2.0403.3b Coverage	An air barrier and vapor retarder will be installed a minimum of 1' or as high as possible above outside grade	Prevent air and moisture penetration		1807
2.0403.3c Termite inspection gap	Where termite pressure exists or local code requires, a 3" inspection gap will be maintained from the top of the insulation to the bottom of any wood	Allow for termite detection		1808
2.0403.3d Attachment	Vapor retarder will be attached with a durable connection	Ensure vapor retarder maintains a fixed position on the exterior wall		1809

	Vapor retarder will be sealed at punctures and all 12" overlapped seams to prevent air entry	Ensure vapor retarder is air tight		
2.0403.3e Piers and interior walls	Vapor retarder will be installed a minimum of 6" above interior grade Vapor retarder will be attached with a durable connection Vapor retarder will be sealed at punctures and all 12" overlapped seams to prevent air entry	Prevent ground moisture penetration		1810

2.0404.1 Stand-Alone Dehumidifiers

Topic: Moisture

Subtopic: Space Conditioning

Desired Outcome: Energy used to control humidity in conditioned spaces reduced

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0404.1a Selection	Equipment will have a minimum efficiency level of ENERGY STAR® or better Equipment will have a fan-off option Equipment will retain settings after power-off Equipment will have features that reduce both peak electric use (e.g., internal and external timers) and absolute energy use Equipment will have standby losses of 1 watt or less Controls will be labeled so they are understandable, readable, and accurate for occupant needs Systems located in a basement or crawl space will be rated for cold temperature operation Operating environment will be determined and appropriate equipment will be selected for that environment (e.g., low temperature and high relative humidity)	Reduce energy use Provide durable equipment Control moisture Provide equipment appropriate for occupant use		1811
2.0404.1b Installation	Installation will proceed only when the following applicable	Reduce or retire dehumidifiers		1812

	steps have been taken to control moisture: Downspouts are re-directed away from foundation Moisture from drying clothes is vented to the outside Sump pit is covered and sealed Dirt in crawl space is covered with a vapor barrier Plumbing leaks are eliminated Equipment will be installed according to manufacturer specifications and meet all applicable codes Equipment will be installed to permit adequate air flow Equipment will have a timer for off-peak operation if time-of-use program is available and if the equipment can handle power interruptions Any penetrations to the exterior of the home created by the installation of the appliance will be sealed Initial relative humidity and temperature settings will be set by the installer to ensure the space does not reach dew point Operation of controls and needed maintenance will be reviewed with occupant A user guide for dehumidifier settings in different climate conditions will be created by the installer and provided to the occupant Installer will commission the equipment to ensure it is functioning properly An independent measurement will be made to verify relative humidity System will be connected directly to condensate line that drains to a plumbing drain or the exterior, away from the home's foundation and in compliance with the plumbing code or the authority having jurisdiction	Reduce allergens and asthma triggers Improve health and reduce irritants Improve building durability Improve comfort Reduce pest populations Reduce risk of mold issues Educate occupant on how to operate and maintain equipment		

	Specific information on the proper maintenance of the equipment will be provided to the occupant Warranty information, operation manuals, and installer contact information will be provided to the occupant			
2.0404.1c Decommissioning	Removed equipment will be recycled or disposed of properly in accordance with local regulations	Prevent the reuse of inefficient equipment and its components Reduce waste Protect the environment		1813

2.0404.2 Crawl Spaces—Preliminary Dehumidification

Topic: Moisture

Subtopic: Space Conditioning

Desired Outcome: A dry and moisture controlled space ensured

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0404.2a Close vents	Vents and other openings will be closed after ensuring sufficient combustion air for fuel-burning appliances in accordance with IRC	Reduce moisture load coming from outside of the crawl space		1814
2.0404.2b Drying	If liquid moisture is present, the area will be dried until any liquid moisture is eliminated	Improve work environment Reduce moisture in the crawl space		1815
2.0404.2c Drying time	Space will be dehumidified until wood moisture content in solid, untreated lumber is less than 20%	Reduce moisture content of wood		1816

2.0404.3 Closed Crawl Spaces—Crawl Space Conditioning

Topic: Moisture

Subtopic: Space Conditioning

Desired Outcome: Humidity in closed crawl space is controlled to reduce moisture damage, energy consumption, and pests

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

2.0404.3a Option 1: dehumidifier	Option 1 may be used in combination with any other specified options A permanent, low-temperature, auto-restart, minimum ENERGY STAR® rated dehumidifier will be installed with a minimum rated capacity of 15 pints per day Condensate will be drained to daylight or a condensation pump A return pathway from the crawl space to the living space will not be allowed	Maintain low relative humidity Reduce conditions conducive to pest activity Reduce conditions conducive to mold growth and wood rot Improve IAQ in the conditioned space Improve equipment service life Save energy in cooling-dominated climates Improve IAQ in the living space		1818
2.0404.3b Option 2: supply air	Option 2 may be used in combination with any other specified options Air from a central forced-air conditioning system will be supplied at a rate of 1 cubic foot per minute (CFM) per 30 square feet of closed crawl space area The supply air duct will be fitted with a backflow damper	Maintain low relative humidity Reduce conditions conducive to pest activity Reduce conditions conducive to mold growth and wood rot Improve IAQ in the conditioned space Improve equipment service life Save energy in cooling-dominated climates Prevent crawl space air from entering the living space when forced air system is off		1819
2.0404.3c Option 3: conditioned house air	Option 3 may be used in combination with any other specified options A continuous-duty, Home Ventilation Institute (HVI)-rated, 1-sone or less fan will be installed that supplies 1 CFM of conditioned house air per 50 square feet of closed crawl space area Optional: An air relief vent to the outside having backdraft protection may be installed A return pathway from the crawl space to the living space will not be allowed	Maintain low relative humidity Reduce conditions conducive to pest activity Reduce conditions conducive to mold growth and wood rot Improve IAQ in the conditioned space Improve equipment service life Save energy in cooling-dominated climates Improve IAQ in the living space		1820
2.0404.3d Option 4: exhaust	A continuous-duty, HVI-rated, 1 sone or less fan will be installed that exhausts 1 CFM of closed crawl space air per 50 square feet of closed crawl space area This option will not be installed for exhaust crawl space ventilation if a radon mitigation system is installed or anticipated in the crawl space	Maintain low relative humidity Reduce conditions conducive to pest activity Reduce conditions conducive to mold growth and wood rot Improve IAQ in the conditioned space Improve equipment service life Save energy in cooling-dominated climates		1821

2.0404.3e Monitoring alarm system	A durable humidity monitoring system with alarm capability will be installed A minimum expected service life of 10 years will be ensured	Alert occupant to system failure		1822

2.0404.4 Basements—Dehumidification

Topic: Moisture

Subtopic: Space Conditioning

Desired Outcome: Basement humidity controlled with supplemental dehumidification

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0404.4a Dehumidifier	A permanent, low-temperature, auto-restart, minimum ENERGY STAR® rated dehumidifier will be installed Manufacturer specifications will be followed for size and use Condensate will be drained to daylight or a condensation pump	Maintain a dry basement Reduce conditions conducive to mold growth, wood rot, and pests		1823
2.0404.4b Dehumidification for divided spaces	Drying will be provided to all basement areas	Maintain a dry basement Reduce conditions conducive to mold growth, wood rot, and pests		1824
2.0404.4c Relative humidity	All basement spaces will be maintained at a relative humidity that ensures condensation will not occur on cool surfaces	Maintain a dry basement Reduce conditions conducive to mold growth, wood rot, and pests		1825
2.0404.4d Condensing surfaces(e.g., cold water pipes)	Condensing surfaces in basement will be insulated and sealed	Maintain a dry basement Reduce conditions conducive to mold growth, wood rot, and pests		1826
2.0404.4e Dehumidification (option for dry climates and heating-dominated climates seasonally)	Ventilation in the basement will be controlled to maintain relative humidity that ensures condensation will not occur on cool surfaces	Maintain a dry basement Reduce conditions conducive to mold growth, wood rot, and pests		1827
2.0404.4f Occupant education	Occupant will be educated on how and when to change filter and clean condensate drain of the	Ensure occupant health Preserve integrity of system		1828

	dehumidifier in accordance with manufacturer specifications			

2.0501.1 Radon—Air Sealing Considerations, Basements, and Crawl spaces

Topic: Radon

Subtopic: Air Sealing

Desired Outcome: Work completed without increasing occupant exposure to radon

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0501.1a Radon testing and mitigation	Radon testing and mitigation will be done in accordance with the Environmental Protection Agency (EPA) Healthy Indoor Environment Protocols for Home Energy Upgrades	Reduce potential for occupant exposure to radon		1829

2.0601.1 Knob and Tube Wiring

Topic: Electrical

Subtopic: Knob and Tube Wiring

Desired Outcome: Live unsafe wiring identified and brought to local codes

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0601.1a Knob and tube identification	Contractor, assessor, auditor, or similar will inspect and assess the house to identify knob and tube wiring	Ensure occupant safety Preserve the integrity and safety of the house		1831
2.0601.1b Live wire testing	Non-contact testing method will be used to determine if wiring is live	Protect occupant safety Preserve the integrity and safety of the house		1832
2.0601.1c Isolation and protection	Proper clearance will be maintained around live knob and tube as required by the National Electrical Code (NEC) or authority having jurisdiction	Ensure occupant safety Preserve the integrity and safety of the house		1833

	When required, a dam that does not cover the top will be created to separate insulation from the wire path			
2.0601.1d Replacement	Wiring will be replaced with new appropriate wiring in accordance with the NEC National Electrical Code and local codes Old wiring will be rendered inoperable by licensed electrician in accordance with the NEC National Electrical Code and local codes	Ensure occupant safety Preserve the integrity and safety of the house		1834

2.0701.1 Crawl Spaces—Providing New Access

Topic: Occupant Education and Access

Subtopic: Basements and Crawl Spaces

Desired Outcome: Access to the closed crawl space is controlled and the ground moisture barrier is protected to maintain the integrity of the system

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0701.1a Crawl Spaces - Providing New Access	Crawl space will be accessible in accordance with IRC Access to mechanical equipment located in the crawl space will be in accordance with IRC Service and maintenance of the crawl space and equipment will be performed without risk of damage to the thermal barrier, air barrier, and ground moisture barrier in accordance with IRC	Provide crawl space access Maintain integrity of the crawl space system		1835
2.0701.1b Security	At client's/resident's discretion, a lockable access will be provided if access is from the exterior.	Control access and prevent intruders		1836

2.0701.2 Crawl Space Information Sign

Topic: Occupant Education and Access

Subtopic: Basements and Crawl Spaces

Desired Outcome: Posted signs inside of the crawl space provide essential safety and maintenance information to occupant and users of the crawl space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0701.2a Sign specifications	A durable, easily seen sign will be installed at all accesses inside of the crawl space (minimum 8 ½" x 11") A minimum expected service life of 10 years will be ensured	Prevent damage to the crawl space after upgrade		1837
2.0701.2b Sign content	Those entering the crawl space will be cautioned not to damage the air barrier, ground moisture barrier, insulation, and mechanical components specific to the crawl space type Anyone entering the crawl space will be alerted that immediate repairs are needed in case of damage Installer contact information will be included on the sign in case there are questions or needs for repairs	Prevent damage to the crawl space after upgrade Educate anyone entering the crawl space Provide occupants with a way to contact the installer		1838
2.0701.2c Hazard warning	Language prohibiting storage of hazardous and flammable materials will be provided on site	Prevent storage of hazardous or flammable materials in the crawl space Maintain indoor air quality Prevent a fire hazard		1839

2.0701.3 Crawl Space—Occupant Education

Topic: Occupant Education and Access

Subtopic: Basements and Crawl Spaces

Desired Outcome: Occupants educated on the crawl space system and how to maintain it

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0701.3a Written communication	Occupants will be given written documentation that describes components of the system, maintenance requirements, and health and safety considerations at a minimum Information will be provided in simple terms Text and pictures will be used Documentation may be provided electronically Literacy levels and language of occupants will be considered in selecting appropriate materials	Provide occupant with a basic understanding and documentation of the system, its maintenance, and related health and safety issues		1840

2.0701.3b Oral communication	When possible, the written documents will be reviewed with the occupants	Confirm that occupants have received the information Provide an opportunity for questions and answers		1841
2.0701.3c Contact information	Information about the installation company and warranty will be provided	Provide occupants with a way to contact the installer		1842

2.0702.1 Warranty and Service Agreement

Topic: Occupant Education and Access

Subtopic: Installed Equipment

Desired Outcome: Occupants provided recourse for failures in materials, workmanship, and serviceability and informed of potential hazards

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
2.0702.1a Warranty	A minimum 1-year warranty for materials, workmanship, and serviceability will be provided to occupants upon completion of work	Provide recourse to occupants for failures in materials, workmanship, and serviceability		1843
2.0702.1b Warranty and Maintenance Agreement - Client Education	Provide occupants with manufacturers' warranties on installed equipment and inform of installer maintenance agreement options Share information on company related annual inspections and maintenance agreements as well as manufacturer related warranty details	Ensure occupants are aware of warranty and maintenance agreement options		1844
2.0702.1c General conditions	At a minimum, the following concerns and warnings will be addressed within the warranty, as applicable to the work being warrantied: Possible drying and shrinking effects Storage of hazardous and flammable materials Mold	Educate occupants on potential hazards		1845

Section 3: Air Sealing

3.1001.1 Penetrations and Chases

Topic: Attics

Subtopic: Penetrations and Chases

Desired Outcome: Penetrations and chases sealed to prevent air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1001.1a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a chase Repairs will be completed before work	Repair moisture-related issues		1846
3.1001.1b Backing and infill	Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the hole The infill or backing will not bend, sag, or move once installed	Minimize hole size to ensure successful use of sealant Ensure closure is permanent and supports any load (e.g., wind, insulation) Ensure sealant does not fall out		1847
3.1001.1c Sealant selection	Sealants will be compatible with their intended surfaces Sealants will allow for differential expansion and contraction between dissimilar materials Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction	Select permanent sealant Ensure sealant meets or exceeds the performance characteristics of the surrounding materials		1848
3.1001.1d High temperature application	Only non-combustible sealant will be used in contact with chimneys, vents, and flues Local codes will be referenced	Prevent a fire hazard		1849

3.1001.2 Chase Capping

Topic: Attics

Subtopic: Penetrations and Chases

Desired Outcome: Chase capped to prevent air leakage and moisture movement between the attic and conditioned space

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1001.2a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a chase Repairs will be completed before work begins	Repair moisture-related issues		1850

3.1001.2b Standard chase (interior walls covered with drywall or plaster)	Entire opening will be spanned with rigid material Material will be cut to fit and fastened as required	Reduce opening to what can be sealed with sealant		1851
3.1001.2c Non-standard chase (interior walls covered with wood or paneling)	Material will be used that can be exposed to the interior of the house and meet the flame and smoke spread indexes as required in IRC	Prevent a fire hazard		1852
3.1001.2d Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1853
3.1001.2e Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1854
3.1001.2f Adjacent framing	All remaining gaps at the top of the chase will be sealed	Ensure airtight seal from one finished side of the chase to the other		1855

3.1001.3 Walls Open to Attic—Balloon Framing and Double Walls

Topic: Attics

Subtopic: Penetrations and Chases

Desired Outcome: Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1001.3a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1856

3.1001.3b Sealing methods	Entire opening will be spanned with rigid material in line with the ceiling level Material will be cut to fit and fastened as required OR Wall below openings will be dense packed OR Wall below openings will be bridged and sealed with spray polyurethane foam (SPF) Sealants will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Prevent air leakage from wall cavity to attic		1857
3.1001.3c Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1858
3.1001.3d Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1859
3.1001.3e Adjacent framing	All remaining gaps at the top of the opening will be sealed OR All remaining gaps at the top of the chase will be sealed	Ensure airtight seal from one finished side of the wall assembly to the other		1860

3.1002.1 Interior with Sloped Ceiling

Topic: Attics

Subtopic: Open Stairwells

Desired Outcome: Stairwells sealed to prevent air leakage and moisture movement between the attic and conditioned space

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1002.1a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing an open stairwell Repairs will be completed before work begins	Repair moisture-related issues		1861
3.1002.1b Standard	Entire opening will be spanned with rigid material	Prevent air leakage from wall to attic		1862

void over stairwell (15-minute fire-rated material; e.g., gypsum lined)	Material will be cut to fit and fastened as required	Reduce opening to what can be sealed with sealant Support load as required (e.g., wind, insulation)		
3.1002.1c Non-standard void over stairwell (surfaces around void are not 15-minute fire-rated (e.g., bookcases, chest of drawers), or lined with paneling	Material will be used that can be exposed to the interior of the house	Prevent a fire hazard		1863
3.1002.1d Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1864
3.1002.1e Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1865
3.1002.1f Perimeter sealing	Air barrier will be extended on all four sides from finished ceiling or existing framing to the new barrier Access will be gained as needed (e.g., pull flooring)	Create a continuous air barrier		1866

3.1002.2 Stairwell to Attic—Door at Bottom with No Ceiling Above

Topic: Attics

Subtopic: Open Stairwells

Desired Outcome: Stairwell sealed to prevent air leakage and moisture movement between the attic and the conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1002.2a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing an open stairwell Repairs will be completed before work begins	Repair moisture-related issues		1867
3.1002.2b Option 1: bring stairwell inside	Materials will be installed in line with the ceiling level with an airtight and operable insulated panel weighing no more than 15 pounds, or a pre-fabricated kit may be used for repeated access OR Airtight seal will be provided between level of new closure or cap and interior ceiling around perimeter Access will be gained as needed (e.g., pull flooring)	Prevent air leakage through stairwell between conditioned space and attic Ensure the insulated panel is lightweight and easy for the occupant to use on an ongoing basis Support insulation Bring the stairwell inside of the thermal boundary Ensure the new closure ties into the existing air barrier on all sides		1868
3.1002.2c Option 2: keep stairwell outside	An air barrier will be created and insulation material will be continuously installed across all surfaces of stairwell, including weather-stripped and insulated doors OR All cavities between stairs and conditioned space will be insulated and tested to resist air flow (e.g., walls, floors, landings, under stairs) Door will be weatherstripped and insulated OR A combination of the above methods can be used	Prevent air leakage Provide continuous thermal boundary Maximize thermal performance		1869
3.1002.2d Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1870
3.1002.2e Joint seal	Continuous, airtight seals will be provided around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1871
3.1002.2f Perimeter sealing	Air barrier will be extended on all four sides from finished ceiling or from existing framing to the new barrier Access will be gained as needed (e.g., pull flooring)	Create a continuous air barrier		1872

3.1002.3 Stairwell to Attic—Door at Top with Finished Ceiling Above

Topic: Attics

Subtopic: Open Stairwells

Desired Outcome: Stairwell is sealed to prevent air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1002.3a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing an open stairwell Repairs will be completed before work begins	Repair moisture-related issues		1873
3.1002.3b Option 1: bring stairwell inside	An airtight seal will be provided between level of new closure or cap and interior ceiling around perimeter Access will be gained as needed (e.g., pull flooring) OR An air barrier will be created and insulation material will be continuously installed across all surfaces of stairwell, including weather-stripped and insulated doors OR All cavities between stairs and conditioned space will be insulated and tested to resist air flow (e.g., walls, floors, landings, under stairs) Door will be weatherstripped and insulated OR A combination of the above methods can be used	Reduce air leakage Provide continuous thermal boundary Maximize thermal performance		1874
3.1002.3c Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1875
3.1002.3d Joint seal	Continuous, airtight seals will be provided around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1876
3.1002.3e Perimeter sealing	Air barrier will be extended on all four sides from finished ceiling or existing framing to the new barrier	Create a continuous air barrier		1877

	Access will be gained as needed (e.g., pull flooring)			

3.1003.1 New Ceiling Below Original—Old Ceiling Intact or Repairable

Topic: Attics

Subtopic: Dropped Ceilings and Soffits

Desired Outcome: Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1003.1a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1878
3.1003.1b Sealing methods	Entire opening will be spanned with rigid material in line with the ceiling level Material will be cut to fit and fastened as required OR Side of stud bays will be sealed with rigid material from bottom of dropped ceiling to top-plate OR Wall below openings will be dense packed OR Wall below openings will be bridged and sealed with SPF Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Prevent air leakage from dropped ceiling to attic		1879
3.1003.1c Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1880
3.1003.1d Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1881

3.1003.1e Adjacent framing	All remaining gaps will be sealed at the top of the dropped ceiling OR All remaining gaps at the top of the chase will be sealed	Provide airtight framing from one finished side of the dropped ceiling to the other		1882

3.1003.2 Ceiling Leaks Not Repairable—No Air Barrier Above

Topic: Attics

Subtopic: Dropped Ceilings and Soffits

Desired Outcome: Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1003.2a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1883
3.1003.2b Sealing methods	Ceiling or roof and wall air and thermal barriers will be connected with a rigid airtight connection around the perimeter OR If ceiling will support an air barrier and insulation, a rigid airtight barrier (e.g., gypsum) will be attached to current ceiling either above or below OR Intermediate framing will be used to support air and thermal barrier OR Rigid airtight thermal barrier will be installed at the roof sheathing Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Prevent air leakage from dropped ceiling to attic		1884
3.1003.2c Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1885
3.1003.2d Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1886

3.1003.2e Adjacent framing	All remaining gaps will be sealed at the top of the dropped ceiling OR All remaining gaps at the top of the chase will be sealed	Provide airtight framing from one finished side of the dropped ceiling to the other		1887

3.1003.3 Above Closets and Tubs

Topic: Attics

Subtopic: Dropped Ceilings and Soffits

Desired Outcome: Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1003.3a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1888
3.1003.3b Above closets and tubs	Entire opening will be spanned with rigid material in line with the ceiling level Material will be cut to fit and fastened as required OR Side of stud bays will be sealed with rigid material from bottom of dropped ceiling to top-plate OR Wall below openings will be dense packed OR Wall below openings will be bridged and sealed with SPF Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Prevent air leakage from dropped ceiling to attic		1889
3.1003.3c Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1890
3.1003.3d Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections	Provide airtight, durable seal that does not move, bend, or sag		1891

3.1003.3e Adjacent framing	All remaining gaps at the top of the dropped ceiling will be sealed	Provide airtight framing from one finished side of the dropped ceiling to the other		1892

3.1003.4 Dropped Ceilings

Topic: Attics

Subtopic: Dropped Ceilings and Soffits

Desired Outcome: Continuous air barrier prevents air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1003.4a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1893
3.1003.4b Sealing methods	Entire opening will be spanned with rigid material installed in line with the ceiling level Material will be cut to fit and fastened as required OR Side of stud bays will be sealed with rigid material from bottom of dropped ceiling to top-plate OR Wall below openings will be dense packed OR Wall below openings will be bridged and sealed with SPF Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Prevent air leakage from dropped ceiling to attic		1894
3.1003.4c Support	Support material will be installed for spans wider than 24", except when air barrier material is rated to span greater distance under load (e.g., wind, insulation)	Ensure seal stays in place and does not sag		1895
3.1003.4d Joint seal	Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections Pre-fabricated units may be used when meeting the desired outcome	Provide airtight, durable seal that does not move, bend or sag		1896

3.1003.4e Adjacent framing	All remaining gaps will be sealed at the top of the dropped ceiling OR All remaining gaps at the top of the chase will be sealed	Provide airtight framing from one finished side of the dropped ceiling to the other		1897

3.1003.5 Dropped Ceiling with Light Boxes and Fixtures

Topic: Attics

Subtopic: Dropped Ceilings and Soffits

Desired Outcome: Sealed light boxes safely prevent air leakage and moisture movement between the attic and conditioned space

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1003.5a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1898
3.1003.5b Light boxes (e.g., fluorescent lights)	An airtight seal will be provided around perimeter between light box enclosure and interior ceiling All seams and penetrations of the enclosure will be sealed Access will be gained as needed (e.g., pull flooring) Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Prevent air leakage		1899
3.1003.5c Non-insulation contact (IC) rated recessed lights	Insulation will be kept at least 3 inches away from the top and side of any fixtures If dropped ceiling is to be filled with insulation, then a sealed rigid barrier enclosure will be installed to maintain a 3 inches clearance on all sides Top of rigid barrier enclosure will be sealed with non-insulating rigid material (e.g., gypsum or equivalent perm rating and R-value)	Prevent light fixture from overheating Bring light fixture inside of the air barrier		1900

3.1003.6 Dropped Soffits

Topic: Attics

Subtopic: Dropped Ceilings and Soffits

Desired Outcome: Dropped soffits sealed to prevent air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1003.6a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a dropped ceiling or soffit Repairs will be completed before work begins	Repair moisture-related issues		1901
3.1003.6b Soffit general	Air flow will be blocked at soffit in locations where access allows	Provide continuous air barrier across soffit openings		1902
3.1003.6c Option 1: bring soffit inside (seal at top)	Entire opening will be spanned with rigid material in line with the ceiling level Material will be cut to fit and fastened as required	Prevent air leakage from wall to attic Reduce opening to what can be sealed with sealant Ensure closure is permanent and supports any load (e.g., wind, insulation) Bring soffit into thermal boundary		1903
3.1003.6d Option 2: leave soffit outside (seal at bottom or side)	Each stud bay will be spanned with rigid material will be cut to fit and fastened as required OR Backing at each stud bay will be provided and will be sealed OR Side of stud bays will be sealed with rigid material from bottom of soffit to top-plate OR A sealed rigid barrier will be installed at all transitions	Prevent air leakage from wall to soffit Reduce opening to what can be sealed with sealant Ensure soffit is outside of the thermal boundary		1904
3.1003.6e Soffits containing non-IC rated recessed lights	Insulation will be kept at least 3" away from the top and side of any fixtures If dropped soffit is to be filled with insulation, then a sealed rigid barrier enclosure will be installed to maintain a 3" clearance around the entire fixture Top of rigid barrier enclosure will be sealed with non-insulating rigid material (e.g., gypsum or equivalent perm rating and R-value)	Prevent light fixture from overheating Bring light fixture inside of the air barrier		1905

3.1004.1 Cathedralized Attic Air Sealing (Insulation Installed at Roof Deck)

Topic: Attics

Subtopic: Cathedralized Attic Ceilings

Desired Outcome: Cathedralized attics sealed to prevent air leakage

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1004.1a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a cathedralized ceiling Repairs will be completed before work begins	Repair moisture-related issues		1906
3.1004.1b Backing and infill	Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the open space The infill or backing will not bend, sag, or move once installed	Minimize hole size to ensure successful use of sealant Ensure closure is permanent and supports any load (e.g., wind, insulation) Ensure sealant does not fall out		1907
3.1004.1c Sealant selection	Sealants will be compatible with their intended surfaces Sealants will allow for differential expansion and contraction between dissimilar materials Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction	Select permanent sealant Ensure sealant meets or exceeds the performance characteristics of the surrounding materials		1908

3.1005.1 Tongue and Groove Ceilings

Topic: Attics

Subtopic: Other Ceiling Materials

Desired Outcome: Tongue and groove ceilings sealed to prevent air leakage and moisture movement between the attic and conditioned space

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1005.1a Pre-inspection	An inspection will be conducted for mold, water leaks, and water damage before sealing a tongue and groove ceiling Repairs will be completed before work	Repair moisture-related issues		1909

3.1005.1b Backing	Backing will be installed behind tongue and groove ceilings	Prevent air leakage and allow for sealants		1910
3.1005.1c Sealant selection	Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction No sealant will be allowed to be visible in the living space	Select permanent sealant Ensure sealant meets or exceeds the performance characteristics of the surrounding materials Ensure ceiling remains aesthetically pleasing		1911

3.1201.1 Double-Hung Wood Windows

Topic: Windows and Doors

Subtopic: Maintenance, Repair, and Sealing

For supporting material, see Building America Solution Center.

Desired Outcome: Windows operable and weather tight; improved energy efficiency performance of fenestration

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1201.1a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's Renovation, Repair and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards	Protect worker and occupant from potential lead hazards		1912
3.1201.1b Weather stripping	Existing weather stripping and sash sealant will be removed Surface where the sill meets the sash will be cleaned Seal between the fixed components of the window (e.g., jambs, sill) will be continuous and complete while maintaining the operability of the window Continuous and complete weather stripping will be installed on the bottom of the lower sash where it makes contact with the sill and at the top of the upper sash where it makes	Form a complete seal from the outer edge of the sash to the jamb Maintain operability of the window		1913

	contact with the upper part of the window frame			
3.1201.1c Sash locks	Locks will be installed so that the rails of the upper and lower sashes are flush and in full contact No gaps will be visible between the two sashes Locks will be installed to achieve compression of the two sashes	Form a secure connection between the two sashes		1914
3.1201.1d Replacement sills	Beveled sill will be flush with interior wall and sloped to the exterior Seams will be continuously and completely sealed with sealant to the jambs and to the frame Sill will be water-sealed and primed	Form a complete seal from the bottom of the lower sash to the sill Maintain operability of the window Allow for drainage to the exterior		1915
3.1201.1e Sash replacement	Lower sash will have the same bevel on the bottom rail as the sill Sash will be water-sealed and primed	Ensure sash remains in a fixed position when open or partially open Maintain operability of the window Form a complete seal from the bottom of the lower sash to the sill		1916
3.1201.1f Adjust stops	Stops will be adjusted to eliminate visible gaps between the stops and the jamb while maintaining operability of the window	Form a complete seal between the jamb, sash, and stop Maintain operability of the window		1917
3.1201.1g Replace stops	Stops will be installed to keep the window securely in place Stops will be adjusted to eliminate visible gaps between the stops and the jamb while maintaining operability of the window	Form a complete seal between the jamb, sash, and stop Maintain operability of the window		1918

3.1201.2 Single-Unit Window and Fixed Frame with Wood Sash

Topic: Windows and Doors

Subtopic: Maintenance, Repair, and Sealing

For supporting material, see Building America Solution Center.

Desired Outcome: Windows operable and weather tight; improved energy efficiency performance of fenestration

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1201.2a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and	Protect worker and occupant from potential lead hazards		1919

	proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards			
3.1201.2b Operable windows	All egress windows will be operable as required by local codes	Maintain operability of egress windows		1920
3.1201.2c Air infiltration	Details that reduce air infiltration will be repaired, replaced, sealed, or installed (e.g., new latch for meeting rail connection, pulley seals, rope caulking for other cracks, interior storm windows) State Energy Conservation Code or local code requirements for air leakage should be met (whichever is more stringent)	Reduce air infiltration		1921
3.1201.2d Water infiltration	Details that reduce water infiltration will be repaired, replaced, or installed (e.g., replace missing glazing compound on sash, exterior caulking, exterior storm windows)	Reduce water infiltration		1922
3.1201.2e Occupant education and maintenance	Occupants will be notified of changes or repairs made and will be educated on how to operate and maintain window	Ensure long-term weather tightness		1923

3.1201.3 Exterior Doors

Topic: Windows and Doors

Subtopic: Maintenance, Repair, and Sealing

For supporting material, see Building America Solution Center.

Desired Outcome: Doors operable and weather tight

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1201.3a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/	Protect worker and occupant from potential lead hazards		1924

	May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards			
3.1201.3b Door operation and fit	Door will be adjusted to properly fit the jamb and allow for ease of operation (e.g., hinge replacement, re-plane door, door strike adjustment)	Ensure proper operation of the door		1925
3.1201.3c Air infiltration	Details that reduce air infiltration will be repaired, replaced, sealed, or installed in accordance with State Energy Conservation Code or local code—whichever is more stringent (e.g., weather stripping, door bottoms, trim replacement with foam)	Reduce air infiltration		1926
3.1201.3d Water infiltration	Details that reduce water infiltration will be repaired, replaced, sealed, or installed (e.g., adjust threshold, caulk jamb to threshold, caulk trim, flashing)	Reduce water infiltration		1927
3.1201.3e Occupant education and maintenance	Occupants will be notified of changes or repairs made and will be educated on how to operate and maintain weather stripping and caulk around door and trim	Ensure long-term weather tightness		1928

3.1201.4 Pocket Door

Topic: Windows and Doors

Subtopic: Maintenance, Repair, and Sealing

Desired Outcome: Pocket door sealed top and back to prevent leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1201.4a Backing and infill	Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the hole The infill will not bend, sag, or move once installed	Minimize hole size to ensure successful use of sealant Ensure closure is permanent and supports any load (e.g., wind, insulation) Ensure sealant does not fall out		1929
3.1201.4b Sealant selection	Sealants will be compatible with their intended surfaces	Select permanent sealant Ensure sealant meets or exceeds the performance characteristics of the surrounding materials		1930

	Sealants will allow for differential expansion and contraction between dissimilar materials Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction Sealant will be used in accordance with OSHA/manufacturer safety protocol for worker and occupant safety Manufacturer SDS sheet will be followed for worker safety			

3.1202.1 Fixed Frame with Wood Sash—Older House

Topic: Windows and Doors

Subtopic: Repairing/Replacing Cracked and Broken Glass

Desired Outcome: Glass complete and intact; improved energy efficiency performance of fenestration

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1202.1a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/ May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards	Protect worker and occupant from potential lead hazards		1931
3.1202.1b Broken glass removal	Putty and push points will be removed Broken or cracked glass will be removed	Safely remove old glass		1932
3.1202.1c Sash preparation	Opening will be cleaned	Prepare opening for new glass		1933
3.1202.1d New glass installation	Glass will be sized 1/8" to 3/16" smaller than opening to allow for movement of frame Safety glass will be installed in accordance with local codes Push points will be provided on each side to secure glass in frame	Ensure glazing compound will adhere to sash Install, seal, and secure new glass in place Allow glazing compound to harden to ensure secure installation		1934

	Glazing compound will be added in accordance with manufacturer specifications			

3.1202.2 Single-Unit Window, Mounted on Rough Opening—Newer House

Topic: Windows and Doors

Subtopic: Repairing/Replacing Cracked and Broken Glass

Desired Outcome: Glass complete and intact; improved energy efficiency performance of fenestration

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1202.2a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards	Protect worker and occupant from potential lead hazards		1935
3.1202.2b Broken glass removal	Window stops and damaged glass will be removed	Safely remove old glass		1936
3.1202.2c Opening preparation	Opening will be cleaned Glazing tape will be removed or replaced	Prepare opening for new glass		1937
3.1202.2d New glass installation	Replacement glass will be sized to original width, height, and depth Stops will be replaced or installed Wood stops will be sealed to glass with appropriate sealant Glass will be selected with comparable tint and coating (color and look) Tempered glass will be installed as required by local codes Glazing compound will be added in accordance with manufacturer specifications	Install, seal, and secure new glass in place Allow glazing compound to harden to ensure secure installation		1938

3.1203.1 Replacement Window in Existing Window Frame

Topic: Windows and Doors

Subtopic: Replacement

For supporting material, see Building America Solution Center.

Desired Outcome: Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1203.1a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/ May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards	Protect worker and occupant from potential lead hazards		1939
3.1203.1b Opening preparation	Interior stops, sashes, parting strips, and pulleys will be removed Opening will be cleaned	Provide a clean opening for replacement window unit		1940
3.1203.1c Replacement window installation	Replacement window will be installed in accordance with manufacturer specifications, ensuring that the exterior stops are caulked	Ensure replacement window operates properly Ensure replacement window has a weather tight fit		1941
3.1203.1d Safety	Egress windows and safety glass will be installed in accordance with local codes	Meet all codes when replacing windows		1942
3.1203.1e Occupant education and maintenance	Occupants will be notified of changes or repairs made and will be educated on how to operate and maintain window	Ensure long-term weather tightness		1943

3.1203.2 Single-Unit Window, Mounted on Rough Opening—Newer House

Topic: Windows and Doors

Subtopic: Replacement

Desired Outcome: Replacement window provides weather tight fit; improved energy efficiency performance of fenestration

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

3.1203.2a Lead paint assessment	Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise EPA's RRP Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards	Protect worker and occupant from potential lead hazards		1944
3.1203.2b Opening preparation	Replacement window will be laid out with trim Exterior trim will be removed or exterior siding will be cut back to fit new window with trim Existing window will be removed Window opening will be flashed in accordance with accepted industry standards	Provide a clean and properly flashed opening for replacement window unit		1945
3.1203.2c Replacement unit preparation	Mounting detail will be determined based on depth of window and location of window liner	Allow for good fit and finish of replacement window		1946
3.1203.2d Replacement window installation	Replacement windows will be installed in accordance with manufacturer specifications and will be integrated with flashing Gaps between the new window and existing frame will be sealed with low-expanding foam	Ensure replacement window operates properly Ensure replacement window is weather tight		1947
3.1203.2e Safety	Egress windows and safety glass will be installed in accordance with local codes	Meet all codes when replacing windows		1948
3.1203.2f Occupant education and maintenance	Occupant will be notified of changes or repairs made and will be educated on how to operate and maintain window	Ensure long-term weather tightness		1949

3.1401.1 Basements Connected to Crawl Spaces—Sealing and Insulating

Topic: Basements and Crawl Spaces

Subtopic: Basements Connected to Crawl Spaces

Desired Outcome: Crawl spaces and basements separated using appropriate methods that define spaces and allow for treatment in accordance with specifications

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1401.1a Conditioned basements with vented crawl spaces	Crawl space will be separated from the conditioned basement with a continuous air barrier, ground moisture barrier, and thermal boundary	Create separation and define spaces Enable treatment of crawl spaces and basements by referenced specifications Increase house durability and energy efficiency		1950
3.1401.1b Conditioned basements with closed crawl spaces	Crawl space will be separated from the conditioned basement with a continuous air barrier and ground moisture barrier	Create separation and define spaces Enable treatment of crawl spaces and basements by referenced specifications Increase house durability and energy efficiency		1951
3.1401.1c Unconditioned basements with vented crawl spaces	Vented crawl space will be separated from the unconditioned basement with a continuous air barrier and ground moisture barrier	Create separation and define spaces Enable treatment of crawl spaces and basements by referenced specifications Increase house durability and energy efficiency		1952
3.1401.1d Unconditioned basements with closed crawl spaces	Unconditioned basement will be treated as an extension of the closed crawl space	Create separation and define spaces Enable treatment of crawl spaces and basements by referenced specifications Increase house durability and energy efficiency		1953

3.1402.1 Crawl Spaces—Sealing Floor Penetrations

Topic: Basements and Crawl Spaces

Subtopic: Crawl Spaces

Desired Outcome: Air leakage prevented and indoor air quality protected

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1402.1a Backing and infill	Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration The backing or infill will not bend, sag, or move once installed	Ensure resulting closure is permanent and supports any load (e.g., insulation) Ensure sealant does not fall out		1954
3.1402.1b Sealant selection	Sealants will be used to fill holes no larger than recommended by manufacturer specifications Sealants will be compatible with their intended surfaces	Create a permanent seal Ensure sealant meets or exceeds the performance characteristics of the surrounding materials		1955

	Sealants will allow for differential expansion and contraction between dissimilar materials Sealants will be continuous and meet fire barrier specifications, according to authority having jurisdiction			
3.1402.1c High temperature application	Only non-combustible materials will be used in contact with chimneys, vents, and flues in accordance with authority having jurisdiction	Prevent a fire hazard		1956

3.1402.2 Closed Crawl Spaces—Air Sealing Foundation Vents

Topic: Basements and Crawl Spaces

Subtopic: Crawl Spaces

Desired Outcome: Air and moisture penetration through the existing vent into the crawl space blocked

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1402.2a Vent closure	Vent opening will be permanently closed and sealed	Prevent air and moisture penetration		1957

3.1402.3 Closed Crawl Spaces—Air Sealing Exterior Wall

Topic: Basements and Crawl Spaces

Subtopic: Crawl Spaces

Desired Outcome: Well-sealed exterior wall prevents leakage and pests

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1402.3a Seal penetrations	Penetrations will be sealed with a durable material A minimum expected service life of 10 years will be ensured	Prevent air and moisture penetration into crawl space		1958
3.1402.3b Pest exclusion	If penetration is greater than ¼ inches, caulking, steel wool, or other pest-proof material will be used to fill the penetration before sealing	Prevent pest entry		1959

3.1402.4 Closed Crawl Spaces—Air Sealing Brick Curtain Wall with Piers

Topic: Basements and Crawl Spaces

Subtopic: Crawl Spaces

Desired Outcome: Well-sealed exterior wall prevents leakage and pests

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1402.4a Seal penetrations	Penetrations will be sealed with a durable material, including the following: Sealing rain screen to crawl space connection Re-venting exterior weep holes with wicking rope A minimum expected service life of 10 years will be ensured	Reduce moisture vapor and water from entering the crawl space through the rain screen Decrease probability of rot		1960
3.1402.4b Pest exclusion	If penetration is greater than ¼", a pest-proof material will be used to fill the penetration before sealing	Prevent pest entry		1961

3.1402.5 Closed Crawl Spaces—Attached Crawl Spaces Under Unconditioned Spaces

Topic: Basements and Crawl Spaces

Subtopic: Crawl Spaces

Desired Outcome: Closed, attached crawl spaces sealed but accessible

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1402.5a Separate crawl spaces	A continuous air and vapor barrier between the attached crawl space under unconditioned spaces and the closed crawl space will be maintained	Prevent air and moisture penetration		1962
3.1402.5b Entry point	When adding access to a crawl space: Access openings through the floor will be a minimum of 18 inches by 24 inches or as constrained by existing framing members Openings through a perimeter wall will be not less than 16 inches by 24 inches or as constrained by existing framing members When any portion of the through-wall access is below grade, an area way not	Provide access to attached crawl space for inspections		1963

	less than 16 inches by 24 inches will be provided Under-floor spaces containing appliances will be provided with an unobstructed access large enough to remove the largest appliance but not less than 30 inches high and 22 inches wide or more than 20 feet long measured along the center line of the passageway from the opening to the appliance A level service space at least 30 inches deep and 30 inches wide will be present at the front or service side of the appliance If the depth of the passageway or the service space exceeds 12 inches below the adjoining grade, the walls of the passageway will be lined with concrete or masonry extending 4 inches above the adjoining grade in accordance with Chapter 4 IRC The rough-framed access opening dimensions will be a minimum of 22 inches by 30 inches and large enough to remove the largest appliance			

3.1488.1 Skirting Post and Pier Foundations

Topic: Basements and Crawl Spaces

Subtopic: Special Considerations

Desired Outcome: Protective skirting effectively installed to retard damage from natural causes such as wind, water, and pests

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1488.1a Skirting	Any materials making contact with the ground will be rated for ground contact Skirting will be continuous around the perimeter and enclose the entire floor area below the conditioned living space	Minimize pests, wind, water, and freezing of pipes under house		1964
3.1488.1b Flashing	Skirting will be flashed to prevent the entrance of water	Prevent water from entering space under house		1965
3.1488.1c Fastening	Entire skirting will be mechanically fastened	Ensure lasting upgrade		1966

3.1501.1 Penetrations, Cracks, and Doors Between Garage and House

Topic: Attached Garages

Subtopic: Garage Openings

Desired Outcome: Openings from garage sealed to prevent leakage

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1501.1a Penetrations	All lighting fixtures, wiring, plumbing, venting, ducting, and gas piping penetrations will be sealed	Prevent air leakage and pollutant entry		1967
3.1501.1b Ductwork	All joints and connections in ductwork will be fastened and sealed with UL 181B or 181B-M welds, gaskets, adhesive mastics, or mastic-plus- embedded-fabric systems	Prevent air leakage and pollutant entry		1968
3.1501.1c Cracks	All cracks in house and garage separation wall will be sealed, including cracks between mud sill, rim joists, subfloors, and bottom of gypsum board, ensuring the air sealing enhances the integrity of the fire resistance construction of that wall All cracks in ceiling surfaces will be sealed	Prevent air leakage and pollutant entry		1969
3.1501.1d Garage to house door	Weather stripping, door sweep, and threshold will be installed to stop air leakage	Prevent air leakage and pollutant entry		1970
3.1501.1e Glass	Broken glass panes in doors will be replaced, pointed, and glazed where needed	Prevent air leakage and pollutant entry		1971
3.1501.1f Carbon monoxide (CO) alarm	CO alarms will be installed in accordance with ASHRAE 62.2, applicable codes and manufacturer specifications	Warn occupants of CO exposure from attached garage		1972
3.1501.1g Occupant education	Occupant will be educated on need to keep door from garage to house closed and not to warm up vehicles or use any gas engine appliances or grills in the garage, even if the main door is left open	Reduce risk of CO poisoning inside of garage and adjacent rooms		1973

3.1601.1 Preparation and Mechanical Fastening

Topic: Ducts

Subtopic: Duct Preparation

Desired Outcome:

Ducts and plenums properly fastened to prevent leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1601.1a Preparation	Type and R-value of existing duct insulation (e.g., fiberglass, stone wool, asbestos) will be identified as will the location of vapor retarders, if any If asbestos insulation was used, it will not be disturbed; consult with an asbestos abatement expert for removal Surrounding insulation will be cleared to expose joints being sealed Duct surface to accept sealant will be cleaned Insulation will be returned or replaced with equivalent R-value	Gain access while maintaining insulation value Achieve proper adhesion for airtight seal		1974
3.1601.1b Metal to metal	Round ducts will be mechanically fastened to maintain alignment Other shaped ducts will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes	Ensure durable joints		1975
3.1601.1c Flex to metal	Joints will be fastened with tie bands using a tie band tensioning tool	Ensure durable joints		1976
3.1601.1d Duct board to duct board	Joints will be fastened with clinch stapler	Ensure durable joints		1977
3.1601.1e Flexible duct to duct board	Metal take-off collar will be used and attached in accordance with IRC	Ensure durable joints		1978
3.1601.1f Metal plenum to	Plenum will be mechanically fastened	Ensure durable joints		1979

air handler cabinet				
3.1601.1g Duct board plenum to air handler cabinet	Termination bar or metal strip will be fastened with screws Duct board will be installed between the screw and the termination bar	Ensure durable joints		1980
3.1601.1h Boot to wood	Screws or nails will be used to fasten boot to wood	Ensure durable joints		1981
3.1601.1i Boot to gypsum	Boot hanger will be fastened to adjacent framing with screws or nails Boot will be connected to boot hanger with screws Integral snap boots will be installed	Ensure durable joints		1982
3.1601.1j Flex to duct board	Take-offs will be in accordance with IRC and applicable local code	Ensure durable joints		1983

3.1601.2 Duct Preparation for SPF Application

Topic: Ducts

Subtopic: Duct Preparation

Desired Outcome: Condition of ductwork identified and necessary repairs made in preparation for spray polyurethane foam (SPF) application

For supporting material, see Referenced Standards, General Information on Spray Polyurethane Foam (SPF), Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1601.2a Inspection	All exposed ductwork in unconditioned spaces (e.g., attics, basements, crawl spaces) will be inspected Broken joints or large cracks, gaps, or holes will be identified Type of ductwork (e.g., metal, duct board, flex duct) will be identified Type and R-value of existing duct insulation (e.g., fiberglass, stone wool, asbestos) will be identified as will the location of vapor retarders, if any If asbestos insulation was used, it will not be disturbed; consult with an asbestos abatement expert for removal	Identify damaged ductwork in need of repair Identify type and R-value of existing insulation		1984

	Loose fitting or damaged fiberglass or stone wool insulation will be removed using proper safety equipment Necessary clearances for installation of SPF will be ensured			
3.1601.2b Repair	Broken or missing ductwork will be repaired or replaced All cracks, gaps, or holes greater than ¼" will be taped or sealed as feasible Dust, dirt, and grease will be removed from exterior surfaces of ducts	Cover openings in ducts to prevent SPF from entering the interior of the duct Ensure surfaces of duct are clean to promote proper adhesion of SPF		1985

3.1601.3 Support

Topic: Ducts

Subtopic: Duct Preparation

Desired Outcome: Ducts and plenums properly supported

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1601.3a Support (applies to all duct types)	Flexible and duct board ducts and plenums will be supported every 4' using a minimum of 1 ½" wide material Support materials will be applied in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified (e.g., ceiling, framing, strapping); duct support must be installed in accordance with authority having jurisdiction Metal ducts will be supported by 1/2 inch wide eighteen gauge metal straps or 12-gauge galvanized wire at intervals not exceeding 10 feet or other approved means	Eliminate falling and sagging		1986

3.1602.1 Air Sealing Duct System

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: Ducts and plenums sealed to prevent leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.1a New component to new component sealant selection	Any closure system used will be in accordance with IRC Chapter 16	Ensure effectiveness of air sealing system		1987
3.1602.1b New component to existing component	Seams, cracks, joints, holes, and penetrations less than ¼" will be sealed using fiberglass mesh and mastic Mastic alone will be acceptable for holes less than ¼" that are more than 10' from air handler Seams, cracks, joints, holes, and penetrations between ¼" and ¾" will be sealed in two stages: They will be backed using temporary tape (e.g., foil tape) as a support prior to sealing They will be sealed using fiberglass mesh and mastic	Eliminate air leakage into or out of ducts and plenums Ensure adhesion of primary seal (mastic and fiberglass mesh) to the duct Reinforce seal Support mastic and fiberglass mesh during curing		1988
3.1602.1c Existing component to existing component	Seams, cracks, joints, holes, and penetrations less than ¼" will be sealed using UL 181 fiber-embedded mastic Seams, cracks, joints, holes, and penetrations between ¼" and ¾" will be sealed in two stages: * They will be backed using temporary tape (e.g., foil tape) as a support prior to sealing * They will be sealed using fiberglass mesh and mastic Seams, cracks, joints, holes, and penetrations larger than ¾" will be repaired using rigid duct material Mastic will overlap repair joint or existing temporary tape by at least 1" on all sides	Eliminate air leakage into or out of ducts and plenums Ensure adhesion of primary seal (fiberglass mesh and mastic) to the duct Reinforce seal Support fiberglass mesh and mastic during curing		1989

3.1602.2 Duct Spray Polyurethane Foam (SPF) Installation

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: Exposed ductwork in unconditioned spaces insulated and sealed

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.2a Installation	Insulation will be installed according to manufacturer specifications and all provisions of the IRC SPF will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer Sufficient insulation will be applied to all joints and around all penetrations to the conditioned space through walls, floors, and ceilings SPF will be covered with proper fire protective coverings or coatings appropriate for location of ductwork and type of foam used and provisions of the IRC and local codes If ducts are used for air-conditioning, an appropriate vapor retarder will be applied on the SPF if open-cell SPF used If 2" or more of closed-cell SPF is used, follow manufacturer specification to determine if additional vapor retarder is needed The flame spread index will not be greater than 25 and the smoke-developed index is not greater than 450 at the specified installed thickness The foam plastic will be protected with an ignition barrier	Insulate and seal all exposed ductwork in unconditioned spaces Manage moisture condensation on ductwork that carry cooled air in warm, moist climates Provide adequate fire protection for exposed SPF		1990

3.1602.3 Proprietary Spray Application

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: Ducts and plenums sealed to prevent leakage

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.3a Internal or external application	Installation of sealant will be applied in accordance with manufacturer specifications as well as UL 181M, NFPA 90A, and NFPA 90B	Reduce duct leakage		1991

3.1602.4 Air Sealing System Components

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: Ducts and plenums sealed to prevent leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.4a Duct boot to interior surface	All gaps between boot and interior surface that defines conditioned space will be air sealed Gypsum edge will be wetted before applying water-based sealant Sealants will be continuous and be in accordance with IRC	Prevent air leakage Prevent a fire hazard		1992
3.1602.4b Wooden plenums and building cavities	Accessible connections and joints will be made airtight using approved material	Ensure ducts and plenums will not leak		1993
3.1602.4c Air handler cabinet	Joints will be closed and cracks and holes not needed for proper function of unit will be sealed using removable sealant (e.g., foil tape) or in accordance with the original equipment manufacturer directions (if available)	Reduce air leakage while maintaining accessibility		1994
3.1602.4d Filter slot	A pre-manufactured or site manufactured durable filter slot cover will be installed	Reduce air leakage while maintaining accessibility		1995

3.1602.5 Return—Framed Platform

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: The return duct installed to prevent air leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.5a Preparation	Debris and dirt will be cleaned out of the return platform	Allow for the application of rigid materials and sealants		1996
3.1602.5b Infill and backing	Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the open space Backing or infill will not bend, sag, or move once installed Material will be rated for use in return duct systems	Minimize hole size to ensure successful use of sealant Ensure closure is permanent and supports any load (e.g., return air pressure) Ensure sealant does not fall out		1997
3.1602.5c Sealant selection	Sealants will be continuous and be in accordance with IRC	Select permanent sealant Ensure sealant meets or exceeds the performance characteristics of the surrounding materials		1998

3.1602.6 Capping Dual-Cooling Up-Ducts

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: Dual-cooling up-duct is sealed to prevent leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.6a Backing and infill	Backing or infill will be provided as needed to meet the specific characteristics of the selected material and the characteristics of the up-duct opening A material will be rated for use in duct systems The infill will not bend, sag, or move once installed	Minimize hole size to ensure successful use of sealant Ensure closure is permanent and supports any pressure produced by wind or air handler fan Ensure sealant does not fall out		1999
3.1602.6b Sealant selection	Sealants will be continuous and be in accordance with IRC	Select permanent sealant Ensure sealant meets or exceeds the performance characteristics of the surrounding materials		2000

3.1602.7 Return and Supply Plenums in Basements and Crawl Spaces

Topic: Ducts

Subtopic: Duct Sealing

Desired Outcome: Connections between the crawl space/ unconditioned basement and living space eliminated to improve indoor air quality (IAQ) and efficiency of the distribution system

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1602.7a Supply plenums (includes conditioned crawl spaces)	Basements and crawl spaces that are used as heating and cooling supply plenums will not be allowed	Eliminate connection between the crawl space/unconditioned basement and living space		2001
3.1602.7b Return plenums	Basements and crawl spaces that are used as heating and cooling return plenums will not be allowed	Eliminate connection between the crawl space/unconditioned basement and living space		2002

3.1802.1 Roof/Exterior Wall Connection, Including Joints at Roof/Parapet/Wall Connections

Topic: Roofs

Subtopic: Roof/Wall Connections

Desired Outcome: Continuous air barrier between roof and exterior walls where connection is within conditioned space

For supporting material, see Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
3.1802.1a Pre-inspection	Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization Existing water control measures will be identified Air sealing locations will be identified between the roof and the exterior wall	Provide a safe and stable work environment Avoid compromising existing water control system Ensure a continuous air barrier will be appropriately located at the roof/exterior wall junction		4548
3.1802.1b Backing and infill	Where gaps, cracks, or holes are larger than 1/4" across and/or where the air sealing materials will be subject to temperature variations in	Minimize gap or hole size to ensure successful use of sealant Ensure closure is permanent and supports appropriate load (e.g., wind, snow, insulation)		4549

	excess of 50° F, the need for backing or infill will be evaluated If used, backing or infill will meet specific characteristics of the fire-resistance-rated assembly, and be compatible with the characteristics of the gap, crack, or hole, including preservation of any expansion/contraction characteristics for assembly (e.g., expansion joints, steam pipes, or dissimilar material interfaces with differing coefficients of expansion) Backing or infill will be selected that maintains sealant placement and durability while allowing for the expected movement from expansion, contraction, load deflection, settling at the location, or if existing water control measures are compromised (e.g., rain screen, drip edge, weep holes, gutter and roof drains, scuppers, or other exterior water management elements)	Ensure sealant does not fall out Ensure integrity of the existing water control system		
3.1802.1c Sealant selection	Sealants will be compatible with their intended surfaces and applied in accordance with manufacturer specifications Selection will be durable, pest resistant, and have a weather-appropriate seal Indoor sealants will be low volatile organic compound (VOC) products that meet independent testing and verification protocols, such as Green Seal GS-36, "GREENGUARD Children and Schools," or comparable certifications Fire-resistance-rated assemblies will be provided with sealants permitted by the authority having jurisdiction and adopted building code	Prevent intrusion of moisture and pests into the sealed assembly Prevent exposing workers or occupants to excessive VOC levels Ensure sealant meets or exceeds the performance characteristics of the assembly and is compliant with local fire code requirements		4550
3.1802.1d Joint seal	Continuous seal will be installed at roof/exterior wall junctions or roof/exterior and wall/parapet junctions, including, but not limited to, beams, cracks, joints, edges, penetrations, and connections For metal roof decks, flutes will be accessed to install sealant between top side of roof deck and roof assembly	Provide airtight, durable seal that does not move, bend, or sag Ensure hidden flutes are properly sealed		4551

3.1802.1e Cavity seal	For framed parapets that are open between conditioned and unconditioned space, the parapet/wall cavity will be accessed, and an internal air barrier will be created within the parapet wall cavity at the roof plane For parapet walls constructed with hollow core concrete masonry units, the hollow cores will be accessed at the roof plane, and an internal air barrier will be created within the parapet wall cavity at the roof plane For exterior insulated finishing system (EIFS) parapet, air sealing measures will preserve designed moisture control gaps between EIFS and wall sheathing	Stop air movement within the parapet/wall cavity to create a continuous air barrier at the roof plane Provide airtight, durable seal that does not move, bend, or sag		4552

Section 4: Insulation

4.1001.1 Non-Insulation Contact (IC) Recessed Light

Topic: Attics

Subtopic: General Preparation

Desired Outcome: Ensure safety from fire and prevent air leakage

For supporting material, see Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1001.1a Air barrier system	A fire-rated air barrier system (i.e., equivalent to 5/8 fire code gypsum wallboard) will be used to separate non- IC rated recessed lights from insulation, using one of the methods below: A fire-rated airtight closure taller than surrounding attic insulation will be placed over non- IC rated recessed lights OR The non- IC rated light fixture will be replaced with an airtight IC - rated fixture or insert OR	Prevent a fire hazard Prevent air leakage through fixture		2003

	The fixture(s) may be replaced with surface mounted fixture and opening sealed OR Air sealing measures as approved by the authority having jurisdiction			
4.1001.1b Enclosure top	The top-fire rated enclosure material will have an R-value of 0.56 or less The top of the enclosure will be left free of insulation	Prevent heat build up		2004
4.1001.1c Clearance	The entire closure will maintain a 3" clearance between the closure and the fixture including wiring, box, and ballast	Keep an air space around the fixture		2005
4.1001.1d Sealants and weather stripping	Caulk, mastic, or foam will be used on all edges, gaps, cracks, holes, and penetrations of closure material only	To prevent air leakage, completely adhere the sealant to all surfaces to be sealed		2006

4.1001.2 Knob and Tube Wiring

Topic: Attics

Subtopic: General Preparation

Desired Outcome:

Insulation kept away from contact with live wiring

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1001.2a Identifying knob and tube wiring	Contractor, assessor, auditor, or similar will inspect and assess the house to identify knob and tube wiring	Determine if knob and tube wiring exists		2007
4.1001.2b Testing to determine if live	Non-contact testing method will be used to identify live wiring	Ensure safety of occupants, workers, and house Plan where remediation is needed		2008
4.1001.2c Isolate or replace	Proper clearance will be maintained around live knob and tube as required	Ensure work can be completed safely Protect occupant and house Ensure future work can be done safely		2009

	by the National Electrical Code (NEC) or authority having jurisdiction When required, a dam that does not cover the top will be created to separate insulation from the wire path	Prevent the overheating of the wiring		

4.1001.3 Fireplace Chimney and Combustion Flue Vents

Topic: Attics

Subtopic: General Preparation

Desired Outcome: Combustible materials kept away from combustion sources

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1001.3a Verify attic prep	Holes, penetrations, and bypasses will be sealed Dams will be fixed in places that maintain required clearance	Prevent air leakage Ensure insulation dams maintain clearance		2010
4.1001.3b Required clearance	A rigid dam having a height to ensure a 3" clearance area free of insulation or combustibles between combustion flue vent and dam, unless the flue vent is listed for a lesser clearance	Ensure dam material does not bend, move, or sag Prevent a fire hazard		2011
4.1001.3c Safety	Insulation will not be allowed between a heat-generating appliance and a dam unless material is rated for contact with heat generating sources	Prevent a fire hazard		2012
4.1001.3d Occupant education	Documentation of material and R-value will be provided to occupant	Provide occupant with documentation of installation		2013

4.1001.4 Vented Eave or Soffit Baffles

Topic: Attics

Subtopic: General Preparation

For supporting material, see Building America Solution Center.

Desired Outcome: Attic ventilation meets code requirements and insulation is protected from wind washing

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1001.4a Installation	If soffit venting or eave venting is present, baffles will be mechanically fastened to block wind entry into insulation or to prevent insulation from blowing back into the attic If soffit venting or eave venting is present, baffles will be installed to maintain clearance between the roof deck and baffle in accordance with manufacturer specifications Installation will allow for the highest possible R-value above the top plate of the exterior wall	Ensure insulation R-value is not reduced Maintain attic ventilation		2014

4.1001.5 Dense Pack Preparation

Topic: Attics

Subtopic: General Preparation

Desired Outcome: Proper material density achieved safely and cleanly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1001.5a Preparation	Lead safety procedures will be followed Cavities will be free of hazards, intact, and able to support dense pack pressures All escape openings will be blocked for material Access will be gained and each cavity will be probed, locating all attic floor joists and blockers Interior will be masked and dust controlled during drilling when accessing from interior, shrouds and containment devices are recommended Electricity supply will be confirmed and will support blowing machine power demand Blowing machine pressure test will be performed with air on full, feed off, agitator running, and gate closed Hose outlet pressure will be at least 80" of water column (IWC) or 2.9 pounds per square inch (psi) for cellulose insulation; for other types of dense pack insulation, check	Prevent damage to house Provide thorough access to allow 100% coverage Use proper equipment and process to achieve consistent density, prevent settling, and retard air flow through cavities		2015

	manufacturer specifications for blowing machine set up			

4.1001.6 Unvented Roof Deck—Preparation for Spray Polyurethane Foam

Topic: Attics

Subtopic: General Preparation

Desired Outcome: Backstop provided to prevent SPF from entering soffit areas

For supporting material, see Referenced Standards, General Information on Spray Polyurethane Foam (SPF) and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1001.6a Surface preparation	Underside of roof deck will be prepared by sealing penetrations Roof deck will be free of contaminants to ensure adhesion of foam	Ensure proper bonding of SPF to substrate surfaces		2016
4.1001.6b Installation of insulation dams	Dams will be fastened to underside of roof deck and outside edge of exterior wall top plate to prevent SPF insulation from entering soffit area Installation will allow for the highest possible R-value above the top plate of the exterior wall	Ensure insulation R-value is not reduced Minimize waste of SPF Ensure continuous insulation and air seal of exterior wall top plate and roof deck		2017
4.1001.6c Elimination of attic venting	All gable vents, ridge vents, and roof vents will be covered with suitable backstop material to provide substrate for SPF application	Remove ventilation points when converting from vented to unvented attic		2018
4.1001.6d Removal of existing insulation and vapor retarder	All existing attic floor insulation and vapor retarder will be removed	Ensure the new conditioned space is coupled with the house		2019

4.1001.7 Vented Roof Deck—Preparation for SPF

Topic: Attics

Subtopic: General Preparation

Desired Outcome: Backstop or substrate provided to prevent SPF from entering soffit areas while ensuring required attic ventilation is provided

For supporting material, see Referenced Standards, General Information on Spray Polyurethane Foam (SPF), Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1001.7a Surface preparation	All surfaces where SPF is applied will be clean, dry, and free of contamination and degradation Substrate surfaces will be wiped, blown, or vacuumed to be free of excessive dust and dirt Grease and oil will be removed using appropriate cleaners or solvents Moisture content of all wood substrate materials will be checked to ensure it is below 20%	Ensure proper bonding of SPF to substrate surfaces		2020
4.1001.7b Installation of vent chutes	Vent chutes will be installed between all rafters or trusses to ensure a continuous ventilation path between the eave or soffit area and the ridge or roof vent Vent chutes will penetrate dams as needed	Allow ventilation of underside of roof deck sheathing while creating an unvented, conditioned attic space		2021
4.1001.7c Installation of insulation dams	Dams will be fastened to underside of roof deck and outside edge of exterior wall top plate to prevent SPF insulation from entering soffit area Installation will allow for the highest possible R-value above the top plate of the exterior wall	Ensure insulation R-value is not reduced Minimize waste of SPF Provide a ventilation path from eave or soffit to ridge vent when a vented roof deck is required Ensure continuous insulation and air seal of top plate and roof deck		2022
4.1001.7d Removal of existing insulation and vapor retarder	All existing attic floor insulation and vapor retarder will be removed	Ensure the new conditioned space is coupled with the house		2023

4.1002.1 Above Roof Deck Insulation: Preparation

Topic: Attics

Subtopic: Above Roof Deck Insulation

Desired Outcome: Roof covering removed and replaced to expose roof deck for installation of above roof deck insulation

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1002.1a Roof covering removal	Existing roof covering will be removed	Expose existing roof deck to prepare for installation of above roof deck insulation		2024
4.1002.1b Roof covering replacement	New roof covering will be installed in accordance with manufacturer specifications and local building code requirements after installation of above roof deck insulation	Install roof covering correctly Meet local code requirements		2025

4.1002.2 Above Deck Roof Deck Insulation: Installation

Topic: Attics

Subtopic: Above Roof Deck Insulation

Desired Outcome: Properly installed roof deck insulation

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1002.2a Sealing	Holes, gaps, and penetrations in existing roof deck will be sealed	Prevent air leaks		2026
4.1002.2b Installation	Insulation will be installed according to manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Install insulation properly		2027
4.1002.2c Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and settled thickness (settled thickness required for loose-fill only) ☐ Number of bags installed in accordance with manufacturer specifications (for loose-fill only)	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2028

4.1003.1 Pitched/Vaulted/Cathedralized Ceilings—Loose Fill Over

Topic: Attics

Subtopic: Attic Ceilings

Desired Outcome: Reduce the rate of heat transfer through cathedral or vaulted ceiling

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.1a Ventilation	Venting will be continuous, if applicable	Ensure capacity to increase R-value while not altering ventilation		2029
4.1003.1b Lighting	Existence of rated insulation contact can lights, which allow for insulation encapsulation, will be verified Non-insulation contact rated can lights will not be insulated	Prevent a fire hazard		2030
4.1003.1c Installation	When using cellulose, stabilized product is preferred when available On roof pitches less than 6/12, loose fill cellulose can be used; on roof pitches greater than 6/12, install non-woven polypropylene netting (webbing) baffles of the same height as the insulation every 6' across slope to prevent the loose fill insulation from sliding downward, or dense pack cellulose above webbing stapled to the bottom (underside) of the rafters Loose fill fiberglass will only be used on a slope less than or equal to a 6/12 pitch or the slope application approved by the manufacturer, whichever is less (dense packed fiberglass at slopes greater than 6/12 may be used) Roof cavities will be insulated with loose fill according to manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Ensure appropriate material and application Insulate to prescribed R-value		2031
4.1003.1d Occupant education	A dated receipt signed by the installer will be provided that includes: □ Insulation type □ Coverage area □ R-value □ Installed thickness and minimum settled thickness □ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2032

4.1003.2 Pitched/Vaulted/Cathedralized Ceilings—Dense Pack Over

Topic: Attics

Subtopic: Attic Ceilings

Desired Outcome: Insulation reduces heat transfer through ceiling and closed attic sections as well as framing cavities inaccessible to other treatments

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.2a Fill slant ceilings	Using fill tube, 100% of each cavity will be filled to a consistent density: Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot Loose fiberglass material will be installed and will be specifically approved for air flow resistance per manufacturer's recommendation The number of bags installed will be confirmed and will match the number required on the coverage chart Insulation will be verified to prevent visible air movement at 50 pascals of pressure difference using chemical smoke, IR scans, or other approved verification method.	Ensure complete and consistent coverage throughout ceiling plane Eliminate voids and settling Minimize framing cavity air flows		2033
4.1003.2b Onsite documentation	A dated receipt signed by the installer will be provided that includes: • Coverage area • Thickness • R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6780

4.1003.3 Unvented Flat Roof with Existing Insulation

Topic: Attics

Subtopic: Attic Ceilings

For supporting material, see Building America Solution Center.

Desired Outcome: Insulation reduces heat flow through unvented roof

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.3a Ventilation	Code compliant ventilation will be installed before insulation	Reduce possibility of moisture issues		2034
4.1003.3b Installation	Roof cavities will be blown with loose fill insulation (or roof cavities will be dense packed with insulation) without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2035
4.1003.3c Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and minimum settled thickness ☐ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2036

4.1003.4 Cape Cod Side Attic Roof—Dense Pack Installation

Topic: Attics

Subtopic: Attic Ceilings

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.4a Vapor barrier removal	Vapor barriers will be removed from existing attic floor	Ensure the new conditioned space is coupled with the house		2037
4.1003.4b Netting, fabric, rigid sheathing	When using netting or fabric, staples will be placed in accordance with manufacturer specifications, whichever is more stringent Netting or fabric will meet local fire codes Rigid materials will close the cavity	Secure insulation		2038
4.1003.4c Installation	Roof cavities will be dense packed with loose fill insulation in accordance with manufacturer density specifications Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2039

4.1003.4d Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and minimum settled thickness ☐ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2040
4.1003.4e Occupant education	Documentation of material and R-value will be provided to occupants	Provide occupant with documentation of installation		2041

4.1003.5 Unvented Roof Deck—Spray Polyurethane Foam Installation

Topic: Attics

Subtopic: Attic Ceilings

Desired Outcome: Reduced heat transfer and air leakage through roof and closed attic sections as well as framing cavities inaccessible to other treatments

For supporting material, see Calculation of the Infiltration Credit, General Information on Spray Polyurethane Foam (SPF), Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.5a Installation	Insulation will be installed to prescribed R-value in accordance with manufacturer specifications SPF will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer, onto roof sheathing between rafters or trusses When desired, underside of rafters or trusses will be covered with SPF to provide layer of continuous insulation Upper vent openings will be covered with SPF, including ridge, roof, and gable that are covered with a substrate In colder climates (IECC Zones 5-8), SPF will be installed to a thickness of least Class II vapor retarder or have at least Class II	Ensure complete and consistent coverage throughout roof plane Eliminate cracks, gaps, and voids Improve structural integrity of roof deck (closed cell SPF only) Ensure alignment of insulation and air barrier		2042

	vapor retarder coating or covering in direct contact with the underside of the SPF			
4.1003.5b Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2043
4.1003.5c Occupant education	Documentation of material and R-value will be provided to occupant	Provide occupant with documentation of installation		2044

4.1003.6 Vented Roof Deck—Spray Polyurethane Foam Installation

Topic: Attics

Subtopic: Attic Ceilings

Desired Outcome: Reduced heat transfer and air leakage through roof and closed attic sections as well as framing cavities inaccessible to other treatments

For supporting material, see Calculation of the Infiltration Credit, General Information on Spray Polyurethane Foam (SPF), Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.6a Installation	Insulation will be installed at the ceiling level to prescribed R-value in accordance with manufacturer specifications SPF will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer, onto roof sheathing between rafters or trusses In colder climates (IECC Zones 5-8), SPF will be installed to a thickness of least Class II vapor retarder or have at least Class II vapor retarder coating or covering in direct contact with the underside of the SPF	Ensure complete and consistent coverage throughout ceiling plane Eliminate cracks, gaps, and voids Ensure alignment of insulation and air barrier		2045
4.1003.6b Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2046

4.1003.6c Occupant education	Documentation of material and R-value will be provided to occupant	Provide occupant with documentation of installation		2047

4.1003.7 Ignition and Thermal Barriers—Spray Polyurethane Foam

Topic: Attics

Subtopic: Attic Ceilings

Desired Outcome: Meet building code requirements for fire protection of spray polyurethane foam

For supporting material, see Referenced Standards, General Information on Spray Polyurethane Foam (SPF) and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1003.7a Identify fire safety requirements	Meet or exceed local fire safety requirements for installation of SPF foam Consult local codes to ensure installation complies with fire safety requirements If code requirements are unclear, consult local code officials for clarification	Ensure SPF installed in attic meets fire safety requirements		2048
4.1003.7b Installation of ignition barrier	If attic is to be used only for the service of utilities, foam will be separated from the attic space using a suitable ignition barrier covering or coating Check manufacturer specifications and/or local codes for appropriate ignition barrier coatings/materials	Protect SPF insulation in the attic to minimize possibility of ignition and combustion		2049
4.1003.7c Installation of thermal barrier	If attic is to be used for storage or occupancy, spray foam will be separated from the attic space using thermal barrier material (e.g., ½" gypsum wallboard) Consult manufacturer specifications and local codes for approved ignition/thermal barrier, materials, or coatings	Protect SPF insulation in the attic to minimize possibility of ignition and combustion		2050
4.1003.7d Occupant education	Documentation of ignition or thermal barrier material installation and limitations on attic use, if any, will be provided	Provide occupant with documentation of installation		2051

4.1004.1 Preparation for Dense Packing

Topic: Attics

Subtopic: Knee Walls

Desired Outcome: Airtight cavity and insulated knee wall

For supporting material, see Calculation of the Infiltration Credit, General Information on Spray Polyurethane Foam (SPF), Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1004.1a Backing	All knee walls will have top and bottom plate or blockers installed using rigid materials When knee wall floor and walls are being insulated, the floor joist running under the knee wall will be air sealed If fabric is used before dense packing, it will be secured, according to manufacturers specifications or with furring strips every wall stud If rigid material is used, material will be installed to cover 100% of the surface of the accessible knee wall area If foam sheathing is used, sheathing will be listed for uncovered use in an attic or covered with a fire barrier	Eliminate bending, sagging, or movement that may result in air leakage Prevent air leakage through the top or bottom of the knee wall Ensure material will not tear under stress from wind loads or insulation		2052
4.1004.1b Installation	All existing batted insulation will be adjusted to ensure it is in full contact with the interior cladding and the top and bottom plates Insulation that is blown behind fabric or air barrier material will be blown dense to a minimum specification of 3.5 pounds per cubic foot for cellulose Follow manufacturer's requirements for fiberglass dense pack applications	Eliminate misalignment of existing insulation Prevent insulation from settling or moving		2053

4.1004.2 Preparation for Batt Insulation

Topic: Attics

Subtopic: Knee Walls

For supporting material, see Building America Solution Center.

Desired Outcome: Airtight cavity and properly insulated knee wall

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1004.2a Knee wall prep for batts	All knee walls will have a top and bottom plate or blockers installed using a Rigid material All joints, cracks, and penetrations will be sealed in finished material, including interior surface to framing connections When knee wall floor and walls are being insulated, the floor joist running under the knee wall will be air sealed.	Eliminate bending, sagging, or movement that may result in air leakage Prevent air leakage through the top or bottom of the knee wall Create an air barrier		2054
4.1004.2b Installation	Insulation will be installed using one of the following methods: New batts will be installed in accordance with manufacture specifications All existing batted insulation will be adjusted to ensure it is in full contact with the interior cladding and the top and bottom plates	Eliminate misalignment of existing insulation		2055
4.1004.2c Backing knee wall	If rigid material is used, material will be installed to cover 100% of the surface of the knee wall If foam sheathing is used, sheathing will be listed for uncovered use in attic, or covered with a fire barrier	Prevent insulation from settling or moving		2056

4.1004.3 Strapping for Existing Insulation

Topic: Attics

Subtopic: Knee Walls

Desired Outcome: Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1004.3a Sealing	Holes and penetrations will be sealed Bypasses will be blocked and sealed	Prevent air leakage		2057
4.1004.3b Installation	Insulation will be installed in full contact with all sides of existing cavity without gaps, voids, compressions, misalignments, or wind intrusions	Insulate to prescribed R-value		2058

4.1004.3c Attachment	Strapping material will have a minimum expected service life of 20 years	Maintain alignment		2059
4.1004.3d Occupant education	Documentation of material and R-value will be provided to occupant	Provide occupant with documentation of installation		2060

4.1004.4 Knee Wall Without Framing

Topic: Attics

Subtopic: Knee Walls

Desired Outcome: Consistent uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1004.4a Sealing	Holes and penetrations will be sealed Bypasses will be blocked and sealed	Prevent air leakage		2061
4.1004.4b Flat cavity present	Gap between framing and existing air barrier will be insulated	Create a flat insulated surface		2062
4.1004.4c Installation	A rigid insulated sheathing will be mechanically fastened to code required R-value Seams will be sealed	Insulate to prescribed R-value		2063
4.1004.4d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2064

4.1004.5 Knee Walls and Gable End Walls—Preparation for and Installation of Spray Polyurethane Foam (SPF)

Topic: Attics

Subtopic: Knee Walls

Desired Outcome: Airtight and insulated knee and gable end walls

For supporting material, see General Information on Spray Polyurethane Foam (SPF), Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1004.5a Installation of backing	Knee walls will have a top and bottom plate or blockers installed using a rigid material A suitable backstop material attached to the back of the knee wall will be used to support the application of SPF If foam sheathing is used as a backstop, sheathing will be listed for uncovered use in an attic or covered with an ignition barrier, thermal barrier, or approved alternate assembly	Provide a backstop or substrate for application of SPF		2065
4.1004.5b Installation	Insulation will be installed to prescribed R-value Using SPF application, SPF will be applied to desired thickness onto substrate material from top to bottom plate between studs using pass thickness maximum in accordance with manufacturer specifications In colder climates (IECC Zones 5-8), the SPF will be installed to a thickness of at least Class II vapor retarder or have at least Class II vapor retarder coating or covering in direct contact with the interior of the SPF	Eliminate cracks, gaps, and voids Minimize framing cavity air flows Minimize moisture migration and unwanted condensation in insulation (vapor retarders) Ensure alignment of insulation and air barrier		2066
4.1004.5c Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6786

4.1005.1 Accessible Floors—Batt Installation

Topic: Attics

Subtopic: Attic Floors

For supporting material, see Building America Solution Center.

Desired Outcome: Consistent, thermal boundary between conditioned and unconditioned space controls the heat flow

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1005.1a Preparation	Subfloor or drywall will be removed to access cavities as necessary, including inaccessible knee-wall attic floor spaces All electrical junctions will be flagged to be seen above the level of the insulation Open electrical junction boxes will have covers installed	Access the workspace Provide location of electrical junctions for future servicing Prevent an electrical hazard		2067
4.1005.1b Installation	Batt insulation will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to the prescribed R-value	Insulate to prescribed R-value		2068
4.1005.1c Occupant education	A dated receipt signed by the installer will be provided that includes: □ Coverage area □ Thickness □ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2069

4.1005.2 Accessible Floors—Loose Fill Installation

Topic: Attics

Subtopic: Attic Floors

Desired Outcome: Consistent, thermal boundary between conditioned and unconditioned space controls the heat flow

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1005.2a Preparation	Subfloor or drywall will be removed to access cavities as necessary, including inaccessible knee-wall attic floor spaces Insulation will be adequately marked for depth a minimum of every 300 square feet of attic area, with measurement beginning at the air barrier All electrical boxes will be flagged to be seen above the level of the insulation Open electrical junctions will have covers installed	Access the workspace Verify uniformity of insulation material Provide location of electrical boxes for future servicing Prevent an electrical hazard		2070

	Insulation dams and enclosures will be installed as required			
4.1005.2b Air barrier	Existence of air barrier material in line with the knee walls will be installed or verified when dense packing Air barrier material will not bend, sag, or move once dense packed	Hold dense pack in place		2071
4.1005.2c Installation	All insulation will be installed to the minimum unsettled depth and the maximum coverage per bag to reach a consistent depth for desired R-value indicated on the manufacturer's coverage chart.	Reduce heating and air conditioning costs Improve comfort Minimize noise		2072
4.1005.2d Onsite documentation	A dated receipt signed by the installer will be provided that includes: Insulation type Coverage area R-value Installed thickness and settled thickness Number of bags installed in accordance with manufacturer specification	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2073
4.1005.2e Occupant education	Documentation of material and R-value will be provided to occupants	Provide occupant with documentation of installation		6990

4.1005.3 Accessible Floors—Batt Insulation Over Existing Insulation

Topic: Attics

Subtopic: Attic Floors

For supporting material, see Building America Solution Center.

Desired Outcome: Insulation controls heat transfer through ceiling

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1005.3a Preparation	Existing insulation will be in contact with the air barrier prior to installing additional insulation on top	Ensure proper performance of insulation		2074
4.1005.3b Installation	If the top of the existing insulation is below the top of the framing, new batts will be installed parallel with framing members	Ensure uniform depth of insulation in continuous contact with existing insulation Eliminate voids and gaps		2075

	If the top of the existing insulation is above the top of the framing, new batts will be installed perpendicular to framing members			
4.1005.3c Insulation	Batts will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2076
4.1005.3d Safety	Insulation will not be allowed on top of non-IC rated can light boxes or between a heat generating appliance and a dam, unless material is rated for contact with heat generating sources	Prevent a fire hazard		2077
4.1005.3e Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2078

4.1005.4 Accessible Floors—Loose Fill Over Existing Insulation

Topic: Attics

Subtopic: Attic Floors

Desired Outcome: Insulation controls heat transfer through ceiling

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1005.4a Preparation	Existing insulation will be in contact with the air barrier prior to installing additional insulation on top Insulation will be adequately marked for depth a minimum of every 300 square feet of attic area, with measurement beginning at the air barrier All electrical junction boxes will be flagged to be seen above the level of the insulation	Ensure proper performance of insulation Verify uniformity of insulation material Provide location of electrical junctions for future servicing Prevent an electrical hazard		2079

	Open electrical junction boxes will have covers installed Insulation dams and enclosures will be installed as required			
4.1005.4b Installation	The correct depth and number of bags will be blown in accordance with manufacturer specifications Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2080
4.1005.4c Safety	Insulation will not be allowed on top of non-IC rated can light boxes or between a heat-generating appliance and a dam, unless material is rated for contact with heat generating sources	Prevent a fire hazard		2081
4.1005.4d Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and minimum settled thickness ☐ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2082

4.1005.5 Enclosed Bonus Room Floor Over Unconditioned Space—Dense Pack Installation

Topic: Attics

Subtopic: Attic Floors

Desired Outcome: A consistent thermal boundary between conditioned and unconditioned space controls the heat flow

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1005.5a Air barrier	Existence of air barrier material in line with the knee walls will be installed or verified when dense packing Air barrier material will not bend, sag, or move once dense packed	Hold dense pack in place		2083
4.1005.5b Fill floors	Each cavity will be 100% filled to consistent density:	Eliminate voids and settling Minimize framing cavity air flows		2084

	Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot or to a maximum density structurally allowable Loose fiberglass material will be installed and will be specifically approved for air flow resistance to a minimum density per the manufacturer's recommendations The number of bags installed will be confirmed and will match the number required on the coverage chart Insulation will be verified to prevent visible air movement at 50 pascals of pressure difference using chemical smoke or other approved verification method by the authority having jurisdiction			
4.1005.5c Safety	Insulation will not be allowed on top of non-IC rated can light boxes or between a heat-generating appliance and a dam, unless material is rated for contact with heat generating sources	Prevent a fire hazard		2085
4.1005.5d Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2086

4.1005.6 Enclosed Attic Storage Platform Floor—Dense Pack Installation

Topic: Attics

Subtopic: Attic Floors

Desired Outcome: Insulation reduces heat flow through floor and framing cavities inaccessible to other treatments

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1005.6a Fill floors	Each cavity will be 100% filled to consistent density:	Eliminate voids and settling Minimize framing cavity air flows		2087

	Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot or to a maximum density structurally allowable Loose fiberglass material will be installed and will be specifically approved for air flow resistance to a minimum density per the manufacturer's recommendations The number of bags installed will be confirmed and will match the number required on the coverage chart Insulation will be verified to prevent visible air movement at 50 pascals of pressure difference using chemical smoke or other approved verification method by the authority having jurisdiction			
4.1005.6b Safety	Insulation will not be allowed on top of non-IC rated can light boxes or between a heat generating appliance and a dam, unless material is rated for contact with heat generating sources	Prevent a fire hazard		2088
4.1005.6c Onsite documentation	A dated receipt signed by the installer will be provided that includes: □ Coverage area □ Thickness □ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2089
4.1005.6d Occupant education	Documentation of material and R-value will be provided to occupants	Provide occupant with documentation of installation		6967

4.1005.7 Attic Floor—Preparation and Installation of Spray Polyurethane Foam (SPF)

Topic: Attics

Subtopic: Attic Floors

Desired Outcome: Consistent, thermal boundary and air barrier between conditioned and unconditioned space controls the heat flow and air leakage

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1005.7a Preparation	Subfloor or drywall will be removed to access cavities as necessary (e.g., beneath attic knee walls) All electrical junctions will be flagged to be seen above the level of the insulation Open electrical junction boxes will have covers installed	Access the workspace Provide location of electrical junctions for future servicing Prevent an electrical hazard		2090
4.1005.7b Installation	Insulation will be installed to prescribed R-value SPF will be applied to desired thickness onto attic floor to ceiling material below between attic floor joists using pass thickness maximum as indicated by manufacturer	Insulate to prescribed R-value		2091
4.1005.7c Safety	Spray foam should never be installed over light fixtures regardless of if fixture is rated for IC or not. Nor between a heat-generating appliance and a dam, unless material is rated for contact with heat-generating sources.	Prevent a fire hazard		2092
4.1005.7d Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2093
4.1005.7e Occupant education	Documentation of material and R-value will be provided to occupant	Provide occupant with documentation of installation		2094

4.1006.1 Pull-Down Stairs

Topic: Attics

Subtopic: Attic Openings

Desired Outcome: Pull-down attic stair properly sealed and insulated

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1006.1a Installation	Top-side of the attic enclosure will be insulated to the maximum R-value structurally allowable up to	Achieve uniform R-value Prevent loose insulation from entering the living area		2095

	the R-value of the adjoining insulated assembly Pull-down stair rough opening will be surrounded with a durable, rigid dam that is higher than the level of the attic floor insulation Counter-weights should be considered to ease accessibility for excessively heavy hatches			
4.1006.1b Sealing	Entire pull-down stair assembly will be covered with an airtight and removable/openable enclosure inside the attic space Pull-down stair frame will be caulked, gasketed, weatherstripped, or otherwise sealed with an air barrier material, suitable film, frictionally engaging components or solid material that allows attic door operation	Prevent air leakage		2096
4.1006.1d Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2098

4.1006.2 Access Doors and Hatches

Topic: Attics

Subtopic: Attic Openings

Desired Outcome: Attic access door properly sealed and insulated

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1006.2a Installation	Hatches will be insulated to the maximum R-value structurally allowable up to the R-value of the adjoining insulated assembly Attic hatches rough opening will be surrounded with a durable, rigid protective baffle that is higher than the level of the surrounding attic floor insulation	Achieve uniform R-value on the attic door or hatch Achieve uniform R-value on the attic floor Prevent loose attic floor insulation from entering the living area		2099

4.1006.2b Sealing	Access hatch frames will be sealed using caulk, gasket, weather-strip, or otherwise sealed with an air barrier material, suitable film, or solid material Options will include installing a latch or lock or frictionally engaged components that do not require a latch The measure must include a protective baffle or insulation barrier	Prevent air leakage		2100
4.1006.2c Attachment	Insulation will be permanently attached and in complete contact with the air barrier	Insulate to prescribed R-value		2101
4.1006.2e Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2103

4.1006.3 Whole-House Fan

Topic: Attics

Subtopic: Attic Openings

For supporting material, see Building America Solution Center.

Desired Outcome: Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value of an adjoining insulated assemb

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1006.3a Installation	Sides of fan insulation box assembly will be insulated to the same R-value as adjoining insulated assembly	Insulate to prescribed R-value		2104
4.1006.3b Air sealing	Fan insulation box frame will be continuously weatherstripped to ensure a tight fit Fan insulation box will be constructed at a depth to protect the fan housing and motor from insulation	Prevent air leakage		2105
4.1006.3c Attachment	Non-compressible insulation will be permanently attached in contact with fan insulation box	Ensure continuous alignment with air barrier		2106

	Appropriate adhesive or mechanical fastener will be used			
4.1006.3d Durability	Material integrity will meet a minimum expected service life of 20 years	Ensure a minimum expected service life		2107
4.1006.3e Occupant education	Purpose of insulation will be communicated to occupant	Educate occupant on how to use the whole-house fan to ensure integrity of the fan insulated assembly throughout service life		2108

4.1088.1 Attic Ventilation

Topic: Attics

Subtopic: Special Considerations

Desired Outcome: Properly restored vents minimize moisture and ice dams

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1088.1a Air barrier and thermal boundary	Attic ventilation will be recommended or installed if local code requires attic ventilation during weatherization or retrofits The presence of an effective air barrier and thermal boundary between the attic and the living space must be verified and appropriate attic sealing and proper insulation is specified as part of the scope of work	Ensure presence of continuous air barrier and thermal boundary		2109
4.1088.1b Vent type	Attic vent types will be made of corrosion-resistant material for their specific location (e.g., exterior soffit, gable end, roof) and material and intended use (e.g., metal vent on metal roof) Attic-powered ventilators will not be used	Ensure vent meets proper performance characteristics for location and roofing type		2110
4.1088.1c Vent location	Placement of attic vents will be considered for proper air flow and prevention of entry of wind driven rain or snow	Encourage proper air flow Minimize entry of wind driven rain or snow		2111
4.1088.1d Ventilation baffling	Baffling for attic soffit vents will be installed to: Ensure proper air flow Prevent wind washing of insulation Allow maximum insulation coverage	Ensure vent allows proper air flow without compromising insulation performance		2112

	Ensure baffle terminates above insulation			
4.1088.1e Ventilation screens	All attic ventilation will have screens with non-corroding wire mesh with openings of 1/16" to 1/4" to prevent pest entry (e.g., birds, bats, bees) Existing vents that are not screened will be covered with non-corroding wire mesh with openings of 1/16" to 1/4" Ensure net free area requirements are met Additional vents or larger vents can be added if screen size is smaller than designated	Prevent pest entry		2113

4.1088.2 Radiant Barrier

Topic: Attics

Subtopic: Special Considerations

For supporting material, see Building America Solution Center.

Desired Outcome: Radiant heat flow reduced

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1088.2a Stapling	An air space no less than ¾" will be maintained between the barrier and the bottom of the roof deck	Ensure performance of radiant barrier		2114
4.1088.2b Ventilation	A minimum of 3" clearance from soffit vents and ridge vents will be maintained	Allow for air flow behind barrier		2115
4.1088.2c Gable walls	Radiant barrier will apply to gable walls while maintaining a ¾" air space Radiant barrier will not block gable vents	Ensure performance of radiant barrier		2116
4.1088.2d Porch and garage attic spaces	Radiant barrier will be installed to separate the attic above conditioned space from adjacent attics Radiant barrier will be installed to withstand local wind loads	Reduce radiant heat entry Ensure durability		2117
4.1088.2e Onsite documentation	A dated receipt signed by the installer will be provided that includes: Number and thickness of air spaces R-value Direction of heat flow	Document job completion to contract specifications Comply with 16 CFR 460.17		6788

4.1088.3 Skylights

Topic: Attics

Subtopic: Special Considerations

Desired Outcome: Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1088.3a Sealing	Holes and penetrations will be sealed Bypasses will be blocked and sealed	Prevent air leakage		2118
4.1088.3b Installation	Insulation will be installed in accordance with manufacturer specifications and will be in full contact with all sides of existing cavity without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2119
4.1088.3c Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and settled thickness (settled thickness required for loose-fill only) ☐ Number of bags installed in accordance with manufacturer specifications (for loose-fill only)	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2120

4.1088.4 Parapet Walls—Dense Pack

Topic: Attics

Subtopic: Special Considerations

Desired Outcome: Properly installed insulation reduces heat flow through parapet wall

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1088.4a Access	Proper access in wall exterior or interior containment area will be ensured	Protect worker and occupant health		2121

	Lead safety procedures in houses built before 1978 will be followed in accordance with EPA Healthy Indoor Environment Protocols for Home Energy Upgrades			
4.1088.4b Installation	Dense pack insulation will be installed in accordance with manufacturer specifications at void area	Seal wall		2122
4.1088.4c Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6790

4.1088.5 Parapet Walls—Spray Polyurethane Foam (SPF)

Topic: Attics

Subtopic: Special Considerations

Desired Outcome: Properly installed insulation reduces heat flow through parapet wall

For supporting material, see Calculation of the Infiltration Credit, General Information on Spray Polyurethane Foam (SPF) and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1088.5a Access	Proper access in wall exterior or interior containment area will be ensured Lead safety procedures in houses built before 1978 will be followed in accordance with EPA Healthy Indoor Environment Protocols for Home Energy Upgrades	Protect worker and occupant health		2123
4.1088.5b Installation	SPF insulation will be installed in accordance with manufacturer specifications at void area	Seal and insulate wall		2124
4.1088.5c Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6792

4.1101.1 Exterior Wall Dense Packing

Topic: Walls

Subtopic: Preparation

Desired Outcome: Walls properly prepared to receive dense pack insulation

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1101.1a Preparation	Lead and asbestos safety procedures will be followed Cavities will be free of hazards, intact, and able to support dense pack pressures Drilling hazards (e.g., wiring, venting, fuel piping) will be located Blocking will be installed around: All openings to inside crawl space and basement for fibrous material High temperature fire-rated materials Wiring and electrical hazards Heat sources Access to exterior wall cavities will be gained, sheathing will be drilled as needed and probed to locate each cavity, wall studs, and blockers Interior will be masked and dust controlled during drilling when accessing from interior Electricity supply will be confirmed and will support blowing machine power demand Blowing machine pressure test will be performed with air on full, feed off, agitator running, and gate closed Hose outlet pressure will be at least 80 IWC or 2.9 psi for cellulose insulation; for other types of dense pack insulation, check manufacturer specification for blowing machine set up	Prevent damage to house Provide a clean work space Provide thorough access to allow 100% coverage Ensure proper equipment and process results in consistent density Prevent settling and retard air flow through cavities Protect worker and occupant health		2125
4.1101.1b Exterior dense pack	Using fill tube, 100% of each cavity will be filled to a consistent density: Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot Loose fiber glass material will be installed and will be specifically	Eliminate voids and settling Minimize framing cavity air flows		2126

	approved for air flow resistance per manufacturer's specifications The number of bags installed will be confirmed and will match the number required on the coverage chart Insulation density will be verified by bag count, core sampling, or infrared camera with the blower door at 50 pascals to prevent visible air movement using chemical smoke at 50 pascals of pressure difference			

4.1101.2 Exterior Wall Insulating Sheathing

Topic: Walls

Subtopic: Preparation

Desired Outcome: Wall cladding removed and replaced to expose wall sheathing for installation of insulating wall sheathing

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1101.2a Wall cladding removal	Existing cladding will be removed Lead and asbestos safety procedures will be followed	Expose existing wall sheathing to prepare for installation of insulating sheathing		2127
4.1101.2b Wall cladding replacement	New cladding will be installed in accordance with manufacturer specifications and local codes after exterior wall insulation is installed	Install wall cladding correctly Meet local codes		2128

4.1101.3 Exterior Wall Spray Polyurethane Foam (SPF)—Masking and Surface Preparation

Topic: Walls

Subtopic: Preparation

Desired Outcome: Finished surfaces are protected and SPF has a suitable surface to adhere to

For supporting material, see Referenced Standards, General Information on Spray Polyurethane Foam (SPF), Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1101.3a Surface protection	Finished surfaces that should not be covered with SPF (e.g., windows, doors) will be identified Surfaces will be covered or sealed with appropriate material (e.g., plastic film, masking tape) to protect from SPF overspray	Prevent overspray and potential damage to finished surfaces		2129
4.1101.3b Substrate repair	Cracks, gaps, and holes in the substrate will be covered or sealed in accordance with manufacturer specifications with appropriate material	Prevent waste of SPF Prevent overspray into adjacent areas		2130
4.1101.3c Substrate cleaning	All surfaces where SPF is applied will be clean, dry, and free of contamination and degradation Substrate surfaces will be wiped, blown, or vacuumed to be free of excessive dust and dirt Grease and oil will be removed using appropriate cleaners or solvents Moisture content of all wood substrate materials will be checked to ensure it is below 20%	Ensure proper bonding of SPF to substrate surfaces		2131

4.1101.4 Exterior Wall Spray Polyurethane Foam (SPF)—Electrical System Considerations

Topic: Walls

Subtopic: Preparation

Desired Outcome: Outlet, junction, switch, and light fixture boxes and existing wiring are protected from SPF

For supporting material, see Referenced Standards, General Information on Spray Polyurethane Foam (SPF) and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1101.4a Box protection	All front and back openings of all outlet, switch, and light fixture boxes will be covered with masking tape All electrical junction boxes will be accessible after the installation of SPF Open electrical junction boxes will have covers installed	Prevent SPF from covering any switches and outlets and from entering the inside of any electrical box		2132

4.1102.1 Open-Cavity Wall Insulation—General

Topic: Walls

Subtopic: Accessible Walls

Desired Outcome: Consistent, uniform thermal boundary between the conditioned space and unconditioned space to prescribed R-value

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1102.1a Sealing	Holes and penetrations will be sealed Bypasses will be blocked and sealed	Prevent air leakage		2133
4.1102.1b Installation	Insulation will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2134
4.1102.1c Pre-drywall verification	Verification of complete installation without gaps, voids, compressions, misalignments, or wind intrusions will be provided	Install insulation correctly		2135
4.1102.1d Onsite documentation	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and settled thickness (settled thickness required for loose-fill only) ☐ Number of bags installed in accordance with manufacturer specifications (for loose-fill only)	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2136

4.1102.2 Open-Cavity Wall—Spray Polyurethane Foam (SPF) Installation

Topic: Walls

Subtopic: Accessible Walls

Desired Outcome: Exterior walls are insulated and sealed

For supporting material, see General Information on Spray Polyurethane Foam (SPF), Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1102.2a Installation	Interior cladding or interior finish material will be removed on areas to be insulated SPF will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer SPF will be applied onto exterior sheathing or interior finish materials between studs and top/bottom plates	Insulate and seal exterior walls		2137
4.1102.2b Vapor retarders	If vapor retarder is needed, it will be applied in proper location In colder climates (IECC Zones 5-8), the SPF used will be installed to a thickness of at least Class II vapor retarder or have at least Class II vapor retarder coating or covering in direct contact with the inside surface of the SPF	Minimize water vapor condensation in walls		2138
4.1102.2c Fire protection	SPF will be separated from the occupied interior spaces of the building with a thermal barrier (typically ½" or thicker gypsum wallboard or approved alternate assembly) Check local codes for fire protection requirements	Provide necessary fire protection for combustible SPF insulation		2139
4.1102.2d Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6796

4.1103.1 Dense Pack Exterior Walls

Topic: Walls

Subtopic: Enclosed Walls

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

For supporting material, see Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1103.1a Exterior dense pack	Using fill tube or an alternative method as approved by the authority having jurisdiction, 100% of each cavity will be filled to a consistent density: Cellulose insulation used in an enclosed cavity will be installed at 3.5 pounds per cubic foot or greater density Blown fiberglass, mineral fiber, or rock and slag wool used in an enclosed cavity will be installed at or above the manufacturer recommended density to limit air flow that corresponds to an air permeance value of 3.5 cfm /sq. ft. at 50 pascals, as measured using ASTM C 522, E 283, or E 2178; the number of bags installed will be confirmed and will match the number required on the coverage chart All holes and penetrations will be plugged and/or sealed Insulation will be verified to prevent visible air movement using chemical smoke at 50 pascals of pressure difference	Eliminate voids and settling Minimize framing cavity air flows		2140
4.1103.1b Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6798

4.1103.2 Additional Exterior Wall Cavities

Topic: Walls

Subtopic: Enclosed Walls

Desired Outcome: Properly installed insulation reduces heat flow through walls and framing cavities inaccessible to other treatments

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1103.2a Location of cavities	Details remaining in or between completed wall sections will be located and accessed	Ensure the last gaps and framing edges in the thermal boundary, roof-wall joints, floor-wall joints, etc., are found and finished		2141
4.1103.2b Sealing	Backing will be provided and all newly uncovered openings will be sealed with air barriers, foam, or mastic, maintaining all required clearances	Ensure the air barrier is connected across all accessible house elements		2142
4.1103.2c Dense packing	Using fill tube, 100% of each cavity will be filled to a consistent density: Cellulose insulation used in an enclosed cavity will be installed at 3.5 pounds per cubic foot or greater density Blown fiberglass, mineral fiber, or rock and slag wool used in an enclosed cavity will be installed at or above the manufacturer recommended density to limit airflow that corresponds to an air permeance value of 3.5 cfm/sq. ft. at 50 pascals, as measured using ASTM , SITE C 522, E 283, or E 2178 The number of bags installed will be confirmed and will match the number required on the coverage chart Insulation will be verified to prevent visible air movement at 50 pascals of pressure difference using chemical smoke or other approved verification method by the authority having jurisdiction	Eliminate voids and settling Minimize framing cavity air flows		2143
4.1103.2d Quality assurance	Completed wall sections will be viewed using infrared camera with blower door operating Any voids or low density areas will be drilled and re-packed	Establish air barrier and thermal boundary Confirm no voids or hidden air flows remain		2144
4.1103.2e Close holes	Installation holes will be plugged as follows: Exterior holes will be weather barrier patched Interior holes will be coated and patched to match original interior surface All construction debris and dust will be collected and removed	Ensure house is returned to watertight and clean condition		2145

4.1103.2f Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6800

4.1103.3 Insulated Sheathing and Insulated Siding Installation

Topic: Walls

Subtopic: Enclosed Walls

For supporting material, see Building America Solution Center.

Desired Outcome: Properly installed insulated wall sheathing and insulated siding

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1103.3a Sealing	Holes, gaps, and penetrations in existing sheathing will be sealed	Prevent air leaks		2146
4.1103.3b Location of wall framing	Wall studs and other framing will be located and marked	Provide secure attachment of insulating sheathing		2147
4.1103.3c Installation	Insulation will be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions Insulation will be installed to prescribed R-value	Install insulation properly		2148
4.1103.3d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2149

4.1301.1 Standard Floor System—Batt Installation

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.1a Sealing	Sealing the floor system will be completed before insulating	Ensure airtight envelope Prevent leakage		2150
4.1301.1b Installation	Insulation will be installed in contact with subfloor without gaps, voids, compressions, misalignments, or wind intrusions If kraft-faced batts are used, they will be installed with kraft facing to subfloor Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2151
4.1301.1c Securing batts	Batts will be secured with physical fasteners	Ensure insulation remains in contact with subfloor		2152
4.1301.1d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2153

4.1301.2 Standard Floor System—Loose Fill with Netting

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.2a Sealing	Sealing the floor system will be completed before insulating	Ensure airtight envelope Prevent leakage		2154
4.1301.2b Netting, fabric	When using netting or fabric, staples will be placed according to manufacturer specifications Netting or fabric will meet local fire codes	Secure insulation		2155
4.1301.2c Installation	Insulation in netted or fabric cavities will be dense packed with loose fill insulation in accordance with manufacturer specifications Insulation will be installed to prescribed R-value Insulation will be in continuous contact with air barrier	Insulate to prescribed R-value Ensure a continuous thermal boundary between conditioned and unconditioned space		2156

4.1301.2d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and minimum settled thickness ☐ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2157

4.1301.3 Standard Floor System—Loose Fill with Rigid Barrier

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.3a Sealing	Sealing the floor system will be completed before insulating	Ensure airtight envelope Prevent leakage		2158
4.1301.3b Rigid air barrier	A rigid air barrier will be mechanically fastened to underside of floor assembly, providing 100% coverage of the floor assembly Seams and penetrations will be sealed	Relocate air barrier		2159
4.1301.3c Installation	Loose fill insulation will be installed between air barrier and subfloor according to manufacturer specifications Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2160
4.1301.3d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and minimum settled thickness ☐ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2161

4.1301.4 Dense Pack Floor System with Rigid Barrier

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.4a Sealing	Sealing the floor system will be completed before insulating	Ensure airtight envelope Prevent leakage		2162
4.1301.4b Rigid air barrier	A rigid air barrier will be mechanically fastened to underside of floor assembly, providing 100% coverage of the floor assembly Seams and penetrations will be sealed	Relocate air barrier		2163
4.1301.4c Installation	Dense pack insulation will be installed between air barrier and subfloor according to manufacturer specifications Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2164
4.1301.4d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2165

4.1301.5 Cantilevered Floor—Batt Installation

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.5a Air barrier	Air barrier will be installed between joists and sealed Air barrier will be placed to the most interior edge of the top plate of the wall below	Separate cantilevered floor from conditioned floor space Allow for insulation		2166

4.1301.5b Installation	Air barrier will be insulated between joist from top plate of the wall below to subfloor above Cantilevered subfloor will be insulated in complete contact with the floor without gaps, voids, compressions, misalignments, or wind intrusions If kraft-faced batts are used, they will be installed with kraft facing to the air barrier Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2167
4.1301.5c Attachment	Batts will be secured with physical fasteners	Ensure insulation remains in contact with subfloor and air barrier		2168
4.1301.5d Exterior soffit	Exterior soffit material will be installed and sealed	Cover and protect insulation		2169
4.1301.5e Occupant education	A dated receipt signed by the installer will be provided that includes: □ Coverage area □ Thickness □ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2170

4.1301.6 Pier Construction Subfloor Insulation—Batt Installation with Rigid Barrier

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal barrier between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.6a Subfloor preparation	Sealing between house and crawl space will be completed before insulating	Ensure airtight envelope Prevent leakage		2171
4.1301.6b Installation	Insulation will be installed in contact with subfloor without gaps, voids, compressions, misalignments, or wind intrusions If kraft-faced batts are used, they will be installed with kraft facing to subfloor Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2172

4.1301.6c Secure batts	Batts will be secured with physical fasteners	Ensure insulation remains in contact with subfloor		2173
4.1301.6d Rigid air barrier	A rigid air barrier will be mechanically fastened to underside of floor assembly Seams and penetrations will be sealed	Protect insulation		2174
4.1301.6e Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Coverage area ☐ Thickness ☐ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2175

4.1301.7 Pier Construction Subfloor Insulation—Loose Fill with Rigid Barrier

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal barrier between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.7a Subfloor preparation	Sealing between house and crawl space will be completed before insulating	Prevent air leakage		2176
4.1301.7b Rigid air barrier	A rigid air barrier will be mechanically fastened to underside of floor assembly, providing 100% coverage of the floor assembly Seams and penetrations will be sealed	Relocate air barrier		2177
4.1301.7c Installation	Loose fill insulation will be installed between air barrier and subfloor according to manufacturer specifications Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2178
4.1301.7d Occupant education	A dated receipt signed by the installer will be provided that includes: ☐ Insulation type ☐ Coverage area ☐ R-value ☐ Installed thickness and minimum settled thickness ☐ Number of bags installed in accordance with manufacturer specifications	Document job completion to contract specifications Confirm amount of insulation installed Ensure ability to match bags required for total area completed Comply with 16 CFR 460.17		2179

4.1301.8 Pier Construction Subfloor Installation—Dense Pack with Rigid Barrier

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Consistent, uniform thermal barrier between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1301.8a Subfloor preparation	Sealing between house and crawl space will be completed before insulating	Prevent air leakage		2180
4.1301.8b Rigid air barrier	A rigid air barrier will be mechanically fastened to underside of floor assembly, providing 100% coverage of the floor assembly Seams and penetrations will be sealed	Relocate air barrier		2181
4.1301.8c Installation	Dense pack insulation will be installed between air barrier and subfloor according to manufacturer specifications Insulation will be installed to prescribed R-value	Insulate to prescribed R-value		2182
4.1301.8d Occupant education	A dated receipt signed by the installer will be provided that includes: □ Coverage area □ Thickness □ R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		2183

4.1301.9 Open Floors Over Unconditioned Space and Cantilevered Floors, Floors Over Garages, Floors Over Unconditioned Crawl Spaces—Spray Polyurethan

Topic: Floors

Subtopic: Accessible Floors

Desired Outcome: Floors over unconditioned spaces (e.g., basements, garages) insulated and sealed

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

4.1301.9a Preparation	All floor areas will be open and accessible for SPF application Cracks, gaps, and holes will be covered or sealed per manufacturer guidelines with appropriate material Insulation dams or end blockers will be installed where needed All surfaces where SPF is applied will be clean, dry, and free of contamination and degradation Substrate surfaces will be wiped, blown, or vacuumed to be free of excessive dust and dirt Grease and oil will be removed using appropriate cleaners or solvents Moisture content of all wood substrate materials will be checked to ensure it is below 20%	Prepare all substrate surfaces for the application of SPF		2184
4.1301.9b Installation	Insulation will be installed to prescribed R-value according to manufacturer specifications SPF will be applied to desired thickness, using pass thickness maximum as indicated by manufacturer, onto subfloor between floor joists and all rim/band joists When desired, underside of joists will be covered with SPF to provide layer of continuous insulation	Insulate and seal floors		2185
4.1301.9c Fire protection	SPF will be separated from the interior occupied space of the building with a 15-minute thermal barrier (typically ½" or thicker gypsum wallboard or approved ignition barrier coating) Check local codes for fire protection requirements	Provide necessary fire protection for combustible SPF insulation		2186
4.1301.9d Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6817

4.1401.1 Band/Rim Joists—Spray Polyurethane Foam (SPF) Installation

Topic: Basements and Crawl Spaces

Subtopic: Band/Rim Joists

Desired Outcome: Insulate and seal all band/rim joist areas between subfloor and foundation or top plate of wall below

For supporting material, see Calculation of the Infiltration Credit, General Information on Spray Polyurethane Foam (SPF) and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1401.1a Preparation	All band/rim joist areas will be open and accessible for SPF application All surfaces where SPF is applied will be clean, dry, and free of contamination and degradation Substrate surfaces will be wiped, blown, or vacuumed to be free of excessive dust and dirt Grease and oil will be removed using appropriate cleaners or solvents Moisture content of all wood substrate materials will be checked to ensure it is below 20%	Prepare all substrate surfaces for the application of SPF		2187
4.1401.1b Installation	SPF will be applied to desired thickness, using pass thickness maximum in accordance with manufacturer specifications, onto subfloor between floor joists and all rim/band joists When applied to first floor,SPF will be continuous from subfloor surface, over band/rim joist and sill plate, and in contact with foundation below, except as stipulated by classification 4.1402.1c When applied to second story floor or above,SPF will be continuous from subfloor surface, over band/rim joist, and in contact with top plate below	Insulate and seal floors		2188
4.1401.1c Fire protection	If SPF exceeds a thickness of 3", all SPF will be separated from the occupied interior space of the building with an approved thermal barrier material (typically ½" or	Provide necessary fire protection for combustible SPF insulation		2189

	thicker gypsum wallboard or an approved thermal barrier coating) Application to rim/band joist up to 3" can be left exposed if the foam is Class I, unless the space is a habitable space and then cover it with drywall or another thermal barrier Local codes will be confirmed and followed for fire protection requirements			
4.1401.1d Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6819

4.1401.2 Band/Rim Joists – Insulation other than Spray Polyurethane Foam

Topic: Basements and Crawl Spaces

Subtopic: Band/Rim Joists

Desired Outcome: Closed crawl spaces insulated to achieve best thermal performance possible

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1401.2a Preparation	The rim joist, sill plate and adjacent surfaces will be sufficiently clean and free of debris to allow for the proper adhesion of any caulks, adhesives or spray foam used during installation.	Prepare all surfaces for the installation of insulation		7054
4.1401.2b Insulation installation	A foam-based insulation will be installed so as to create a continuous thermal and pressure boundary or vinyl faced fiberglass batt insulation, installed tightly to the wood and sealed at all edges. If rigid insulation is used, all edges will be sealed and the insulation will be installed tightly to the wood to prevent the movement of moisture throughout the assembly. Insulation will be installed in	Improve thermal performance Prevent moisture condensation on the inside of the band joist		7055

	accordance with local/national code requirements and/or manufacturer's instructions regarding flame spread.			
4.1401.2c Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		7056

4.1402.1 Closed Crawl Spaces—Wall Insulation

Topic: Basements and Crawl Spaces

Subtopic: Basements and Crawl Space Walls

Desired Outcome: Closed crawl spaces insulated to achieve best thermal performance possible

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1402.1a Insulation selection	A fire-rated insulation (25 or less flame spread or Class I or Class A) will be used with a minimum life expectancy of 10 years	Provide fire-safe, durable insulation that will not exacerbate moisture issues in the crawl space		2190
4.1402.1b R-value	Regional International Energy Conservation Code (IECC) will be followed for required R-values	Improve thermal performance		2191
4.1402.1c Termite inspection gap	Where termite pressure exists, a 3" inspection gap will be maintained from the top of the insulation to the bottom of any wood	Allow for termite detection		2192
4.1402.1d Attachment	Insulation will be attached with a durable connection better than or equal to manufacturer specifications	Prevent insulation from detaching from the foundation wall		2193
4.1402.1g Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6772

4.1402.2 Basement Wall Insulation—No Groundwater Leakage

Topic: Basements and Crawl Spaces

Subtopic: Basements and Crawl Space Walls

Desired Outcome: Basement insulation improves thermal performance and ensures sufficient drying potential

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1402.2a R-value	Regional IECC will be followed for required R-values	Improve thermal performance of the basement and living space		2205
4.1402.2b Air barrier	A continuous air barrier will be installed on the warm side of the insulation	Prevent condensation on the basement wall		2206
4.1402.2c Vapor permeability	When absorbent insulation materials are installed, assembly will remain vapor semi-impermeable to the interior in all climate zones except Zone 7	Provide drying potential to the basement		4242

4.1402.3 Basement Wall Insulation—Groundwater Leakage

Topic: Basements and Crawl Spaces

Subtopic: Basements and Crawl Space Walls

Desired Outcome: Basement insulation improves thermal performance and ensures sufficient drying potential

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1402.3a Drainage	A continuous drainage plane at the interior surface of the exterior basement wall will be created from the top of the wall to a drainage field at the bottom of the wall or sub-slab Drainage field will be run to daylight or pumped to the outside	Remove moisture on the surface of the exterior basement wall		2196
4.1402.3b Rough finish walls (e.g., rubble walls)	Drainage plane will be replaced with a waterproof membrane Only a non-absorbent insulation that complies with ASTM C665-06 will be applied Insulation will adhere to the waterproof membrane without voids	Create an air and moisture barrier on the interior side of the exterior basement wall and allow the insulation to conform to the irregularity of the surface Improve thermal performance of the basement and the living space		2197

	Drainage field will be run to daylight or pumped to the outside			
4.1402.3c Thermal barrier, insulation	A non-absorbent insulation will be used with a minimum expected service life of 10 years A fire-rated material will be used if the insulation is left exposed	Improve thermal performance of the basement and the living space		2198
4.1402.3d Location	Insulation will be installed continuously from the top of the band joist to the top of the slab	Maintain a continuous thermal boundary on the interior side of the exterior basement wall		2199
4.1402.3e Termite protection	Where termite pressure exists, if sub-slab drainage is installed, termite treatment will be performed before re-installing the slab	Provide termite protection		2200
4.1402.3f Insulation attachment	Insulation will be attached with a durable connection equal to or better than the manufacturer specifications, whichever is more durable A minimum expected service life of 10 years will be ensured	Secure thermal boundary without compromising the insulation		2201
4.1402.3g R-value	Regional IECC will be followed for required R-value	Improve thermal performance of the basement and living space		2202
4.1402.3h Sealing	A continuous air barrier on the warm side of the thermal boundary will be installed, including floor-to-wall and wall-to-ceiling connections	Prevent convective air leakage from the basement, through the drainage plane, and back into the basement		2203
4.1402.3i Finish wall requirements	IRC will be followed for finished wall details in basements	Install a durable, finished wall		2204
4.1402.3j Onsite documentation	A dated receipt signed by the installer will be provided that includes: Coverage area Thickness R-value	Document job completion to contract specifications Confirm amount of insulation installed Comply with 16 CFR 460.17		6821

4.1601.1 Insulating Flex Ducts

Topic: Ducts

Subtopic: Insulating Ducts

Desired Outcome: Lower conductive heat transfer by ducts and decreased condensation on duct vapor barrier

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1601.1a Removal of existing flexible ducting	All accessible low R-value flexible ducting will be removed from premises	Ensure installation of proper R-value ducts		2208
4.1601.1b Selection of new flexible ducting	All flexible ducting will have a minimum of R-8	Minimize thermal conductance of the duct system		2209
4.1601.1c Sizing of new flex	Duct sizing procedures will be conducted when replacing flex duct	Improve comfort in rooms Improve fan performance		2210
4.1601.1d Installation of flex	Flexible ducts will be supported in accordance with flex duct manufacturer's directions or local codes	Prevent sags, drops, or other bends that may interfere with correct air flow		2211
4.1601.1e Interior liner attachment	Interior liner of the flex-to-metal connection will be fastened with tie bands using a tie band tensioning tool or a mechanical band	Create a strong, secure attachment		2212
4.1601.1f Sealing of interior liner	Systems used to seal flexible air ducts and flexible air connectors will comply with UL 181B and will be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic	Create an airtight connection		2213
4.1601.1g Attachment of exterior liner	Liner will be pulled up onto the metal duct as far as possible before securing The exterior liner of the flex duct will be fastened with tie bands using a tie band tensioning tool	Create a strong, durable attachment		2214
4.1601.1h Sealing of all accessible ducts	All accessible joints, seams, and connections in ductwork will be securely fastened and sealed with UL "181 B-M" compliant mastic (adhesives) or mastic-plus-embedded-fabric systems	Minimize duct leakage		2215
4.1601.1i Insulation of all fittings	All metal fittings including boots, elbows, and take-offs will be insulated separately using an R-11 duct wrap with vapor retarder	Minimize thermal conductance of the duct system		2216
4.1601.1j Completeness of vapor barrier	Vapor retarder of all duct insulation will be taped to the flex duct using tape that complies with UL 181B and will be marked "181 B-FX" for pressure-sensitive tape or "181 B-M" for mastic	Ensure a complete vapor barrier		2217

4.1601.2 Insulating Metal Ducts

Topic: Ducts

Subtopic: Insulating Ducts

Desired Outcome: Lowered thermal conductance of duct system and minimized condensation on the duct system

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
4.1601.2a Selection of duct insulation material	Duct insulation on all ducts located in unconditioned spaces will be a minimum of R-8, in accordance with local code, or buried under attic insulation, whichever is greater, and have an attached vapor retarder Hot humid and warm coastal regions will not bury ducts	Decrease heat loss and condensation problems		2218
4.1601.2b Duct sealing	All joints, seams, and connections in ductwork shall be securely fastened and sealed with UL 181 B-M mastics (adhesives) or mastic- plus-embedded-fabric systems installed in accordance with the manufacturer's instructions before insulation is applied	Minimize duct leakage		2219
4.1601.2c Attachment of duct insulation	Duct insulation will be secured to the duct system using metal wire or rot-proof nylon twine Pattern of the wire or twine will be sufficient to securely hold the duct insulation tight to the duct	Ensure a secure connection between the duct system and the duct insulation		2220
4.1601.2d Taping of the duct insulation	Using a tape approved by the manufacturer, all seams and connection of the duct insulation will be taped No gaps will exist between pieces of duct insulation	Prevent gaps in the vapor barrier of the insulation		2221

Section 5: Heating and Cooling

5.3001.1 Load Calculation and Equipment Selection

Topic: Forced Air

Subtopic: Design

Desired Outcome: Equipment sized properly and operates efficiently

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3001.1a Load calculation	Load calculation will be performed in accordance with ANSI/ACCA 2 Manual J (Residential Load Calculation) and manufacturer specifications	Properly size equipment for load		2222
5.3001.1b Equipment selection	Equipment selection will be performed in accordance with ANSI/ACCA Manual S and manufacturer specifications	Ensure equipment is able to heat, cool, and dehumidify the house		2223
5.3001.1c Air filtration	New central forced air HVAC systems will have minimum MERV 6 filtration with no air bypass around the filters	Particle removal to protect equipment and help maintain indoor air quality		2224

5.3001.2 Ductwork and Termination Design

Topic: Forced Air

Subtopic: Design

Desired Outcome: Efficient air flow to all rooms ensured by proper ductwork

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3001.2a Duct design	Duct design will be performed in accordance with ANSI/ACCA Manual D and manufacturer specifications	Maximize air flow		2225
5.3001.2b Termination design	Termination design will be performed in accordance with ANSI/ACCA Manual T and manufacturer specifications	Maximize air flow Ensure occupant comfort		2226
5.3001.2c Air filtration	New central forced air HVAC systems will have minimum MERV 6 filtration with no air bypass around the filters	Particle removal to protect equipment and help maintain indoor air quality		2227

5.3002.1 Preparation for New Equipment

Topic: Forced Air

Subtopic: Site Preparation

For supporting material, see Building America Solution Center.

Desired Outcome: Existing equipment removed safely and lawfully

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3002.1a Access	A code compliant walkway and service platform will be installed in attics, if not present Walkway and platform will be above the level of insulation (if practical)	Ensure new equipment can be installed and serviced Maintain adequate insulation level		2228
5.3002.1b Utility disconnect	Electricity and fuel will be turned off prior to starting removal of old appliance	Protect workers and occupants from injury		2229
5.3002.1c Refrigerant recovery	Refrigerant will be recovered in accordance with 40 CFR 608 (EPA) by a licensed contractor	Comply with Safe Handling of Refrigerant Law Protect workers and occupants from injury		2230
5.3002.1d Equipment disconnection	Refrigerant lines, plumbing, ducts, electric, control wires, vents, and fuel supply will be disconnected	Ensure equipment can be removed		2231
5.3002.1e Removal	Equipment will be removed (e.g., furnace, air handler, evaporator, condensing unit) Equipment will be removed from space without damaging property and disturbing or compressing the insulation Equipment will be disposed of in accordance with local laws and regulations, recycling materials when feasible	Provide room to install new equipment and work safely Comply with applicable disposal laws		2232

5.3003.1 Data Plate Verification

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Data for commissioning and future service work is recorded

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

5.3003.1a Data plate verification	Equipment will be visually inspected Information will be recorded from the equipment data plates indoors and outdoors where available	Ensure technician has equipment data necessary for commissioning and future service work		2233

5.3003.10 Condensate Drainage of Heating and Air Conditioning Equipment

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Equipment and condensate drain operate as designed

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.10a Connection	Connections in condensate drain system will be watertight	Ensure condensate drain connections do not leak		2290
5.3003.10b Insulation	Condensate drainlines will be insulated with a minimum 1" of insulation with a vapor retarder when there is potential for condensation or freezing on the drainline	Ensure condensate drain connections do not leak		2291
5.3003.10c Overflow protection: upflow	Secondary drain pan and float switch will be installed when overflow could damage finished surfaces OR Float switch in the primary condensate drain for upflow systems will be installed when overflow could damage finished surfaces	Ensure condensate drain connections do not leak		2292
5.3003.10d Pumps	Condensate drain pumps will be installed when condensate cannot be drained by gravity Power source for pump will be installed Operation and drainage of pump will be verified	Ensure condensate drain connections do not leak		2293
5.3003.10e Vents and traps	Vents and traps will be installed on condensate drainlines Trap supplied with the equipment will be used and manufacturer specifications will be followed	Ensure condensate drain operates as designed Ensure condensate drain does not leak air		2294
5.3003.10f Drain pan	Condensate from all cooling coils or evaporators shall be conveyed from	Prevent water damage from drain system malfunction		2295

	the drain pan outlet to an approved place of disposal Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1% slope) Condensate shall not discharge into a street, alley, or other areas where it would cause a nuisance			
5.3003.10g Float switch	All secondary drain pans will have a float switch and be drained away through a drainline	Prevent water overflowing the pan and draining onto the ceiling below		2296
5.3003.10h Termination	Condensate drain will be terminated in accordance with local codes	Ensure condensate does not leak to the house Ensure condensate drain does not freeze		2297

5.3003.14 Combustion Analysis of Gas-Fired Appliances (LP and Natural Gas)

Topic: Forced Air

Subtopic: System Assessment and Maintenance

For supporting material, see Building America Solution Center.

Desired Outcome: Analysis of critical components and operations completed in accordance with industry and manufacturer specifications

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.14a Gas Pressure	Measurement will be verified by a certified professional in accordance with fuel type and manufacturer specifications	Ensure equipment: Operates as designed Operates safely Operates efficiently Is durable		3967
5.3003.14b Place appliance in operation	Heating equipment will be placed in operation in accordance with applicable NFPA standards and manufacturer specifications when available	Ensure equipment: Operates as designed Operates safely Operates efficiently Is durable		3970
5.3003.14c Carbon dioxide (CO2)and oxygen (O2)	Measurement will be verified in accordance with industry manuals (e.g., Testo, Bacharach)	Ensure equipment: Operates as designed Operates safely Operates efficiently Is durable		3971

5.3003.14d Carbon monoxide (CO) in flue gas	CO in the undiluted flue gas will be less than 400 ppm air-free	Ensure equipment: Operates as designed Operates safely Operates efficiently Is durable		3972
5.3003.14e Testing/inspection holes	All testing and inspection holes will be sealed with manufacturer approved materials	Ensure equipment: Operates as designed Operates safely Operates efficiently Is durable		6957

5.3003.2 Combustion Analysis of Oil-Fired Appliances

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Analysis on critical components and operations completed in accordance with industry and manufacturer specifications to ensure equipment operates as designed, safely, efficiently and is durable.

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail. If new installation or replacement is necessary, ANSI / ACCA 5 QI HVAC Quality Installation Specification will be followed

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.2a Oil system: filter	Filter will be present, clean, and leak free	Ensure oil filter is present and functional		2234
5.3003.2b Nozzle	Nozzle size, angle, and spray pattern will be correct for design input and within equipment firing rate of the heating system manufacturer. Position of nozzle and electrodes will be in accordance with manufacturer specifications	Ensure equipment is outfitted with the correct nozzle per manufacturer guidelines		2235
5.3003.2c Fuel pressure	Measurement will be verified in accordance with manufacturer specifications	Ensure correct oil pump pressure for nozzle installed and at OEM's specified values per ACCA		2236
5.3003.2d Place appliance in operation	Heating equipment will be placed in operation in accordance with applicable standards and manufacturer specifications when available	Prepare equipment for combustion analysis tests		2237

5.3003.2e Smoke Test	Smoke test will be conducted before any combustion testing is completed Smoke spot reading will be in accordance with burner manufacturer specifications If smoke test is more than actionable levels, specify a clean and tune	Determine whether equipment is operating within acceptable range according to smoke test and call for action if needed		2238
5.3003.2f Steady state efficiency (SSE)	Measurement will be verified in accordance with manufacturer specifications	Determine whether steady state efficiency is within manufacturer range		2239
5.3003.2g Net stack temperature	Net stack temperature will be measured and verified in accordance with manufacturer specifications	Determine whether net stack temperature is within manufacturer's recommended range		2240
5.3003.2h Carbon dioxide (CO2) and oxygen (O2)	Measurement will be verified in accordance with manufacturer specifications	Verify combustion performance of equipment is within manufacturer recommended range based on CO2 and O2 readings		2241
5.3003.2i Excess combustion air	Excess combustion air will be calculated and shown to be in accordance with manufacturer specifications	Verify combustion performance of equipment is within manufacturer recommended range based on excess combustion air readings		6969
5.3003.2j CO in flue gas	Measure CO and recommend actions to ensure that CO in the undiluted flue gas will be less than 400 ppm air-free	Ensure CO in undiluted flue gas is less than 400 ppm air-free		6970
5.3003.2k Testing/inspection holes	All testing and inspection holes will be sealed with approved materials	Ensure equipment: Operates as designed Operates safely Operates efficiently Is durable		6971

5.3003.3 Evaluating Air Flow

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Air flow is properly tested

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

5.3003.3a Total air flow	Total system air flow will be measured by one of the following methods: Temperature rise Flow plate Fan depressurization device (e.g., Duct Blaster®, DucTester®)	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2242
5.3003.3b External static pressure	External static pressure will be in accordance with manufacturer specifications	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2243
5.3003.3c Pressure	Pressure drop across cooling coils will be in accordance with manufacturer specifications	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2244
5.3003.3d Filter Inspection	Visual inspection to verify filter type is per manufacturer specifications, and is clean	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2245
5.3003.3e Balancing room flow: new ductwork	Proper air flow delivery to each room will be ensured by one of the following: Measuring air flow at each register OR Measuring heat rise, room pressures, and interviewing residents to ensure their comfort.	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2246
5.3003.3f Supply and return temperature measurements	Supply and return wet bulb (wet bulb temperature is measured for cooling systems only) and dry bulb air temperatures will be recorded	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2247
5.3003.3h Temperature rise: gas and oil furnaces only	Temperature rise between the supply and return will be in accordance with manufacturer specifications	Ensure equipment: Operates as designed Operates efficiently Provides comfort Operates safely Is durable		2249

5.3003.4 Evaluating Electrical Service

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Electrical components properly tested

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.4a Polarity	Polarity of equipment will be correct	Ensure equipment operates as designed Ensure equipment operates safely		2250
5.3003.4b Voltage/amperage: incoming power	Voltage/amperage will be in accordance with manufacturer specifications	Ensure equipment operates as designed		2251
5.3003.4c Voltage: contactor	In accordance with manufacturer specifications, voltage drop will be within acceptable range	Ensure contactor does not overheat Ensure equipment operates as designed		2252
5.3003.4d Grounding	Grounding must conform to meet NFPA 70 National Electric Code	Ensure equipment operates as designed Ensure equipment operates safely		2253
5.3003.4e Blower amperage	Amperage will not exceed manufacturer full load amperage	Ensure equipment operates as designed Ensure equipment operates efficiently Ensure equipment operates safely		2254
5.3003.4f Compressor amperage	Amperage will not exceed manufacturer full load amperage	Ensure equipment operates as designed Ensure equipment operates efficiently Ensure equipment operates safely		2255
5.3003.4g Door switch operation	Blower compartment safety switch operation will be verified	Ensure blower does not operate during service		2256
5.3003.4h Heat pump: emergency heat	Emergency heat circuit functions will be verified	Ensure system delivers heat in case of compressor failure		2257

5.3003.5 Refrigerant Line Inspection

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Refrigerant lines properly installed

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.5a Insulation	All suction or vapor refrigerant lines, will be insulated to a minimum of R-4 High-side or liquid refrigerant lines will not be insulated unless specified by the equipment's manufacturer	Ensure refrigerant lines do not gain excessive heat, or cause condensation to occur inside the building envelope		2258
5.3003.5b Ultraviolet (UV) protection of insulation	If exposed to sunlight, refrigerant line insulation will be protected from UV degradation in accordance with manufacturer specifications, IRC or local code	Install insulation so it does not degrade		2259
5.3003.5c Sizing	Refrigerant lines will be sized to meet manufacturer specifications for the installed equipment	Ensure system moves appropriate volume of refrigerant		2260
5.3003.5d Installation quality	Refrigerant lines will be installed without kinks, crimps, or excessive bends	Ensure system moves appropriate volume of refrigerant		2261
5.3003.5e Support	Refrigerant lines will be routed, supported, and secured to house in a manner that protects the line from damage by workers or occupants	Ensure refrigerant lines do not move, vibrate, or sag Protect lines from damage		2262

5.3003.6 Evaluating Sequence of Operation

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Sequence of operation of the system verified

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.6a Verification	The sequence of operation of the system will be verified in accordance with the manufacturer installation, operation, and maintenance manual. If every effort to secure the manufacturer's manual proves unsuccessful, the technician will rely on standard industry testing protocols.	Ensure system components function and operate in the correct sequence		2263

5.3003.7 Occupant Education

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Occupants understand their role and responsibility in the safe, effective, and efficient operation of the equipment

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.7a Basic operation	Basic operation of the equipment will be explained to the occupant (e.g., design conditions, efficiency measures, differences from previous system or situation)	Ensure occupant has a reasonable expectation of the equipment's capability		2264
5.3003.7b System controls (e.g., thermostat, humidistat)	Proper operation and programming of system controls to achieve temperature and humidity control will be explained to the occupant	Ensure occupant can operate system controls		2265
5.3003.7c System disconnects	Indoor and outdoor electrical disconnects and fuel shut-offs will be demonstrated to occupant	Ensure occupant can shut off equipment in emergencies		2266
5.3003.7d Combustion air inlets	Location of combustion air inlets will be identified for occupant in accordance with NFPA 31, 54, and 58 Importance of not blocking inlets will be explained to occupant	Ensure occupant does not block combustion air inlets		2267
5.3003.7e Blocking air flow	Importance of cleaning dust and debris from return grilles will be explained to occupant Proper placement of interior furnishings with respect to registers will be explained to occupant Negative consequences of closing registers will be explained to occupant Importance of leaving interior doors open as much as possible will be explained to occupant	Ensure occupant does not prevent equipment from operating as designed		2268
5.3003.7f Routine maintenance	Proper filter selection and how to change the filter will be explained to occupant Importance of keeping outside unit clear of debris, vegetation, decks, and other blockage will be explained to occupant	Ensure equipment operates as designed		2269

	Importance and timing of routine professional maintenance will be explained to occupant There will be no air bypass around the filters and new central forced air HVAC systems will have minimum MERV 6 filtration			
5.3003.7g Calling heating, ventilation, and air conditioning (HVAC) contractor	Situations when the occupant should contact the HVAC contractor will be explained, including: Fuel odors Water draining from secondary drainline Emergency heat indicator always on for a heat pump system System blowing cold air during heating season and vice versa Icing of the evaporator coil during cooling mode Outside unit never defrosts Unusual noises Unusual odors	Notify occupant to contact installer when system is not operating as designed		2270
5.3003.7h Carbon monoxide (CO)	A carbon monoxide (CO) alarm will be installed	Occupant will be made aware of operation of CO alarm		2271
5.3003.7i Warranty and service	Occupant will be provided with relevant manuals and warranties The labor warranty will be explained and the occupant will be given a phone number to call for warranty service	Provide manuals and warranties for future servicing		2272

5.3003.8 Evaporative Cooler Maintenance and Repairs

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Evaporative cooler evaluated and maintained as needed

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.8a Assessment and diagnosis	The following system elements will be assessed: Pump Pan Spider	Ensure all components function properly		2273

	Float Damper Roof jack support Water line Water valve Electrical Pads Motor Fan Elements will be repaired or replaced as needed in accordance with manufacturer instructions			
5.3003.8b Repair and maintenance	Calcium deposits will be removed Pads will be replaced Any additional repairs or replacements will be made as necessary in accordance with manufacturer's instructions	Protect the potable water supply from cross-contamination Ensure evaporative cooler functions properly		2274
5.3003.8c Occupant education	A regular service schedule will be recommended to occupant Issues regarding multiple systems running will be discussed with occupant	Ensure the occupant understands basic operation and the importance of regular maintenance		2275

5.3003.9 Heating and Cooling Controls

Topic: Forced Air

Subtopic: System Assessment and Maintenance

Desired Outcome: Heating and cooling controls installed and set properly

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3003.9a Removal of mercury- based thermostats	Mercury based thermostat will be removed safely and disposed of in accordance with EPA regulations	Protect workers and occupants from injury Protect environment from damage		2276
5.3003.9b Removal of existing controls	Existing controls will be removed in accordance with EPA lead-safe work rules	Protect workers and occupants from injury Protect environment from damage		2277
5.3003.9c Penetrations	Penetrations for control wiring will be sealed with a durable sealant (e.g., caulk, silicone, foam)	Ensure controls operate as designed Minimize infiltration and exfiltration from house		2278

5.3003.9d Thermostat location	Thermostats will be installed to reflect the temperature of the zone in which they are installed Thermostats will not be exposed to extreme temperatures, radiant heat sources, and drafts	Ensure controls operate as designed		2279
5.3003.9e Blower speed	Blower speed will be set for equipment in accordance with manufacturer specifications	Ensure equipment has correct air flow		2280
5.3003.9f Thermostat selection: heat pump	A thermostat with equipment supplementary heat lockout that can interface with an outside temperature sensor will be selected	Ensure supplementary heater operation is prevented when the heat pump is capable of meeting the load		2281
5.3003.9g Heat pump: supplementary heat	Supplementary heat will be used on air-to-air heat pumps with conditions that allow for a balance point of less than 30°F Supplementary heat lockout will be installed and set to manufacturer specifications	Ensure supplementary heater operation is prevented when the heat pump is capable of meeting the load		2282
5.3003.9h Heat pump: low ambient compressor lockout	For air-to-air heat pumps, low ambient compressor lockout will be set to 0°F outdoor temperature or to manufacturer specifications	Ensure supplementary heater operation is prevented when the heat pump is capable of meeting the load		2283
5.3003.9i Heat pump: outside temperature sensor	An outdoor temperature sensor will be installed in accordance with manufacturer specifications	Ensure equipment operates as designed		2284
5.3003.9j Heat pump: supplementary heat wiring	Supplementary heat will be wired onto second-stage heating terminal in accordance with manufacturer specifications	Do not operate supplementary heat in stage one heating		2285
5.3003.9k Thermostat: installer programming	The installer options will be set to match the thermostat to the equipment and control board settings	Ensure equipment operates as designed		2286
5.3003.9l Time delay settings	Time delay for equipment will be set in accordance with manufacturer specifications and as appropriate for the climate zone (e.g., no time delay for hot humid climates)	Maximize transfer of heat without adversely affecting indoor humidity levels		2287
5.3003.9m Humidistat: location	Humidistat will be installed to reflect humidity of the zone in which it is installed Humidistat will be installed in a dry location	Ensure controls operate as designed		2288

5.3003.9n Occupant education	Occupants will be educated on proper use of thermostat including: Proper use of setbacks for air conditioners and heat pumps Allowing occupant comfort to determine setback for combustion heating appliances Using emergency heat appropriately	Ensure equipment and controls operate as designed Provide comfort throughout house		2289

5.3101.1 Heat Load Calculation—Whole House

Topic: Hydronic Heating (Hot Water and Steam)

Subtopic: Design

Desired Outcome: A properly sized heating appliance selected

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3101.1a Heating load calculation	Load calculation will be performed in accordance with ANSI/ACCA Manual J (Residential Load Calculation) or equivalent, and manufacturer specifications	Enable proper sizing of the heating appliance		2298
5.3101.1b Equipment selection	Equipment selection will be performed in accordance with ANSI/ACCA Manual S or equivalent, and manufacturer specifications	Ensure equipment is able to heat the house		2299

5.3101.2 Space Load Calculation—Heat Emitter Sizing

Topic: Hydronic Heating (Hot Water and Steam)

Subtopic: Design

Desired Outcome: Heat emitter selected provides adequate heat output

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3101.2a Space load calculation	Load calculation will be performed in accordance with ANSI/ACCA 2 Manual J (Residential Load Calculation) or equivalent, and manufacturer specifications	Enable proper sizing of the heating appliance		2300

5.3104.1 Controls—Thermostat Replacement

Topic: Hydronic Heating (Hot Water and Steam)

Subtopic: Equipment Maintenance, Testing, and Repair

For supporting material, see Building America Solution Center.

Desired Outcome: Thermostat replaced when appropriate

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3104.1a Visual inspection	Thermostats will be visually located Verify anticipator setting, if appropriate for thermostat model Replacement will be recommended if a digital, double setback thermostat is not present	Determine if existing thermostats need to be replaced		2301
5.3104.1b Mercury assessment	Thermostats containing mercury will be identified and disposed of in accordance with EPA guidance	Protect workers and occupants from mercury exposure		2302
5.3104.1c Removal (if removal is recommended)	Heating system will be de-energized before removal Thermostat will be removed Compatibility will be verified (e.g., voltage, wiring condition, location) and documented Location of existing thermostat will be assessed for appropriateness (e.g., central to the house, out of direct sunlight, away from supply air, protected from abnormal radiant surface temperatures)	Proper removal of thermostat		2303
5.3104.1d Installation	Location for new thermostat will be determined Compatibility with new thermostat will be verified (e.g., voltage, wiring, condition, location) Replacement will be recommended if a digital, double setback thermostat is not present Heating system will be re-energized and cycled Thermostat will be programmed to occupant lifestyle choices	Achieve comfort and energy savings for the occupant		2304
5.3104.1e Disposal	Thermostats will be disposed of in accordance with EPA guidelines and local regulations	Prevent mercury from entering the environment		2305

5.3104.1f Occupant education	Occupant will be involved in the initial programming of thermostat and educated on common settings and programming On new installs, occupants will be encouraged to save the manual and keep it accessible	Educate occupant on best use		2306

5.3104.2 Maintenance: Gas Boiler Service Inspection

Topic: Hydronic Heating (Hot Water and Steam)

Subtopic: Equipment Maintenance, Testing, and Repair

Desired Outcome: Boiler service improves safety, efficiency, and performance

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3104.2a Visual inspection	The following conditions will be assessed by a licensed contractor: Water, steam, and fuel leaks Damaged or missing pipe insulation Venting issues—draft and condensation (e.g., soot, rusting of flue pipe, burned paint or wires, efflorescence) Corrosion (e.g., rust, mineral deposits) General condition of components	Observe general conditions to determine needed repairs or maintenance		2307
5.3104.2b Appliance gas valve	When replacement is necessary, gas valve will be removed and replaced according to manufacturer specifications	Provide gas to burner when there is a call for heat Control volume of gas for burner Ensure the safe shut off of gas at the end of a call for heat		2308
5.3104.2c Ignition system	Components of ignition system will be repaired or replaced in accordance with manufacturer specifications	Do not allow flow of main burner gas without proof of ignition		2309
5.3104.2d Main gas burners	Problems that may interfere with flame (e.g., dust, debris, misalignment) will be cleaned, vacuumed, and adjusted	Produce combustion in a safe, clean, and efficient manner		2310
5.3104.2e Venting	Flue gases will be removed from the venting system in accordance with IRC or per manufacturer specifications	Ensure the safety and durability of the venting system		2311

5.3104.2f Flue gas testing	Undiluted flue gases will be checked with a calibrated combustion analyzer in accordance with BPI 1200 or other approved standard If combustion is not in compliance with the referenced standard, diagnostics and adjustments will be referred to a qualified technician to meet manufacturer specifications or local codes	Confirm that combustion occurs safely with maximum efficiency		2312
5.3104.2g Combustion efficiency checks	Undiluted flue gases will be checked with a calibrated combustion analyzer in accordance with accepted protocol to determine if acceptable boiler efficiency is being maintained If boilers are found to be out of compliance, a combustion analysis will be administered and minimum stack temperature will be in accordance with manufacturer specifications	Increase the operational efficiency of the system Improve occupant comfort		2313
5.3104.2h Occupant health	All homes will have a carbon monoxide (CO) alarm	Ensure ambient CO does not exceed acceptable levels after completion of work		2314
5.3104.2i Occupant education	Occupants will be educated on the operation and maintenance of the carbon monoxide (CO) alarm Completed work and recommended maintenance will be reviewed	Ensure occupant is informed of the safe and efficient operation and maintenance of the work performed		2315

5.3104.3 Maintenance: Checklist

Topic: Hydronic Heating (Hot Water and Steam)

Subtopic: Equipment Maintenance, Testing, and Repair

Desired Outcome: Thorough maintenance improves safety, efficiency, and performance

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3104.3a Health and safety	Combustion safety testing will be performed in accordance with the Health and Safety Chapter of the (Standard Work Specifications for	Identify potential health and safety issues		2316

	Single Family Housing) or other equivalent practice			
5.3104.3b Visual inspection	The following conditions will be inspected: Water, steam, and fuel leaks Damaged or missing pipe insulation Venting issues—draft and condensation (e.g., soot, rusting of flue pipe, burned paint or wires, efflorescence) Corrosion (e.g., rust, mineral deposits) General condition of components	Observe general conditions to determine needed repairs or maintenance		2317
5.3104.3c Pipe insulation inspection	Pipe insulation will be inspected, including: Integrity—complete coverage, no holes or tears Damage—holes or tears Complete coverage—insulation missing If asbestos is suspected, occupants will be notified and asbestos will not be disturbed Required repair or replacement will be performed in accordance with the following conditions: Materials will be approved for steam heating pipes Materials will be approved for hot water heating pipes Insulation will completely cover pipe Pipe insulation will be installed in accordance with manufacturer specifications	Minimize heat loss Improve performance of the system		2318
5.3104.3d Check system pressure	Check system pressure will be verified Check system pressure will be 1 pound per square inch gauge (psig) per 28" of system height	Keep system operating within pressure parameters		2319
5.3104.3e Purge system	Devices that are under performing or have need of purging will be purged as needed	Remove air from the system to maximize performance		2320
5.3104.3f Automatic fill	Automatic fill valve will be inspected to ensure it maintains system pressure If pressure is not maintained, replacement will be made in accordance with the following criteria:	Maintain optimal system pressure to maximize performance		2321

	Valve will be replaced and include backflow prevention; existing backflow protection shall be tested to verify operation Components will be installed in accordance with manufacturer specifications Correct system pressure will be verified			
5.3104.3g Gauge glass	Gauge glass will be inspected for erosion, cracks, or drying Damaged gauge glass on boiler will be replaced in accordance with manufacturer specifications Gauge glass that is coated with dirt or sediment, making it difficult to observe the water level of the boiler, will be removed, cleaned, and replaced	Ensure gauge glass is in safe operating condition to allow observation of water level in boiler		2322
5.3104.3h Low water cut-off: float type	Operation of low-water cutoff on steam boilers will be observed by opening blow-off valve If combustion is not extinguished, remediation will be accomplished by the following procedure: Electricity will be disconnected from boiler Problem will be diagnosed Low-water cutoff will be repaired, serviced, or replaced in accordance with manufacturer specifications A blow-down valve will be added, if not already present Boiler will be retested for proper operation Operation of low-water cutoff on hot water boilers is applicable only if proper test setup is available on-site, to avoid draining the system Occupants will be educated on the correct method to drain the low water cutoff weekly (must drain once per week to remove sediment from float chamber of low-water cutoff)	Ensure safe minimum water level of the boiler Maintain safe operation of the low water cut-off on ongoing basis		2323
5.3104.3i Low water cut-off: immersion	An immersion low-water cutoff will be installed and operable	Ensure safe minimum water level of the boiler		2324

5.3104.3j Expansion tank: non-bladder and bladder	An expansion tank will be installed and operable Tanks that leak or have excessive corrosion will be replaced, and non-bladder tanks will include an expansion tank drain Tank will be installed in accordance with manufacturer specifications Expansion tanks will be properly supported with strapping Tanks that are full of water will be drained; after expansion tank is drained, re-establish the correct water level in relation to system pressure Expansion tanks with bladders will have air charged to the manufacturer pressure specifications while water is not present in the tank Bladder tanks that have water inside of the air bladder will be replaced in accordance with manufacturer specifications	Absorb water expansion of the system		2325
5.3104.3k Flush or skim steam boiler	Manufacturer specifications for flushing or skimming steam boiler will be followed	Ensure boiler produces dry steam		2326
5.3104.3l System temperature or pressure gauge	The temperature or pressure gauge will be inspected for erosion, cracks, or dirt Damaged temperature or pressure gauges will be replaced in accordance with manufacturer specifications	Allow for accurate observation of system temperature and pressure		2327
5.3104.3m Circulators	Non-working motors that cannot be serviced will be replaced with a new motor New motors will be installed in accordance with manufacturer specifications Oil-lubricated circulators will be installed in proper alignment with the pump coupler and will be supported so they do not sag Bearings will have free movement without binding Shaft seals will not leak Bearings in inoperable, water-lubricated circulators will be freed, if possible, before replacement with a new circulation pump	Ensure circulation of water at designated velocity in system without leaks in the circulators		2328

5.3104.3n Zone valves	Zone valves will be inspected for the following conditions: Leaking water Not responding to a call for heat New equipment will be replaced in accordance with manufacturer specifications	Ensure proper zonal control of the system for comfort and efficiency		2329
5.3104.3o Condensate	If boiler is 90% efficient or more, condensate discharge will be an acceptable pH level, in accordance with local code, and will be drained to the exterior of the house, away from the foundation Condensate pumps will be installed, if needed, to ensure proper drainage	Bring the condensate to an acceptable pH and discharge to appropriate location		2330
5.3104.3p Temperature, pressure valves, and air vents	Occupant will be informed that air vents have potential to cause moisture problems if not operating properly Occupant will be reminded to call for maintenance if vents discharge steam or have moisture issues	Maintain efficient operation of the system		2331
5.3104.3q Maintenance records	Keeping records of all maintenance will be recommended to occupants Copies or access to installation and operation manuals will be provided	Provide a history of system installation and maintenance to improve future maintenance or repair		2332
5.3104.3r Occupant health and safety	All homes will have a carbon monoxide (CO) alarm	Ensure occupant health and safety		2333
5.3104.3s Occupant education	Completed work will be reviewed Occupants will be educated on the safe and efficient operation and maintenance of the system	Ensure occupant is informed of the safe, efficient operation and maintenance of the system		2334

5.3201.1 Indigenous Shading

Topic: Shading

Subtopic: Landscaping

Desired Outcome: Heat gain and loss reduced through use of indigenous plants

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
5.3201.1a Plant selection	All plantings intended for shading will be indigenous and drought resistant	Ensure plantings survive in local conditions using a minimum amount of water		2335
5.3201.1b Size	No planting will be chosen that will grow to a height that would cause	Reduce possibility of damage to the house		2336

	damage to the house if it or any part of it fell on the house			

Section 6: Ventilation

6.6002.1 Ducts

Topic: Exhaust

Subtopic: Components

Desired Outcome: Installed ducts effectively move the required volume of air and prevent condensation

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6002.1a Duct design and configuration	Ventilation ducts will be as short, straight, and smooth as possible Ventilation ducts will not be smaller than the connections to which they are attached	Effectively move the required volume of air		2337
6.6002.1b Duct insulation	Ducts installed outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local codes	Prevent condensation from forming or collecting inside of the ductwork		2338
6.6002.1c Duct support	Flexible and duct board ducts and plenums will be supported every 4' using a minimum of 1 ½" wide material Support materials will be applied in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified (e.g., ceiling, framing, strapping); duct support must be installed in accordance with authority having jurisdiction Metal ducts will be supported by 1/2" or wider 18-gauge strapping or 12 gauge or thicker galvanized wire no less than 10' apart	Effectively move the required volume of air Preserve the integrity of the duct system Eliminate falling and sagging		2339
6.6002.1d Duct connections	Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds,	Effectively move the required volume of air Preserve the integrity of the duct system		2340

	gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material			
6.6002.1e Duct materials	Flexible materials will be UL 181 listed or Air Diffusion Council approved The metal gauge of rigid kitchen fan ducting shall meet code requirements or the approval of the authority having jurisdiction.	Effectively move the required volume of air Preserve the integrity of the duct system		2341

6.6002.2 Terminations

Topic: Exhaust

Subtopic: Components

Desired Outcome: Securely installed termination fittings with unrestricted air flow

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6002.2a Hole in building shell	A hole no greater than a 1/4" greater than the fitting will be cut to accommodate termination fitting	Allow for ease of weatherproofing		2342
6.6002.2b Termination fitting	A termination fitting with an integrated collar will be used Collar will be at least the same diameter as the exhaust fan outlet; if collar is larger than exhaust fan outlet, a rigid metal transition will be used Fitting will be appropriate for regional weather conditions and installation location on house so as not to be rendered inoperable	Effectively move the required volume of air to the outside Preserve integrity of the building envelope Ensure durable installation		2343

6.6002.2c Duct to termination connection	Duct will be connected and sealed to termination fitting as follows: Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material Fasteners will not inhibit damper operation	Effectively move the required volume of air to the outside Preserve integrity of the building envelope Ensure durable installation		2344
6.6002.2d Weatherproof installation	Exterior termination fitting will be flashed or weather sealed Water will be directed away from penetration Installation will not inhibit damper operation Manufacturer specifications will be followed	Preserve integrity of the building envelope Ensure a weather tight and durable termination installation Ensure unrestricted air flow		2345
6.6002.2e Pest exclusion	Screen material with no less than ¼" and no greater than ½" hole size in any direction will be used Installation will not inhibit damper operation or restrict air flow	Prevent pest entry Ensure proper air flow		2346
6.6002.2f Termination location	Terminations will be ducted to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors. Terminations will be installed: A minimum of 3' away from any property line A minimum of 3' away from operable opening to houses A minimum of 10' away from mechanical intake	Prevent exhaust from reentering house		2347

	As required by authority having jurisdiction			
6.6002.2g Kitchen exhaust	Galvanized steel, stainless steel, or copper will be used for termination fitting for kitchen exhaust	Prevent a fire hazard		2348

6.6002.3 Exhaust-Only Ventilation—Fan Intake Grille Location

Topic: Exhaust

Subtopic: Components

Desired Outcome: Exhaust grille location optimizes either primary or local ventilation

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6002.3a Primary whole house ventilation	Fan intake grille will be installed in a central location within the main body of the house Ensure it is accessible for filter change and cleaning	Provide whole house air exchange		2349
6.6002.3b Local ventilation	Fan intake grille will be installed in the space where odor, moisture vapor, or other contaminants are generated	Remove contaminated air at the source		2350

6.6003.1 Surface-Mounted Ducted

Topic: Exhaust

Subtopic: Fans

Desired Outcome: Surface-mounted ducted fans installed to specification

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6003.1a Hole through interior surface	A hole no greater than a 1/4" greater than the assembly will be cut to accommodate fan assembly	Minimize repair work Ensure a secure installation		2351
6.6003.1b Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes	Prevent an electrical hazard		2352

6.6003.1c Fan mounting	Fan outlet will be oriented toward the final termination location Fan will be oriented so the equivalent length of the duct run is as short as possible Fan will be mounted securely in accordance with manufacturer specifications	Ensure short duct run to achieve optimum air flow Ensure a secure installation Ensure fan housing does not shake, rattle, or hum when operating		2353
6.6003.1d Backdraft damper	A backdraft damper will be installed between the outlet side of the fan and the exterior	Prevent reverse air flow when the fan is off		2354
6.6003.1e Duct to fan connection	Duct-to-fan outlet will be connected and sealed as follows: Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened according to manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material	Exhaust to outside		2355
6.6003.1f Fan housing seal	Gaps and holes in fan housing will be sealed with caulk or other sealants in accordance with manufacturer recommendations Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage through fan housing Ensure a permanent seal Prevent a fire hazard		2356
6.6003.1g Fan to interior surface seal	Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage between house and fan		2357
6.6003.1h Air flow	Air flows in cubic feet per minute (CFM) will be measured and adjusted to meet the whole house upgrade design requirements	Exhaust sufficient air from desired locations to outside		2358

6.6003.1i Preventing air leakage caused by exhaust fans	Leakage to the house from other spaces will be prevented (e.g., garages, unconditioned crawl spaces, unconditioned attics)	Ensure occupant health and safety		2359
6.6003.1j Combustion safety	Pressure effects will be assessed and corrected on all combustion appliances	Ensure safe operation of combustion appliances		2360

6.6003.2 Inline

Topic: Exhaust

Subtopic: Fans

Desired Outcome: Inline fans installed to specification

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6003.2a Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications and local and national electrical and mechanical codes	Prevent an electrical hazard		2361
6.6003.2b Access	Fan and service switch will be accessible for maintenance according to NFPA 70 National Electric Code or local authority having jurisdiction	Fan and service switch will be accessible for maintenance		2362
6.6003.2c Fan mounting	Fan outlet will be oriented toward the final termination location Fan will be oriented so the equivalent length of the duct run is as short as possible Fan will be mounted securely in accordance with manufacturer specifications Fan will be isolated from the building framing unless specifically designed to be directly attached Fan will be installed remotely by installing ducting from intake grille	Ensure short duct run to achieve optimum air flow Ensure fan is installed securely Ensure fan housing or building framing does not shake, rattle, or hum when operating Minimize noise		2363
6.6003.2d Backdraft damper	A backdraft damper will be installed between the outlet side of the fan and the exterior	Prevent reverse air flow when the fan is off		2364

6.6003.2e Duct connections	Ducts will be connected and sealed to the intake fan and termination fitting as follows: Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material	Exhaust from desired location to outside Preserve integrity of the duct system and building envelope		2365
6.6003.2f Boot to interior surface seal	Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage around intake housing Prevent a fire hazard		2366
6.6003.2g Air flow	Air flows in CFM will be measured and adjusted to meet the design requirements	Exhaust sufficient air from desired locations to outside		2367
6.6003.2h Preventing air leakage caused by exhaust fans	Leakage to the house from other spaces will be prevented (e.g., garages, unconditioned crawl spaces, unconditioned attics)	Ensure occupant health and safety		2368
6.6003.2i Combustion safety	Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards Exhaust fans and other exhausting systems shall be provided with makeup air or other pressure relief	Ensure safe operation of combustion appliances		2369

6.6003.3 Through the Wall

Topic: Exhaust

Subtopic: Fans

Desired Outcome: Through the wall fans installed to specification

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6003.3a Hole in building shell	A hole no greater than a 1/4 inch greater than the assembly will be cut to accommodate fan assembly	Allow for ease of weatherproofing		2370
6.6003.3b Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes	Prevent an electrical hazard		2371
6.6003.3c Fan mounting	Fan outlet will be oriented toward the final termination location Fan will be oriented so the equivalent length of the duct run is as short as possible Fan will be mounted securely according to manufacturer specifications	Install mounting fan securely Ensure fan housing does not shake, rattle, or hum when operating		2372
6.6003.3d Weatherproof installation	Exterior termination fitting will be flashed or weather sealed Water will be directed away from penetration Termination fitting installation will not inhibit damper operation Manufacturer specifications will be followed	Preserve integrity of the building envelope Ensure a weather tight and durable installation Ensure unrestricted air flow		2373
6.6003.3e Backdraft damper	A backdraft damper will be installed between the outlet side of the fan and the exterior	Prevent reverse air flow when the fan is off		2374
6.6003.3f Fan housing seal	Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage through fan housing Ensure a permanent seal to the building air barrier		2375
6.6003.3g Fan to interior surface seal	Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage around intake housing Prevent a fire hazard		2376
6.6003.3h Insulation	All components outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local code	Preserve integrity of the duct system		2377

	Exception: If system operates continuously, fan housing need not be insulated			
6.6003.3i Air flow	Air flows in CFM will be measured and adjusted to meet the design requirements	Exhaust sufficient air from desired locations to outside		2378
6.6003.3j Preventing air leakage caused by exhaust fans	Leakage to the house from other spaces will be prevented (e.g., garages, unconditioned crawl spaces, unconditioned attics)	Ensure occupant health and safety		2379
6.6003.3k Combustion safety	Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards Make-up air will be provided in accordance with the current version of ASHRAE 62.2 and in compliance with the authority having jurisdiction.	Ensure safe operation of combustion appliances		2380

6.6003.4 Multi-Port System

Topic: Exhaust

Subtopic: Fans

Desired Outcome: Multi-port fans installed to specification

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6003.4a Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes	Prevent an electrical hazard		2381
6.6003.4b Access	Fan and access switch shall be accessible for maintenance according to NFPA 70 National Electric Code or local authority having jurisdiction	Achieve designed exhaust flow from desired locations to the outside		2382
6.6003.4c Fan mounting	Fan outlet will be oriented toward the final termination location Fan will be oriented so the equivalent length of the duct run is as short as possible	Ensure short duct runs to achieve optimum air flows Ensure mounting is installed securely		2383

	Fan will be mounted securely in accordance with manufacturer specifications Fan will be isolated from the building framing unless specifically designed to be directly attached Fan will be installed remotely by ducting from intake grilles	Ensure fan housing or building framing does not shake, rattle, or hum when operating Minimize noise		
6.6003.4d Backdraft dampers (required in intermittent systems)	A backdraft damper will be installed between the fan and the exterior unless the system operates continuously A backdraft damper will be installed in any duct serving any room with a separate exhaust (e.g., dryer)	Prevent reverse air flow when the system is off Prevent spread of contaminants between rooms		2384
6.6003.4e Combining intake ducts	All individual exhaust intake ducts will be combined on the upstream side of fan (e.g., Y-fitting, T-fitting, collector box) with the exception of dryer, kitchen, and garage	Exhaust air from desired locations to outside		2385
6.6003.4f Duct connections	Ducts will be connected and sealed to applicable intakes, collector box, fan, and termination fitting Ducts will be connected and sealed as follows: Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance to manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material	Exhaust air from desired locations to outside Preserve integrity of the duct system and building envelope		2386
6.6003.4g Insulation	All components outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local code	Preserve integrity of the duct system		2387

	Exception: If system operates continuously, fan housing need not be insulated			
6.6003.4h Boot to interior surface seal	Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage around boot Ensure a permanent seal to the building air barrier Prevent a fire hazard		2388
6.6003.4i Air flow	Air flows in CFM will be measured and adjusted to meet the design requirements	Exhaust sufficient air from desired locations to outside		2389
6.6003.4j Preventing air leakage caused by exhaust fans	Air leakage into the house from other spaces will be prevented (e.g., garages, unconditioned crawl spaces, unconditioned attics)	Ensure occupant health and safety		2390
6.6003.4k Combustion safety	Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards	Ensure safe operation of combustion appliances		2391

6.6003.5 Garage Exhaust Fan

Topic: Exhaust

Subtopic: Fans

Desired Outcome: Contaminants properly removed from house

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6003.5a System selection	Ventilation for garage will be exhaust only and provide a minimum installed capacity of 100 CFM of ventilation per vehicle bay and will vent directly outdoors Garage exhaust fan will be wired for continuous operation or installed with automatic controls that activate the fan whenever the garage is occupied and for at least 15 minutes after the garage has been vacated If a ducted fan (not through-the-wall) is used, measure and verify the minimum air flow and adjust as necessary	Remove contaminants from garage Reduce contaminant migration from garage to house Ensure occupant health and safety		2392
6.6003.5b Air leakage	Air leakage between the house and garages will be prevented by sealing and weather stripping	Ensure occupant health and safety Reduce conditioned air being drawn from the house		2393

		Reduce contaminant migration from garage to house		
6.6003.5c Combustion safety	Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards Exhaust fans and other exhausting systems shall be provided with makeup air or other pressure relief	Ensure safe operation of combustion appliances Ensure occupant health and safety		2394

6.6005.1 Clothes Dryer

Topic: Exhaust

Subtopic: Appliance Exhaust Vents

Desired Outcome: Dryer air exhausted efficiently and safely

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6005.1a Clothes dryer ducting	Clothes dryers will be ducted to the outdoors, which does not include unconditioned spaces such as attics and crawl spaces that are ventilated with the outdoors As short a run as practical of rigid sheet metal or semi-rigid sheet metal venting material will be used in accordance with manufacturer specifications Dryer ducts exceeding 35' in duct equivalent length will have a dryer booster fan installed Plastic venting material will not be used Uninsulated clothes dryer duct will not pass through unconditioned spaces such as attics and crawl spaces, except where allowed by the authority having jurisdiction Ducts will be connected and sealed as follows: UL listed foil type or semi-rigid sheet metal to rigid metal will be fastened with clamp	Preserve integrity of building envelope Effectively move air from clothes dryer to outside		2395

	Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material In addition: Sheet metal screws or other fasteners that will obstruct the exhaust flow will not be used Condensing dryers will be plumbed to a drain			
6.6005.1b Termination fitting	Termination fitting manufactured for use with dryers will be installed A backdraft damper will be included, as described in termination fitting detail	Preserve integrity of building envelope Effectively move air from clothes dryer to outside		2396
6.6005.1c Make-up air	If natural draft combustion appliances are present and if worst-case CAZ and/or other performance based testing is conducted and indicates a need for make-up air, make-up air will be provided in accordance with the current version of ASHRAE 62.2 and in compliance with the authority having jurisdiction. If natural draft combustion appliances are present and if no performance based testing is conducted, make-up air will be provided prescriptively in accordance with the current version of ASHRAE 62.2 and in compliance with the authority having jurisdiction.	Preserve integrity of building envelope Effectively move air from clothes dryer to outside		2397
6.6005.1d Combustion safety	Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards	Ensure safe operation of combustion appliances Ensure occupant health and safety		2398
6.6005.1e Occupant education	Occupant will be instructed to keep lint filter and termination fitting clean Occupant will be instructed to keep dryer booster fan clean, if present Occupant will be instructed on clothes dryer operation safety including information on items that must not be placed in the clothes dryer (items with any oil or other flammable liquid on it, foam, rubber, plastic or other heat-sensitive fabric, glass fiber materials)	Effectively move air from clothes dryer to outside		2399

6.6005.2 Kitchen Range

Topic: Exhaust

Subtopic: Appliance Exhaust Vents

Desired Outcome: Kitchen range fan installed to specification

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6005.2a Wiring	Wiring will be installed in accordance with local regulations or the IRC in the absence of such regulations or where those regulations are not as stringent as the IRC Wiring will be installed in accordance with original equipment manufacturer specifications and local and national electrical and mechanical codes	Prevent an electrical hazard		2400
6.6005.2b Fan venting	Kitchen range fans will be vented to the outdoors Recirculating fans will not be used as a ventilating device	Remove cooking contaminants from the house Preserve integrity of building envelope		2401
6.6005.2c Fan ducting	Kitchen range fans will be ducted to the outdoors As short a run as practical of smooth wall metal duct will be used, following manufacturer specifications Ducting will be connected and sealed as follows: Metal-to-metal will be fastened with a minimum of three equally spaced screws Other metal-to-metal connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes For down-draft exhaust systems, PVC-to-PVC materials will be fastened with approved PVC cement	Preserve integrity of building envelope Effectively move air from range to outside		2402

	Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material			
6.6005.2d Termination fitting	Termination fitting will be installed including a backdraft damper, as described in termination fitting detail	Ensure safe operation of combustion appliances Ensure occupant health and safety		2403
6.6005.2e Make-up air	If natural draft combustion appliances are present and if worst-case CAZ and/or other performance based testing is conducted and indicates a need for make-up air, make-up air will be provided in accordance with the current version of ASHRAE 62.2 and in compliance with the authority having jurisdiction. If natural draft combustion appliances are present and if no performance based testing is conducted, make-up air will be provided prescriptively in accordance with the current version of ASHRAE 62.2 and in compliance with the authority having jurisdiction.	Ensure safe operation of combustion appliances Ensure occupant health and safety		2404
6.6005.2f Combustion safety	Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards	Ensure safe operation of combustion appliances Ensure occupant health and safety		2405
6.6005.2g Occupant education	Occupant will be instructed to keep grease filters and termination fitting clean	Effectively move air from kitchen range to outdoors		2406

6.6102.1 Outside Air Ventilation Supply Ducts

Topic: Supply

Subtopic: Components

Desired Outcome: Ventilation supply ducts effectively move the required amount of air and prevent condensation

For supporting material, see Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6102.1a Duct design	Ventilation ducts will be as short, straight, and smooth as possible	Effectively move the required volume of air		2407

and configuration	Ventilation ducts will not be smaller than the connections to which they are attached			
6.6102.1b Duct insulation	Ventilation supply ducts installed outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local codes	Prevent moisture condensation		2408
6.6102.1c Duct support	Flexible and duct board ducts and plenums will be supported every 4' using a minimum of 1 ½" wide material Support materials will be applied in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified (e.g., ceiling, framing, strapping); duct support must be installed in accordance with authority having jurisdiction Metal ducts will be supported by 1/2" or wider 18-gauge strapping or 12 gauge or thicker galvanized wire no less than 10' apart	Effectively move the required volume of air Preserve integrity of the ventilation supply duct system Eliminate falling and sagging		2409
6.6102.1d Duct connections	All connections will have a contact overlap of at least 1" Ducts will be connected and sealed as follows: Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded- fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool Flexible duct between the cable tie and end of metal or PVC duct will be screwed PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications	Effectively move the required volume of air Preserve integrity of the ventilation supply duct system and building envelope		2410

	Outdoor air ventilation supply ducts attached to the return side of forced air systems will be: Attached as close to the heating, ventilation, and air conditioning (HVAC) systems fan as possible while remaining in compliance with manufacturer specifications Set up to provide filtration of outdoor ventilation air before reaching the HVAC system (for minimum MERV 6 filter) Attached via a mechanically fastened takeoff collar All joints and connections in ductwork will be fastened and sealed with UL181B or 181B-M welds, gaskets, adhesive mastics, or mastic-plus-embedded-fabric systems			
6.6102.1e Duct materials	Flexible air duct material will meet UL 181, NFPA 90A/90B, International Mechanical Code, or the Uniform Mechanical Code	Effectively move the required volume of air Preserve integrity of the duct system and building envelope		2411
6.6102.1f Outdoor air intake location	Outdoor air intake will be installed in accordance with the following: A minimum of 6" from grade A minimum of 10' from contaminant sources or exhaust outlets Above local snow or flood line A minimum of 18" above an asphalt based roof Never on a flat roof As required by authority having jurisdiction	Prevent contaminants from entering house Ensure unrestricted air flow		2412

6.6102.2 Intakes

Topic: Supply

Subtopic: Components

Desired Outcome: Intake optimizes air flow while limiting the entry of insects, debris, and contaminants

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

6.6102.2a Hole in building shell	A hole no greater than a 1/4" greater than the fitting will be cut to accommodate intake fitting	Ensure a weather tight installation		2413
6.6102.2b Intake fitting	Collar will be at least the same diameter as the duct; if collar is larger than duct, a rigid metal transition will be used Fitting will be appropriate for regional weather conditions and installation location on house so as not to be rendered inoperable	Effectively draw the required volume of air from the outdoors Preserve integrity of the building envelope Ensure durable installation		2414
6.6102.2c Occupant education	Intake fitting will be labeled "ventilation air intake" Occupant will be instructed to keep yard debris and other contaminants clear of the intake	Ensure unrestricted air flow		2415
6.6102.2d Damper (if applicable)	The damper will be installed to open in the direction of the desired flow Damper will close when system is off	Ensure unrestricted air flow		2416
6.6102.2e Connection to intake fitting	Duct to intake fitting will be connected and sealed as follows: Round metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Other metal-to-metal or metal-to-PVC connections will be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, or tapes Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool Flexible duct between tie band and end of metal or PVC duct will be screwed into place PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material	Preserve integrity of the building envelope Ensure a weather tight and durable intake installation Ensure unrestricted air flow		2417

	Ensure fasteners do not inhibit intake damper operation			
6.6102.2f Weatherproofing	Exterior termination fitting will be flashed or weather sealed Water will be directed away from penetration Installation will not inhibit damper operation Manufacturer specifications will be followed	Preserve integrity of the building envelope Ensure a weather tight and durable intake installation Ensure unrestricted air flow		2418
6.6102.2g Pest exclusion	Corrosion resistant screen, louver, or grille material no less than ¼" and no greater than ½" hole size in any direction will be used, or as specified by authority having jurisdiction Screen will be installed so it does not inhibit intake damper operation	Prevent pest entry Ensure unrestricted air flow		2419
6.6102.2h Intake location	Intake will be installed according to the following: A minimum of 6" from grade A minimum of 10' from contaminant sources or exhaust outlets Above local snow or flood line A minimum of 18" above an asphalt based roof Never on a flat roof As required by authority having jurisdiction	Prevent contaminants from entering house Ensure unrestricted air flow		2420

6.6102.3 Intake for Ventilation Air to Forced Air System Used for Heating or Cooling

Topic: Supply

Subtopic: Components

Desired Outcome: Intake reduces pollutant entry, is easily maintained, has proper flow, and enhances house durability

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6102.3a Forced air	Existing forced air system leakage to outside will be less than 10% of the	Reduce migration of pollutants		2421

system requirements	air handler flow when measured at 25 pascals with reference to outside Any portion of the return located inside the combustion appliance zone will be air sealed			
6.6102.3b Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications and local and national electrical and mechanical codes	Prevent an electrical hazard		2422
6.6102.3c Access	Motorized damper and service switch will be accessible for maintenance in accordance with required code or authority having jurisdiction	Ensure accessibility for maintenance		2423
6.6102.3d Mounting intake duct	Ventilation duct will be attached as close to the HVAC system's fan as possible while remaining in compliance with HVAC manufacturer specifications Filtration of ventilation air will be provided before passing through the thermal conditioning components Duct will be connected to intake fitting Connection and seal will be performed according to supply duct detail	Ensure short duct run to achieve optimum air flow Preserve integrity of the duct system and building envelope		2424
6.6102.3e Motorized damper	A motorized damper or equivalent technology will be installed between the intake fitting and the return side of the air handler Air flow will be provided by sequenced operation of the damper or equivalent technology	Prevent air flow when none is desired		2425
6.6102.3f Intake filter	An accessible filter will be installed Filter will be able to remove contaminants consistent with at least minimum efficiency reporting value (MERV) 6 or better when tested in accordance with ANSI/ASHRAE 52.2 Filter or air cleaning systems that intentionally produce ozone will not be allowed	Ensure occupant health and safety Preserve integrity of the building envelope		2426
6.6102.3g Occupant education	Occupant will be educated on how and when to change filter	Protect occupant health and safety Preserve integrity of the building envelope		2427

6.6103.1 Inline or Multi-Port

Topic: Supply

Subtopic: Fans

Desired Outcome: Inline or multi-port fan installed in accordance with specifications

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6103.1a Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes	Prevent an electrical hazard		2428
6.6103.1b Access	Fan and service switch will be accessible for maintenance, service, and replacement in accordance with applicable code or authority having jurisdiction	Ensure accessibility for maintenance		2429
6.6103.1c Fan mounting	Fan will be oriented with inlet toward the fan intake fitting Fan will be oriented so the equivalent length of the duct run is as short as possible Fan will be securely mounted in accordance with manufacturer specifications Fan will be isolated from the building framing unless specifically designed to be directly attached Fan will be installed remotely by ducting from supply register or grilles	Ensure short duct run to achieve optimum air flow Ensure fan is mounted securely Ensure fan housing or building framing does not shake, rattle, or hum when operating Minimize noise		2430
6.6103.1d Damper (required for intermittent operation)	Damper will be installed to open in the direction of the desired flow Damper will close when system is off	Ensure unrestricted air flow		2431
6.6103.1e Duct connections	Ducts will be connected and sealed to the intake fitting, fan, and register or grilles as follows: Metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws	Provide desired air flow Preserve integrity of the duct system and building envelope		2432

	Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool Flexible duct between the cable tie and end of metal or PVC duct will be screwed PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications All joints and connections in ductwork will be fastened and sealed with UL 181B or 181B-M welds, gaskets, adhesive mastics, or mastic-plus- embedded-fabric systems			
6.6103.1f Filter	An accessible filter will be installed between the intake fitting and the fan Contaminant removal will be consistent with at least minimum efficiency reporting value (MERV) 6 or better when tested in accordance with ANSI/ASHRAE 52.2 Filter or air cleaning systems that intentionally produce ozone will not be allowed	Ensure occupant health and safety Preserve integrity of the building envelope		2433
6.6103.1g Occupant education	Occupant will be educated on how and when to change filter	Ensure occupant health and safety		2434
6.6103.1h Boot to interior surface seal	All gaps between boot and interior surface will be air sealed Gypsum edge will be wetted before applying water-based sealant Sealants will be continuous and be in accordance with IRC	Prevent air leakage around intake housing Ensure a permanent seal to the building air barrier Prevent a fire hazard		2435

6.6188.1 Removing Supply Vents from Garages

Topic: Supply

Subtopic: Special Considerations

For supporting material, see Building America Solution Center.

Desired Outcome: Safe removal of supply garage vents

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

6.6188.1a Removal of supply/return in garage	Supply run feeding the register will be truncated as near to the supply plenum as possible If directly connected to the plenum, it will be truncated at the plenum If connected to a Y or T branch system, it will be truncated at the Y or T Return grille located in garage will be removed in the same manner as supply	Minimize surface area of duct		2436
6.6188.1b Patching of the hole in the duct system created by removal	All holes in sheet metal ducts will be patched with sheet metal and secured with sufficient screws to hold the patch flat without gaps Holes left in any Y or T will be capped with sheet metal caps and fastened with at least three screws	Ensure a secure and strong patch		2437
6.6188.1c Sealing of the patch	All patches will be sealed with mastic meeting UL 181M and in accordance with manufacturer specifications	Ensure an airtight patch		2438
6.6188.1d Removal of discarded ducts	All abandoned ductwork will be removed from work area	Provide a clean work site		2439
6.6188.1e Patching of the register hole in garage	Hole created by the removal of the register and boot will be patched and taped using material meeting local codes	Prevent a fire hazard		2440
6.6188.1f External static pressure testing	Units will be tested for external static pressure (ESP) before and after work If there is a significant rise in ESP, air flow testing will be required	Ensure correct fan performance		2441

6.6201.2 Primary Ventilation Air Flow between Rooms

Topic: Whole Building Ventilation

Subtopic: Air Flow Requirements

Desired Outcome: Air circulates freely between rooms

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)

6.6201.2a Balancing pressure	An appropriate means of pressure balancing will be installed (e.g., transfer grilles, jumper ducts, individual room returns) No room will exceed +/- 3 pascals with reference to the common area with all interior doors closed and ventilation systems running	Ensure free flow of air between rooms Preserve integrity of the building envelope		2445

6.6202.1 Controls

Topic: Whole Building Ventilation

Subtopic: Components

For supporting material, see Building America Solution Center.

Desired Outcome: Fan controls support ventilation strategy

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6202.1a Primary ventilation fan (whole-house volume)	Controls will be used that can meet the following conditions: Run fan continuously or intermittently depending upon the intended schedule of operation Operate fan to produce the intended flow for each intended flow setting	Deliver intended air exchange Ensure fan controls meet intended ventilation strategy		2446
6.6202.1b Local exhaust—local fan	Controls will be used that meet the following conditions: Run fan continuously or intermittently depending on the intended schedule of operation Run fan for intended time for timed operation Operate fan to produce the intended flow for each intended flow setting	Deliver intended air exchange Ensure fan controls meet intended ventilation strategy		2447
6.6202.1c Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes	Prevent an electrical hazard Ensure fan controls meet intended ventilation strategy		2448
6.6202.1d Manual override	A labeled switch for manual override will be included for the ventilation system	Ensure fan controls meet intended ventilation strategy		2449
6.6202.1e Occupant education	A system operation guide designed for occupants (non-professionals) will	Educate occupants about system operation and importance Deliver intended air exchange		2450

	be provided to explain how and why to operate system A label indicating the presence and purpose of the ventilation system will be included or a copy of the system operation guide will be posted at the electrical panel			

6.6202.2 Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) Installation

Topic: Whole Building Ventilation

Subtopic: Components

Desired Outcome: HRV and ERV systems installed to specifications

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6202.2a Wiring	Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes	Prevent an electrical hazard		2451
6.6202.2b Access	Fans, service switch, filters, drain, and drain pan will be accessible for maintenance in accordance with authority having jurisdiction	Maintain designed air flows and system performance Ensure occupant health and safety		2452
6.6202.2c Fan mounting	Fan will be securely mounted in accordance with manufacturer specifications Fan will be oriented so the equivalent length of the duct run is as short as possible; calculate "equivalent length" in accordance with ANSI/ACCA Manual D (Residential Duct Systems) Fan will be isolated from the building framing unless specifically designed to be directly attached	Ensure short duct runs achieve optimum air flows Ensure fan is mounted securely Ensure fan housing or building framing does not shake, rattle, or hum when operating Minimize noise		2453
6.6202.2d Backdraft dampers (required for intermittent operation)	A backdraft damper will be installed between the heat recovery ventilator (HRV) or energy recovery ventilator (ERV) and the exterior, unless the system operates continuously Outdoor air intakes and exhausts will be equipped with automatic or	Prevent reverse air flow when the system is off		2454

	gravity dampers that close when the ventilation system is not operating			
6.6202.2e Installation of fittings	Collar will be at least the same diameter as the exhaust fan outlet; if collar is larger than exhaust fan outlet, a rigid metal transition will be used Fitting will be appropriate for regional weather conditions and installation location on house so as not to be rendered inoperable	Achieve the desired air flows to and from the designated locations Ensure unrestricted air flow Preserve integrity of the building envelope		2455
6.6202.2f Duct connections	Ducts will be connected to applicable registers or grilles, collector box, HRV or ERV, intake fitting, and termination fitting Ducts will be connected and sealed as follows: Metal-to-metal or metal-to-PVC will be fastened with a minimum of three equally spaced screws Flexible duct-to-metal or flexible duct-to-PVC will be fastened with tie bands using a tie band tensioning tool Flexible duct between tie band and end of metal or PVC duct will be screwed into place PVC-to-PVC materials will be fastened with approved PVC cement Other specialized duct fittings will be fastened in accordance with manufacturer specifications In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material	Achieve the desired air flows to and from the desired locations Preserve integrity of the duct system and building envelope		2456
6.6202.2g Duct layout	Air to be exhausted to the outdoors will not be taken directly from the forced air system Supply ducts attached to the return side of forced air systems will be: Attached as close to the HVAC system's fan as possible while remaining in compliance with manufacturer specifications Set up to provide filtration of outdoor ventilation air before reaching the HVAC system with minimum MERV 6 filter Connected to the intake fitting Connected and sealed in accordance with the supply duct detail	Achieve the desired air flows to and from the desired locations Preserve integrity of duct system and house Ensure occupant health and safety		2457

6.6202.2h Insulation	Ducts installed outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local codes	Preserve integrity of the duct system by eliminating condensation		2458
6.6202.2i Sealant selection	Gap between registers or grilles and interior surface will be sealed Sealants will be compatible with their intended surfaces Sealants will be continuous and meet fire barrier specifications	Prevent air leakage around registers or grilles Ensure a permanent seal Prevent a fire hazard		2459
6.6202.2j Balance and flow	Air flows will be measured and adjusted to match to the system's intent	Achieve the desired air flows to and from the desired locations		2460
6.6202.2k Occupant education	Occupant will be educated on how and when to change filter and clean drain pan, if applicable, according to manufacturer specifications	Ensure occupant health and safety Preserve integrity of system		2461

6.6203.1 Ventilator Dehumidifiers

Topic: Whole Building Ventilation

Subtopic: Dehumidifiers

Desired Outcome: Humidity controlled to achieve optimum indoor air quality (IAQ)

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6203.1a Equipment	Equipment will be ENERGY STAR® rated Settings will be maintained through power failure (auto restart) Dehumidification ventilator will be a ducted unit Dehumidification ventilator will be able to provide outside air	Efficiently remove humidity Ensure ease of operation Provide ventilation with outside air		2462
6.6203.1b Sizing	System with enough capacity to handle humidity from outside air ventilation and internal gains will be selected Humidity levels inside the home will be maintained less than 60%	Efficiently remove humidity		2463
6.6203.1c Location	Equipment will be located in an area with access to HVAC supply trunk line or plenum and ducted outdoor air	Distribute outside air Easily maintain equipment		2464

	Access for maintenance, electrical service, and removal of condensate will be provided			
6.6203.1d Installation	Installation will be in accordance with manufacturer specifications and local codes	Maintain manufacturer warranty and proper installation		2465
6.6203.1e Duct connections	Duct connections will be sized, sealed, and attached in accordance with manufacturer specifications	Achieve the desired air flows to and from the desired locations		2466
6.6203.1f Controls	Humidity control and sensor will be installed in accordance with manufacturer specifications near thermostat	Ensure humidity in the house controls the system operation		2467

6.6204.1 Commissioning Ventilation Systems

Topic: Whole Building Ventilation

Subtopic: System Evaluation

Desired Outcome: Verify proper operation of existing system, installed system air flow meets required standard and provides continuous ventilation for background pollutant sources

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6204.1a Identification	Identify whole building ventilation strategy that was installed in the home, based on options described in current version of ASHRAE 62.2, e.g., exhaust only, supply only, balanced, combining local and whole home ventilation delivery, incorporating infiltration credit, etc.	Ensure suitable whole building ventilation strategy is installed Identify testing requirements to determine installed system air flow		3040
6.6204.1b Equipment inspection	Visually inspect and document status of: Electrical connections Name plate (rated sone and flow) Motor cleanliness	Evaluate equipment		3041
6.6204.1c Pathway inspection	Visually inspect and document status of ducting or other airflow pathways to ensure proper: Conections (proper materials, sealed and connected) Insulation Support Sizing, and Termination locations and fittings Verify proper damper operation	Preserve integrity of building envelope Effectively move air along selected pathways		3042

6.6204.1d Measurement and Adjustment	Using a calibrated device, measure air flow of all necessary components, including building air leakage when relevant Adjust ventilation equipment air flows as necessary to meet the ventilation rates required by the current version of ASHRAE 62.2.	Provide sufficient air flows per current ventilation standards Verify suitable performance of installed ventilation strategy		3043
6.6204.1e Work order	Develop work order as necessary to correct deficiencies identified during inspections and measurement	Correct deficiencies Ensure proper operation		6952
6.6204.1f Occupant education	Instruct occupant on purpose, use and maintenance of ventilation, and typical signs that ventilation is needed, e.g., condensation on windows	Occupant understands benefits of good indoor air quality and can operate ventilation equipment as needed		6953

6.6288.1 Sound-Rating Limits

Topic: Whole Building Ventilation

Subtopic: Special Considerations

Desired Outcome: Systems operate as quietly as possible

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.6288.1a Primary ventilation system or any continuously operating fan	System shall be rated for sound in accordance with current ASHRAE 62.2 standard	Minimize noise		2468
6.6288.1b Intermittent local ventilation system	Local ventilation will be rated for sound at a maximum of 3 sone, unless their maximum rated airflow exceeds 400 cfm, in accordance with current ASHRAE 62.2 standard	Minimize noise		2469

6.9901.1 Supplemental Ventilation Information—ASHRAE 62.2

Topic: Additional Resources

Subtopic: Codes and Standards Resources

Desired Outcome: To provide supplemental ventilation information—ASHRAE 62.2

For supporting material, see Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
6.9901.1a Ventilation fan flow rate	ASHRAE Standard 62.2 and the calculation of the infiltration credit allow adjustments to primary ventilation fan flow rates for existing houses using a single fan.	To provide supplemental ventilation information--ASHRAE 62.2		4283

Section 7: Baseload

7.8001.1 Refrigerator and Freezer Replacement

Topic: Plug Load

Subtopic: Refrigerators/Freezers

Desired Outcome: A more energy efficient appliance installed

For supporting material, see Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8001.1a Selection	Appliance shall be ENERGY STAR® qualified or at least as energy efficient Appliance will fit in the available space without blocking access to light switches, cabinets, etc. Appliance will carry a minimum one-year warranty that will provide a replacement appliance if repeated issues relating to health, safety, or performance occur	Energy efficient appliance installed		2470
7.8001.1b Installation	Appliance will be installed in accordance with manufacturer specifications and local codes Any penetrations to the exterior of the home created by the installation of the appliance will be sealed Energy-related appliance controls will be demonstrated to the occupant Specific information on the proper maintenance of the equipment will be provided to the occupant	Achieve intended appliance function Preserve food at low energy use Educate occupant on how to operate and maintain the appliance		2471

	Warranty information, operation manuals, and installer contact information will be provided to the occupant			
7.8001.1c Decommissioning	Appliances replaced by new units will be recycled or disposed of in accordance with federal, state, or local regulations Appliances infested with pests will be enclosed before moving	Prevent reuse of inefficient equipment and components Protect the environment Protect worker safety		2472

7.8001.2 Cleaning and Tuning Existing Refrigerators and Freezers

Topic: Plug Load

Subtopic: Refrigerators/Freezers

Desired Outcome: Energy used for food preservation reduced

For supporting material, see Referenced Standards and Calculation of the Infiltration Credit.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8001.2a Clean and tune	Dirty or clogged coils will be cleaned Air flow to the coils will be provided in accordance with manufacturer specifications Appliance will be located away from heat sources (e.g., supply registers, direct sunlight) if possible Interior temperatures will be measured, and the appliance must maintain: Freezer temperature at 0° Fresh food at 35-40° Specific information about the proper maintenance of the equipment will be provided to the occupant Condensation control switch will be left in the appropriate position, given occupant preference and moisture load in the house	Reduce energy use Improve performance Educate occupant on how to operate and maintain the appliance		2473

7.8002.1 Entertainment and Computer Systems and Components Replacement

Topic: Plug Load

Subtopic: Electronics

Desired Outcome: Energy used for electronic entertainment and computer use reduced while effective performance is maintained

For supporting material, see Referenced Standards, Calculation of the Infiltration Credit and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8002.1a Selection	Category of equipment selected will meet occupant preferences and have the lowest available energy use [e.g., plasma vs. light-emitting diode (LED)] Equipment will have a minimum energy efficiency level of ENERGY STAR® Equipment will be selected that does not have to be left on during non- use periods for updates (e.g., gaming systems, set-top boxes) Standby losses for system will be one watt or less	Reduce energy use Ensure occupant satisfaction with appliance		2474
7.8002.1b Installation	Equipment will be installed in accordance with manufacturer specifications (e.g., air circulation) and meet all applicable codes Any penetrations to the exterior of the home created by the installation of the equipment will be sealed All energy saving features will be enabled unless specifically directed otherwise by the occupant A readily accessible means of disconnection (e.g., power strip, timer) will be provided for equipment that must be disconnected from the power source to avoid standby losses and whose performance will not be damaged by being disconnected All equipment controls will be demonstrated to the occupant Specific information about the proper maintenance of the equipment will be provided to the occupant Warranty information, operation manuals, and installer contact	Reduce energy use Ensure equipment is available for use when needed Ensure equipment is convenient to turn off when not in use Educate occupant on how to operate and maintain equipment		2475

	information will be provided to the occupant			
7.8002.1c Decommissioning	Equipment will be recycled or disposed of using Environmental Protection Agency (EPA) Responsible Recycling (R2) initiative principles	Prevent reuse of inefficient equipment and components Reduce waste Properly dispose of hazardous materials		2476

7.8003.1 Lighting Upgrade

Topic: Plug Load

Subtopic: Lighting

Desired Outcome: Energy used for lighting reduced while maintaining adequate and safe lighting levels

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8003.1a Daylighting	Window coverings (e.g., blinds, shades, movable insulation) will be replaced or maneuvered to maximize useful daylight where appropriate Active and passive day lighting will be properly oriented, designed, and installed where appropriate	Reduce energy use without negative consequences (e.g., glare, unintentional heating)		2477
7.8003.1b Selection	All bulbs, fixtures, and controls will be appropriate for the intended application (e.g., enclosed, orientation, dimmable, potential for breakage, indoor, and outdoor) All bulbs, fixtures, and controls will be selected to provide the brightness and light quality required in that application (e.g., task lighting, trip-and- fall hazards, nightlights) Selected equipment should have the highest level of efficiency within a technology [e.g., compact fluorescent lamp (CFL), LED] All bulbs, fixtures, and controls will be ENERGY STAR® rated where applicable When possible, bulbs, fixtures, and controls will be selected that will facilitate the use of future lighting technologies (e.g., LEDs)	Provide improved lighting quality at lower energy use Select equipment that will not be an unnecessary barrier to future technologies Avoid inferior products and unsatisfied occupants		2478

	When incandescent bulbs cannot be replaced or when occupant chooses not to replace, a dimmer will be selected Light/lamp wattage should not exceed rated wattage of fixture Bulb replacements will be chosen based on expected durability, light quality, and lifetime energy use of the bulb Controls to turn off lights when not needed (e.g., no one in room) will be provided All bulbs, fixtures, and controls will be UL-approved and installed in accordance with local code(s) and NFPA 70 National Electric Code Fluorescent light ballasts containing polychlorinated biphenyls (PCBs) will be replaced in accordance with the EPA's Healthy Indoor Environment Protocols for Home Energy Upgrades			

7.8004.1 Washing Machine

Topic: Plug Load

Subtopic: Laundry

Desired Outcome: Energy and environmental impact for washing clothes reduced

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8004.1a Selection	Minimum appliance efficiency will be ENERGY STAR® and WaterSense® or better Classes within ENERGY STAR® standards will be considered so as to achieve greater savings Adequate clearance will be maintained around appliance when fit into available space so access to	Reduce energy use Ensure occupant satisfaction with appliance		2479

	cabinets and light switches are not blocked Appliance will be covered by a minimum one-year warranty Equipment will be selected with features that reduce peak electric demand, absolute energy use, and water use Standby losses for equipment will be one watt or less			
7.8004.1b Installation	Appliance will be installed in accordance with manufacturer specifications (e.g., leveling, plumbing connection, electrical connection, interior lighting) and meet all applicable codes Shut-off valves will be installed if not already present Hoses that can withstand water pressure at the location will be installed If located in conditioned or finished area, overflow pan will be installed and drained to a safe location Any penetrations to the exterior of the home created by the installation of the appliance will be sealed Energy-related appliance controls will be demonstrated to the occupant Specific information about proper maintenance of the equipment will be provided to the occupant Water quality will be evaluated using a pH and hardness tests, and the occupant will be informed on detergent levels and type to optimize performance Warranty information, operation manuals, and installer contact information will be provided to the occupant	Ensure equipment functions as designed Reduce water consumption Prevent water damage Educate occupants on how to maintain washer to ensure savings		2480
7.8004.1c Decommissioning	Replaced appliances will be recycled or removed in accordance with local regulations, including older equipment switches containing mercury	Prevent the reuse of inefficient equipment and its components Reduce waste Ensure occupant health		2481

7.8004.2 Clothes Dryer Replacement

Topic: Plug Load

Subtopic: Laundry

Desired Outcome: Energy and environmental impact for drying clothes reduced

For supporting material, see Calculation of the Infiltration Credit, Referenced Standards and Building America Solution Center.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8004.2a Selection	Total energy use will be factored into the selection process if fuel switching is being considered Dryer will be equipped with moisture sensor Equipment will be selected with energy features that reduce both peak electric demand and absolute energy use Standby losses for equipment will be one watt or less A dryer best matched to the venting options will be selected (e.g., central location, length of vent, cost of venting) Appliance will be covered by a minimum one-year warranty	Reduce energy use Avoid increasing total energy use (gas and electric) when fuel switching		2482
7.8004.2b Installation	Appliance will be installed in accordance with manufacturer specifications (e.g., leveling, plumbing connection, electrical connection, interior lighting) and meet all applicable codes If existing venting does not meet the following criteria (as well as manufacturer specifications and applicable codes), new venting will be installed using the following specifications: Appliance will be vented to the outside using metal-to-metal or UL listed foil-type venting material Venting design will meet standards for optimal venting	Ensure equipment functions as designed Install appliance safely and effectively Ensure house as a whole system is not adversely affecting the proper functioning/venting of equipment Reduce energy use In case of fuel switching, reduce cost		2483

	Venting will not be constricted or blocked and should be free of lint and/or debris Must be mechanically fastened to connect metal-to-metal and must not catch lint inside venting material Only clamps will be used on semi-rigid metal and UL listed foil-type venting materials At least 3' of the vent closest to the exterior of the house will be insulated with a minimum of R-6 All dryers, other than condensing dryers, will be vented to the outdoors If a combustion appliance is used, combustion safety testing will be performed in accordance with the Health and Safety Chapter of the Standard Work Specifications for Single Family Housing or other equivalent practice Any penetrations to the exterior of the home created by the installation of the appliance will be sealed Energy-related appliance controls will be demonstrated to the occupant Specific information of the proper maintenance of the equipment will be provided to the occupant Warranty information, operation manuals, and installer contact information will be provided to the occupant			
7.8004.2c Decommissioning	Replaced appliances will be recycled or removed and disposed of in accordance with local regulations, including older equipment switches containing mercury	Prevent the reuse of inefficient equipment and its components Reduce waste Ensure occupant health		2484

7.8101.1 Shower Head and Faucet Aerator

Topic: Water Heating

Subtopic: Water Use Reduction

Desired Outcome: Energy and water use reduced while occupant needs for water flow maintained

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8101.1a Work assessment	Installer pre-work assessment will be conducted to determine if plumbing needs correction before installing high-efficiency shower head or faucet	Verify scope of work		2485
7.8101.1b Selection	The rated flow of new shower heads will be 2.5 gallons per minute (GPM) or less If multiple heads are provided, the total flow rate will not exceed 2.5 GPM Aerator flow rate will be 2.2 GPM or less Features will be selected that meet any special needs of the occupant (e.g., shut off, swivel, handheld showers)	Reduce water and energy consumption Ensure occupant satisfaction		2486
7.8101.1c Installation	Equipment will be installed in accordance with manufacturer specifications and meet all applicable building codes Water quality will be evaluated for debris that may clog the equipment Once installed, high-efficiency shower heads or faucet aerators will be tested to determine if equipment is tightened adequately to prevent leakage at the point of connection If needed, shower diverter will be repaired or replaced Any penetrations to the exterior of the home created by the installation of the equipment will be sealed Any damage done to the house during installation will be repaired Specific information about proper maintenance of the equipment will be provided to the occupant Warranty information, operation manuals, and installer contact information will be provided to the occupant	Reduce water and energy consumption Ensure occupant satisfaction with water flow Eliminate water leakage Prevent water damage		2487

	Water flow that satisfies the occupant will be provided by all shower heads and faucet aerators Occupant's acceptance of the shower head and/or aerator will be documented			
7.8101.1d Decommissioning	Replaced shower heads and faucet aerators will be recycled or disposed of properly	Prevent the reuse of inefficient equipment and components		2488

7.8102.1 Water Heater Selection

Topic: Water Heating

Subtopic: Installation and Replacement

Desired Outcome: Safe, reliable, and efficient hot water source selected that meets occupant needs at lowest possible cost of ownership and operation

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8102.1a Selection parameters	Equipment will provide sufficient, affordable, safe, and healthy hot water for the occupant in accordance with IRC Potential for solar hot water heating or other renewable energy systems will be assessed in selecting the hot water equipment Potential for health and safety hazards (e.g., backdrafting, flame rollout, obstructions) will be assessed in selecting equipment and the cost of remedying such problems will be included in any cost and benefit calculations If a combustion based system is selected, it will be either direct vented or power vented, and ENERGY STAR® qualified or an Energy Factor (EF) of 0.58 or higher If combustion equipment is selected, a low nitrogen oxide burner will be included Equipment will be functional at high efficiency under all load conditions Standby losses will be reduced to maximum potential	Save energy and water Protect the environment Identify appliance options based on the needs and wants of the occupant		2489

	Fuel type will be selected based on affordability to occupant Equipment will be freeze resistant or installed in a conditioned space Efficiency of equipment will be maintained throughout life of system Occupant control of hot water temperature will be provided on the equipment The following will be determined from the occupant: Lifestyle Current and future needs Space considerations Fuel options Health and safety considerations Appliance options Maintenance and operation costs Return on investment concerns			
7.8102.1b Product selection	Water heater will be selected based on performance requirements of the occupant, available fuel sources, energy efficiency, and total life cycle cost In very cold climates, on-demand water heaters will be sized to meet the demand of water flow at very low water intake temperatures When evaluating an existing thermal solar water heating system, a solar expert should be consulted The proper installation and maintenance of solar hot water systems is provided in the Uniform Solar Energy Code (USEC) and IRC	Ensure equipment meets the occupant's expectations while providing efficient energy and water use		2490

7.8102.2 Storage-Type Appliance

Topic: Water Heating

Subtopic: Installation and Replacement

Desired Outcome: Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8102.2a Hazardous material removal	Health concerns in the removal and replacement of equipment (e.g., asbestos, other hazardous materials) will be identified Written notification will be provided to occupants of the discovery of hazardous material, including contact information for regional EPA asbestos coordinator Occupant will be asked to contract with an EPA-certified asbestos contractor to conduct abatement before equipment removal and replacement (occupant is responsible for abatement or remediation)	Remediate health hazards using EPA-certified contractors		2491
7.8102.2b Equipment removal	Accepted industry procedures and practices will be followed to: Remove old water heater and associated components in accordance with IRC or authority having jurisdiction Seal any unused chimney openings and penetrations in accordance with IRC or authority having jurisdiction Remove unused oil tank, lines, valves, and associated equipment in accordance with IRC or authority having jurisdiction All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards	Ensure the safety of the workers and occupants Preserve integrity of the building Remove old equipment in a timely and efficient manner		2492
7.8102.2c New equipment installation	New water heater and associated components will be installed to accepted industry standards, in accordance with the IRC and manufacturer specifications The system will be installed to be freeze resistant Any existing water leaks will be repaired before installation begins Any penetrations to the exterior of the home created by the installation of the equipment will be sealed	Ensure the safety of the workers and occupants Preserve integrity of the building Remove old equipment in a timely and efficient manner		2493
7.8102.2d Emergency drain pan	An emergency drain pan and drain line shall be installed in accordance with the IRC	Collect and safely dispose of water escaping from the storage tank		2494

7.8102.2e Expansion tank	Expansion tanks will be installed where required and in accordance with the AHJ	Protect the storage tank from expansion		2495
7.8102.2f Temperature and pressure relief valve	Correct temperature and pressure relief valve will be installed in compliance with IRC and according to manufacturer specifications Temperature and pressure relief valve discharge tube will be installed in accordance with IRC	Discharge excessive energy (pressure or temperature) from storage tank to safe location		2496
7.8102.2g Dielectric unions	Dielectric unions will be installed in accordance with the IRC, authority having jurisdiction, and according to manufacturer specifications	Break the stray voltage electrical circuit through the storage tank		2497
7.8102.2h Backflow prevention	Backflow prevention will be installed in accordance with manufacturer specifications and all applicable codes	Protect water supply from contamination		2498
7.8102.2i Thermal efficiency	If additional tank insulation is installed, it will be rated a minimum of R-11 and will be installed to manufacturer specifications If additional insulation is installed, it will be installed based on fuel type, making sure not to obstruct draft diverter, pressure relief valve, thermostats, hi-limit switch, plumbing pipes or elements, and thermostat access plates The first 6' of inlet and outlet piping will be insulated in accordance with manufacturer specifications Combustible pipe insulation must maintain a minimum clearance of 6" from gas water heater draft hood and/or single wall metal pipe. Clearance from vent such as "B" vent should be maintained per vent manufacturer's specifications Heat traps will be installed on the inlet and outlet piping where not provided by manufacturer	Reduce standby loss from near tank piping and storage tank Ensure insulation does not make contact with flue gas venting		2499
7.8102.2j Fuel supply	Electric or fossil fuel supply components will be installed to accepted industry standards as per NFPA 31 and 54, or NFPA 70 National Electric Code (NEC) for electric components, or authority having jurisdiction	Provide sufficient fuel to the water heater, burner, or element		2500

7.8102.2k Discharge temperature	Discharge temperature will be set not to exceed 120° or as prescribed by local code	Ensure safe hot water supply temperature to fixtures		2501
7.8102.2l Commissioning of system	The following will be checked once the system has been filled and purged: Safety controls Combustion safety and efficiency Operational controls Fuel and water leaks Local code requirements Commissioning will be in compliance with manufacturer specifications and relevant industry standards	Ensure safe system function Keep cost of ownership as low as possible		2502
7.8102.2m Occupant safety	Carbon monoxide (CO) alarms will be installed in each dwelling in accordance with ASHRAE 62.2 and authority having local jurisdiction Occupant will be provided information regarding the health effects and risk of high CO concentrations as well as a list of monitors that can provide more detail regarding CO levels	Ensure occupant life safety; CO alarms are designed to detect levels at which occupants might become unable to evacuate		2503
7.8102.2n Occupant education	Completed work will be reviewed Occupants will be educated on the safe and efficient operation and maintenance of the system, including: Adjustment of water temperature and target temperature in accordance with local code Periodic drain and flush Expansion tank and backflow preventer (no occupant maintenance required) Periodic inspection, maintenance, or replacement	Ensure occupant is informed of the safe, efficient operation and maintenance of the system		2504

7.8102.3 On-Demand Appliance

Topic: Water Heating

Subtopic: Installation and Replacement

Desired Outcome: Safe and reliable hot water source provided that meets occupant needs at lowest possible cost of ownership

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8102.3a Hazardous material removal	Health concerns in the removal and replacement of equipment (e.g., asbestos, other hazardous materials) will be identified Written notification will be provided to occupants of the discovery of hazardous material, including contact information for regional EPA asbestos coordinator Occupants will be asked to contract with an EPA-certified asbestos contractor to conduct abatement before equipment removal and replacement (occupant is responsible for abatement or remediation)	Remediate health hazards using EPA-certified contractors		2505
7.8102.3b Equipment removal	Accepted industry procedures and practices will be followed to: Remove old water heater and associated components in accordance with IRC Seal any unused chimney openings and penetrations in accordance with IRC Remove unused oil tank, lines, valves, and associated equipment in accordance with IRC All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards	Ensure the safety of the workers and occupants Preserve integrity of the building Remove old equipment in a timely and efficient manner		2506
7.8102.3c New equipment installation	A new water heater and associated components will be installed to accepted industry standards, in accordance with the IRC, authority having jurisdiction and manufacturer specifications	Ensure the safety of the workers and occupants Preserve integrity of the building Remove old equipment in a timely and efficient manner		2507
7.8102.3d Emergency drain pan	An emergency drain pan and drain line shall be installed in accordance with the IRC	Collect and safely dispose of water escaping from the storage tank		2508
7.8102.3e Temperature and pressure relief valve	Correct temperature and pressure relief valve will be installed in compliance with IRC and according to manufacturer specifications	Discharge excessive energy (pressure or temperature) from storage tank to safe location		2509

	Temperature and pressure relief valve discharge tube will be installed in accordance with IRC			
7.8102.3f Dielectric unions	Dielectric unions will be installed to accepted industry standards, in accordance with the IRC and according to manufacturer specifications	Break the stray voltage electrical circuit through the storage tank		2510
7.8102.3g Backflow prevention and pressure regulator	Backflow prevention will be installed in accordance with manufacturer specifications House water pressure and volume will be verified as sufficient to be in accordance with manufacturer specifications All applicable codes will be followed	Protect the water supply from contamination Provide for sufficient volume and pressure		2511
7.8102.3h Thermal efficiency	Any accessible hot water lines at the appliance will be insulated to meet IRC or local requirements, whichever is greater.	Reduce line losses		2512
7.8102.3i Required combustion air	Electric or fossil fuel supply components will be installed to accepted industry standards as per IRC , NFGC and NFPA 31 and 54 for gas and oil, or NEC for electric Energy input required by the appliance will be in accordance with manufacturer specifications All on-demand appliances will be installed per manufacturer recommendations/specifications	Ensure adequate combustion air for operation of the appliance		2513
7.8102.3j Venting of flue gases	Combustion byproducts will be removed in accordance with IRC, authority having jurisdiction, and manufacturer specifications	Ensure the safety and durability of the venting system		2514
7.8102.3k Flue gas testing	Undiluted flue gases will be checked with a calibrated combustion analyzer in accordance with BPI-1100-T If combustion is not in compliance with BPI-1100-T, diagnostics and adjustments will be done to manufacturer specifications or local codes	Confirm that combustion is occurring safely with maximum efficiency		2515
7.8102.3l Electric and fossil fuel supply	Electric or fossil fuel supply components will be installed to accepted industry standards as per IRC, NFGC and NFPA 31 and 54 for gas and oil, or NEC for electric	Provide sufficient fuel to the water heater burner or element		2516

	Energy input required by the appliance will be in accordance with manufacturer specifications			
7.8102.3m Cold water supply	The volume and pressure of the water supplied to the appliance will be in accordance with manufacturer specifications	Provide sufficient volume and pressure of water to the appliance		2517
7.8102.3n Discharge temperature	Discharge temperature will be set in accordance with manufacturer instructions and in compliance with local codes Use extreme caution when temperature setting is above 120°F	Ensure safe hot water supply temperature to fixtures		2518
7.8102.3o Commissioning of system	The following will be checked once the system has been connected and filled: Safety controls Combustion safety and efficiency Operational controls Fuel and water leaks Cycle unit Local code requirements Manufacturer specifications and all relevant industry standards will be met in commissioning	Ensure system functions safely with lowest possible cost of ownership		2519
7.8102.3p Ambient carbon monoxide (CO)	All homes will have a CO alarm	Ensure occupant health and safety		2520
7.8102.3q Occupant education	Completed work will be reviewed Occupants will be educated on the safe and efficient operation and maintenance of the system, including: Adjustment of water temperature and target temperature in accordance with local code Operation of backflow preventer and pressure regulator (no occupant maintenance required) Importance of keeping operating manuals accessible	Ensure occupant is informed of the safe, efficient operation and maintenance of the system		2521

7.8103.1 Storage-Type Appliance

Topic: Water Heating

Subtopic: Maintenance/Inspection

Desired Outcome: Safe, reliable, and efficient operation of the appliance maintained

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8103.1a Health and safety	Combustion safety testing will be performed in accordance with the Health and Safety Chapter of the Standard Work Specifications for Single Family Housing or other equivalent practice Electrical components will be verified to comply with NEC (e.g., no electrical box connector, no disconnect, improperly sized breaker and wire)	Identify potential health and safety issues		2522
7.8103.1b Visual inspection	Inspection will be conducted to show compliance with the IRC, including but not limited to: Water or fuel leaks Damaged wiring Venting issues with draft and condensation (e.g., soot, rusting of flue pipe, burned paint or wires, efflorescence) Corrosion (e.g., rust, mineral deposits) General condition of components	Determine needed repairs or maintenance		2523
7.8103.1c Thermal efficiency	Water heater storage tanks shall have a minimum R-value of R-24, unless the SIR to add insulation is less than 1.0 Added insulation will not obstruct the unit's draft diverter, pressure relief valve, thermostats, hi-limit switch, plumbing pipes or elements, and thermostat access plates The first 6' of inlet and outlet piping will be insulated in accordance with IRC or local requirements, whichever is greater	Reduce standby losses from near tank piping and storage tank Ensure insulation does not make contact with flue gas venting		2524
7.8103.1e Temperature and pressure relief valve	Correct temperature and pressure relief valve will be installed in compliance with IRC and according to manufacturer specifications Temperature and pressure relief valve discharge tube will be installed in accordance with IRC	Discharge excessive energy (pressure or temperature) from storage tank to safe location		2526

7.8103.1f Maintenance records	Occupants will be advised to keep records of all maintenance done to their system Copies of or access to installation and operation manuals will be provided	Provide a history of system installation and maintenance to improve chance of successful future maintenance or repair		2527
7.8103.1g Occupant safety	Carbon monoxide (CO) alarms will be installed in each dwelling in accordance with ASHRAE 62.2 and authority having local jurisdiction Occupant will be provided information regarding the health effects and risk of high CO concentrations as well as a list of monitors that can provide more detail regarding CO levels	Ensure occupant life safety Inform occupant regarding possible CO hazards		2528
7.8103.1h Occupant education	Completed work will be reviewed Occupants will be educated on the safe and efficient operation and maintenance of the system, including: Adjustment of water temperature and target temperature in accordance with local code Periodic drain and flush Periodic inspection, maintenance, or replacement of anode rod	Ensure occupant is informed of the safe, efficient operation and maintenance of the system		2529

7.8103.2 On-Demand Appliance

Topic: Water Heating

Subtopic: Maintenance/Inspection

Desired Outcome: Safe, reliable, and efficient operation of the appliance maintained

Note: The authority having jurisdiction may require that a licensed professional perform certain tasks outlined in this detail.

For supporting material, see Calculation of the Infiltration Credit and Referenced Standards.

TITLE	SPECIFICATION(S)	OBJECTIVE(S)		
7.8103.2a Health and safety	Combustion safety testing will be performed in accordance with the Health and Safety Chapter of the Standard Work Specifications for Single Family Housing or other equivalent practice	Identify potential health and safety issues		2530

	Electrical components will be verified to comply with NEC (e.g., no electrical box connector, no disconnect, improperly sized breaker and wire)			
7.8103.2b Visual inspection	Inspection will be conducted to show compliance with the IRC, including but not limited to: Water or fuel leaks Damaged or missing pipe insulation and tank insulation, where applicable Damaged wiring Venting issues with draft and condensation (e.g., soot, rusting of flue pipe, burned paint or wires, efflorescence) Corrosion (e.g., rust, mineral deposits) General condition of components	Determine needed repairs or maintenance		2531
7.8103.2c Temperature and pressure relief valve	Correct temperature and pressure relief valve will be installed in compliance with IRC and according to manufacturer specifications Temperature and pressure relief valve discharge tube will be installed in accordance with IRC	Discharge excessive energy (pressure or temperature) from storage tank to safe location		2532
7.8103.2d Flue gas testing	Undiluted flue gases will be checked with a calibrated combustion analyzer in accordance with BPI-1100-T If combustion is not in compliance with BPI-1100-T, diagnostics and adjustments will be done to manufacturer specifications or local codes	Perform combustion testing		2533
7.8103.2e Required combustion air	If sealed combustion has not been installed: Combustion and ventilation (excess air) requirements of gas-fired appliances, including provision of outside and inside air to account for building tightness, will be provided The minimum required volume will be 50 cubic feet per 1,000 Btu/h in accordance with IRC If needed, additional combustion air will be provided in accordance with IRC	Ensure adequate combustion air for operation of the appliance		2534

7.8103.2f Venting of flue gases	Condition of venting will be inspected in accordance with Section 504 IFGC for gas water heaters or NFPA 31 for oil water heaters	Verify proper venting of flue gases		2535
7.8103.2g Fuel supply	Condition of fuel supply components will be checked in accordance with NFPA 31 for oil, NFPA 54 for gas, NFPA 58 for propane, or NFPA 70 National Electric Code for electric, and authority having jurisdiction	Verify sufficient fuel to the water heater burner and element		2536
7.8103.2h Cold water supply	Water supplied to the appliance will be of sufficient volume and pressure to be in accordance with manufacturer specifications	Verify sufficient volume and pressure of water to the appliance		2537
7.8103.2i Discharge temperature	Discharge temperature will be set not to exceed 120°F or in accordance with local code, whichever is lower	Ensure safe hot water supply temperature to fixtures		2538
7.8103.2j Test the system safety and operation	The following will be tested: Safety controls (e.g., water, air pressure switches) Combustion safety and efficiency Operational controls Fuel and water leaks Unit runs through complete cycle Local code requirements Manufacturer specifications and all relevant industry standards will be met	Ensure system functions safely with lowest possible cost of ownership		2539
7.8103.2k Maintenance records	Occupants will be advised to keep records of all maintenance done to their system Copies of or access to installation and operation manuals will be provided	Improve chance of successful future maintenance or repair		2540
7.8103.2l Occupant health and safety	All homes will have a carbon monoxide (CO) alarm	Ensure occupant health and safety		2541
7.8103.2m Occupant education	Completed work will be reviewed Occupants will be educated on the safe and efficient operation and maintenance of the system, including: Adjustment of water temperature Target temperature in accordance with local code	Ensure occupant is informed of the safe, efficient operation and maintenance of the system		2542

Appendices

Referenced Standards

The following lists the codes, standards, and other technical publications that support the standard work specifications for single-family home energy upgrades and can be used in two ways:

1. Starting with a publication, a reader can identify which specification(s) that publication supports.
2. Starting with a specification, a reader can identify which publication(s) support that specification.

List of Acronyms

ACRONYM	NAME
ACCA	Air Conditioning Contractors of America
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASTM	American Society for Testing and Materials
BPI	Building Performance Institute
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
IBC	International Building Code
IECC	International Energy Conservation Code
IFGC	International Fuel Gas Code
IMC	International Mechanical Code
IRC	International Residential Code
NAECA	National Appliance Energy Conservation Act
OSHA	U.S. Occupational Safety and Health Administration
SPFA	Spray Polyurethane Foam Alliance
FTC	Federal Trade Commission
NYCDH	New York City Department of Health
ADC	Air Diffusion Council
FDA	U.S. Food and Drug Administrations
NIOSH	National Institute for Occupational Safety and Health
SMACNA	Sheet Metal and Air Conditioning Contracts National Association

Publications Referenced in the Standard Work Specifications

STANDARD REFERENCE	TITLE	SPECIFICATION
2012 IRC	International Residential Code for One-and Two-Family Dwellings	See IRC tables in Appendix C
Air Diffusion Council	Flex Duct Standard	3.1601.1j, 3.1601.2b, 4.1601.1b, 4.1601.1c, 4.1601.1d, 4.1601.1f, 4.1601.1g, 4.1601.1h, 4.1601.1j
ANSI Z21.1	Household Cooking Gas Appliances	2.0201.2d

ANSI Z21.10.1	Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings Of 75,000 Btu Per Hour Or Less	2.0201.1g
ANSI Z21.11.2	Gas-fired room heaters Volume II, unvented room heaters	2.0202.1a, 2.0401.1e
ANSI Z21.74	Gas-Fired Central Furnaces	5.3003.2h
ANSI Z223.1	National Fuel Gas Code	2.0201.1f, 2.0203.1a, 2.0203.1b, 2.0203.2b, 2.0203.2c, 2.0203.2d, 5.3003.7d, 6.6003.2i, 6.6003.3j, 6.6003.4k, 6.6003.5c, 7.8102.2j, 7.8102.3i, 7.8102.3l, 7.8103.2c
ANSI/ACCA D	Residential Duct Systems	4.1601.1c, 5.3001.2a, 6.6202.2c
ANSI/ACCA J	Residential Load Calculation	5.3001.1a, 5.3101.1a, 5.3101.2a
ANSI/ACCA S	Residential Equipment Selection	5.3001.1b, 5.3101.1b
ANSI/ACCA Standard 12 QH-2011	Existing Home Evaluation and Performance Improvement	2.0201.1a, 2.0201.1i
ANSI/ACCA Standard 4 QM-2007	Maintenance for Residential HVAC Systems	5.3104.2a, 5.3104.2b
ANSI/ACCA Standard 5 QI-2010	HVAC Quality Installation Specification	5.3003.3a, 5.3003.6a, 6.6003.1h, 6.6003.2g, 6.6201.1c, 6.6202.2j
ANSI/ACCA T	Air Distribution Basics	5.3001.2b
ANSI/ASHRAE 111-2008	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems	6.6003.1h, 6.6003.2g
ANSI/ASHRAE 52.2	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size	6.6102.3f, 6.6103.1f
ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings	2.0401.1e, 5.3003.7i, 5.3104.3q, 6.6005.1a, 6.6005.1e, 6.6005.2b, 6.6005.2d, 6.6102.1f, 6.6102.3f, 6.6103.1f, 6.6201.1a, 6.6201.1b, 6.6201.1c, 6.6288.1a, 6.6288.1b, 6.9901.1
ASHRAE Handbook	Fundamentals	6.6203.1b
ASTM C522	Standard Test Method for Airflow Resistance of Acoustical Materials	4.1103.1a, 4.1103.2c
ASTM C665-06	Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing	4.1402.3b
ASTM D703	Standard Specification for Polystyrene Molding and Extrusion Materials	2.0403.1c, 2.0403.2c
ASTM E2178	Standard Test Method for Air Permeance of Building Materials	4.1103.1a, 4.1103.2c
ASTM E283	Standard Test Method for Determining Rate of Air Leakage	4.1103.1a, 4.1103.2c

	Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen	
BPI 102	Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications—Material Specification	4.1005.6a, 4.1103.1a, 4.1103.2c
BPI 104	Envelope Professional	4.1004.1b, 4.1005.5b, 4.1005.6a, 4.1101.1b, 4.1103.1a, 4.1103.2c, 6.6102.3a
BPI-1100-T-2012	Home Energy Auditing Standard	2.0100.1e, 2.0201.1a, 2.0201.1b, 2.0201.1c, 2.0201.1d, 2.0201.1g, 2.0201.1h, 2.0201.1i, 2.0201.2d, 2.0201.2e, 2.0201.2f, 2.0203.3a, 2.0301.1 (all), 2.0301.2 (all), 5.3003.2d, 5.3003.2h, 5.3104.2f, 7.8102.3k, 7.8103.2d
Canadian General Standards Board	Section 51.71	2.0299.1 (all)
DE-FC26-00NT40998 (2005)	A Field Study Comparison of the Energy and Moisture Performance Characteristics of Ventilated Versus Sealed Crawl Spaces in the South	2.0404.3c
DOE WPN 11-06	DOE Weatherization Program Notice	2.0100.1o, 2.0100.1p. 4.1101.2a, 4.1101.1a
ENERGY STAR	General	2.0404.1a, 2.0404.3b, 2.0404.4a, 6.6203.1a, 7.8002.1a, 7.8003.1b, 7.8004.1a
Environmental Protection Agency	EPA Indoor airPLUS	2.0401.1f
Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades	2.0100.1e, 2.0202.1a, 2.0203.2f, 2.0203.2g, 2.0203.3d, 2.0501.1a, 2.0501.2a, 4.1088.5a, 4.1101.2a, 7.8003.1b
FDA Consumer Health Website	Are you storing food safely?	7.8001.2a
Federal Trade Commission	16 CFR Part 460	4.1003.4d, 4.1003.5b, 4.1003.6b, 4.1005.4d
IECC	Section C301	4.1402.1b, 4.1402.2a, 4.1402.3g
IECC	Section R402.2.3	3.1402.5a
IECC	Section R402.2.4	4.1006.1a, 4.1006.2a
IFGC	International Fuel Gas Code	2.0203.2b, 7.8103.2f
IMC	International Mechanical Code	6.6003.5a, 6.6005.1a, 6.6102.1e, 6.6003.5a
International Building Code	Section 1203.3.2	3.1402.2a
Minnesota Energy Code	Section 7672.0900	2.0299.1 (all)
NAECA	National Appliance Energy Conservation Act	2.0404.1a, 7.8001.1a, 7.8002.1a, 7.8004.1a, 7.8004.2a

New York City Department of Health	Guidelines on Assessments and Remediation of Fungi in Indoor Environments	2.0111.2c
NFPA 211	Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances	2.0203.2b
NFPA 31	Standard for the Installation of Oil-Burning Equipment	5.3003.2 (all), 5.3003.7d, 7.8102.2j, 7.8102.3l, 7.8103.2f, 7.8103.2g,
NFPA 54	National Fuel Gas Code	2.0201.1f, 2.0203.1a, 2.0203.1b, 2.0203.2b, 2.0203.2c, 2.0203.2d, 5.3003.7d, 6.6003.2i, 6.6003.3j, 6.6003.4k, 6.6003.5c, 7.8102.2j, 7.8102.3i, 7.8102.3l, 7.8103.2c, 7.8103.2f
NFPA 58	Liquefied Petroleum Gas Code	5.3003.7d, 7.8102.3l, 7.8103.2f
NFPA 70	National Electrical Code®	2.0111.2b, 2.0601.1c, 2.0601.1d, 4.1001.2c, 5.3003.4d, 6.6003.2b, 6.6003.4b, 7.8003.1b, 7.8102.2j, 7.8102.3l, 7.8103.1a, 7.8103.2a, 7.8103.2g
NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings	2.0100.1d, 7.8001.1b
NFPA 70E	Standard for Electrical Safety in the Workplace®	2.0100.1d
NFPA 90A/B	Standard for the Installation of Air-Conditioning and Ventilating Systems / Standard for the Installation of Warm Air Heating and Air-Conditioning Systems	3.1602.3a, 6.6102.1e
NIOSH	Recommended Exposure Limit for Carbon Monoxide	2.0100.1e, 2.0105.1b, 2.0201.1a
OSHA	General	2.0100.1f, 2.0104.1b, 3.1201.4b
SMACNA	Duct Construction Standards	3.1601.1 (all), 4.1601.2a, 4.1601.2b, 4.1601.2c, 4.1601.2d, 6.6002.1 (all)
Spray Polyurethane Foam Alliance	AY-141 Spray Polyurethane Foam and Cathedral Roofs and Cathedralized Attics	4.1003.5a, 4.1003.6a
Wood Handbook	Wood as an Engineering Material	2.0404.2c, 4.1001.7a, 4.1101.3c, 4.1301.9a, 4.1401.1a

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Publications Supporting Each Specification

SPECIFICATION	STANDARD REFERENCE	TITLE
2.0100.1d	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
2.0100.1d	NFPA 70E	Standard for Electrical Safety in the Workplace®
2.0100.1e	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0100.1e	BPI-1100-T-2012	Home Energy Auditing Standard
2.0100.1e	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0100.1e	NIOSH	Recommended Exposure Limit for Carbon Monoxide
2.0100.1f	OSHA	General
2.0100.1o	DOE WPN 11-06	DOE Weatherization Program Notice
2.0100.1p	DOE WPN 11-06	DOE Weatherization Program Notice
2.0103.2a	OSHA	10-hour and 30-hour education
2.0103.2c	ANSI/ACCA Manual J	Residential Load Calculation
2.0103.2c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0103.2c	BPI	General
2.0103.2d	EPA Indoor airPLUS	Construction Specifications Section 1.1
2.0104.1b	OSHA	General
2.0104.2a	OSHA 1910	Occupational Safety and Health Standards, Section 134
2.0104.2a	OSHA 1926	Safety and Health Regulations for Construction, Section 103
2.0104.2b	OSHA 1926	Safety and Health Regulations for Construction, Section 1101
2.0104.2c	OSHA 1910	Occupational Safety and Health Standards, Subpart Z
2.0104.2c	OSHA 1910	Occupational Safety and Health Standards, Section 134

2.0104.2c	OSHA 1926	Safety and Health Regulations for Construction, Section 103
2.0104.2d	EPA	40 CFR Part 745
2.0104.2d	EPA	40 CFR Part 745
2.0105.1b	NIOSH	Recommended Exposure Limit for Carbon Monoxide
2.0107.2a	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
2.0107.2a	NFPA 70E	Standard for Electrical Safety in the Workplace®
2.0107.2a	OSHA	General
2.0111.2a	2012 IRC	General
2.0111.2b	NFPA 70	National Electrical Code®
2.0111.2c	New York City Department of Health	Guidelines on Assessments and Remediation of Fungi in Indoor Environments
2.0111.2d	2012 IRC	General
2.0111.2e	2012 IRC	General
2.0111.2f	2012 IRC	General
2.0111.2g	2012 IRC	General
2.0111.3a	2012 IRC	R408.5
2.0201.1a	ANSI/ACCA Standard 12 QH-2011	Existing Home Evaluation and Performance Improvement
2.0201.1a	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.1a	NIOSH	Recommended Exposure Limit for Carbon Monoxide
2.0201.1b	2012 IRC	G2417.1.2
2.0201.1b	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.1c	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.1d	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.1f	ANSI Z223.1	National Fuel Gas Code
2.0201.1f	NFPA 54	National Fuel Gas Code
2.0201.1g	ANSI Z21.10.1	Gas Water Heaters Volume I, Storage Water Heaters With Input Ratings Of 75,000 Btu Per Hour Or Less
2.0201.1g	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.1h	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.1i	ANSI/ACCA Standard 12 QH-2011	Existing Home Evaluation and Performance Improvement
2.0201.1i	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.2a	2012 IRC	Chapter 24
2.0201.2a	2012 IRC	General
2.0201.2b	2012 IRC	G2427.8
2.0201.2c	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0201.2d	ANSI Z21.1	Household Cooking Gas Appliances
2.0201.2d	BPI-1100-T-2012	Home Energy Auditing Standard
2.0201.2e	BPI-1100-T-2012	Home Energy Auditing Standard

2.0201.2f	BPI-1100-T-2012	Home Energy Auditing Standard
2.0202.1a	ANSI Z21.11.2	Gas-Fired Room Heaters Volume II, Unvented Room Heaters
2.0202.1a	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0203.1a	2012 IRC	G2407.5.1
2.0203.1b	2012 IRC	G2407
2.0203.2b	2012 IRC	G2425
2.0203.2b	2012 IRC	General
2.0203.2b	ANSI Z223.1	National Fuel Gas Code
2.0203.2b	IFGC	International Fuel Gas Code
2.0203.2b	NFPA 211	Standard for Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances
2.0203.2b	NFPA 54	National Fuel Gas Code
2.0203.2c	ANSI Z223.1	National Fuel Gas Code
2.0203.2c	NFPA 54	National Fuel Gas Code
2.0203.2d	2012 IRC	G2407.5.1
2.0203.2e	2012 IRC	G2407
2.0203.2f	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0203.2f	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0203.2g	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0203.3a	BPI-1100-T-2012	Home Energy Auditing Standard
2.0203.3d	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0203.3d	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0203.7a	IFGC	International Fuel Gas Code
2.0203.7a	NFPA 31	Standard for the Installation of Oil-Burning Equipment
2.0203.7a	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
2.0203.7b	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
2.0203.7b	BPI-1100-T-2012	Home Energy Auditing Standard
2.0203.7c	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007
2.0203.7c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
2.0204.2b	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
2.0204.2c	OSHA 1910	Occupational Safety and Health Standards

2.0204.2c	OSHA 1926	Safety and Health Regulations for Construction
2.0204.2d	Green Seal Standard GS-36	Adhesives for Commercial Use
2.0204.2d	GREENGUARD Children and Schools Certification Program	General
2.0205.1a	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
2.0205.1a	IFGC	International Fuel Gas Code
2.0205.1a	NFPA 31	Standard for the Installation of Oil-Burning Equipment
2.0205.1a	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
2.0205.1b	IFGC	International Fuel Gas Code
2.0205.1b	NFPA 31	Standard for the Installation of Oil-Burning Equipment
2.0205.1b	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
2.0205.1c	IFGC	International Fuel Gas Code
2.0205.1c	NFPA 31	Standard for the Installation of Oil-Burning Equipment
2.0205.1c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
2.0299.1 (all)	Canadian General Standards Board	Section 51.71
2.0299.1 (all)	Minnesota Energy Code	Section 7672.0900
2.0301.1 (all)	BPI-1100-T-2012	Home Energy Auditing Standard
2.0301.1a	2012 IRC	General
2.0301.1a	2012 IRC	R314
2.0301.1b	2012 IRC	General
2.0301.1b	2012 IRC	R314
2.0301.2 (all)	BPI-1100-T-2012	Home Energy Auditing Standard
2.0301.2a	2012 IRC	R315
2.0301.2a	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0301.2b	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0401.1b	2012 IRC	R408.1
2.0401.1b	2012 IRC	R408.2
2.0401.1b	2012 IRC	R408.3
2.0401.1b	2012 IRC	R702.7.2
2.0401.1e	2012 IRC	M1502
2.0401.1e	2012 IRC	M1503
2.0401.1e	2012 IRC	M1504
2.0401.1e	2012 IRC	M1505
2.0401.1e	2012 IRC	M1506
2.0401.1e	2012 IRC	M1507
2.0401.1e	ANSI Z21.11.2	Gas-Fired Room Heaters Volume II, Unvented Room Heaters
2.0401.1e	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0401.1f	2012 IRC	R405

2.0401.1f	2012 IRC	R406
2.0401.1f	2012 IRC	R703.8
2.0401.1f	Environmental Protection Agency	EPA Indoor airPLUS
2.0401.2a	2012 IRC	General
2.0401.2a	2012 IRC	R408.2
2.0402.1c	2012 IRC	R405
2.0402.1c	2012 IRC	R406
2.0403.1c	ASTM D703	Standard Specification for Polystyrene Molding and Extrusion Materials
2.0403.2c	ASTM D703	Standard Specification for Polystyrene Molding and Extrusion Materials
2.0403.3a	2012 IRC	R408.3
2.0404.1a	ENERGY STAR	General
2.0404.1a	NAECA	National Appliance Energy Conservation Act
2.0404.1b	2012 IRC	G2439.1
2.0404.1b	2012 IRC	M1502.2
2.0404.1b	2012 IRC	P3303.1.2
2.0404.2a	2012 IRC	G2407.5.1
2.0404.2c	Wood Handbook	Wood as an Engineering Material
2.0404.3b	ENERGY STAR	General
2.0404.3c	DE-FC26-00NT40998 (2005, Advanced Energy)	A Field Study Comparison of the Energy and Moisture Performance Characteristics of Ventilated Versus Sealed Crawl Spaces in the South
2.0404.4a	ENERGY STAR	General
2.0501.1a	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0501.2a	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
2.0502.1a	EPA - Healthy Indoor Environment Protocols for Home Energy Retrofits	Single Family Residential
2.0601.1c	NFPA 70	National Electrical Code®
2.0601.1d	NFPA 70	National Electrical Code®
2.0701.1a	2012 IRC	AF103.4.10
2.0701.1a	2012 IRC	M1305.1.4
2.0701.1a	2012 IRC	N1102.2.4
2.0701.1a	2012 IRC	R408.4
2.0702.2a	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.2b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.2c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

2.0702.2d	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.2e	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.2i	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.3a	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.3b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.3c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.3d	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.3e	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.3g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4a	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4d	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4e	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
2.0702.4i	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
3.1001.2b	2012 IRC	N1102.4.1.2
3.1001.2c	2012 IRC	R302.9

3.1001.3b	2012 IRC	N1102.4.1.2
3.1001.5	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1001.5c	ASTM C834 - 10	Standard Specification for Latex Sealants
3.1001.5c	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1001.5c	GREENGUARD Children and Schools Certification Program	General
3.1001.5d	ASTM E136 - 09b	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
3.1001.6c	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1001.6c	GREENGUARD Children and Schools Certification Program	General
3.1001.7c	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1001.7c	GREENGUARD Children and Schools Certification Program	General
3.1001.8b	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1001.8b	IBC - 2009	International Building Code
3.1001.8b	IRC	International Residential Code
3.1001.8b	NFPA	General
3.1001.8e	ASTM C1015 - 06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
3.1001.8f	Federal Trade Commission	16 CFR Part 460, Section 460.17
3.1001.9d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1001.9d	GREENGUARD Children and Schools Certification Program	General
3.1001.9e	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1001.9f	IECC - 2009	International Energy Conservation Code, Section 402.2.3
3.1001.9h	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1001.9j	Federal Trade Commission	16 CFR Part 460, Section 460.17
3.1002.1b	2012 IRC	N1102.4.1.2
3.1003.5b	2012 IRC	N1102.4.1.2
3.1003.5b	2012 IRC	R402.4.1.2
3.1005.2d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1005.2d	GREENGUARD Children and Schools Certification Program	General
3.1005.2e	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

3.1005.2f	ASTM C1015 - 06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
3.1005.2g	Federal Trade Commission	16 CFR Part 460, Section 460.17
3.1005.3c	ASTM C1015 - 06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
3.1005.3c	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1005.3e	ASTM C834 - 10	Standard Specification for Latex Sealants
3.1005.3f	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1005.3f	GREENGUARD Children and Schools Certification Program	General
3.1005.3g	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1102.1c	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1102.1c	GREENGUARD Children and Schools Certification Program	General
3.1102.1d	ASTM E136 - 09b	Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
3.1201.4b	OSHA	General
3.1201.7f	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1201.7f	GREENGUARD Children and Schools Certification Program	General
3.1201.7i	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1201.7i	ASTM E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
3.1201.8e	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1201.8e	GREENGUARD Children and Schools Certification Program	General
3.1201.8h	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1201.8h	ASTM E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
3.1203.4a	AMAA/WDMA/CSA/101/IS2/A440	North American Fenestration Standard/Specification for windows, doors and skylights
3.1203.4a	National Fenestration Rating Council (NFRC)	General
3.1203.4e	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1203.4e	GREENGUARD Children and Schools Certification Program	General

3.1203.4g	ASTM E1105-00	Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
3.1203.4g	ASTM E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
3.1203.5a	CPSC 16 CFR Part 1201	General
3.1203.5a	National Fenestration Rating Council (NFRC)	General
3.1203.5d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1203.5d	GREENGUARD Children and Schools Certification Program	General
3.1203.5f	ASTM E1105-00	Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform or Cyclic Static Air Pressure Difference
3.1203.5f	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1203.5f	ASTM E783-02	Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors
3.1402.2a	International Building Code	Section 1203.3.2
3.1402.5a	IECC	Section 402.2.3
3.1402.5b	2012 IRC	Chapter 4
3.1402.5b	2012 IRC	M1305.1.4
3.1402.5b	2012 IRC	R408.4
3.1403.1a	ANSI-AARST	Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings
3.1403.1b	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1403.1c	OSHA 1910	Occupational Safety and Health Standards
3.1403.1c	OSHA 1926	Safety and Health Regulations for Construction
3.1403.1d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1403.1d	GREENGUARD Children and Schools Certification Program	General
3.1501.1b	2012 IRC	N1103.2.2
3.1501.1f	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
3.1501.2a	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
3.1501.2c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
3.1501.2e	CPSC 16 CFR 1201	General

3.1502.1b	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1502.1c	OSHA 1910	Occupational Safety and Health Standards
3.1502.1c	OSHA 1926	Safety and Health Regulations for Construction
3.1502.1d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1502.1d	GREENGUARD Children and Schools Certification Program	General
3.1502.2f	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
3.1502.2f	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
3.1601.1 (all)	SMACNA	Duct Construction Standards
3.1601.1a	2012 IRC	Chapter 16
3.1601.1a	2012 IRC	N1103.2
3.1601.1b	2012 IRC	Chapter 16
3.1601.1b	2012 IRC	M1601.1.1
3.1601.1b	2012 IRC	N1103.2
3.1601.1c	2012 IRC	Chapter 16
3.1601.1c	2012 IRC	N1103.2
3.1601.1d	2012 IRC	Chapter 16
3.1601.1d	2012 IRC	N1103.2
3.1601.1e	2012 IRC	M1601.4.1
3.1601.1f	2012 IRC	M1601.4.1
3.1601.1g	2012 IRC	Chapter 16
3.1601.1g	2012 IRC	N1103.2
3.1601.1h	2012 IRC	Chapter 16
3.1601.1h	2012 IRC	N1103.2
3.1601.1i	2012 IRC	Chapter 16
3.1601.1i	2012 IRC	N1103.2
3.1601.1j	2012 IRC	N1103.2
3.1601.1j	Air Diffusion Council	Flex Duct Standard
3.1601.1l	2012 IRC	Chapter 16
3.1601.2b	Air Diffusion Council	Flex Duct Standard
3.1601.3a	2012 IRC	Chapter 16
3.1601.3a	2012 IRC	M1601.4.3
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	UL 181B	Closure Systems for Use With Flexible Air Ducts and Air Connectors
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard
3.1601.6	SMACNA	Duct Construction Standard

3.1601.6	NAIMA	Fibrous Glass Duct Construction Standards
3.1601.7	NAIMA	Fibrous Glass Duct Construction Standards
3.1601.7	SMACNA	Duct Construction Standard
3.1601.8a	SMACNA	Duct Construction Standard
3.1601.8b	SMACNA	Duct Construction Standard
3.1601.8c	SMACNA	Duct Construction Standard
3.1601.8c	UL 181B	Closure Systems for Use With Flexible Air Ducts and Air Connectors
3.1601.8d	SMACNA	Duct Construction Standard
3.1601.8e	NAIMA	Fibrous Glass Duct Construction Standards
3.1601.8e	SMACNA	Duct Construction Standard
3.1601.8i	SMACNA	Duct Construction Standard
3.1601.8j	SMACNA	Duct Construction Standard
3.1601.8k	SMACNA	Duct Construction Standard
3.1601.8l	SMACNA	Duct Construction Standard
3.1601.9a	NAIMA	Fibrous Glass Duct Construction Standards
3.1601.9a	SMACNA	Duct Construction Standard
3.1601.9a	SMACNA	Duct Construction Standard
3.1601.9b	SMACNA	Duct Construction Standard
3.1601.9c	SMACNA	Duct Construction Standard
3.1602.1 (all)	2012 IRC	Chapter 16
3.1602.15b	OSHA 1910	Occupational Safety and Health Standards
3.1602.15b	OSHA 1929	Lead in Construction
3.1602.15c	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1602.15g	UL 181	Factory-Made Air Ducts and Air Connectors
3.1602.15j	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
3.1602.16	SMACNA	Duct Construction Standard
3.1602.16	SMACNA	Duct Construction Standard
3.1602.16	SMACNA	Duct Construction Standard
3.1602.17	SMACNA	Duct Construction Standard
3.1602.17	SMACNA	Duct Construction Standard
3.1602.17	SMACNA	Duct Construction Standard
3.1602.18	ASTM C834 - 10	Standard Specification for Latex Sealants
3.1602.18	SMACNA	Duct Construction Standard
3.1602.19	NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
3.1602.19	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

3.1602.20	NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
3.1602.20	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
3.1602.20	SMACNA	Duct Construction Standard
3.1602.20	UL 181B	Closure Systems for Use With Flexible Air Ducts and Air Connectors
3.1602.22a	SMACNA	Duct Construction Standard
3.1602.22b	SMACNA	Duct Construction Standard
3.1602.22c	SMACNA	Duct Construction Standard
3.1602.22c	UL 181	Factory-Made Air Ducts and Air Connectors
3.1602.23a	NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
3.1602.23a	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
3.1602.23a	SMACNA	Duct Construction Standard
3.1602.23a	UL 181M	General
3.1602.2a	2012 IRC	M1601.3
3.1602.2a	2012 IRC	R316.1
3.1602.2a	2012 IRC	R316.2
3.1602.2a	2012 IRC	R316.3
3.1602.2a	2012 IRC	R316.4
3.1602.2a	2012 IRC	R316.5
3.1602.2a	2012 IRC	R316.6
3.1602.2a	2012 IRC	R316.7
3.1602.3a	NFPA 90A/B	Standard for the Installation of Air-Conditioning and Ventilating Systems / Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
3.1602.4a	2012 IRC	N1102.4.1.1
3.1602.4a	2012 IRC	R302.9
3.1602.4b	2012 IRC	N1103.2.2
3.1602.5c	2012 IRC	N1102.4.1.1
3.1602.5c	2012 IRC	R302.9
3.1602.6b	2012 IRC	N1102.4.1.1
3.1602.6b	2012 IRC	R302.9
3.1801.2e	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1801.2e	GREENGUARD Children and Schools Certification Program	General
3.1801.2i	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1802.1c	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1802.1c	GREENGUARD Children and Schools Certification Program	General
3.1802.2h	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems

3.1802.2i	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
3.1802.2i	UL 723	Test for Surface Burning Characteristics of Building Materials
3.1901.1b	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1901.1c	OSHA 1910	Occupational Safety and Health Standards
3.1901.1c	OSHA 1926	Safety and Health Regulations for Construction
3.1901.1d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1901.1d	GREENGUARD Children and Schools Certification Program	General
3.1901.3b	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1901.3c	OSHA 1910	Occupational Safety and Health Standards
3.1901.3c	OSHA 1926	Safety and Health Regulations for Construction
3.1901.3d	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1901.3d	GREENGUARD Children and Schools Certification Program	General
3.1901.4c	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1901.4c	OSHA	Lock Out Standard
3.1901.4d	OSHA 1910	Occupational Safety and Health Standards
3.1901.4d	OSHA 1926	Safety and Health Regulations for Construction
3.1901.4e	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1901.4e	GREENGUARD Children and Schools Certification Program	General
3.1901.c	OSHA 1910	Occupational Safety and Health Standards
3.1901.c	OSHA 1926	Safety and Health Regulations for Construction
3.1901.d	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
3.1901.e	Green Seal Standard GS-36	Adhesives for Commercial Use
3.1901.e	GREENGUARD Children and Schools Certification Program	General
4.1001.1a	2012 IRC	E4003.2
4.1001.1a	2012 IRC	E4004.2
4.1001.1b	2012 IRC	E4004.9
4.1001.1c	2012 IRC	E4003.2

4.1001.1c	2012 IRC	E4004.9
4.1001.1d	2012 IRC	N1102.4.4
4.1001.2c	NFPA 70	National Electrical Code®
4.1001.3b	2012 IRC	M1801.3.4
4.1001.3b	2012 IRC	R1003.18
4.1001.7a	Wood Handbook	Wood as an Engineering Material
4.1001.8d	IRC	International Residential Code, Section 806.4
4.1003.12d	IRC	International Residential Code, Section 806.4
4.1003.12e	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1003.12e	IBC - 2009	International Building Code, Section 1405.3
4.1003.12e	IRC - 2009	International Residential Code, Section R806.4
4.1003.12e	Spray Polyurethane Foam Alliance - AY-141	Spray Polyurethane Foam and Cathedral Roofs and Cathedralized
4.1003.12e	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1003.13a	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1003.13a	IBC - 2009	International Building Code, Section 1405.3
4.1003.13a	IRC - 2009	International Residential Code, Section R806.4
4.1003.13a	Spray Polyurethane Foam Alliance - AY-141	Spray Polyurethane Foam and Cathedral Roofs and Cathedralized
4.1003.13a	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1003.13b	Federal Trade Commission	16 CFR Part 460, Section 460.17
4.1003.13c	Federal Trade Commission	16 CFR Part 460, Section 460.17
4.1003.14d	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1003.14d	IECC 2012	International Energy Conservation Code, Section 303.1.1.1
4.1003.14d	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1003.14e	ASTM C1015 - 06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
4.1003.1a	2012 IRC	R806
4.1003.2a	2012 IRC	N1102.2.2
4.1003.2c	BPI 104	Envelope Professional
4.1003.4d	2012 IRC	N1101.16
4.1003.4d	Federal Trade Commission	16 CFR Part 460

4.1003.5a	Spray Polyurethane Foam Alliance	AY-141 Spray Polyurethane Foam and Cathedral Roofs and Cathedralized Attics
4.1003.5b	2012 IRC	N1101.16
4.1003.5b	Federal Trade Commission	16 CFR Part 460
4.1003.6a	Spray Polyurethane Foam Alliance	AY-141 Spray Polyurethane Foam and Cathedral Roofs and Cathedralized Attics
4.1003.6b	2012 IRC	N1101.16
4.1003.6b	Federal Trade Commission	16 CFR Part 460
4.1004.1b	BPI 104	Envelope Professional
4.1005.2d	2012 IRC	N1101.16
4.1005.4d	2012 IRC	N1101.16
4.1005.4d	Federal Trade Commission	16 CFR Part 460
4.1005.5b	BPI 104	Envelope Professional
4.1005.5d	2012 IRC	N1101.16
4.1005.6a	BPI 102	Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications—Material Specification
4.1005.6a	BPI 104	Envelope Professional
4.1005.6c	2012 IRC	N1101.16
4.1005.7c	2012 IRC	N1101.16
4.1005.8a	IECC 2012	International Energy Conservation Code, Section 303.1.1.1
4.1005.8b	ASTM C1015 - 06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
4.1005.8c	ASTM C1015 - 06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
4.1005.8c	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1005.8d	Federal Trade Commission	16 CFR Part 460, Section 460.17
4.1006.1a	IECC	Section R402.2.4
4.1006.2a	IECC	Section R402.2.4
4.1088.1a	2012 IRC	N1102.4.1.1
4.1088.1a	2012 IRC	R806
4.1088.1b	2012 IRC	R806.1
4.1088.1c	2012 IRC	R806
4.1088.1d	2012 IRC	R806.3
4.1088.1e	2012 IRC	R806.1
4.1088.1e	2012 IRC	R806.2
4.1088.5a	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
4.1088.9d	Green Seal Standard GS-36	Adhesives for Commercial Use
4.1088.9d	GREENGUARD Children and Schools Certification Program	General
4.1101.1a	DOE WPN 11-06	DOE Weatherization Program Notice
4.1101.1b	BPI 104	Envelope Professional
4.1101.2a	DOE WPN 11-06	DOE Weatherization Program Notice

4.1101.2a	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
4.1101.3c	Wood Handbook	Wood as an Engineering Material
4.1103.1a	ASTM C522	Standard Test Method for Airflow Resistance of Acoustical Materials
4.1103.1a	ASTM E2178	Standard Test Method for Air Permeance of Building Materials
4.1103.1a	ASTM E283	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
4.1103.1a	BPI 102	Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications—Material Specification
4.1103.1a	BPI 104	Envelope Professional
4.1103.2c	ASTM C522	Standard Test Method for Airflow Resistance of Acoustical Materials
4.1103.2c	ASTM E2178	Standard Test Method for Air Permeance of Building Materials
4.1103.2c	ASTM E283	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
4.1103.2c	BPI 102	Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications—Material Specification
4.1103.4a	OSHA 3142-09R	Lead in Construction
4.1103.4e	Green Seal Standard GS-36	Adhesives for Commercial Use
4.1103.4e	GREENGUARD Children and Schools Certification Program	General
4.1103.4f	ASTM C522	Standard Test Method for Airflow Resistance of Acoustical Materials
4.1103.4f	ASTM E1186 - 03(2009)	03(2009) Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems
4.1103.4f	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1103.4f	BPI-102	Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications - Material Specification
4.1103.4f	E 2178	General
4.1103.4f	E 283	General
4.1103.4f	Federal Trade Commission	16 CFR Part 460, Section 460.17
4.1103.5c	IBC - 2009	International Building Code, Section 2603.4
4.1103.5e	Green Seal Standard GS-36	Adhesives for Commercial Use

4.1103.5e	GREENGUARD Children and Schools Certification Program	General
4.1301.10b	OSHA 1910	Occupational Safety and Health Standards
4.1301.10b	OSHA 1926	Safety and Health Regulations for Construction
4.1301.10c	IBC - 2009	International Building Code, Section 2603.1
4.1301.10c	IBC - 2009	International Building Code, Section 2603.4
4.1301.10c	IBC - 2009	International Building Code, Section 2603.4.1
4.1301.10c	IBC - 2009	International Building Code, Section 2603.4.1.14
4.1301.10c	IBC - 2009	International Building Code, Section 718
4.1301.10c	NFPA 275	Standard Method of Fire Tests for the Evaluation of Thermal Barriers
4.1301.14b	OSHA 1910	Occupational Safety and Health Standards
4.1301.14b	OSHA 1926	Safety and Health Regulations for Construction
4.1301.14f	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1301.14f	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1301.14g	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1301.14g	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1301.15e	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1301.15e	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1301.15f	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
4.1301.15f	UL 723	Test for Surface Burning Characteristics of Building Materials
4.1301.15f	Green Seal Standard GS-36	Adhesives for Commercial Use
4.1301.15f	GREENGUARD Children and Schools Certification Program	General
4.1301.9a	Wood Handbook	Wood as an Engineering Material
4.1301.9c	2012 IRC	R316.4
4.1401.1a	Wood Handbook	Wood as an Engineering Material
4.1401.1c	2012 IRC	R316.4
4.1402.1b	IECC	Section 301
4.1402.2a	IECC	Section 301

4.1402.3b	ASTM C665-06	Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
4.1402.3g	IECC	Section 301
4.1402.3i	2012 IRC	General
4.1601.1b	Air Diffusion Council	Flex Duct Standard
4.1601.1c	Air Diffusion Council	Flex Duct Standard
4.1601.1c	ANSI/ACCA D	Residential Duct Systems
4.1601.1d	Air Diffusion Council	Flex Duct Standard
4.1601.1e	2012 IRC	M1601.1
4.1601.1f	2012 IRC	M1601.4.1
4.1601.1f	Air Diffusion Council	Flex Duct Standard
4.1601.1g	Air Diffusion Council	Flex Duct Standard
4.1601.1h	2012 IRC	M1601.4.1
4.1601.1h	Air Diffusion Council	Flex Duct Standard
4.1601.1j	2012 IRC	M1601.4.1
4.1601.1j	Air Diffusion Council	Flex Duct Standard
4.1601.2a	SMACNA	Duct Construction Standards
4.1601.2a	SMACNA	Duct Construction Standards
4.1601.2b	2012 IRC	M1601.4.1
4.1601.2b	SMACNA	Duct Construction Standards
4.1601.2b	SMACNA	Duct Construction Standards
4.1601.2c	SMACNA	Duct Construction Standards
4.1601.2c	SMACNA	Duct Construction Standards
4.1601.2d	2012 IRC	Chapter 16
4.1601.2d	SMACNA	Duct Construction Standards
4.1601.2d	SMACNA	Duct Construction Standards
5.3001.1a	ANSI/ACCA J	Residential Load Calculation
5.3001.1b	ANSI/ACCA S	Residential Equipment Selection
5.3001.2a	ANSI/ACCA D	Residential Duct Systems
5.3001.2b	ANSI/ACCA T	Air Distribution Basics
5.3001.4d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3001.4d	ANSI/ACCA Manual J	Residential Load Calculation
5.3001.4d	ANSI/ACCA Manual N	Commercial Load Calculation for Small Commercial Buildings
5.3001.4d	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
5.3001.4d	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
5.3001.4d	ASHRAE	Fundamentals Handbook
5.3001.4d	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
5.3001.4d	ASHRAE	Fundamentals Handbook
5.3001.4d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3001.4d	ANSI/ACCA Manual CS	Commercial Applications, Systems and Equipment
5.3001.4d	ANSI/ACCA Manual J	Residential Load Calculation
5.3001.4d	ANSI/ACCA Manual S	Residential Equipment Selection

5.3001.4d	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
5.3001.4e	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
5.3001.4f	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
5.3001.5a	ANSI/ACCA Manual D	Residential Duct Systems
5.3001.5a	ANSI/ACCA Manual Q	Low Pressure, Low Velocity Duct System Design
5.3001.5a	ASHRAE	Fundamentals Handbook
5.3001.5b	ANSI/ACCA Manual D	Residential Duct Systems
5.3001.5b	ASHRAE	Fundamentals Handbook
5.3001.5c	ANSI/ACCA Manual D	Residential Duct Systems
5.3001.5c	ASHRAE	Fundamentals Handbook
5.3001.5e	NAIMA	Fibrous Glass Duct Construction Standards
5.3001.5e	SMACNA	Duct Construction Standard
5.3001.5f	ASHRAE	Fundamentals Handbook
5.3001.5h	ACCA Manual T	Air Distribution Basics
5.3001.5i	ACCA Manual T	Air Distribution Basics
5.3001.5l	SMACNA	Duct Construction Standard
5.3001.6a	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3001.6a	ANSI/ACCA Manual J	Residential Load Calculation
5.3001.6a	ANSI/ACCA Manual N	Commercial Load Calculation for Small Commercial Buildings
5.3001.6a	ASHRAE	General
5.3001.6b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3001.6b	ANSI/ACCA Manual CS	Commercial Applications, Systems and Equipment
5.3001.6b	ANSI/ACCA Manual S	Residential Equipment Selection
5.3001.6b	ASHRAE	General
5.3001.6h	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3002.12a	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3002.12a	ASHRAE Standard 15	Safety Standard for Refrigeration Systems
5.3002.12ac	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12af	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12b	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12d	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings

5.3002.12e	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12h	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12j	ASHRAE Standard 15	Safety Standard for Refrigeration Systems
5.3002.12n	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12q	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12t	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12v	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3002.12w	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.12y	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3002.12z	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3002.13a	OSHA	9 CFR 1926 Subpart M - Fall Protection
5.3002.13c	NAHB-OSHA	Jobsite Safety Handbook, Second Edition: Electrical
5.3002.13c	OSHA	29 CFR 1926 Subpart K – Electrical
5.3002.13d	EPA	40 CFR 608
5.3002.13d	EPA	40 CFR 82.154
5.3002.16b	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
5.3002.16c	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
5.3002.16h	NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
5.3002.16h	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
5.3002.16h	SMACNA	Duct Construction Standard
5.3002.4a	OSHA 1926	Safety and Health Regulations for Construction, Subpart M
5.3002.4c	NAHB-OSHA	Jobsite Safety Handbook
5.3002.4c	OSHA 1926	Safety and Health Regulations for Construction, Subpart K
5.3002.4d	EPA	40 CFR 82.154
5.3002.7b	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

5.3002.7c	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
5.3002.7h	SMACNA	Duct Construction Standard
5.3003.10a	2012 IRC	M1411.3
5.3003.10c	2012 IRC	M1411.3
5.3003.10d	2012 IRC	M1411.3
5.3003.10e	2012 IRC	M1411.3
5.3003.10f	2012 IRC	M1411.3
5.3003.18a	BPI	General
5.3003.18b	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.18c	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.19d	EPA	40 CFR 608
5.3003.2 (all)	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.20a	NFPA 70	National Electrical Code
5.3003.20b	NFPA 70	National Electrical Code
5.3003.20e	NFPA 70	National Electrical Code
5.3003.20f	NFPA 70	National Electrical Code
5.3003.20g	NFPA 70	National Electrical Code
5.3003.20h	NFPA 70	National Electrical Code
5.3003.21d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.21d	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.21h	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.21h	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.21l	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.21l	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.21m	OSHA	General
5.3003.22b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.22c	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22d	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22e	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22f	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22g	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22h	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22i	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22j	NFPA 31	Standard for the Installation of Oil-Burning Equipment

5.3003.22k	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.22l	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.23c	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.23d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.24c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3003.25d	EPA	40 CFR 608
5.3003.26a	NFPA 70	National Electrical Code
5.3003.26b	NFPA 70	National Electrical Code
5.3003.26e	NFPA 70	National Electrical Code
5.3003.26f	NFPA 70	National Electrical Code
5.3003.26g	NFPA 70	National Electrical Code
5.3003.26h	NFPA 70	National Electrical Code
5.3003.26j	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
5.3003.26j	NFPA 70E	Standard for Electrical Safety in the Workplace®
5.3003.26k	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
5.3003.26k	NFPA 70E	Standard for Electrical Safety in the Workplace®
5.3003.27	OSHA	General
5.3003.27d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.27d	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.27h	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.27h	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.27i	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.27i	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.28a	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.28d	NFPA 70	National Electrical Code
5.3003.28f	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007
5.3003.28f	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3003.2d	BPI-1100-T-2012	Home Energy Auditing Standard
5.3003.2h	BPI-1100-T-2012	Home Energy Auditing Standard
5.3003.30c	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.30d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.32c	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007

5.3003.32c	ANSI/ACCA/ASHRAE Standard 180-2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3003.33a	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.33b	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.34a	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.34b	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.34c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.34d	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.35a	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.35a	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.35c	NFPA 211	Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances
5.3003.35c	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.35c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.35d	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.35d	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
5.3003.36	Air Diffusion Council	Flex Duct Standard
5.3003.36	NAIMA	Fibrous Glass Duct Construction Standards
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
5.3003.36	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	UL 181A	Closure Systems for Use With Rigid Air Ducts
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	ACCA Manual T	Air Distribution Basics
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.36	ASHRAE	General
5.3003.36	SMACNA	Duct Construction Standard
5.3003.36	SMACNA	Duct Construction Standard
5.3003.37a	EPA	40 CFR 271.13
5.3003.37b	OSHA 3142-09R	Lead in Construction

5.3003.37c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
5.3003.37e	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.37e	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3003.37m	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3003.39a	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.39b	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.39c	AGA	General
5.3003.39c	NFPA	General
5.3003.40a	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.40b	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.41a	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.41a	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.41c	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.41c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3003.42a	SMACNA	Duct Construction Standard
5.3003.42b	SMACNA	Duct Construction Standard
5.3003.42d	SMACNA	Duct Construction Standard
5.3003.42e	Air Diffusion Council	Flex Duct Standard
5.3003.42e	NAIMA	Fibrous Glass Duct Construction Standards
5.3003.42e	SMACNA	Duct Construction Standard
5.3003.42g	SMACNA	Duct Construction Standard
5.3003.42h	NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
5.3003.42h	NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
5.3003.42h	SMACNA	Duct Construction Standard
5.3003.42i	UL 181A	Closure Systems for Use With Rigid Air Ducts
5.3003.42j	SMACNA	Duct Construction Standard
5.3003.42k	SMACNA	Duct Construction Standard
5.3003.42m	SMACNA	Duct Construction Standard
5.3003.42n	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.42r	SMACNA	Duct Construction Standard
5.3003.42s	SMACNA	Duct Construction Standard
5.3003.43a	EPA	40 CFR 271.13
5.3003.43b	OSHA 3142-09R	Lead in Construction
5.3003.43c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
5.3003.43e	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3003.43e	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems

5.3003.43m	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3003.4d	NFPA 70	National Electrical Code®
5.3003.5a	2012 IRC	M1411.5
5.3003.5b	2012 IRC	N1103.3.1
5.3003.7d	ANSI Z223.1	National Fuel Gas Code
5.3003.7d	NFPA 31	Standard for the Installation of Oil-Burning Equipment
5.3003.7d	NFPA 54	National Fuel Gas Code
5.3003.7d	NFPA 58	Liquefied Petroleum Gas Code
5.3003.7h	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3003.7i	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3003.8b	2012 IRC	M1202.3
5.3003.8b	2012 IRC	M1413
5.3003.8b	2012 IRC	P2902
5.3003.9j	2012 IRC	N1103.1
5.3088.3a	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3088.3b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3088.3c	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3088.3d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3088.3e	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3088.3f	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3101.1a	ANSI/ACCA J	Residential Load Calculation
5.3101.1b	ANSI/ACCA S	Residential Equipment Selection
5.3101.2a	ANSI/ACCA J	Residential Load Calculation
5.3102.19b	ANSI/ACCA Manual J	Residential Load Calculation
5.3102.19b	ANSI/ACCA Manual N	Commercial Load Calculation for Small Commercial Buildings
5.3102.19b	ASHRAE	General
5.3102.19b	ASHRAE Standard 183	Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings
5.3102.19i	IPC	International Plumbing Code, Section 101.3
5.3102.19i	IPC	International Plumbing Code, Section 101.4
5.3102.19i	IPC	International Plumbing Code, Section 301.7
5.3102.19i	UPC	Universal Plumbing Code, Section 101.2
5.3102.1b	ANSI/ACCA Manual J	Residential Load Calculation
5.3102.1b	ANSI/ACCA Manual N	Commercial Load Calculation for Small Commercial Buildings
5.3102.1b	ASHRAE	General

5.3102.1b	ASHRAE Standard 183	Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings
5.3102.1h	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3102.24c	NFPA 31	Standard for the Installation of Oil-Burning Equipment, Section 3.3.50
5.3102.26b	NFPA 31	Standard for the Installation of Oil-Burning Equipment, Section 3.3.50
5.3102.27d	EPA	General
5.3102.28a	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007
5.3102.28a	ANSI/ASHRAE/ACCA Standard 180 - 2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3102.28b	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007
5.3102.28b	ANSI/ASHRAE/ACCA Standard 180 - 2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3102.28f	NFPA 31	Standard for the Installation of Oil-Burning Equipment, Section 3.3.50
5.3102.2e	ANSI	General
5.3102.31f	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3102.31f	IECC 2012	International Energy Conservation Code
5.3102.37b	EPA	General
5.3102.37c	Federal Fair Housing Act	General
5.3102.37c	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
5.3102.37e	EPA	40 CFR 271.13
5.3102.37f	ANSI/ACCA 5 -- 2010 QI	HVAC Quality Installation Specification
5.3102.37f	ANSI/ACCA Manual S	Residential Equipment Selection
5.3102.37f	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3102.38a	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3102.38e	ASHRAE	General
5.3102.38e	LEED	NC/EB
5.3103.1f	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3103.1f	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3103.4d	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
5.3103.4d	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
5.3103.4e	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3103.4e	IECC 2012	International Energy Conservation Code

5.3103.7e	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3103.7e	IECC 2012	International Energy Conservation Code
5.3103.8e	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3103.8e	IECC 2012	International Energy Conservation Code
5.3103.9e	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3103.9e	IECC 2012	International Energy Conservation Code
5.3104.10a	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
5.3104.10a	BPI-1100-T-2012	Home Energy Auditing Standard
5.3104.10b	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007
5.3104.10b	ANSI/ACCA 4 -- 2007	Maintenance of Residential HVAC Systems in One- and Two-Family Dwellings Less Than Three Stories, 2007
5.3104.10b	ANSI/ASHRAE/ACCA Standard 180 - 2008	Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems
5.3104.10b	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.10c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.10d	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.10e	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.10f	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.10g	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
5.3104.10g	BPI	General
5.3104.10g	NATE	General
5.3104.10h	NFPA	General
5.3104.10h	NFPA 720	Standard for the Installation of Carbon Monoxide Detection and Warning Equipment
5.3104.10i	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3104.11f	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3104.11f	IECC 2012	International Energy Conservation Code
5.3104.12f	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
5.3104.12f	IECC 2012	International Energy Conservation Code
5.3104.2a	ANSI/ACCA Standard 4 QM-2007	Maintenance for Residential HVAC Systems

5.3104.2b	ANSI/ACCA Standard 4 QM-2007	Maintenance for Residential HVAC Systems
5.3104.2e	2012 IRC	G2427
5.3104.2f	BPI-1100-T-2012	Home Energy Auditing Standard
5.3104.2h	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3104.3g	2012 IRC	M2002.3
5.3104.3h	2012 IRC	M2002.5
5.3104.3i	2012 IRC	M2002.5
5.3104.3j	2012 IRC	M2003
5.3104.3k	2012 IRC	M2001
5.3104.3q	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3104.3r	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3104.9d	NFPA 720	Standard for the Installation of Carbon Monoxide Detection and Warning Equipment
5.3104.9d	NFPA 720	Standard for the Installation of Carbon Monoxide Detection and Warning Equipment
5.3104.9g	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.9i	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.9j	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.9m	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.9q	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
5.3104.9r	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3104.9t	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
5.3202.2a	LEED	New Construction
5.3301.1a	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 314.27 C
5.3301.1b	ENERGY STAR	General
5.3301.1c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Section 903
5.3301.1c	NFPA 70E	Standard for Electrical Safety in the Workplace®
5.3301.1c	EISA	General
5.3301.1c	ENERGY STAR	General
5.3301.1c	NFPA 13R	Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies

5.3301.1c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
5.3301.1f	EPA	General
5.3301.1h	EPA	General
5.3302.1a	NFPA 70	National Electrical Code, Section 440
5.3302.1b	ENERGY STAR	General
5.3302.1c	ANSI/NFPA 101	Building Exit Codes
5.3302.1c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
5.3302.1c	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
5.3302.1c	NFPA 70	National Electrical Code, Section 440
5.3302.1d	Clean Air Act	Section 608
6.6002.1 (all)	SMACNA	Duct Construction Standards
6.6002.1a	2012 IRC	M1601.1
6.6002.1c	2012 IRC	M1601.4.3
6.6002.1d	2012 IRC	Chapter 16
6.6002.1d	2012 IRC	M1601.1.1
6.6002.1e	2012 IRC	M1503.2
6.6002.1e	2012 IRC	M1601.2
6.6002.2b	2012 IRC	R303.5
6.6002.2c	2012 IRC	Chapter 16
6.6002.2c	2012 IRC	M1601.1.1
6.6002.2d	2012 IRC	N1102.4
6.6002.2e	2012 IRC	R303.6
6.6002.2f	2012 IRC	M1506.2
6.6002.2g	2012 IRC	M1503.2
6.6003.1b	2012 IRC	E3403
6.6003.1c	2012 IRC	M1307
6.6003.1e	2012 IRC	Chapter 16
6.6003.1e	2012 IRC	M1601.1.1
6.6003.1f	2012 IRC	N1103.2
6.6003.1g	2012 IRC	N1103.2
6.6003.1h	2012 IRC	M1507
6.6003.1h	ANSI/ASHRAE 111-2008	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6003.1i	2012 IRC	N1103.2
6.6003.1j	2012 IRC	R102.7
6.6003.2a	2012 IRC	E3403
6.6003.2b	2012 IRC	M1401.2
6.6003.2b	NFPA 70	National Electrical Code®
6.6003.2c	2012 IRC	M1307
6.6003.2d	2012 IRC	N1103.5
6.6003.2e	2012 IRC	Chapter 16
6.6003.2e	2012 IRC	M1601.1.1
6.6003.2f	2012 IRC	N1103.2
6.6003.2g	2012 IRC	M1507
6.6003.2g	ANSI/ASHRAE 111-2008	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6003.2h	2012 IRC	N1103.2

6.6003.2i	2012 IRC	R102.7
6.6003.2i	ANSI Z223.1	National Fuel Gas Code
6.6003.2i	NFPA 54	National Fuel Gas Code
6.6003.3b	2012 IRC	E3403
6.6003.3c	2012 IRC	M1307
6.6003.3d	2012 IRC	Chapter 16
6.6003.3d	2012 IRC	N1102.4
6.6003.3f	2012 IRC	N1103.2
6.6003.3g	2012 IRC	N1103.2
6.6003.3i	2012 IRC	M1507
6.6003.3i	2012 IRC	N1103.2
6.6003.3i	ANSI/ASHRAE 111-2008	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6003.3j	2012 IRC	R102.7
6.6003.3j	ANSI Z223.1	National Fuel Gas Code
6.6003.3j	NFPA 54	National Fuel Gas Code
6.6003.4a	2012 IRC	E3403
6.6003.4b	2012 IRC	M1401.2
6.6003.4b	NFPA 70	National Electrical Code®
6.6003.4c	2012 IRC	M1307
6.6003.4d	2012 IRC	N1103.5
6.6003.4e	2012 IRC	M1502
6.6003.4e	2012 IRC	M1503
6.6003.4f	2012 IRC	Chapter 16
6.6003.4f	2012 IRC	M1601.1.1
6.6003.4h	2012 IRC	N1102.4.1.1
6.6003.4i	2012 IRC	M1507
6.6003.4j	2012 IRC	N1103.2
6.6003.4k	2012 IRC	R102.7
6.6003.4k	ANSI Z223.1	National Fuel Gas Code
6.6003.4k	NFPA 54	National Fuel Gas Code
6.6003.5a	IMC	International Mechanical Code
6.6003.5a	IMC	International Mechanical Code
6.6003.5b	2012 IRC	N1102.4.1.1
6.6003.5b	2012 IRC	N1103.2
6.6003.5c	2012 IRC	R102.7
6.6003.5c	ANSI Z223.1	National Fuel Gas Code
6.6003.5c	NFPA 54	National Fuel Gas Code
6.6004.1b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6004.1b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6004.1b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6004.1c	HVI	General
6.6004.1c	NEMA	National Electricla Manufacturers Association
6.6004.1e	NFPA 70	National Electrical Code
6.6004.1l	SMACNA	Duct Construction Standard

6.6004.1n	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
6.6004.1o	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, Addendum J
6.6004.1o	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
6.6004.1p	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6004.1p	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6004.1q	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
6.6004.2b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6004.2b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6004.2b	ANSI/ASHRAE Standard 62.1-2010	Ventilation and Acceptable Indoor Air Quality
6.6004.2b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6004.2c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
6.6004.2d	NFPA 70	National Electrical Code
6.6004.2g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6004.2g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6004.2i	SMACNA	Duct Construction Standard
6.6004.2k	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
6.6004.2l	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, Section 6.1
6.6004.2l	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
6.6004.2n	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
6.6004.3b	ANSI/ASHRAE Standard 62.1-2010	Ventilation and Acceptable Indoor Air Quality, Table 5-1
6.6004.3b	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
6.6004.3b	NEMA	National Electricla Manufacturers Association
6.6004.3c	NFPA 70	National Electrical Code
6.6004.3g	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6004.3g	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems

6.6004.3h	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
6.6005.1a	2012 IRC	M1502
6.6005.1a	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.1a	IMC	International Mechanical Code
6.6005.1b	2012 IRC	M1502.3
6.6005.1c	2012 IRC	G2439.4
6.6005.1e	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.2a	2012 IRC	General
6.6005.2b	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.2c	2012 IRC	M1503.1
6.6005.2c	2012 IRC	M1503.2
6.6005.2d	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.2f	2012 IRC	G2407
6.6005.2f	2012 IRC	G2447
6.6005.3b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.3c	ANSI/ASHRAE Standard 62.1-2010	Ventilation and Acceptable Indoor Air Quality, Table 5-1
6.6005.3f	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
6.6005.3g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.4b	NFPA 70	National Electrical Code
6.6005.4b	OSHA	Technical Manual Section VIII: Chapter 1, part III
6.6005.4c	HVI 2100	General
6.6005.4d	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.4e	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.4e	IMC-2009	International Mechanical Code, Section 505

6.6005.4f	ANSI/ASHRAE Standard 62.1-2010	Ventilation and Acceptable Indoor Air Quality, Table 5-1
6.6005.4f	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6005.4g	IMC-2009	International Mechanical Code, Section 504.5
6.6005.4i	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
6.6005.4j	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6102.1c	2012 IRC	M1601.4.3
6.6102.1d	2012 IRC	M1601.1.1
6.6102.1d	2012 IRC	M1601.4.1
6.6102.1e	IMC	International Mechanical Code
6.6102.1e	NFPA 90A/B	Standard for the Installation of Air-Conditioning and Ventilating Systems / Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
6.6102.1f	2012 IRC	R303.5.1
6.6102.1f	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6102.2b	2012 IRC	R303.5
6.6102.2d	2012 IRC	N1103.5
6.6102.2e	2012 IRC	Chapter 16
6.6102.2e	2012 IRC	M1601.1.1
6.6102.2f	2012 IRC	R303.6
6.6102.2h	2012 IRC	R303.5.1
6.6102.3a	BPI 104	Envelope Professional
6.6102.3b	2012 IRC	E3403
6.6102.3c	2012 IRC	M1401.2
6.6102.3e	2012 IRC	N1103.5
6.6102.3f	ANSI/ASHRAE 52.2	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
6.6102.3f	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6102.6c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6102.6g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

6.6102.6g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6102.6h	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6102.7a	ANSI/ACCA Manual D	Residential Duct Systems
6.6102.7a	ANSI/ACCA Manual Q	Low Pressure, Low Velocity Duct System Design
6.6102.7a	SMACNA	Duct Construction Standard
6.6102.7c	SMACNA	Duct Construction Standard
6.6102.7d	SMACNA	Duct Construction Standard
6.6102.7e	SMACNA	Duct Construction Standard
6.6102.7f	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6103.1a	2012 IRC	E3403
6.6103.1b	2012 IRC	M1401.2
6.6103.1c	2012 IRC	M1307
6.6103.1d	2012 IRC	N1103.5
6.6103.1e	2012 IRC	M1601.4.1
6.6103.1f	ANSI/ASHRAE 52.2	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
6.6103.1f	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6103.1h	2012 IRC	N1103.2
6.6103.1h	2012 IRC	R302.9
6.6104.1b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6104.1b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6104.1b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6104.1c	NEMA	National Electrical Manufacturers Association
6.6104.1d	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6104.1g	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6104.1i	NFPA 70	National Electrical Code
6.6104.1m	SMACNA	Duct Construction Standard
6.6104.1o	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
6.6104.1p	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, Addendum J
6.6104.1q	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification

6.6104.1q	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6104.2b	NFPA 70	National Electrical Code
6.6104.2c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6201.1a	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6201.1b	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6201.1c	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6201.4g	OSHA	General
6.6202.1c	2012 IRC	E3403
6.6202.2a	2012 IRC	E3403
6.6202.2b	2012 IRC	M1401.2
6.6202.2c	2012 IRC	M1401.1
6.6202.2c	2012 IRC	M1601.1
6.6202.2c	ANSI/ACCA D	Residential Duct Systems
6.6202.2d	2012 IRC	N1103.5
6.6202.2e	2012 IRC	R303.5
6.6202.2f	2012 IRC	Chapter 16
6.6202.2f	2012 IRC	N1103.2.2
6.6202.2i	2012 IRC	Chapter 16
6.6202.3c	UL 181	Factory-Made Air Ducts and Air Connectors
6.6202.3e	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6202.3e	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6202.4c	NFPA 70	National Electrical Code
6.6202.5b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6202.5b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6202.5b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6202.5c	NFPA 70	National Electrical Code
6.6202.6b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6202.6b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6202.6b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6202.6c	NFPA 70	National Electrical Code

6.6202.6l	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6202.6q	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
6.6202.9b	ASHRAE Standard 52.2-2007	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
6.6203.1a	ENERGY STAR	General
6.6203.1b	ASHRAE Handbook	Fundamentals
6.6203.1c	2012 IRC	M1401.2
6.6203.2b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6203.2b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6203.2b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6203.2b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6203.2f	NFPA 70	National Electrical Code
6.6203.3a	ENERGY STAR	General
6.6203.3b	ANSI/ACCA 5 - 2010 QI	HVAC Quality Installation Specification
6.6203.3b	ANSI/ASHRAE Standard 111	Measurement, Testing, Adjusting and Balancing of Building HVAC Systems
6.6203.3b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6203.3b	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6203.3f	NFPA 70	National Electrical Code
6.6207.1b	ANSI/ASHRAE Standard 62.1-2010	Ventilation and Acceptable Indoor Air Quality, Table 5-1
6.6207.1c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6288.1a	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.6288.1b	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
6.9901.1	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
7.8001.1a	NAECA	National Appliance Energy Conservation Act
7.8001.1b	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8001.2a	FDA Consumer Health Website	Are you storing food safely?

7.8001.3a	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 440
7.8001.3b	ENERGY STAR	General
7.8001.3b	NAECA	National Appliance Energy Cnservation Act
7.8001.3c	Federal Fair Housing Act	General
7.8001.3c	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
7.8001.3c	NFPA 70	National Electrical Code
7.8001.3f	OSHA 1910	Occupational Safety and Health Standards
7.8002.1a	ENERGY STAR	General
7.8002.1a	NAECA	National Appliance Energy Conservation Act
7.8002.2a	NFPA 70	National Electrical Code, Section 422
7.8002.2b	ENERGY STAR	General
7.8002.2b	NAECA	National Appliance Energy Cnservation Act
7.8002.2e	EPA	Responsible Recycling (R2)
7.8002.2f	OSHA	General
7.8003.10c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.10c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.10e	ANSI/NFPA 101	Building Exit Codes
7.8003.11b	ENERGY STAR	General
7.8003.11b	UL 1570	Fluorescent Lighting Fixtures
7.8003.11b	UL 542	Fluorescent Lamp Starters
7.8003.11c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8003.11d	ANSI/NFPA 101	Building Exit Codes
7.8003.11e	EPA	General
7.8003.11f	EPA	General
7.8003.11g	EPA	Chapter
7.8003.12a	LCA EE110	Lighting Control Association
7.8003.12c	ANSI/NFPA 101	Building Exit Codes
7.8003.12c	IBC - 2009	International Building Code
7.8003.13b	ANSI C82.1	Ballasts - for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type)
7.8003.13b	ANSI/NEMA C82.4	Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type)
7.8003.13b	NEMA	National Electricla Manufacturers Association
7.8003.13b	UL 1029	High-Intensity-Discharge Lamp Ballasts
7.8003.13b	UL 924	Emergency Lighting and Power Equipment

7.8003.13c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.13c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8003.13d	ANSI/NFPA 101	Building Exit Codes
7.8003.14b	UL 153	Portable Electric Luminaires
7.8003.14b	UL 1598	Luminaires
7.8003.14b	ENERGY STAR	General
7.8003.14c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.14c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.14c	NECA/IESNA 500	General
7.8003.14c	NFPA 101	Life Safety Code
7.8003.14c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8003.14d	ANSI/NFPA 101	Building Exit Codes
7.8003.14f	EPA	General
7.8003.14h	EPA	General
7.8003.15b	UL 1570	Fluorescent Lighting Fixtures
7.8003.15b	UL 542	Fluorescent Lamp Starters
7.8003.15c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.15c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8003.15f	EPA	General
7.8003.1b	ENERGY STAR	General
7.8003.1b	Environmental Protection Agency	Healthy Indoor Environment Protocols for Home Energy Upgrades
7.8003.1b	NFPA 70	National Electrical Code®
7.8003.2a	IBC - 2009	International Building Code, Section 1011
7.8003.2a	NFPA 101	Life Safety Code
7.8003.2b	IFC	General
7.8003.2b	IBC - 2009	International Building Code
7.8003.2b	NEMA	Premium Exit Sign List
7.8003.2b	NFPA 70	National Electrical Code, Section 700.12 F
7.8003.2b	NFPA 70	National Electrical Code
7.8003.2b	UL 924	Emergency Lighting and Power Equipment
7.8003.2c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.2c	NFPA 70	National Electrical Code
7.8003.2c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8003.2d	ANSI/NFPA 101	Building Exit Codes
7.8003.2d	NFPA 70	National Electrical Code, Section 700.12 F

7.8003.2e	EPA	General
7.8003.2f	EPA	Chapter
7.8003.3b	NFPA 70	National Electrical Code, Section 700.12 F
7.8003.3b	UL 1570	Fluorescent Lighting Fixtures
7.8003.3b	UL 542	Fluorescent Lamp Starters
7.8003.3c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.3c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8003.3d	ANSI/NFPA 101	Building Exit Codes
7.8003.3d	NFPA 110	Life Safety Code
7.8003.3d	NFPA 70	National Electrical Code, Section 700.12 F
7.8003.3e	EPA	General
7.8003.3f	EPA	Chapter
7.8003.4c	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8003.4c	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
7.8003.4c	NFPA 101	Life Safety Code
7.8003.4c	NFPA 70	National Electrical Code
7.8003.4e	ANSI/NFPA 101	Building Exit Codes
7.8003.5b	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.5b	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.5c	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8003.5c	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
7.8003.5c	ANSI/NFPA 101	Building Exit Codes
7.8003.5c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.5d	ANSI/NFPA 101	Building Exit Codes
7.8003.6b	UL 60730-1	Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements
7.8003.6c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.6c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.6f	ANSI/NFPA 101	Building Exit Codes
7.8003.7b	UL 917	Clock Operated Switches
7.8003.7c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.7c	NFPA 70E	Standard for Electrical Safety in the Workplace®

7.8003.7d	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8003.7d	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
7.8003.7f	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8003.7f	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
7.8003.7f	ANSI/NFPA 101	Building Exit Codes
7.8003.8b	UL 60730-1	Automatic Electrical Controls for Household and Similar Use, Part 1: General Requirements
7.8003.8c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.8c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.8f	ANSI/NFPA 101	Building Exit Codes
7.8003.9c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8003.9c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8003.9f	ANSI/NFPA 101	Building Exit Codes
7.8004.1a	ENERGY STAR	General
7.8004.1a	NAECA	National Appliance Energy Conservation Act
7.8004.1b	2012 IRC	P2903.9.3
7.8004.1b	2012 IRC	P2903.9.4
7.8004.2a	NAECA	National Appliance Energy Conservation Act
7.8004.3a	NFPA 70	National Electrical Code, Section 422
7.8004.3b	NAECA	National Appliance Energy Cnservation Act
7.8004.3c	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
7.8004.3c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8004.3c	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
7.8004.3c	Federal Fair Housing Act	General
7.8004.3c	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
7.8004.3c	NFPA 70	National Electrical Code
7.8004.3f	OSHA	General
7.8004.3h	AHAM	Association of Home Appliance Manufacturers
7.8005.1a	UL 541	Refrigerated Vending Machines
7.8005.1a	ENERGY STAR	General

7.8005.1b	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 422.51
7.8005.1b	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
7.8005.1c	EPA	40 CFR 82.156
7.8005.2a	UL 751	Vending Machines
7.8005.2b	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 422.51
7.8005.2b	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
7.8005.2d	ANSI/NFPA 101	Building Exit Codes
7.8005.3a	ENERGY STAR	General
7.8005.3b	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
7.8005.3c	Clean Air Act	Section 608
7.8101.4a	NFPA 70	National Electrical Code
7.8101.4b	ENERGY STAR	General
7.8101.4b	NAECA	National Appliance Energy Cnservation Act
7.8101.4b	EPA	WaterSense
7.8101.4c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8101.4c	NFPA 70	National Electrical Code
7.8101.4f	OSHA	General
7.8101.5a	NFPA 70	National Electrical Code, Article 422.31
7.8101.5a	NFPA 70	National Electrical Code, Article 422.16
7.8101.5b	ENERGY STAR	General
7.8101.5c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 422.16
7.8101.5c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8101.5c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8101.5c	OSHA 1910	Occupational Safety and Health Standards, Subpart S
7.8102.1a	2012 IRC	P2801
7.8102.1b	2012 IRC	Chapter 23
7.8102.2b	2012 IRC	M2201.7
7.8102.2b	2012 IRC	N1102.4.1.1
7.8102.2b	2012 IRC	R105.1
7.8102.2d	2012 IRC	P2801.5
7.8102.2d	2012 IRC	P2801.5.2
7.8102.2f	2012 IRC	P2803
7.8102.2f	2012 IRC	P2803.6.1
7.8102.2g	2012 IRC	G2415.5
7.8102.2g	2012 IRC	G2420.5
7.8102.2g	2012 IRC	G2422.1.4

7.8102.2g	2012 IRC	General
7.8102.2g	2012 IRC	P2905.17
7.8102.2g	2012 IRC	P3003.18.2
7.8102.2i	2012 IRC	N1103.4.2
7.8102.2j	ANSI Z223.1	National Fuel Gas Code
7.8102.2j	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.2j	NFPA 54	National Fuel Gas Code
7.8102.2j	NFPA 70	National Electrical Code®
7.8102.2m	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
7.8102.3b	2012 IRC	M2201.7
7.8102.3b	2012 IRC	N1102.4.1.1
7.8102.3b	2012 IRC	R105.1
7.8102.3c	2012 IRC	General
7.8102.3d	2012 IRC	P2801.5
7.8102.3d	2012 IRC	P2801.5.2
7.8102.3e	2012 IRC	P2803
7.8102.3e	2012 IRC	P2803.6.1
7.8102.3f	2012 IRC	G2415.5
7.8102.3f	2012 IRC	G2420.5
7.8102.3f	2012 IRC	G2422.1.4
7.8102.3f	2012 IRC	General
7.8102.3f	2012 IRC	P2905.17
7.8102.3f	2012 IRC	P3003.18.2
7.8102.3h	2012 IRC	N1103.4.2
7.8102.3i	2012 IRC	G2407
7.8102.3i	2012 IRC	G2407.5.1
7.8102.3i	ANSI Z223.1	National Fuel Gas Code
7.8102.3i	NFPA 54	National Fuel Gas Code
7.8102.3j	2012 IRC	Chapter 24
7.8102.3k	BPI-1100-T-2012	Home Energy Auditing Standard
7.8102.3l	2012 IRC	Chapter 24
7.8102.3l	ANSI Z223.1	National Fuel Gas Code
7.8102.3l	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.3l	NFPA 54	National Fuel Gas Code
7.8102.3l	NFPA 58	Liquefied Petroleum Gas Code
7.8102.3l	NFPA 70	National Electrical Code®
7.8102.3p	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
7.8102.4b	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8102.4c	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8102.4c	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.4d	IPC	International Plumbing Code, Section 504.7
7.8102.4d	UPC	Universal Plumbing Code, Section 507.4

7.8102.4f	IPC	International Plumbing Code, Section 504
7.8102.4f	ANSI Z21.22	Relief Valves for Hot Water Supply Systems
7.8102.4g	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.4j	IFGC	International Fuel Gas Code
7.8102.4j	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.4j	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.4k	IFGC	International Fuel Gas Code
7.8102.4k	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.4k	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.4l	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
7.8102.4m	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.4m	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.4m	NFPA 70	National Electrical Code
7.8102.4o	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.4o	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.4o	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.4p	NFPA 720	Standard for the Installation of Carbon Monoxide Detection and Warning Equipment
7.8102.4q	ANSI/ASHRAE Standard 62.2-2010	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
7.8102.5b	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8102.5c	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.5c	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.5d	IPC	International Plumbing Code, Section 504.7
7.8102.5d	UPC	Universal Plumbing Code, Section 507.4
7.8102.5e	IPC	International Plumbing Code, Section 504
7.8102.5e	ANSI Z21.22	Relief Valves for Hot Water Supply Systems
7.8102.5f	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.5g	NFPA 70	National Electrical Code
7.8102.5i	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.5j	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings

7.8102.5j	IECC	International Energy Conservation Code
7.8102.5k	ANSI/ASHRAE Standard 90.2 - 2007	Energy Efficient Design of Low-Rise Residential Buildings
7.8102.5k	IFGC	International Fuel Gas Code
7.8102.5k	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.5k	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.5l	IFGC	International Fuel Gas Code
7.8102.5l	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.5l	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.5m	ASTM E1998 - 02(2007)	Standard Guide for Assessing Depressurization-Induced Backdrafting and Spillage from Vented Combustion Appliances
7.8102.5n	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.5n	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.5n	NFPA 70	National Electrical Code
7.8102.5o	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.5o	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.5o	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.5q	ANSI/ASHRAE Standard 62.1-2010	Ventilation and Acceptable Indoor Air Quality
7.8102.5q	NFPA 720	Standard for the Installation of Carbon Monoxide Detection and Warning Equipment
7.8102.6e	IPC	International Plumbing Code, Section 504
7.8102.6e	ANSI Z21.22	Relief Valves for Hot Water Supply Systems
7.8102.6e	UPC	Universal Plumbing Code
7.8102.6g	NFPA 70	National Electrical Code
7.8102.6h	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8102.6h	IECC	International Energy Conservation Code
7.8102.6i	NFPA 70	National Electrical Code
7.8102.6k	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.6k	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.6k	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.7h	IPC	International Plumbing Code, Section 504.7
7.8102.7h	UPC	Universal Plumbing Code, Section 507.4
7.8102.7i	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.7i	UPC	Universal Plumbing Code

7.8102.7k	NFPA 70	National Electrical Code
7.8102.7m	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8102.7m	IECC	International Energy Conservation Code
7.8102.7o	NFPA 70	National Electrical Code
7.8102.8b	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8102.8e	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.8e	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.8e	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.8f	IRC	International Residential Code, Section 20801.5.1
7.8102.8f	UPC	Universal Plumbing Code, Section 5.10.7
7.8102.8g	IPC	International Plumbing Code, Section 504
7.8102.8g	ANSI Z21.22	Relief Valves for Hot Water Supply Systems
7.8102.8g	UPC	Universal Plumbing Code
7.8102.8h	IPC	International Plumbing Code, Section 504.7
7.8102.8h	UPC	Universal Plumbing Code, Section 507.4
7.8102.8i	NFPA 70	National Electrical Code
7.8102.8l	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8102.8l	IECC	International Energy Conservation Code
7.8102.8n	NFPA 70	National Electrical Code
7.8102.9b	ASTM C1193 - 09	Standard Guide for Use of Joint Sealants
7.8102.9f	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8102.9f	NFPA 54/ANSI/AGA Z223.1	National Fuel Gas Code
7.8102.9f	NFPA 70A	National Electrical Code® Requirements for One- and Two-Family Dwellings
7.8102.9g	IPC	International Plumbing Code, Section 504.7
7.8102.9g	UPC	Universal Plumbing Code, Section 507.4
7.8102.9h	IPC	International Plumbing Code, Section 504
7.8102.9h	ANSI Z21.22	Relief Valves for Hot Water Supply Systems
7.8102.9h	UPC	Universal Plumbing Code
7.8102.9j	NFPA 70	National Electrical Code
7.8102.9k	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8102.9k	IECC	International Energy Conservation Code
7.8102.9l	NFPA 70	National Electrical Code
7.8103.1a	NFPA 70	National Electrical Code®
7.8103.1b	2012 IRC	General
7.8103.1c	2012 IRC	N1103.4.2

7.8103.1e	2012 IRC	P2803
7.8103.1e	2012 IRC	P2803.6.1
7.8103.1g	ANSI/ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
7.8103.2a	NFPA 70	National Electrical Code®
7.8103.2b	2012 IRC	General
7.8103.2c	2012 IRC	P2803
7.8103.2c	2012 IRC	P2803.6.1
7.8103.2c	ANSI Z223.1	National Fuel Gas Code
7.8103.2c	NFPA 54	National Fuel Gas Code
7.8103.2d	BPI-1100-T-2012	Home Energy Auditing Standard
7.8103.2e	2012 IRC	G2407
7.8103.2e	2012 IRC	G2407.5.1
7.8103.2f	IFGC	International Fuel Gas Code
7.8103.2f	NFPA 31	Standard for the Installation of Oil-Burning Equipment
7.8103.2f	NFPA 54	National Fuel Gas Code
7.8103.2f	NFPA 58	Liquefied Petroleum Gas Code
7.8103.2g	NFPA 70	National Electrical Code®
7.8103.5c	CSA	B483.1
7.8103.5c	NSF 42	Drinking Water Treatment Units - Aesthetic Effects
7.8103.5c	NSF 42	Drinking Water Treatment Units - Aesthetic Effects
7.8103.5c	NSF 53	Drinking Water Treatment Units - Health Effects
7.8103.5c	NSF 62	Drinking Water Distillation Systems
7.8103.5e	NFPA 70	National Electrical Code
7.8103.5h	NACE TPC 7	National Association of Corrosion Engineers
7.8103.5h	NACE	National Association of Corrosion Engineers
7.8104.1c	ASSE 1017	Temperature Actuated Mixing Valves for hot Water Distribution Systems
7.8104.1c	ASSE 1069	Performance Requirements for Automatic Temperature Control Mixing Valves
7.8104.1c	ASSE 1070	Performance Requirements for Water Temperature Limiting Devices
7.8104.3d	ANSI/ASHRAE Standard 90.1-2010	Energy Standard for Buildings Except Low-Rise Residential Buildings
7.8104.3d	IECC	International Energy Conservation Code
7.8104.3h	NFPA 70	National Electrical Code
7.8104.4n	NFPA 70	National Electrical Code
7.8801.1c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 620
7.8801.1c	ASME A17.1	Safety Code for Elevators and Escalators

7.8801.1c	ICC/ANSI A117.1	Accessible and Usable Buildings and Facilities
7.8802.1b	APSP-15	Standard for Energy Efficiency for Residential Inground Swimming Pools and Spas
7.8802.1c	NFPA 70	National Electrical Code® Requirements for One- and Two-Family Dwellings, Article 680
7.8802.1c	NFPA 70E	Standard for Electrical Safety in the Workplace®
7.8802.1c	OSHA 1910	Occupational Safety and Health Standards, Subpart S

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SPECIFICATION	STANDARD REFERENCE	SECTION
2.0111.2A	2012 IRC	GENERAL
2.0111.2d	2012 IRC	General
2.0111.2e	2012 IRC	General
2.0111.2f	2012 IRC	General
2.0111.2g	2012 IRC	General
2.0111.3a	2012 IRC	R408.5
2.0201.1b	2012 IRC	G2417.1.2
2.0201.2a	2012 IRC	Chapter 24
2.0201.2a	2012 IRC	General
2.0201.2b	2012 IRC	G2427.8
2.0201.2c	2012 IRC	R315.3
2.0203.1a	2012 IRC	G2407.5.1
2.0203.1b	2012 IRC	G2407
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2.0203.2b	2012 IRC	General
2.0203.2d	2012 IRC	G2407.5.1
2.0203.2e	2012 IRC	G2407
2.0301.1a	2012 IRC	General
2.0301.1a	2012 IRC	R314
2.0301.1b	2012 IRC	General
2.0301.1b	2012 IRC	R314
2.0301.2a	2012 IRC	General
2.0301.2a	2012 IRC	R315
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2.0401.1b	2012 IRC	R408.1
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2.0401.1b	2012 IRC	R702.7.2
2.0401.1e	2012 IRC	M1502
2.0401.1e	2012 IRC	M1503
2.0401.1e	2012 IRC	M1504

2.0401.1e	2012 IRC	M1505
2.0401.1e	2012 IRC	M1506
2.0401.1e	2012 IRC	M1507
2.0401.1f	2012 IRC	R405
2.0401.1f	2012 IRC	R406
2.0401.1f	2012 IRC	R703.8
2.0401.2a	2012 IRC	General
2.0401.2a	2012 IRC	R408.2
2.0401.2a	2012 IRC	R408.2
2.0402.1c	2012 IRC	R405
2.0402.1c	2012 IRC	R406
2.0403.3a	2012 IRC	R408.3
2.0404.1b	2012 IRC	G2439.1
2.0404.1b	2012 IRC	M1502.2
2.0404.1b	2012 IRC	P3303.1.2
2.0404.2a	2012 IRC	G2407.5.1
2.0701.1a	2012 IRC	AF103.4.10
2.0701.1a	2012 IRC	M1305.1.4
2.0701.1a	2012 IRC	N1102.2.4
2.0701.1a	2012 IRC	R408.4
3.1001.2b	2012 IRC	N1102.4.1.2
3.1001.2c	2012 IRC	R302.9
3.1001.3b	2012 IRC	N1102.4.1.2
3.1002.1b	2012 IRC	N1102.4.1.2
3.1003.5b	2012 IRC	N1102.4.1.2
3.1003.5b	2012 IRC	R402.4.1.2
3.1402.5b	2012 IRC	Chapter 4
3.1402.5b	2012 IRC	M1305.1.4
3.1402.5b	2012 IRC	R408.4
3.1501.1b	2012 IRC	N1103.2.2
3.1601.1a	2012 IRC	Chapter 16
3.1601.1a	2012 IRC	N1103.2
3.1601.1b	2012 IRC	Chapter 16
3.1601.1b	2012 IRC	M1601.1.1
3.1601.1b	2012 IRC	N1103.2
3.1601.1c	2012 IRC	Chapter 16
3.1601.1c	2012 IRC	N1103.2
3.1601.1d	2012 IRC	Chapter 16
3.1601.1d	2012 IRC	N1103.2
3.1601.1e	2012 IRC	M1601.4.1
3.1601.1f	2012 IRC	M1601.4.1
3.1601.1g	2012 IRC	Chapter 16
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3.1601.1h	2012 IRC	Chapter 16
3.1601.1h	2012 IRC	N1103.2
3.1601.1i	2012 IRC	Chapter 16
3.1601.1i	2012 IRC	N1103.2
3.1601.1j	2012 IRC	N1103.2
3.1601.1l	2012 IRC	Chapter 16

3.1601.3a	2012 IRC	Chapter 16
3.1601.3a	2012 IRC	M1601.4.3
3.1602.1 (all)	2012 IRC	Chapter 16
3.1602.2a	2012 IRC	M1601.3
3.1602.2a	2012 IRC	R316.1
3.1602.2a	2012 IRC	R316.2
3.1602.2a	2012 IRC	R316.3
3.1602.2a	2012 IRC	R316.4
3.1602.2a	2012 IRC	R316.5
3.1602.2a	2012 IRC	R316.6
3.1602.2a	2012 IRC	R316.7
3.1602.4a	2012 IRC	N1102.4.1.1
3.1602.4a	2012 IRC	R302.9
3.1602.4b	2012 IRC	N1103.2.2
3.1602.5c	2012 IRC	N1102.4.1.1
3.1602.5c	2012 IRC	R302.9
3.1602.6b	2012 IRC	N1102.4.1.1
3.1602.6b	2012 IRC	R302.9
4.1001.1a	2012 IRC	E4003.2
4.1001.1a	2012 IRC	E4004.2
4.1001.1b	2012 IRC	E4004.9
4.1001.1c	2012 IRC	E4003.2
4.1001.1c	2012 IRC	E4004.9
4.1001.1d	2012 IRC	N1102.4.4
4.1001.3b	2012 IRC	M1801.3.4
4.1001.3b	2012 IRC	R1003.18
4.1003.1a	2012 IRC	R806
4.1003.2a	2012 IRC	N1102.2.2
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4.1601.1e	2012 IRC	M1601.1
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4.1601.1j	2012 IRC	M1601.4.1
4.1601.2b	2012 IRC	M1601.4.1
4.1601.d	2012 IRC	Chapter 16
5.3003.9j	2012 IRC	N1103.1
5.3003.10a	2012 IRC	M1411.3
5.3003.10c	2012 IRC	M1411.3
5.3003.10d	2012 IRC	M1411.3
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5.3104.3j	2012 IRC	M2003
5.3104.3k	2012 IRC	M2001
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6.6003.1g	2012 IRC	N1103.2
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6.6102.2d	2012 IRC	N1103.5
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7.8103.1e	2012 IRC	P2803
7.8103.1e	2012 IRC	P2803.6.1
7.8103.1g	2012 IRC	R315.1
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7.8103.2c	2012 IRC	P2803
7.8103.2c	2012 IRC	P2803.6.1
7.8103.2e	2012 IRC	G2407
7.8103.2e	2012 IRC	G2407.5.1

General Information on Spray Polyurethane Foam (SPF)

Low-Pressure SPF

Low-pressure SPF systems are two-component polyurethane foam products. They are typically delivered to the job site in pressurized canisters (~250 psi), dispensed though unheated hoses through a disposable mixing nozzle system, and applied as a froth-like material to substrate. This type of SPF product is typically used for large sealing and small-scale insulation products.

High-Pressure SPF

High-pressure SPF systems are two-component polyurethane foam products. They are typically delivered to the job site in unpressurized drums or totes and dispensed by a proportioner pump where heat and pressure are added. These chemicals travel through heated hoses to a spray gun where the material is aerosolized during application. This type of SPF product is typically used for larger insulation applications.

Note on SPF Delivery Methods

Once installed, there is essentially no difference in product performance between low- and high-pressure foams. It should be noted that the main differences between the delivery methods are in capital equipment investment, application rate, and PPE requirements.

Installer Training

Applicators should obtain training from the suppliers of SPF to help assure installation quality and use of all equipment as well as safe handling, use, and disposal of all chemicals used in the process. Spray

Polyurethane Foam Alliance (SPFA) also offers additional training and accreditation for high-pressure SPF applicators.

Manufacturer Installation Instructions

SPF applicators should follow all manufacturer installation instructions for the product being used. These instructions include product-specific documents such as application instructions, MSDSs, and evaluation reports.

Calculation of the Infiltration Credit

The infiltration credit that can be used to reduce the required installed fan flow requires estimating the infiltration using the blower door test result. This calculation can be reduced to a few inputs using certain assumptions. This section provides this reduced equation for the infiltration credit. For a more detailed step-by-step discussion, see the end of this page.

The infiltration rate at operating conditions, measured in CFM, can be estimated as:

$$Q_{inf} = 0.052\ast wsf\ast S\ast Q_{50}$$

Where:

\(\mathbf{wsf}\) = a weather factor specific to a geographic location

\(\mathbf{S}\) = a factor accounting for the height of the house, determined from Table A-1

\(\mathbf{Q_{50}}\) = the blower door test result in CFM50 (cubic feet per minute at 50 Pa)

\(\mathbf{Q_{inf}}\) = infiltration in CFM

Table A-1. S-Factors for Various House Heights

STORIES	1	1.5	2	2.5	3
S-Factor	1.00	1.18	1.32	1.44	1.55

In ASHRAE Standard 62.2-2013, the infiltration rate \(\mathbf{Q_{inf}}\) is the same as the infiltration credit, and can be fully subtracted from the fan flow rate.

Use of ASHRAE Standard 62.2-2013, Appendix A

ASHRAE Standard 62.2-2013 includes an appendix that details an alternative compliance method intended for existing homes that did not meet the ASHRAE 62.2 local exhaust requirements when built. The strategy is to evaluate how much local exhaust deficit there is in each room that should have local exhaust, based on intermittent fan requirements, and to increase the continuous primary fan flow rate to account for this deficit. This section provides guidance on how to determine the increase to the primary fan flow rate to comply with ASHRAE 62.2-2013.

Per ASHRAE 62.2-2013

- Each bathroom should have a 50 CFM fan, if used on demand.
    - **Note:** Half baths do not require ventilation per ASHRAE Standard 62.2-2013 – only bathrooms with a shower and/or tub require local exhaust.
- Each kitchen should have a 100 CFM fan, if used on demand.

For each of these rooms that does not meet the stated local exhaust requirements

1. Calculate the deficit. If there is a fan that exhausts to the outside but does not have the required flow, the deficit is only the difference between the required flow and the measured flow.
2. Reduce the deficit by 20 CFM for each of these rooms that have an operable window (if allowed by the authroity having jurisdiction). Sum up all of the individual deficits.
3. Divide by 4.
4. Add the result to the required primary continuous fan flow rate.

Example #1

- Kitchen has no exhaust to outside but has an operable window.
- Bathroom #1 has no exhaust but has an operable window.
- Bathroom #2 has a fan that exhausts to outside but moves only 32 CFM.

Deficit for kitchen is 100-20 = 80 CFM (20 CFM credit for operable window)

Deficit for bathroom #1 is 50-20 = 30 CFM (20 CFM credit for operable window)

Deficit for bathroom #2 is 50-32 = 18 CFM

Sum of deficits is 80+30+18 CFM = 128 CFM

Increase required primary fan flow rate by 128/4 = 32 CFM

Example #2:

- Kitchen has a fan to outside that moves only 60 CFM and an operable window.
- Bathroom #1 has a fan that moves only 20 CFM.
- Bathroom #2 has a fan that moves only 32 CFM.

Deficit for kitchen is 100-60-20 = 20 CFM (20 CFM credit for operable window)

Deficit for bathroom #1 is 50-20 = 30 CFM

Deficit for bathroom #2 is 50-32 = 18 CFM

Sum of deficits is 20+30+18 CFM = 68 CFM

Increase required primary fan flow rate by 68/4 = 17 CFM

Detailed Step-by-Step Process for Determining Infiltration Credit

This process determines the infiltration credit using only a blower door result, three house characteristics (floor area, volume, number of above-grade stories), and a factor used to account for local weather.

The calculations that are required are for the equivalent leakage area (ELA), normalized leakage (NL), and infiltration (I) at normal operating conditions.

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1) Calculation of ELA

$$ELA = \frac{Q_{50}}{50^{n}}\Delta P^{n}\sqrt{\frac{\rho }{2\Delta P}}$$

Where:

\(\mathbf{Q_{50}}\) = blower door leakage at 50 Pa [\(ft^{3}/min\) @ 50 Pa (or CFM50)]

\(\mathbf{n}\) = house leakage curve exponent

\(\mathbf{\Delta P}\) = reference pressure difference between inside and outside (Pa)

\(\mathbf{\rho}\) = density

By assuming that n = 0.65 (experimental average value for residential houses), ΔP = 4 Pa (typical reference value for ELA), and the density is a constant of \(1.2 kg/m^3\), and by converting all metric units to consistent inch-pound (I-P) units, the ELA can be rewritten as:

$$ELA = 0.000381\ast Q_{50}$$

(with \(\mathbf{Q_{50}}\) measured as CFM50, ELA has units of \(ft^2\))

---

2) Calculation of NL

$$NL=\frac{1000\ast ELA}{A_{floor}}\ast \left (\frac{H}{H_{r}} \right)^{0.4}$$

Where:

\(\mathbf{A_{floor}}\) = floor area of the house (\(ft^2\))

\(\mathbf{H}\) = height of the house above grade (ft)

\(\mathbf{H_{r}}\) = reference height of one story = 8 ft

The normalized leakage was developed assuming that the volume is 2.5 meters (8.2 ft) multiplied by the floor area. Using this assumption, substituting for ELA, and by assuming that the height of one story above grade is 8 ft, the NL can be rewritten as:

$$NL = \frac{3.1242\ast Q_{50}}{V}\ast \left (stories \right)^{0.4}$$

Where:

\(\mathbf{V}\) = volume of the house (\(ft^3\))

(**TECHNICAL NOTE:** The height of 2.5 m (8.2 ft) was used for determining the constant in order to be consistent with ASHRAE Standard 62.2-2013 in sections that the user does not need to input information; however, a height of 8 ft was used for the story factor. An analysis of the impact of the use of 8 ft for the story factor instead of 2.5 m (8.2 ft) shows less than a 1% error, which was considered acceptable in the name of simplicity for the user.)

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3) Calculation of infiltration at normal operating conditions

$$I = NL\ast wsf$$

Where:

\(\mathbf{wsf}\) = a weather factor specific to a geographic location

In this equation I is in air changes per hour (ACH). The weather factor can be found in a table in ASHRAE Standard 62.2-2013.

Once the infiltration I is determined, it can be converted to CFM using the volume of the house.

$$Q_{inf} = \frac{I\ast V}{60}$$

Where:

\(\mathbf{Q_{inf}}\) = infiltration in CFM

\(\mathbf{60}\) = conversion from hours to minutes

The infiltration rate at operating conditions, measured in CFM, can then be estimated as

$$Q_{inf} = 0.052\ast wsf\ast \left (stories \right)^{0.4}\ast Q_{50}$$

In ASHRAE Standard 62.2-2013, there is no default infiltration. The measured infiltration rate based on the blower door test can be subtracted from the fan requirement, including any adjustment for deficits, in full.

End of Document