Retrofitting Multifamily Homes in New Mexico

MFA

Housing New Mexico

Standard Work Specifications

Field Guide for

Multifamily Homes

created by

New Mexico Mortgage Finance Authority

In order to aid with the multifamily assessment and field guide use, commplete the worksheet using the following codes:

1. N=Not Applicable
2. E=Existing and already compliant
3. W= Put on the work order
4. A= completed at the assessment level

I. Health and Safety (Section 2 SWS)

Worker Safety:

____Hazzard assessment
____Lead testing or age of building
____Electrical assessment

____Airborne contamination
____Water sources close to wires
____Knob and tube
____Access and egress points
____Moisture
____Mold
____Rodents or Insects
____Evaluation of wires
____Unsafe building assemblies ____Exposed earth
____Dew points greater than 55 F
____Exterior water management
____Grading drainage
____PPE
____Adequate ventilation

Occupant health and safety:

____All combustion air to code

____Hazardous materials removed from mechanical room
____Mechanical room doors closed
____Low VOC products to be used

____Sealants intended to be continuous and fire resistant

____Venting systems proper pitch, material, common venting, clearance, length

____Locking refrigerant caps on access points
____Roof leaks verified and repaired
____EPA guidelines followed for current edition of “Healthy Indoor Environment Protocols for Home Energy Retrofits”
____Radon test for concrete masonry multistory units
____Fibrous insulation will be encapsulated

Occupant and Building Staff Education:

____Basic operation of equipment

____Proper operation of system controls
____Electrical disconnects and fuel shut offs demonstrated
____Location of combustion air inlets identified
____Importance of not blocking inlets

____Importance of cleaning dust and debris from return grills
____Proper placement of interior furnishings in respect to registers

____Negative consequences of closing registers
____Leaving interior doors open as much as possible
____How to change filter
____Keeping outdoor units clear of debris
____Timing of routine professional maintenance
____When occupants are to contact maintenance
____Use of CO alarm
____Warranty manuals
____Labor warranties
____Contact information

II. Air Sealing (Section 3 SWS)

Penetrations and Chases, Firewall in Unconditioned Attic, Wall Penetrations, Attic Access, Concrete Floor Slab, General Air Sealing:

____Gaps, cracks, and holes in fire separations identified
____Backing or infill need evaluated where gaps are larger than ¼”
____Air sealing locations identified between firewall and attic
____Backing or infill selected that allow for expansion and contraction
____Backing or infill selected meets fire rating of existing materials
____Selected sealants compatible with intended surfaces
____Selected sealants low VOC
____Fire-resistant ratings identified on available drawings
____Fire-resistant rating inferred from materials
____Flues design to not present fire, health, or safety risk
____Attic hatches will be insulated with non-compressible insulation
____Roof or outside access inspected for air and water leakage, security, warping, and proper operation
____Identification of air and thermal boundary

Doors, windows and skylights maintenance:

____Doors inspected to properly fit jamb and ease of operation
____Weather stripping chosen will be an effective air barrier
____Doors inspected for curb, stability, warping, proper hardware operation, security, air, and water leakage
____Skylight and window glazing inspected for curb, stability, warping, proper hardware operation, security, air and water leakage
____Insulation strategy determined for skylights

Door and window replacement:

____Glazing type chosen by location in building, building height, code, and climate
____Glazing solar heat gain coefficient selected by building orientation and climate
____Window and/or door selection NFRC rating by climate
____Window and door lowest possible U value chosen
____SHPO considered
____Sealants compatible with selected surfaces and low VOC
____Door frame insulation selected with thermal breaks appropriate to climate
____Door selected with lowest possible air leakage rating

Ducts Preparation, Fastening, and Support, Forced Air:

____Duct fastening currently compliant with 3.1601.6, 8
____Duct support currently compliant with 3.1601.7, 9
____Air tight filter slot cover needed
____Duct fastening modification needed to comply with 3.1601.6, 8
____Duct support modification needed to comply with 3.1601.7, 9
____Duct sealant considered will be UL 181 compliant and meet fire barrier specs

III. Insulation (Section 4 SWS)

Loose Fill over Existing and Flat Roof:

____Air sealing needed
____Electrical junctions need attention, flagging
____Blocking needed for venting
____Intended materials meet ASTM E84 flame spread rating

____Existing insulation in full contact with air barrier
____Dams needed
____IC can light boxes present

Installation/Correction of Unconditioned Attic Ventilation:

____Air barrier effective and present
____Air sealing part of scope or work
____Baffling for attic soffit vents needed
____1/8” non-corroding wire mesh screens needed
____Venting opening area and configuration calculated to comply with codes

____Ignition and thermal boundaries provided if foam plastic used
____Placement of new vents determining proper air flow
____Placement of new vents prevent entry of wind driven rain or snow

Dense Packing Blown Insulation:

____Lead safety procedures needed (built prior to 1980) 4.1003.4
____Fire separations considered
____Repairs needed to stabilize work area
____Moisture related issues to resolve
____Air sealing location on exterior identified
____Air barrier effective and present
____Sealants selected compatible with intended surfaces, low VOC and fire resistant
____Air sealing part of scope or work

____Possible to remove exterior cladding
____Insulation access points identified
____Materials selected meet requirements of SWS 4.1103.14f

Exterior Wall Surface Insulation:

____Prior repairs necessary
____IRC thermal boundary(firestopping)

____Lead safe practices needed
____Moisture related issues to resolve
____Water control measures
____Air sealing locations identified on outside walls
____Sealants selected compatible with intended surfaces, low VOC, durable, pest resistant and fire resistant
____Air sealing part of scope or work

____Mold, water leaks, pests removed

Above-Grade Exposed Floor, Joisted Assemblies:

____Gaps, cracks, and holes in fire separation located
____Repairs necessary to stabilize work
____Isolation needed for lead or asbestos
____Plan to install insulation in contact with subfloor with not gaps, voids or compressions
____Lighting to be provided
____Sealants selected compatible with intended surfaces, low VOC, durable, pest resistant and fire resistant
____Air sealing part of scope or work

____Vapor retarder plans

IV. Heating and Cooling (Section 5 SWS)

Equipment Selection:

____Design not more than 115% of load
____Lowest capacity required heating equipment used
____Lowest capacity required cooling equipment used
____Compliant with 5.3001.4

Ductwork and termination design, maintenance:

____Ducts designed using Manual D
____Return grille equal to or larger than box
____Design using friction charts
____Fire dampers needed
____Existing building cavities not used
____Compliant with 5.3001.5
____Compliant with code
____Fire rating code compliant
____Air flow meets per ton specs and ASHRAE standards
____Total leakage not more than 20% of designed system air flow when tested at 25 pascals
____Vapor retarder
____Supported properly

____Penetrations through firewalls sealed with fire-rated material
____Penetrations through interior walls sealed with durable sealant

Electrical Service:

____Correct polarity
____Wire size appropriate
____Voltage to manufacturer specs
____Proper disconnect service with fuses installed
____Voltage drop within acceptable range
____Adequate grounding
____Amperage within code requirements
____Blower compartment safety switch operation verified
____Emergency heat circuit function verified

Air Flow:

____Air handler has proper rotation
____Pressure drop across coils to manufacturer specs
____Supply wet and dry bulb temp recorded
____Thermostat wet and dry bulb temp recorded
____Return wet and dry bulb temp recorded
____Fan flow to design specs
____Pressure drop across filter to

Manufacturer specs

____Total air flow to ASHRAE Standard 111
____Outdoor temperature sensor installed with manufacturer specs for heat pumps

____Thermal and economic balance point calculated with optimum balance point select in accordance with ANSI/ACCA Manual S

Fuel Delivery System:

____Existing piping approved with NFPA
____Shut off valve, union joint, and drip leg verified
____Gas lines leak free with code-approved standing pressure test

Venting System:

____Venting termination in accordance with NFPA 54, 31, 211
____Category 1 venting in accordance with NFPA 54/ANSI Z223.1

____Vent joints airtight and watertight

Combustion Analysis:

____Burner orifice size with manufacturer specs
____Stack temperature measured and verified with manufacturer specs
____Oxygen with manufacturer specs
____Gas pressure verified with manufacturer specs
____Carbon Dioxide with manufacturer specs
____Excess air with manufacturer specs
____CO in undiluted flue gas less than level specified in ANZI Z 21

Condensate Line:

____Connections watertight
____Overflow protection
____Drained by gravity or pumps
____Vents and traps installed
____Drain pan where water damage can occur

Refrigerant Line and Charge Inspection:

____Existing insulation on the lines
____Secured to building in manner that protects line from damage
____Charge verified
____Lines checked for leaks
____If exposed to sunlight are the lines protected from UV degradation
____Superheat and Subcooling tests done under outdoor ambient temperatures

____Termination in accordance with local code

Evaporative Cooler Maintenance and Repair:

____All system elements assessed: spider, pan, pump, float, damper, roof jack, water line, electrical, pads, motor, fan.
____Existing calcium deposits to be removed

Through the Wall AC:

____Unit and electrical receptacle meets NFPA 70, article 440
____Available voltage matched

____Replacement Energy Star
____Wall opening size determined

V. Ventilation (Section 6 SWS)

Exhaust Serving Multiple Rooms:

____Local code requirements followed
____Outside termination location inspected for screen and louvered cover

____Exhaust outlet location local code compliant
____Air flow measured and ASHRAE 62.2 2013 calculated
____Fan and service switch to be accessible
____New ducts to be sealed to code
____Ducts to have insulation of R8
____Duct run and 90s possible for manufacturer specs
____Exhaust outlet sealed to prevent water leakage or air leakage into building cavaties
____Kitchen range hood exhausted to outside
____Secure mounting possible

VII. Baseloads (Section 7 SWS)

Refrigerators, lighting, low flow devices:

____Electrical receptacle meets NFPA 70 Article 440
____Exit signs considered and maximum of 5 watts
____Emergency lighting meets UL standard 542, 1570 and NFPA 70, 700.12
____Planned lighting levels in common areas compliant with ASHRAE 90.1 or 90.2
____Planned egress lighting in accordance with ANSI/NFPA 70 and 101
____Planned CFLs to be Energy Star
____Tubular light ballasts PCP free
____Unusual pressure conditions noted

Storage Tank Water Heater, piping, expansion tank:

____Potential health concerns in removal of old system identified
____Visible abandoned piping to be removed
____Dissimilar metals connected to prevent galvanic action (di-electric unions)
____Plumbing grounded and bonded as required by NEC (NFPA 70)
____Pressure checked using tire pressure gauge
____Incoming street pressure checked

2 Health and Safety

2.01 Safe Work Practices

2.0100 Safe Work Practices

2.0100.3 Global Worker Safety

2.0100.4 Work Area Inspection and Stabilization

2.0103 Air Sealing

2.0103.2 Air Sealing Worker Safety

2.0104 Insulation

2.0104.2 Insulation Worker Safety

2.0107 Baseload

2.0107.2 Licensed Electrical Professional

2.0110 Material Safety

2.0110.2 Potential Asbestos-Containing Materials

3 Air Sealing

3.10 Attics

3.1001 Penetrations and Chases

3.1001.5 Penetrations and Chases

3.1001.6 Firewall in Unconditioned Attic

3.1001.8 Preparing for and Installing Insulation Around High-Temperature Devices, Systems, and Components

3.1001.9 Sealing Access Doors and Similar Intentional Penetrations

3.1005 Other Ceiling Materials

3.1005.3 Air Sealing Complex Ceiling Planes

3.11 Walls

3.1102 Multifamily Walls

3.1102.1 Wall Penetration Sealing

3.12 Windows and Doors

3.1201 Maintenance, Repair, and Sealing

3.1201.7 Repair, Maintenance, and Weather Stripping of Windows

3.1201.8 Repair, Maintenance, and Weather Stripping of Doors

3.1203 Replacement

3.1203.4 Window Replacement

3.1203.5 Exterior Door Replacement

6 Ventilation

6.60 Exhaust

6.6004 Exhaust Ventilation Systems

6.6004.2 Individual Exhaust Fan Serving Multiple Rooms Within Single Dwelling Unit (All Building Types)

6.6005 Appliance Exhaust Vents

6.6005.4 Kitchen Range Hood within Dwelling Unit (All Building Types)

6.6088 Special Considerations

6.6088.1 Regional Climatic Considerations

6.61 Supply

6.6102 Components

6.6102.6 Intakes

2.0100.3b

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Durable and wrist-protecting gloves that can withstand work activity will be worn

Objective(s):
Minimize skin contact with contaminants

Protect hands from sharp objects

2.0100.3c

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
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 two-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 material safety data sheets (MSDSs) for respiratory protection requirements

OSHA 1910.134 shall be followed for the implementation of a respiratory protection program

Objective(s):
Minimize exposure to airborne contaminants (e.g., insulation materials, mold spores, feces, bacteria, chemicals)

2.0100.3d

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
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

Special precautions will be taken if knob and tube wiring is present. Reference SWS 2.0601.1 Knob and Tube Wiring

Aluminum foil products will be kept away from live wires

For arc flash hazards, NFPA 70E will be consulted

Objective(s):
Avoid electrical shock and arc flash hazards

2.0100.3e

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
All homes will have a functional 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)

Objective(s):
Protect worker and occupant health

2.0100.3f

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
MSDSs and OSHA regulations will be consulted for protective clothing and equipment requirements

Eye protection will always be worn (e.g., safety glasses, goggles if not using full-face respirator)

Objective(s):
Protect worker from skin contact with contaminants

Minimize spread of contaminants

2.0100.3g

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Access and egress points will be located before beginning work

Inspection will be conducted for frayed electrical wires or other physical hazards

Adequate ventilation will be provided

Use of toxic material will be minimized

Objective(s):
Provide adequate access and egress points

Prevent electric shock

Prevent buildup of toxic or flammable contaminants

2.0100.3h

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Power tools will be inspected and used in accordance with manufacturer specifications to eliminate hazards 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

Objective(s):
Prevent power tool injuries

Prevent build up of dangerous exhaust gases

2.0100.3i

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Hazardous materials will be handled in accordance with manufacturer specifications or MSDS standards to eliminate hazards associated with volatile organic compounds (VOCs), sealants, insulation, contaminated drywall, dust, foam, asbestos, lead, mercury, and fibers

Any container holding a hazardous substance will be labeled as to its contents, at a minimum

Appropriate personal protective equipment (PPE) will be provided

Workers will be trained on how to use PPE

Workers will be expected to always use appropriate PPE during work

Objective(s):
Prevent worker exposure to toxic substances

2.0100.3j

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Appropriate PPE will be used (e.g., knee pads, hardhats, additional padding)

Proper equipment will be used for work

Proper lifting techniques will be used

Objective(s):
Prevent injuries from awkward postures, repetitive motions and improper lifting

2.0100.3n

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
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 testing is unavailable, assume asbestos is present

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

Objective(s):
Protect workers and occupants from potential asbestos hazards

2.0100.3o

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

The EPA Renovation, Repair, and Painting 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; see http://www.epa.gov/lead/pubs/renovation.htm

Objective(s):
Protect workers and occupants from potential lead hazards

2.0100.3p

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Work site will be secured to prevent unauthorized entry

Temporarily disconnected equipment will be locked up and tagged out

All loose or unbagged trash and unused materials will be removed from work site daily

Objective(s):
Protect the occupant from exposure to potential hazards

2.0100.4c

Desired Outcome:
Provide a safe and stable work environment that will support and sustain work to be performed

Specification(s):
The inspection will include determination of the presence of adverse environmental conditions, including excess moisture in contact with building assemblies, mold, wood-decaying fungi, and rodent or insect infestation

A visual inspection of exposed electrical wires, junction boxes, and related equipment will be made to identify any unsafe conditions

Where insulation materials will be delivered into closed cavities, evaluation of wiring types within such cavities will be conducted to determine if proposed insulation application is compatible with current performance characteristics of wiring (e.g., wiring types that present a fire hazard when in close contact with insulation materials, wiring types subject to corrosion when in contact with certain types of insulation or which may be adversely affected by heat, moisture, or process conditions associated with the installation of certain insulation types)

Objective(s):
Ensure adverse environmental conditions do not compromise the stability or longevity of proposed work

Ensure the integrity and soundness of building assemblies

Preserve the safety and integrity of existing building assemblies and materials after installation of proposed improvements

2.0100.4d

Desired Outcome:
Provide a safe and stable work environment that will support and sustain work to be performed

Specification(s):
Where excess moisture conditions are identified where their correction is not included in proposed work, such conditions will be corrected before work begins

Where building assemblies or components are found to have been damaged or destroyed, such assemblies will be restored before or during proposed work

Where indications of rodent infestation are identified, air sealing materials will incorporate anti-gnawing measure (e.g., copper wool in-fill, metal sheeting)

When pests have been identified, follow integrated pest management practices to seal holes with pest proof materials (corrosion proof materials)

Objective(s):
Ensure the safety and durability of the associated structures

Ensure proposed work will not cause or perpetuate unsafe or unhealthy building conditions

2.0103.2a

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Complete safety action plan based on hazard; plan will be in place for each job site

Objective(s):
Prevent injury

Minimize exposure to health and safety hazards

2.0103.2b

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Exposed earth will be covered with a continuous, durable, and sealed class I 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

Objective(s):
Ensure durability of repairs

Reduce potential for occupant exposure to mold and other moisture-related hazards

Reduce potential for occupant exposure to radon and other soil gases

2.0103.2c

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
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

Objective(s):
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

2.0103.2d

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
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 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

Objective(s):
Reduce potential for occupant exposure to mold and other moisture-related hazards

2.0104.2a

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

Specification(s):
Worker safety specifications will be followed in accordance with SWS 2.0100.3 Worker Safety

Personal protective equipment (PPE) must comply with OSHA 29 CFR 1910.134 and 29 CFR 1926.103

Objective(s):
Prevent injury

Minimize exposure to health and safety hazards

2.0104.2b

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

Specification(s):
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

Objective(s):
Protect workers and occupants from potential asbestos hazards

2.0104.2c

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

Specification(s):
Least toxic suitable material will be chosen

All materials will be handled in accordance with manufacturer specifications or material safety data sheets (MSDS) standards

Objective(s):
Protect workers from toxic exposure

Eliminate hazards associated with incorrect, defective, or improperly used respirator and PPE

2.0104.2d

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

Specification(s):
Presence of lead-based paint in pre-1978 homes will be assumed unless testing confirms otherwise

EPA's Renovation, Repair and Painting 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

Objective(s):
Protect worker and occupants from potential lead hazards

2.0107.2a

Desired Outcome:
Work completed safely without injury from shock or arc flash

Specification(s):
Any fixture, ballast, line voltage control, receptacle, or circuit modification will be performed by a licensed electrical professional in accordance with ANSI/NFPA 70

All workers will comply with ANSI/NFPA 70E

All OSHA standard practices will be followed

Objective(s):
Prevent property damage

Ensure worker safety

2.0110.2a

Desired Outcome:
Asbestos-Containing Materials treated properly

Specification(s):
Existing insulation will be visually inspected without disturbing the material and evaluated for suspicion of asbestos-containing materials (ACM)

Property manager will be asked about known history of insulation

Property manager will be informed of potential for additional testing if history is unknown

Objective(s):
Confirm likelihood of ACMs

2.0110.2b

Desired Outcome:
Asbestos-Containing Materials treated properly

Specification(s):
Environmental testing service will be retained and notified of area impacted by proposed work

Objective(s):
Confirm presence of ACMs

2.0203.7a

Desired Outcome:
Amount and quality of combustion air allows for safe and efficient operation of equipment

Specification(s):
Combustion air shall be calculated and provided in conformance with the applicable code adopted by the jurisdiction and manufacturer requirements.

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply (i.e., more air rather than less)

In absence of a local code, combustion air shall be calculated and provided in conformance with any of the following: NFPA 54, IFGC, or NFPA 31

Objective(s):
Meet burner combustion air requirements

2.0203.7b

Desired Outcome:
Amount and quality of combustion air allows for safe and efficient operation of equipment

Specification(s):
Property manager/occupant will be educated on proper operation of combustion air systems

Objective(s):
Ensure occupant safety

Ensure optimal operation of equipment

2.0204.2a

Desired Outcome:
Effective air barrier between the combustion appliance room and all other spaces of the building

Specification(s):
Hazardous materials stored in mechanical rooms with air handlers or combustion appliances (e.g., boilers, furnaces) will be identified and removed; operators will be educated on the dangers of storing hazardous materials in these areas

Repairs necessary to stabilize work areas and protect or preserve integrity of energy improvement will be completed before subject work begins

Mechanical room doors in a fire-rated wall will be closed; problems that cause doors to be blocked open will be determined and resolved

Objective(s):
Eliminate existing storage hazards and prevent future dangerous storage occurrences

Repair or address moisture, pest, and structure-related issues

Provide a safe and stable work environment

2.0204.2b

Desired Outcome:
Effective air barrier between the combustion appliance room and all other spaces of the building

Specification(s):
Penetrations will be identified using visual inspections, infrared thermography, smoke, and/or pressure tests [ASTM E1186-03 (2009)]

Objective(s):
Locate air leakage pathways to repair

2.0204.2c

Desired Outcome:
Effective air barrier between the combustion appliance room and all other spaces of the building

Specification(s):
Health and safety concerns will be addressed for occupants, workers, and repair materials in accordance with OSHA standards (OSHA 1926, 1910)

The area will be prepared and isolated in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos, carbon monoxide)

Work lighting, work platform, and adequate ventilation will be provided

Objective(s):
Provide a safe work environment

Provide a safe indoor environmental quality (IEQ) work environment

Provide effective repair access

2.0204.2d

Desired Outcome:
Effective air barrier between the combustion appliance room and all other spaces of the building

Specification(s):
Sealants and materials 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 VOC products that meet independent testing and verification protocols, such as Green Seal GS-36, "GREENGUARD Children and Schools," or comparable certifications

Fire-rated assemblies will be sealed by qualified workers, using materials and sealants permitted by the authority having jurisdiction, and in accordance with adopted building codes

Mechanical and boiler room enclosures may need to be fire-rated assemblies Materials will be rated for application in approved details; for example, the annular space around a pipe penetration through a fire-rated wall can usually be sealed using mineral wool fire safing sealed with a coating of flexible fire dam material

Sealants and materials will be continuous and meet fire resistance rated assembly specifications

Objective(s):
Ensure sealants and materials meet or exceed the performance characteristics required of the assembly (e.g., fire rating)

Prevent intrusion of moisture and pests into the sealed assembly

Prevent exposing workers or occupants to excessive VOC levels

Provide a durable and effective isolation of the identified compartmentalized space

2.0204.2e

Desired Outcome:
Effective air barrier between the combustion appliance room and all other spaces of the building

Specification(s):
Repairs will be verified using visual inspections, infrared thermography, smoke, and/or pressure tests [ASTM E1186-03 (2009)]

Objective(s):
Ensure quality and effectiveness of air sealing

2.0205.1a

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Combustion air shall be calculated and provided in conformance with the applicable code adopted by the jurisdiction, and manufacturer installation requirements

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply

In absence of a local code, combustion air shall be calculated and provided in conformance with any of the following: NFPA 54, IFGC, or NFPA 31

Objective(s):
Do not damage building

Protect workers and occupants from injury

2.0205.1b

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Venting systems will be installed considering proper material, pitch, common venting, chimney liner, clearance, total equivalent length, and termination in accordance with the applicable code adopted by the jurisdiction and manufacturer installation requirements

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply

In absence of local code, combustion byproducts shall be removed in accordance with any of the following: NFPA 54, IFGC, or NFPA 31

Objective(s):
Exhaust combustion products to the outdoors

Protect building from damage

Protect workers and occupants from injury

2.0205.1c

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Existing vent system or chimney will be resized or relined in accordance with the applicable code adopted by the jurisdiction when one or more common vented appliances are removed

In absence of local code, combustion byproducts shall be removed in accordance with any of the following: NFPA 54, IFGC, or NFPA 31

Objective(s):
Exhaust combustion products to the outdoors

Protect building from damage

Protect workers and occupants from injury

2.0401.2a

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

Specification(s):
Roof leaks will be repaired before performing attic/roof air sealing or insulation

Moisture sources in the house that can generate moisture into the attic will be identified and removed or reduced

Conduct coincident humidity control in the living space (e.g., bath and kitchen fans and dryer exhaust safely outside, crawl space/basement humidity control addressed)

Objective(s):
Ensure durability of roof system and repairs

Reduce potential for occupant exposure to mold and other moisture-related hazards

2.0502.1a

Desired Outcome:
Work completed without increasing occupant exposure to radon

Specification(s):
EPA guidelines for radon in current edition of "Healthy Indoor Environment Protocols for Home Energy Retrofits" will be followed

Test will be limited to conditioned spaces with slab-on or below grade serving as floor, or floor immediately above basement or crawl space

Upper floors in multistory buildings with concrete or concrete masonry unit walls will be tested in accordance with AARST standards

Objective(s):
Reduce potential for occupant exposure to radon

2.0702.2a

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

Specification(s):
Basic operation of the equipment will be explained to the building operations staff (e.g., design conditions, efficiency measures, differences from previous system or situation)

Objective(s):
Ensure occupants and building operations staff have a reasonable expectation of the equipment capability

2.0702.2b

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

Specification(s):
Proper operation and programming of system controls to achieve temperature and humidity control will be explained to the occupant and provided in a written format

Objective(s):
Ensure occupants and building operations staff can operate system controls

2.0702.2c

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

Specification(s):
Indoor and outdoor electrical disconnects and fuel shut offs will be demonstrated to occupant

Objective(s):
Ensure occupants and building operations staff can shut off equipment in emergencies

2.0702.2d

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

Specification(s):
Location of combustion air inlets will be identified for occupant

Importance of not blocking inlets will be explained to occupant

Objective(s):
Ensure occupants and building operations staff do not block combustion air inlets

2.0702.2e

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

Specification(s):
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

Occupant will be educated on the importance of leaving interior doors open as much as possible

Objective(s):
Ensure occupants and building operations staff do not prevent the equipment from operating as designed

2.0702.2f

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

Specification(s):
Proper filter selection and how to change filter will be explained to building operations staff

Importance of keeping outdoor unit clear of debris, vegetation, decks, and other blockage will be explained to building operations staff

Importance and timing of routine professional maintenance will be explained to building operations staff, e.g. inspect, clean, lubricate, replace consumables (i.e., filters, belts, lights), repair and replace

Objective(s):
Ensure equipment operates as designed

2.0702.2g

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

Specification(s):
Appropriate situations of when the occupant should contact the building operations staff will be explained, including:

- Fuel odors
- Water draining from secondary drain line
- 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
- Outdoor unit never defrosts
- Unusual noises
- Unusual odors

Objective(s):
Occupant will contact building operations staff when system is not operating as designed

2.0702.2h

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

Specification(s):
A CO alarm will be installed

Objective(s):
Protect occupants from injury

2.0702.2i

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

Specification(s):
Building operations staff/property manager will be provided with relevant manuals and warranties

The labor warranty will be explained, and the building operations staff will be given a phone number to call for warranty service

Objective(s):
Building staff are equipped with manuals and warranties for future equipment servicing

2.0703.1a

Desired Outcome:
Occupants protected from insulation particulate exposure

Specification(s):
Fibrous insulation materials will be encapsulated on all surfaces facing spaces where there is routine human activity

Encapsulation materials will be fire rated, if applicable, to preserve the pre-retrofit fire rating of the building assembly, and/or as required by insulation manufacturer or relevant building code

Vapor permeability of encapsulation materials will be consistent with predetermined vapor retarder placement

Objective(s):
Protect occupants from insulation exposure

Maintain fire rating of assembly

Protect building from moisture damage

3.1001.5a

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

Specification(s):
Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unity), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Objective(s):
Ensure a continuous air and fire barrier will be appropriately located between conditioned and unconditioned space

3.1001.5b

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

Specification(s):
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 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)

Objective(s):
Minimize gap or hole size to ensure successful use of sealant

Ensure closure is permanent and supports appropriate load (e.g., wind, snow, insulation)

Ensure sealant does not fall out

Ensure integrity of the existing water control system

3.1001.5c

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

Specification(s):
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

Objective(s):
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

3.1001.5d

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

Specification(s):
Only noncombustible sealant will be used in contact with chimneys, vents and flues, or any heat source (e.g., non-IC-rated recessed lights, heat lamps, etc.)

Sealant application at factory-built vents, flues, and chimneys shall be listed for use with that vent assembly

Objective(s):
Preserve integrity and any applicable warranty associated with factory built vent, flue, or chimney assemblies

3.1001.6a

Desired Outcome:
Firewall separations in unconditioned attics sealed to prevent air leakage, moisture movement, and spread of fire between the unconditioned attic and conditioned space

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces.

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Air sealing locations will be identified between the firewall and the attic floor

Objective(s):
Ensure a continuous air- and fire-resistance barrier will be appropriately located between conditioned and unconditioned space

3.1001.6b

Desired Outcome:
Firewall separations in unconditioned attics sealed to prevent air leakage, moisture movement, and spread of fire between the unconditioned attic and conditioned space

Specification(s):
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 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)

Objective(s):
Minimize gap or hole size to ensure successful use of sealant

Ensure closure is permanent and supports appropriate load (e.g., wind, snow, insulation)

Ensure sealant does not fall out

Ensure integrity of the existing water control system

3.1001.6c

Desired Outcome:
Firewall separations in unconditioned attics sealed to prevent air leakage, moisture movement, and spread of fire between the unconditioned attic and conditioned space

Specification(s):
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 compounds (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

Objective(s):
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

3.1001.6d

Desired Outcome:
Firewall separations in unconditioned attics sealed to prevent air leakage, moisture movement, and spread of fire between the unconditioned attic and conditioned space

Specification(s):
Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections at:

- The intersection between firewall and attic floor
- If firewall assembly is not monolithic (e.g., balloon framing, CMU, open chase, attic bypass, or with similar penetration through the attic floor plane), attic floor plane penetrations within the firewall assembly will be accessed through the firewall, fully sealed, and firewall surface restored to prevent current or future breaches of the firewall below the attic floor plane from establishing an air flow path to the attic space

Objective(s):
Provide airtight, durable seal that does not move, bend, or sag

3.1001.8a

Desired Outcome:
Combustible materials kept away from combustion sources

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Confirm that flues or other high-temperature elements are functioning as designed and do not present a fire or health and safety risk

Objective(s):
Ensure a safe, durable workspace that will sustain improvement

3.1001.8b

Desired Outcome:
Combustible materials kept away from combustion sources

Specification(s):
Confirm that only noncombustible sealant has been used in contact with chimneys, vents and flues, or any heat source (e.g., non-IC-rated recessed lights, heat lamps, etc.). Remove any noncompliant materials and replace them with materials consistent with application

Sealant application at factory-built vents, flues, and chimneys shall be listed for use with that vent assembly

Fire blocking in the space around site-built and factory-built chimneys, as required by either the IBC, IRC, or NFPA, as applicable, will be completed and inspected before erection of any insulation dams

Objective(s):
Prevent air leakage

Ensure materials coming in contact with high-temperature areas will not present a fire hazard

Ensure insulation dams maintain clearance

3.1001.8c

Desired Outcome:
Combustible materials kept away from combustion sources

Specification(s):
A rigid, fixed dam having a height greater than the insulation to be installed will be constructed to ensure a 3" clearance between combustion flue vent and dam

Objective(s):
Ensure dam material does not bend, move, or sag

Prevent a fire hazard

3.1001.8d

Desired Outcome:
Combustible materials kept away from combustion sources

Specification(s):
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)

Fire-resistance-rated assemblies will be provided with sealants permitted by the authority having jurisdiction and adopted building code

Objective(s):
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

3.1001.8e

Desired Outcome:
Combustible materials kept away from combustion sources

Specification(s):
Insulation will not be allowed between a heat-generating appliance and a dam unless material is rated for contact with heat-generating sources

Objective(s):
Prevent a fire hazard

3.1001.8f

Desired Outcome:
Combustible materials kept away from combustion sources

Specification(s):
Documentation of material and R-value will be provided to building operations staff

Objective(s):
Provide occupant with documentation of installation

3.1001.9a

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

3.1001.9b

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Objective(s):
Ensure occupant safety

3.1001.9c

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
If attic access is below the air and thermal boundary, then the roof and any exterior roof access locations will be addressed in accordance with SWS 3.1801.2 Sealing and Insulating Exterior Roof Access Panels and Hatches

If attic access is part of the air and thermal boundary, it will be airtight and insulated

Objective(s):
Ensure correct plan of work is selected to maintain the air and thermal boundary

3.1001.9d

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
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

Objective(s):
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

3.1001.9e

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
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 be installed with a latch, lock, or frictionally engaged components of a prefabricated unit above the opening that do not require a latch

A rigid dam having a height greater than the insulation to be installed will be constructed to contain insulation when attic access is opened

Objective(s):
Prevent air leakage

3.1001.9f

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
Access hatches will be insulated with noncompressible insulation to the same R-value as adjoining insulated assembly

Attic hatch rough opening will be surrounded with a durable protective baffle that is higher than the level of the surrounding attic floor insulation

Objective(s):
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

3.1001.9g

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
Insulation will be permanently attached and in complete contact with the air barrier

Objective(s):
Insulate to prescribed R-value

3.1001.9h

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
Attic access will be adjusted to properly fit the jamb and allow for ease of operation and security

Attic access system will be tested for air leakage in accordance with ASTM E1186

Objective(s):
Ensure proper operation of the attic access and hardware

Prevent air leakage through assembly

3.1001.9i

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
Completed measure will have a minimum expected service life of 20 years

Objective(s):
Ensure a minimum expected service life

3.1001.9j

Desired Outcome:
Attic access door properly sealed and insulated

Specification(s):
Purpose of insulation and proper hatch operation will be communicated to building operations staff and occupant

Objective(s):
Occupant and staff understand how to use the hatch to ensure integrity of insulated and sealed assembly throughout service life

3.1005.3a

Desired Outcome:
Configuration of complex ceiling planes will be simplified by spanning interior soffits, chases, direct penetrations, and other cavities to provide a continuously sealed air barrier between unconditioned attic and conditioned space

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Repairs necessary to stabilize work areas and protect or preserve integrity of energy improvement will be completed before subject work begins

Objective(s):
Ensure durability of repairs

3.1005.3b

Desired Outcome:
Configuration of complex ceiling planes will be simplified by spanning interior soffits, chases, direct penetrations, and other cavities to provide a continuously sealed air barrier between unconditioned attic and conditioned space

Specification(s):
Work area will be cleared of existing insulation to locate and identify the optimal air sealing plane

Elevation changes, including interior soffits, chases, direct penetrations, and other changes in elevation, will be identified to determine which will be placed on the conditioned side of the air barrier and which will be sealed at all surfaces

Where practical, the total square footage of the air barrier will be minimized by capping or sealing openings in the prime air-barrier plane, rather than on all sides of the elevation change

Objective(s):
Minimize gross air barrier (and subsequent thermal barrier) square footage by sealing over elevation changes in unconditioned attic spaces

3.1005.3c

Desired Outcome:
Configuration of complex ceiling planes will be simplified by spanning interior soffits, chases, direct penetrations, and other cavities to provide a continuously sealed air barrier between unconditioned attic and conditioned space

Specification(s):
Materials used to span elevation changes will be rigid and self-supporting over the distance spanned

Materials will be consistent with existing or intended fire-resistance assemblies

Materials will be compatible with adjacent materials and with any proposed insulation designed to come in contact with it

The perimeters of all materials installed to span elevation changes will be sealed on all exposed edges with compatible sealants

Seals will be used that prevent visible air movement using chemical smoke at 50 pascals of pressure difference

Objective(s):

3.1005.3d

Desired Outcome:
Configuration of complex ceiling planes will be simplified by spanning interior soffits, chases, direct penetrations, and other cavities to provide a continuously sealed air barrier between unconditioned attic and conditioned space

Specification(s):
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)

Objective(s):
Ensure seal stays in place and does not sag

3.1005.3e

Desired Outcome:
Configuration of complex ceiling planes will be simplified by spanning interior soffits, chases, direct penetrations, and other cavities to provide a continuously sealed air barrier between unconditioned attic and conditioned space

Specification(s):
Continuous seal will be installed around seams, cracks, joints, edges, penetrations, and connections

Prefabricated units may be used when meeting the desired outcome

Objective(s):
Provide airtight, durable seal that does not move, bend, or sag

3.1005.3f

Desired Outcome:
Configuration of complex ceiling planes will be simplified by spanning interior soffits, chases, direct penetrations, and other cavities to provide a continuously sealed air barrier between unconditioned attic and conditioned space

Specification(s):
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 compounds (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

Objective(s):
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

3.1102.1a

Desired Outcome:
Wall penetrations sealed to prevent air leakage, moisture movement, pest migration, sound and/or odor transmission, and spread of fire through the wall

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit (CMU), and materials and methods employed will be consistent with restoring or preserving such inferred fire resistance rating

Penetration locations will be identified to determine hole size and fire rating

Objective(s):
Ensure a durable, continuous air barrier and a fire-rated assembly, where appropriate

3.1102.1b

Desired Outcome:
Wall penetrations sealed to prevent air leakage, moisture movement, pest migration, sound and/or odor transmission, and spread of fire through the wall

Specification(s):
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 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)

Objective(s):
Minimize gap or hole size to ensure successful use of sealant

Ensure closure is durable, pest resistant, weather appropriate, and supports appropriate load (e.g., wind, snow, insulation)

Ensure sealant does not fall out

Ensure integrity of the existing water control system

3.1102.1c

Desired Outcome:
Wall penetrations sealed to prevent air leakage, moisture movement, pest migration, sound and/or odor transmission, and spread of fire through the wall

Specification(s):
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

Objective(s):
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

3.1102.1d

Desired Outcome:
Wall penetrations sealed to prevent air leakage, moisture movement, pest migration, sound and/or odor transmission, and spread of fire through the wall

Specification(s):
Only noncombustible sealant will be used in contact with chimneys, vents and flues, or any heat source (e.g. non-IC-rated recessed lights, heat lamps, etc.)

Objective(s):
Provide airtight, durable seal that does not move, bend, sag, or combust

Prevent a fire hazard

3.1102.1e

Desired Outcome:
Wall penetrations sealed to prevent air leakage, moisture movement, pest migration, sound and/or odor transmission, and spread of fire through the wall

Specification(s):
Continuous seal will be installed around seams, cracks, joints, edges, and penetrations

When a penetration goes all the way through a wall, both sides will be sealed

In a hollow core CMU wall, the penetration at the inner wall surface and the exterior wall surface will be sealed, but not compromise existing water control measures (e.g., rain screen, drip edge, weep holes, gutter, and roof drains)

Objective(s):
Provide airtight, durable seal that does not move, bend, or sag

Maintain integrity of the existing water control system

3.1201.7a

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

3.1201.7b

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Occupant will be shown how to properly operate the window system

Objective(s):
Ensure occupant safety

3.1201.7c

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
Glazing systems will be inspected for air and water leakage, warping, stability, holes, proper hardware operation, proper operation, and security; if the items above cannot be repaired, the glazing systems will be recommended for replacement

Objective(s):
Determine the scope of glazing system repair

3.1201.7d

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
Operable glazing system will be adjusted or repaired to properly fit the jamb and allow for ease of operation (e.g., hardware adjustment and/or replacement)

Objective(s):
Ensure proper operation of the operable glazing system

3.1201.7e

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
Fixed glazing system will be adjusted or repaired to properly fit the jamb

In the event the fixed glazing unit has shifted enough to allow light to leak around the perimeter frame, the glass will be properly repositioned in its frame/pocket

After repositioning/adjusting, the glass will be sealed to the frame

When sealing exterior frame components, internal water drainage systems within the glazing system will be maintained

When sealing exterior frame components, wall system water management components will be maintained (e.g., weep holes)

Objective(s):
Ensure proper adjustment of glass (e.g., caulking used to seal a gap can compromise the integrity of the thermal pane seal)

Ensure an airtight and weathertight fixed glazing system

Ensure a durable and secure glazing system

Prevent water intrusion

3.1201.7f

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
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

Objective(s):
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

3.1201.7g

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
When the glazing system trim/frame leaks at wall, the glazing system trim/frame will be sealed to the exterior and/or interior side of the wall

When the glazing system components leak at the frame, areas of leakage will be sealed

When the existing window frame has penetrations due to old hardware, the abandoned penetrations will be sealed

When sealing exterior frame components, internal water drainage systems within the glazing system will be maintained

When sealing exterior frame components, wall system water management components will be maintained (e.g., weep holes)

Objective(s):
Ensure the glazing system frame is airtight and watertight

Prevent water intrusion

3.1201.7h

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
All weather stripping will be an effective air barrier

Durable weather stripping material will be sized to span irregularities in the glazing system, as well as seasonal variations

Where weather stripping fits into an existing track, replacement weather strip will be sized to fit the original track and to span irregularities

Weather stripping will be installed and mechanically fastened around all four sides of the glazing system

Mechanically installed weather stripping carrier will be sealed to surface

Operable glazing systems will be tested for ease of operation and airtightness after weather stripping is installed

Objective(s):
Identify appropriate weather stripping materials to make an airtight and watertight seal while maintaining the operation of the glazing system

Ensure glazing system is airtight and allows for seasonal variation

Ensure operable glazing system operates properly after weather stripping is installed

3.1201.7i

Desired Outcome:
Windows are airtight and weathertight

Specification(s):
Glazing system will be adjusted to properly fit the jamb and allow for ease of operation and security

Glazing system will be tested for air leakage in accordance with ASTM E783-02 or ASTM E1186

Water management systems and enclosure drainage planes will be verified as maintained

Objective(s):
Ensure proper operation of the glazing system and hardware

Prevent air leakage through assembly

Prevent water intrusion

3.1201.8a

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

3.1201.8b

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Occupant will be notified of how to properly operate the door system

Objective(s):
Ensure occupant safety

3.1201.8c

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
Door system will be inspected for air and water leakage, warping, stability, holes, proper hardware operation, proper operation, and security; if the items cannot be repaired, the door will be recommended for replacement

Objective(s):
Determine the scope of door system repair

3.1201.8d

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
Door will be adjusted or repaired to properly fit the jamb and allow for ease of operation (e.g., hardware adjustment and/or replacement, re-plane door)

Objective(s):
Ensure proper operation of the door system

3.1201.8e

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
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

Objective(s):
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

3.1201.8f

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
When the door trim/frame leaks at wall, the door trim/frame will be sealed to both the exterior and interior side of the wall

Door stop will be sealed to door frame

When the existing door frame has penetrations due to old hardware, the abandoned penetrations will be sealed

Door rail (bottom) and threshold will be adjusted and sealed to ensure tight but operable fit

Objective(s):
Ensure the door trim/frame is airtight and watertight

3.1201.8g

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
All weather stripping will be an effective air barrier

Durable weather stripping material will be sized to span irregularities in the door/frame, as well as seasonal variations

For sliders and commercial door systems where weather stripping fits into an existing track, replacement weather strip will be sized to fit the original track and to span irregularities

Weather stripping will be installed around all four sides of the door

Mechanically installed weather stripping carrier will be sealed to surface

Door will be tested for ease of operation and airtightness after weather stripping is installed

Where doors are required to have a fire-resistance rating, all weather strips and sealants applied to the door will be compatible with the listing of the door

Objective(s):
Identify appropriate weather stripping materials to make an airtight and watertight seal while maintaining the operation of the door

Ensure door is airtight to allow for seasonal variation

Ensure door operates properly after weather stripping is installed

3.1201.8h

Desired Outcome:
Doors operable, airtight, and weathertight

Specification(s):
Door will be adjusted to properly fit the jamb, and allow for ease of operation and security

Door system will be tested for air leakage in accordance with ASTM E783-02 or ASTM E1186

Objective(s):
Ensure proper operation of the door and hardware

Prevent air leakage through assembly

3.1203.4a

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
Glazing type will be chosen by location in the building, building height, code, and climate

Window frame will be insulated and selected with thermal breaks appropriate to climate

Window selection will be based on lowest air leakage rating

Window selection will be based on National Fenestration Rating Council (NFRC) rating by climate

Glazing with lowest feasible U-value will be specified

Window glazing solar heat gain coefficient (SHGC) will be selected by building orientation and climate

Water management system will be maintained

Windows will meet the performance standard AMAA/WDMA/CSA/101/IS2/A440

Historic preservation requirements will be considered

Objective(s):
Ensure the most effective and appropriate glazing system is specified

3.1203.4b

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Objective(s):
Ensure safety, effectiveness, and durability of improvements

3.1203.4c

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

3.1203.4d

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Occupant will be shown how to properly operate windows and doors

Building management and occupants will be notified about the risk of a child falling from operable windows with sills located more than 72" above any surface outside window opening

Objective(s):
Ensure occupant safety

3.1203.4e

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
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

Objective(s):
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

3.1203.4f

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
Glazing system frame will be aligned with the wall system's air and thermal boundary to create a continuous air and thermal boundary

Glazing system will be installed in accordance with manufacturer specifications

Rough opening will be prepared and sealed to the wall system's continuous air and thermal boundary with nonexpanding sealants

When replacement windows are being installed within an existing window frame where the original sash has been removed, the window frame will be prepared and sealed to the wall system's continuous air and thermal barrier

When the existing window frame has internal weight pockets, the hardware will be removed and the pocket will be insulated and sealed

Glazing system will be sealed to the airtight rough opening or the airtight existing frame

Objective(s):
Maintain a continuous air and thermal boundary throughout the entire wall system

3.1203.4g

Desired Outcome:
Maintain a continuous air and thermal barrier, and high efficiency window performance

Specification(s):
A sampling protocol will be used to test glazing system for air leakage in accordance with ASTM E783-02

A sampling protocol will be used to test glazing system for water leakage in accordance with ASTM E1105-00

Objective(s):
Ensure airtight and watertight installation

3.1203.5a

Desired Outcome:
Exterior door selection and installation provides a high efficiency continuous air and thermal boundary

Specification(s):
Door/glass will be selected by location in the building, building height, code, and climate

Door frame will be insulated and selected with thermal breaks appropriate to climate

Door selection will be based on lowest air leakage rating

Door selection will be based on National Fenestration Rating Council (NFRC) rating by climate

Door and door glazing with lowest feasible U-value will be specified

Glazing within door assemblies will comply with CPSC 16 CFR Part 1201

Door glazing solar heat gain coefficient (SHGC) will be selected by building orientation and climate

Water management system will be maintained

Historic preservation requirements will be considered

Objective(s):
Ensure the most effective and appropriate door system is specified

3.1203.5b

Desired Outcome:
Exterior door selection and installation provides a high efficiency continuous air and thermal boundary

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

3.1203.5c

Desired Outcome:
Exterior door selection and installation provides a high efficiency continuous air and thermal boundary

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Occupant will be shown how to properly operate the door system

Objective(s):
Ensure occupant safety

3.1203.5d

Desired Outcome:
Exterior door selection and installation provides a high efficiency continuous air and thermal boundary

Specification(s):
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

Objective(s):
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

3.1203.5e

Desired Outcome:
Exterior door selection and installation provides a high efficiency continuous air and thermal boundary

Specification(s):
Door frame will be aligned with the wall system's air and thermal boundary to create a continuous air and thermal boundary

Door system will be installed in accordance with manufacturer specifications

Rough opening will be prepared and sealed to the wall system's continuous air and thermal boundary

Door frame will be sealed and flashed to the airtight and watertight rough opening

When a replacement door is being installed within an existing frame, the original frame will be prepared and sealed to the wall system's continuous air and thermal boundary, and the door will be weather stripped on all four sides

When the existing door frame has penetrations due to old hardware, the abandoned penetrations will be sealed

Door rail (bottom) and threshold will be adjusted to ensure tight but operable fit

Objective(s):
Maintain a continuous air and thermal boundary throughout the entire wall system

3.1203.5f

Desired Outcome:
Exterior door selection and installation provides a high efficiency continuous air and thermal boundary

Specification(s):
Door will be adjusted to properly fit the jamb and allow for ease of operation and security

A sampling protocol will be used to test door system for air leakage in accordance with ASTM E783-02 or ASTM E1186

A sampling protocol will be used to test door system for water leakage in accordance with ASTM E1105-00

Objective(s):
Ensure proper operation of the door and hardware

Ensure airtight and watertight installation

3.1403.1a

Desired Outcome:
Effective air barrier between the conditioned space and the ground

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Where applicable (generally above-grade concrete slabs between conditioned and unconditioned spaces), gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Where applicable, for assembly type and geographic location, test for radon per ANSI-AARST Standard: Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings

Repairs necessary to stabilize work areas and protect or preserve integrity of energy improvement will be completed before subject work begins

Objective(s):
Identify and correct conditions which contribute to excessive radon levels

Provide a stable slab to ensure durability of the work

3.1403.1b

Desired Outcome:
Effective air barrier between the conditioned space and the ground

Specification(s):
Penetrations will be identified using visual inspections, smoke, and/or pressure tests [ASTM E1186-03 (2009)]

Objective(s):
Locate air leakage pathways to repair

3.1403.1c

Desired Outcome:
Effective air barrier between the conditioned space and the ground

Specification(s):
Health and safety concerns for occupants and workers, in relation to repairs and materials, will be addressed in accordance with OSHA standards (OSHA 1926, 1910)

The area will be prepared and isolated in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos, carbon monoxide, moisture)

Work lighting, work platform, and adequate ventilation will be provided

Access not provided will be created to ensure that repairs can be made (may include localized demolition)

Objective(s):
Provide a safe work environment

Provide safe indoor environmental quality in the work environment

Provide effective repair access

3.1403.1d

Desired Outcome:
Effective air barrier between the conditioned space and the ground

Specification(s):
Sealants and materials 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

Where penetrations are due to failed or missing expansion joints, sealing materials will be suitable for this application

Objective(s):
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

3.1403.1e

Desired Outcome:
Effective air barrier between the conditioned space and the ground

Specification(s):
Access holes will be repaired

Objective(s):
Restore surfaces to original condition or better

3.1403.1f

Desired Outcome:
Effective air barrier between the conditioned space and the ground

Specification(s):
Repairs will be verified by visual inspections, smoke, and/or pressure tests consistent with the pre-inspection

Objective(s):
Ensure quality and effectiveness of air sealing

3.1601.6a

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Surrounding insulation will be cleared to expose the joints being sealed

Duct surface that accepts sealant will be cleaned

Objective(s):
Gain access

Achieve proper adhesion for airtight seal

3.1601.6b

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Ducts will be fastened with a minimum of three equally spaced screws or acceptable mechanical connections

Objective(s):
Ensure joints are durable

3.1601.6c

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Joints will be fastened with tie bands using a tie band tensioning tool or mechanical band, and sealed with approved mastic and UL181B tape

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6d

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Joints will be fastened with a clinch stapler, rated tape, and mastic

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6e

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
An appropriate take-off collar in accordance with NAIMA standards will be used and sealed with approved mastic

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6f

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Plenum will be fastened with a minimum of three equally spaced screws on each side

Canvas connection between plenum and unit will be installed so that it does not reduce the inside dimensions of the duct

Objective(s):
Ensure joints are durable

Reduce air leakage

Optimize airflow

3.1601.6g

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Termination bar or metal strip will be fastened with screws

Duct board will be installed between the screw and the termination bar

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6h

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Screws or nails will be used to fasten boot to wood

Seams and boot to subfloor will be sealed with mastic

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6i

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
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

Seams of boot will be sealed with mastic

Boot to gypsum will be sealed with caulk in accordance with local code and standards

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6j

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
An appropriate take-off collar in accordance with NAIMA standards will be used

Objective(s):
Ensure joints are durable

Reduce air leakage

3.1601.6k

Desired Outcome:
Ducts and plenums are properly fastened to prevent leakage

Specification(s):
Insulation will be returned or replaced with equivalent R-value

Objective(s):
Maintain insulation value

3.1601.7a

Desired Outcome:
Ducts and plenums are properly supported

Specification(s):
Ductwork will be supported in accordance with the applicable code adopted by the jurisdiction

Flexible duct board ducts and plenums will be supported by metal strapping rods or other materials in accordance with applicable standards (NAIMA)

Support materials will be applied in a way that does not allow the ductwork to sag, crimp the ductwork, or cause the interior dimensions of the ductwork to be less than specified

Metal ducts will be supported by metal strapping, rods, or other materials, per applicable standards

Objective(s):
Eliminate falling and sagging

3.1602.14a

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

Specification(s):
Crawl spaces that are used as heating and cooling supply plenums will not be allowed

Objective(s):
Improve IAQ in the living space

Eliminate connection between the crawl space and living space

3.1602.14b

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

Specification(s):
Crawl spaces that are used as heating and cooling return plenums will not be allowed

Objective(s):
Improve IAQ in the living space

Eliminate connection between the crawl space and living space

Improve performance efficiency

3.1602.14c

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

Specification(s):
Condition will be corrected to provide supply and/or return plenums isolated from crawl space before work can continue

Objective(s):
Improve IAQ in the living space

3.1602.15a

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Specifications will be field verified as appropriate to site conditions by installer (e.g., fire dampers, other obstructions)

Access to all elements of distribution system will be identified

Access to all dwelling units and elements of distribution system will be ensured by the installer

An inspection will be conducted for mold, water leaks, water damage, and breaches in the surfaces of the isolated space before sealing

Repairs will be completed before subject work

Objective(s):
Prepare for installation

3.1602.15b

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Health and safety concerns for occupants and workers, in relation to repairs and materials, will be addressed in accordance with OSHA standards (OSHA 1926, 1910)

Area will be prepared and isolated in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos)

Work lighting, work platform, and adequate ventilation will be provided

Objective(s):
Provide a safe working environment

Provide safe indoor environmental quality (IEQ) in the work environment

Provide effective repair access

3.1602.15c

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Duct leakage sites will be identified using industry approved approaches (e.g., visual inspections, borescopes, remote cameras, infrared thermography, smoke, and/or pressure tests [ASTM E1186-03 {2009}])

Objective(s):
Locate air leakage pathways to repair

3.1602.15d

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Duct sealing opportunities will be assessed and prioritized by:

Type of hole:

1. Catastrophic holes disconnected, missing ducts, or very large holes

2. Roof curb, close to fan, register boots

3. Holes larger than 1/4"

4. Seams and joints (holes less than 1/4")

Accessibility:

1. Easy to access

2. Demolition required

3. Access by internally applied sealants

Objective(s):
Maximize efficiency of work effort

3.1602.15e

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
When demolition for access is specified, the installer will:

- Make the temporary access using appropriate containment and worker protection
- Seal ductwork in accordance with manual sealing specifications listed in row 3.1602.15h
- Document repairs using photographs, checklist, and testing, as required
- Repair the opening to specification

Objective(s):
Protect occupants and workers from work-related contaminants

Seal ductwork in otherwise inaccessible locations

3.1602.15f

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Ducts and registers will be cleaned before sealing

Presence and type of dampers and smoke control devices will be identified and protected from duct-sealing application

Objective(s):
Establish preconditions for effective adhesion duct sealing materials

Ensure health and safety of occupant

3.1602.15g

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Sealants and materials will be compatible with their intended surfaces and applied in accordance with manufacturer specifications

Duct sealants will be UL 181 compliant

Sealants and materials will be continuous and meet fire barrier specifications

Objective(s):
Ensure sealants and materials meet or exceed the performance characteristics required of the assembly (e.g., fire rating)

3.1602.15h

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Manual sealing of all accessible leakage areas will be completed first:

- Reconnect disconnected ducts
- Repair missing ducts with like materials
- For holes greater than 1/4", backer material with mastic or appropriate sealants will be used
- For holes smaller than 1/4", mastic or appropriate sealants will be used (Some sealed joints will allow for movement [e.g., steam pipes, deflection joints])
- If specified, internally applied spray or aerosol sealing will only be applied after any manual sealing is complete
- Installer will coordinate access to the ventilation ductwork in the affected dwelling units with the building management and specialized subcontractor(s)
- Installer will provide logistical support to subcontractor(s) (e.g., remove/replace rooftop fans, mask duct terminations and openings, manually seal ducts, install flow orifices)
- Sealants and sprays will be applied in accordance with manufacturer specifications by a qualified contractor

These final steps will be performed for all duct-sealing activities:

- Ventilation system will be returned to operational conditions
- Installer will document sealing was completed with photographs, checklist, and testing, as required
- Installer will conduct final inspection and conduct close out meetings with building management

Objective(s):
Provide proper sequencing of duct improvements

Minimize inconvenience to occupants

Prevent air leakage in ductwork

Prevent contamination of ventilation air flow

Improve effectiveness and efficiency of ventilation system

3.1602.15i

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Final visual inspection of duct sealing activities and installer documentation will be completed

Continued operation of dampers and smoke control devices will be verified

Flows and pressures will be measured and balanced

Objective(s):
Ensure the performance of the ventilation system

Ensure occupant health and safety

3.1602.15j

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Objective(s):
Ensure safe operation of combustion appliances

3.1602.15k

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Specification(s):
Occupant/property manager will be educated on how the system works and its purpose

Occupant/property manager will be instructed to not alter or make holes in the ventilation duct system

Objective(s):
Ensure the durability of the ventilation system

3.1602.16a

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
Any closure system used will meet or exceed applicable standards

Objective(s):
Ensure effectiveness of air sealing system

3.1602.16b

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
Seams, cracks, joints, holes, and penetrations less than 1/4" will be sealed using fiberglass mesh and mastic

Mastic alone will be acceptable for holes less than 1/4" that are more than 10' from air handler

Seams, cracks, joints, holes, and penetrations between 1/4" and 3/4" will be sealed in two stages:

- They will be backed using temporary tape (e.g., duct tape) as a support prior to sealing
- They will be sealed using fiberglass mesh and mastic

Objective(s):
Eliminate air leakage into or out of ducts and plenums

Ensure adhesion of primary seal (fiberglass mesh and mastic) to the duct

Reinforce the seal

Support the mastic and fiberglass mesh during curing

3.1602.16c

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
Fiberglass mesh and mastic will overlap temporary tape by at least 1" on all sides

Fiberglass mesh and mastic will become the primary seal

Seams, cracks, joints, holes, and penetrations larger than 3/4" will be repaired using rigid duct material

Objective(s):
Eliminate air leakage into or out of ducts and plenums

Ensure adhesion of primary seal (fiberglass mesh and mastic) to the duct

Reinforce the seal

Support the mastic and fiberglass mesh during curing

3.1602.17a

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
Gaps between boot and gypsum less than a 1/4" will be sealed using mastic

Gypsum edge will be wetted before applying mastic

Objective(s):
Prevent air leakage

3.1602.17b

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
Accessible connections and joints will be made airtight using approved material

Objective(s):
Ensure ducts and plenums will not leak out of or into return or supply plenums and ducts

3.1602.17c

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
Joints will be closed

Cracks and holes not needed for proper function and service of unit will be sealed using removable sealant (e.g., UL 181 approved mastic tape)

Objective(s):
Reduce air leakage while maintaining accessibility

3.1602.17d

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Specification(s):
A pre-manufactured or site-manufactured durable and airtight filter slot cover will be installed

Objective(s):
Reduce air leakage while maintaining accessibility

3.1602.18a

Desired Outcome:
The return duct installed prevents air leakage

Specification(s):
Debris and dirt will be cleaned out of the return platform

Ensure the platform will support the weight of the equipment

Objective(s):
Allow for the application of rigid materials and sealants

3.1602.18b

Desired Outcome:
The return duct installed prevents air leakage

Specification(s):
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

Objective(s):
Minimize the hole size to ensure successful use of sealant

Ensure the closure is permanent and supports any load (e.g., return air pressure)

Ensure the sealant does not fall out

3.1602.18c

Desired Outcome:
The return duct installed prevents air leakage

Specification(s):
Sealants will be compatible with their intended surfaces

Sealants will be continuous and meet fire barrier specifications

Objective(s):
Select permanent sealant

Ensure that sealant meets or exceeds the performance characteristics of the surrounding materials

3.1802.1a

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

Specification(s):
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

Objective(s):
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

3.1802.1b

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

Specification(s):
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 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)

Objective(s):
Minimize gap or hole size to ensure successful use of sealant

Ensure closure is permanent and supports appropriate load (e.g., wind, snow, insulation)

Ensure sealant does not fall out

Ensure integrity of the existing water control system

3.1802.1c

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

Specification(s):
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

Objective(s):
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

3.1802.1d

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

Specification(s):
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

Objective(s):
Provide airtight, durable seal that does not move, bend, or sag

Ensure hidden flutes are properly sealed

3.1802.1e

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

Specification(s):
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

Objective(s):
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

3.1802.2a

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

3.1802.2b

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Objective(s):
Ensure occupant safety

3.1802.2c

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance-ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Identify overhang locations to determine desired location of air barrier, determine hole size, framing, and material requirements (including fire rating)

Objective(s):
Provide a safe and stable work environment

Ensure a durable, continuous air barrier and a fire assembly, where appropriate

3.1802.2d

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
Items and property below and adjacent to work area will be removed from the work areas or will be adequately protected

Objective(s):
Prevent damage to objects near the work and workers

3.1802.2e

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
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 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)

Objective(s):
Minimize gap or hole size to ensure successful use of sealant

Ensure closure is durable, pest resistant, weather appropriate, and supports appropriate load (e.g., wind, snow, insulation)

Ensure sealant does not fall out

Ensure integrity of the existing water control system

3.1802.2f

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
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

Objective(s):
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

3.1802.2g

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
At the overhang, a continuous air barrier will be created to align with the wall air barrier

The opening will be closed off with a rigid material that meets assembly fire rating

The air barrier will be fastened to framing as appropriate

Rigid material and all openings will be sealed to form a complete air barrier

Objective(s):
Prevent air leakage by creating a durable air barrier continuous with the wall air barrier

Ensure material is able to support wind and insulation loads

Ensure final gap is sealed with appropriate sealant

3.1802.2h

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
Overhang will be visually inspected and tested for airtightness in accordance with ASTM E 1186-03

Water management systems will be verified as maintained

Objective(s):
Prevent air leakage through assembly

Prevent water intrusion

3.1802.2i

Desired Outcome:
Rigid, airtight continuous air barrier at overhang/wall interface

Specification(s):
Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-developed index when tested to ASTM E84 or UL 723

Foam, where permissible, will be provided with ignition and thermal barriers as required by code

Other fire stop materials may be required for fire resistance-rated walls with openings required to be protected

Objective(s):
Comply with local codes and ordinances

3.1901.1a

Desired Outcome:
Effective air barrier between identified isolated and other conditioned spaces of the building

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Repairs necessary to stabilize work areas, and protect or preserve integrity of energy improvement will be completed before subject work begins

Objective(s):
Provide a safe and stable work environment

Repair or address moisture, structure, and pest-related issues

Ensure that fire separations are preserved

3.1901.1b

Desired Outcome:
Effective air barrier between identified isolated and other conditioned spaces of the building

Specification(s):
Penetrations will be identified using visual inspections, infrared thermography, smoke, and/or pressure tests (ASTM E1186-03 [2009])

Objective(s):
Locate air leakage pathways to repair

3.1901.1c

Desired Outcome:
Effective air barrier between identified isolated and other conditioned spaces of the building

Specification(s):
Health and safety concerns will be addressed for occupants and workers, in relation to repairs and materials, will be addressed in accordance with OSHA standards (OSHA 1926, 1910)

The area will be prepared and isolated in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos)

Work lighting, work platform, and adequate ventilation will be provided

Objective(s):
Provide a safe work environment

Provide safe indoor environmental quality (IEQ) work in the work environment

Provide effective repair access

3.1901.1d

Desired Outcome:
Effective air barrier between identified isolated and other conditioned spaces of the building

Specification(s):
Sealants and materials 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

Objective(s):
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

3.1901.1e

Desired Outcome:
Effective air barrier between identified isolated and other conditioned spaces of the building

Specification(s):
Repairs will be verified by visual inspections, infrared thermography, smoke, and/or pressure tests consistent with the pre-inspection

Objective(s):
Ensure quality and effectiveness of air sealing

3.1901.2a

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating.

Work order repairs requiring access to dwelling units will be reviewed with all relevant authorities (e.g., building management, property management)

Access to work areas within dwelling units will be obtained

Repairs necessary to stabilize work areas and protect or preserve integrity of energy improvement will be completed before subject work begins

Objective(s):
Provide a safe and stable work environment

Repair or address moisture, pest, and structure-related issues

Obtain access to units and work areas within dwelling units

3.1901.2b

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Work will be coordinated with all other trades performing work in compartmentalized spaces to schedule any required system wide test-out verification

Objective(s):
Ensure system wide air sealing and pressure boundary benefits will be achieved

3.1901.2c

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Health and safety concerns for occupants and workers, in relation to repairs and materials, will be addressed in accordance with OSHA standards (OSHA 1926, 1910)

The area will be prepared and isolated in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos)

Work lighting, work platform, and adequate ventilation will be provided

Objective(s):
Provide a safe work environment

Provide a safe indoor environmental quality (IEQ) in the work environment

Provide effective repair access

3.1901.2d

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Penetrations will be identified using visual inspections, infrared thermography, smoke, and/or pressure tests (ASTM E1186-03 [2009])

Note: Work will preserve existing ventilation performance, including apartment door undercuts, where existing central ventilation design incorporates these undercuts as an intentional pathway from hallways to apartments

Objective(s):
Establish baseline air leakage

Identify air leakage repair locations

Monitor repair progress

Preserve IEQ for occupants

3.1901.2e

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Sealants and materials 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

Objective(s):
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

3.1901.2f

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Repairs will be verified by pressure tests consistent with the pre-inspection

Any pressure balance test-out verification will be performed after all work from all trades is completed

Objective(s):
Ensure quality and effectiveness of air sealing

Meet performance specifications

3.1901.2g

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Documentation of material and maintenance requirements will be provided to property manager/ occupant, as appropriate

Objective(s):
Properly maintain the system

3.1901.3a

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Repairs necessary to stabilize work areas and protect or preserve integrity of energy improvement will be completed before subject work begins

Objective(s):
Provide a safe and stable work environment

Repair moisture and structure-related issues

3.1901.3b

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Penetrations will be identified using visual inspections, infrared thermography, smoke, and/or pressure tests (ASTM E1186-03 [2009])

Access will be provided to ensure that repairs can be made (may include localized demolition)

Attempts will be made to secure existing building drawings and specifications relating to affected areas to aid in diagnostics and minimize temporary demolition

Fire-resistant integrity of existing shafts that span multiple fire separations will be maintained during testing and construction periods

Objective(s):
Locate air leakage pathways to repair

Provide system-wide air flow control benefits

Ensure that breeches of fire-separated spaces are not left unattended during the construction cycle

3.1901.3c

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Health and safety concerns for occupants and workers, in relation to repairs and materials, will be addressed in accordance with OSHA standards (OSHA 1926, 1910)

The area will be prepared and isolated in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos)

Work lighting, work platform, and adequate ventilation will be provided

Objective(s):
Provide a safe work environment

Provide safe indoor environmental quality (IEQ) in the work environment

Provide effective repair access

3.1901.3d

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Sealants and materials 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

Objective(s):
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

3.1901.3e

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Access holes will be repaired

Both temporary (during construction) and permanent demolition repairs will preserve the fire-resistance ratings of affected assemblies

Objective(s):
Restore surfaces to original condition or better

3.1901.3f

Desired Outcome:
Control of one or more of the following: building air leakage, stack effect, noise transmission, or improved indoor air quality

Specification(s):
Repairs will be verified by visual inspections, infrared thermography, smoke, and/or pressure tests consistent with the pre-inspection

Objective(s):
Ensure quality and effectiveness of air sealing

4.1003.14a

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

4.1003.14b

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
An occupant safety plan will be prepared and implemented

Objective(s):
Ensure occupant safety

4.1003.14c

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Insulation will not be installed if moisture-related issues are not resolved

Objective(s):
Ensure a durable, continuous air and thermal boundary

4.1003.14d

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
New insulation that is not designed to also serve as an air barrier will not be added until all air sealing has been completed

Existing insulation will be inspected to confirm that it is not concealing air barrier weaknesses, and is in full contact and alignment with the air barrier

Where the insulation is disturbed or found not to be in contact with the air barrier, it will be reinstalled to be in contact with the air barrier; if it cannot be reinstalled or if its condition compromises its effectiveness, the insulation will be removed

Insulation will be marked for depth a minimum of every 300 square feet of attic area with measurement beginning at the air barrier

All electrical junctions will be flagged to be seen above the level of the insulation

Covers will be installed on open electrical junction boxes

Insulation dams and enclosures (e.g., can lights, sprinkler systems, access hatch, chimney) will be installed as required

Where loose fill or batt insulation is used, it will have a maximum 25 flame spread/50 smoke-developed index when tested to ASTM E84 or UL 723

Where rigid foam plastics are used, in no case will the final thickness exceed the manufacturer's tested thickness used to determine the maximum 75 flame spread and 450 smoke-developed index when tested to ASTM E84 or UL 723

Foam will be provided with ignition and thermal boundaries as required by code

Objective(s):
Minimize potential for warm, moist air to enter the attic and condense on cold surfaces

Ensure proper performance of insulation

Verify uniformity of insulation material

Provide location of electrical junctions for future servicing

Prevent an electrical hazard

4.1003.14e

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
Attic insulation will be installed without gaps, voids, compressions, misalignments, or wind intrusions

Roof cavities will be blown with loose-fill insulation without gaps, voids, compressions, misalignments, or wind intrusions

Insulation will be installed to prescribed R-value

Final R-value will account for the compression of existing insulation

Objective(s):
Insulate to prescribed R-value

4.1003.14f

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
Code compliant ventilation will be installed before insulation

Objective(s):
Reduce possibility of moisture issues

4.1003.14g

Desired Outcome:
Insulation reduces heat flow through unvented roof

Specification(s):
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

Objective(s):
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

4.1005.8a

Desired Outcome:
Insulation controls heat transfer through ceiling

Specification(s):
New insulation will not be added until all air sealing has been completed

Existing insulation will be inspected to confirm that it is not concealing air barrier weaknesses and is in full contact and alignment with the air barrier

Where the insulation is disturbed or found not to be in contact with the air barrier, it will be reinstalled to be in contact with the air barrier; if it cannot be reinstalled or if its condition compromises its effectiveness, the insulation will be removed

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 junctions will be flagged to be seen above the level of the insulation

Open electrical junction boxes will have covers installed

Insulation dams and enclosures will be installed as required

Blocking will be installed to maintain existing vented attic functionality

Objective(s):
Ensure proper performance of insulation

Verify uniformity of insulation material

Provide location of electrical junctions for future servicing

Prevent an electrical hazard

4.1005.8b

Desired Outcome:
Insulation controls heat transfer through ceiling

Specification(s):
The correct depth and number of bags will be blown in accordance with manufacturer specifications

Insulation will be installed to prescribed R-value

Final R-value will account for the compression of existing insulation

Objective(s):
Insulate to prescribed R-value

4.1005.8c

Desired Outcome:
Insulation controls heat transfer through ceiling

Specification(s):
Insulation will not be allowed on top of non-insulation contact (IC)-rated can light boxes or between a heat-generating appliance and a dam unless material is rated for contact with heat-generating sources

All insulation materials used will meet ASTM E84 flame spread/smoke development rating of 25/50

Objective(s):
Prevent a fire hazard

4.1005.8d

Desired Outcome:
Insulation controls heat transfer through ceiling

Specification(s):
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

Objective(s):
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

4.1088.8a

Desired Outcome:
Properly restored vents minimize moisture and ice dams

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Objective(s):
Ensure safety, effectiveness, and durability of improvements

4.1088.8b

Desired Outcome:
Properly restored vents minimize moisture and ice dams

Specification(s):
Attic ventilation will be recommended or installed only if:

- The presence of an effective air barrier and thermal boundary between the attic and the living space is verified
- Appropriate attic sealing and proper insulation is specified as part of the work scope
- Ignition and thermal boundaries are provided when foam plastic materials are used

Objective(s):
Ensure presence of continuous air barrier and thermal boundary

4.1088.8c

Desired Outcome:
Properly restored vents minimize moisture and ice dams

Specification(s):
Attic vent types will be consistent with requirements for their specific location (e.g., exterior soffit, gable end, roof) and material and intended use (e.g., metal vent on metal roof)

Ventilation opening area and configuration will comply with applicable building code

Objective(s):
Ensure vent meets proper performance characteristics for location and roofing type

4.1088.8d

Desired Outcome:
Properly restored vents minimize moisture and ice dams

Specification(s):
Placement of attic vents will be considered for proper air flow and prevention of entry of wind-driven rain or snow

Objective(s):
Encourage proper air flow

Minimize entry of wind-driven rain or snow

4.1088.8e

Desired Outcome:
Properly restored vents minimize moisture and ice dams

Specification(s):
Baffling for attic soffit vents will be installed to:

- Ensure proper air flow
- Prevent wind washing of insulation
- Allow maximum insulation coverage
- Ensure baffle terminates above insulation

Minimum clearance between insulation and roof deck will be 1"

Objective(s):
Ensure vent allows proper air flow without compromising insulation performance

4.1088.8f

Desired Outcome:
Properly restored vents minimize moisture and ice dams

Specification(s):
All attic ventilation will have screens with noncorroding wire mesh with openings of 1/8" to prevent pest entry (e.g., birds, bats, bees)

Existing vents that are not screened will be covered with noncorroding wire mesh with openings of 1/8"

Objective(s):
Prevent pest entry

4.1103.4a

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
All worker safety specifications will be in accordance with SWS 2.0100.3 Worker Safety

Lead safety procedures in buildings built before 1980 will be followed

Objective(s):
Ensure worker safety, especially in regard to fall protection considerations and contaminants found in demolition, such as asbestos, lead, polychlorinated biphenyls, etc.

4.1103.4b

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
Occupant will be notified of changes or repairs to be made

An occupant safety plan will be prepared and implemented

Objective(s):
Ensure occupant safety

4.1103.4c

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Worker Safety

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Repairs necessary to stabilize work areas and protect or preserve the integrity of energy improvement will be completed before work begins

Insulation will not be installed if moisture-related issues are not resolved

Existing water control measures will be identified

Air sealing locations on the exterior walls will be identified

Air sealing will be completed before installing insulation

Objective(s):
Identify and remediate pest, moisture, air leakage, and electrical problems before insulation installation

Ensure a durable, continuous thermal boundary

Avoid compromising existing water control system

4.1103.4d

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
When feasible, insulation will be installed into cavities from the exterior side of the wall

When feasible, exterior cladding at the insulation access point will be removed before creating an access hole through the sheathing

Insulation access point will be created to minimize air barrier and drainage plane disruption

Access point will be sealed to be airtight and watertight after insulation installation before reinstalling the exterior cladding

Water management system will be repaired to function as originally intended (e.g., lapping new felt paper underneath the upper and over the lower joint of the existing felt paper)

Objective(s):
Ensure occupant health and safety

Minimize disruption within the units

Avoid compromising existing water control system

Minimize air and moisture flow through the wall system

4.1103.4e

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
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

Objective(s):
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

4.1103.4f

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
Using fill tube, 100% of each cavity will be completely 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, rock and slag wool, or spray foam used in an enclosed cavity will be installed in accordance at or above manufacturer recommended density to limit air flow that corresponds to an air permeance value of 3.5 cubic feet per minute/square feet at 50 pascals, as measured using the following applicable methods:

BPI-102 Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications, or

Material Specification, or

ASTM C 522, or

ASTM E 283, or

ASTM E 2178

- All insulation materials used will meet ASTM E84 flame spread/smoke development rating of 25/50
- 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 using chemical smoke at 50 pascals of pressure difference

Objective(s):
Eliminate voids and settling

Minimize framing cavity air flow

4.1103.4g

Desired Outcome:
Maintain a consistent, uniform thermal and weather-resistant boundary between conditioned and unconditioned space to prescribed R-value of an adjoining insulated assembly

Specification(s):
A dated receipt signed by the installer will be provided that includes:

- Coverage area
- Thickness
- R-value

Objective(s):
Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1301.10a

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Conduct pre-inspection in accordance with SWS 2.0100.4 Work Area Inspection and Stabilization

Gaps, cracks, and holes in fire separations located within the work area will be visually identified and incorporated into air sealing work scope, including those that span two conditioned or unconditioned spaces

Where drawings are available that identify specific fire-resistance ratings (i.e., 1 hour, 2 hour), materials and methods will be employed to preserve or restore such rating

Where drawings are unavailable or do not identify specific fire-resistance ratings, the fire-resistance rating of the assembly may be inferred from the current construction (i.e., single 5/8 sheetrock, concrete masonry unit), and materials and methods employed will be consistent with restoring or preserving such inferred fire-resistance rating

Repairs necessary to stabilize work areas and protect or preserve integrity of energy improvement will be completed before subject work begins

Objective(s):
Repair moisture-related issues

Provide a safe and stable work environment

4.1301.10b

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Health and safety concerns will be addressed for occupants, workers, and repair materials in accordance with OSHA standards (OSHA 1926, 1910)

Prepare and isolate the area in accordance with health and safety standards for the application and materials (e.g., extreme temperatures, lead, asbestos, carbon monoxide)

Work lighting, work platform, and adequate ventilation will be provided

Objective(s):
Provide a safe working environment

Provide a safe indoor environmental quality working environment

Provide effective repair access

4.1301.10c

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Sealing between conditioned space and unconditioned space will be completed before insulating

Objective(s):
Ensure airtight envelope

Prevent leakage

4.1301.10d

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Insulation will be installed to at least prescribed R-value

Insulation will be installed in contact with subfloor without gaps, voids, compressions, misalignments, or wind intrusions

If vapor retarders are used, they will be installed consistent with local climate/code requirements

Objective(s):
Prevent potential fire chases

Provide effective R-value

Prevent excessive vapor migration into the floor assembly and/or conditioned space

4.1301.10e

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Insulation will completely fill the cavity space within the joists or trusses

Objective(s):
Minimize sagging, gaps, and voids

4.1301.10f

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Rigid insulation will be mechanically fastened to the bottom of the subfloor or at the bottom of the joists or trusses

If attached at the bottom of the joists or trusses, rigid insulation will be attached at the exterior perimeter/band

Insulation will be installed either as in-fill or at the bottom of the joists. Where rigid insulation is installed between joists, the perimeter of each joist bay will be air sealed with appropriate sealants to prevent air bypasses around rigid insulation materials

Rigid foam plastics used as insulation will incorporate a thermal and ignition barrier, as required by the building code

A continuous air barrier will be installed below the insulation and to the exterior

Objective(s):
Minimize convective loops

Prevent freezing of plumbing pipes

Ensure air barrier is aligned with the insulation

4.130.10g

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
SPF will be applied to bottom side of subfloor between floor joists and all rim/band joists

Spray applied foam products will incorporate a thermal and ignition barrier as required by the building code

Insulation will be installed by foam installers

Objective(s):
Minimize convective loops

4.1301.10h

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
All plumbing or mechanical ductwork will be enclosed within the insulated space and will have sufficient insulation on the exterior side

Objective(s):
Prevent freezing of plumbing pipes

4.1301.10i

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
Batts will be secured with physical fasteners

Objective(s):
Ensure insulation remains in contact with subfloor

4.1301.10j

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
A continuous rigid barrier, suitable to withstand weather, moisture, and pest contact, and with a fire-resistance rating equal to the resistance rating of the original floor assembly will be mechanically fastened to underside of floor assembly

Objective(s):
Protect insulation

4.1301.10k

Desired Outcome:
Maintain a consistent, protected, uniform thermal boundary between conditioned and unconditioned space to prescribed R-value

Specification(s):
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)

Objective(s):
Document job completion to contract specifications

Confirm amount of insulation installed

Comply with 16 CFR 460.17

4.1601.6a

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

Specification(s):
Duct insulation 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 barrier

Ducts will not be buried in hot humid and warm coastal regions

Objective(s):
Decrease heat loss and condensation problems

4.1601.6b

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

Specification(s):
Before insulation is applied, all accessible ducts will be sealed with a UL-approved mastic in conformance with the applicable code adopted by the jurisdiction

Objective(s):
Minimize duct leakage

4.1601.6c

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

Specification(s):
Duct insulation will be secured to the duct system using an appropriate material per applicable standards that will securely hold the insulation to the ductwork, without compressing the insulation in the process

Objective(s):
Ensure a secure connection between the duct system and the duct insulation

4.1601.6d

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

Specification(s):
Using a tape or mastic approved by the manufacturer, all seams and connection of the duct insulation will be sealed

No gaps will exist between pieces of duct insulation

Objective(s):
Prevent gaps in the vapor barrier of the insulation

5.3001.4a

Desired Outcome:
Equipment sized properly and operating efficiently

Specification(s):
Heat loss or gain of the building will be calculated considering the following:

- R-values of building components
- U-value and solar heat gain coefficient of glazing
- Orientation and exterior shading of glazing
- Duct heat loss or gain
- Infiltration target or final infiltration after air sealing is completed
- Ventilation
- Internal gains

ANSI/ACCA Manual J Residential Load Calculation, 8th ed., and ANSI/ACCA 5–2010 QI HVAC Quality Installation Specification requirements or ASHRAE equivalents will be used for all residential load calculations

ANSI/ACCA Manual N Commercial Load Calculation or ASHRAE equivalents will be used for all commercial load calculations

Room-by-room calculations will be performed when installing new duct systems or in retro-commission projects

Objective(s):
Accurately calculate sensible and latent load for the total building and each room

Properly size equipment for the load

5.3001.4b

Desired Outcome:
Equipment sized properly and operating efficiently

Specification(s):
Interior design temperatures will be selected based on 75° for cooling and 70° for heating, unless otherwise stated by local code

Ensure the design loads reflect peak sensible and peak latent load conditions per ASHRAE Handbook—Fundamentals

Design sensible loads, which will dominate in dry climates, should be based upon outdoor design cooling conditions for the location (e.g., peak cooling dry bulb temperature in the ASHRAE Handbook—Fundamentals)

Design latent loads, which are most important in moist or humid climates, should be based upon design dehumidification conditions for the location (e.g., design dew point temperature and mean coincident dry bulb temperature in the ASHRAE Handbook—Fundamentals)

Objective(s):
Accurately calculate sensible and latent load for the building

Properly size equipment for the load

5.3001.4c

Desired Outcome:
Equipment sized properly and operating efficiently

Specification(s):
Interior design temperatures will be selected based on 75° for cooling and 70° for heating, unless otherwise stated by local code

Ensure the design loads reflect peak sensible and peak latent load conditions per ASHRAE Handbook—Fundamentals

Design sensible loads, which will dominate in dry climates, should be based upon outdoor design cooling conditions for the location (e.g., peak cooling dry bulb temperature in the ASHRAE Handbook—Fundamentals)

Design latent loads, which are most important in moist or humid climates, should be based upon design dehumidification conditions for the location (e.g., design dew point temperature and mean coincident dry bulb temperature in the ASHRAE Handbook—Fundamentals)

Objective(s):
Accurately calculate sensible and latent load for the building

Properly size equipment for the load

5.3001.4d

Desired Outcome:
Equipment sized properly and operating efficiently

Specification(s):
Equipment capable of meeting the sensible and latent load of the building will be selected using the detailed capacity tables provided by the manufacturer

Equipment will not be sized by more than 115% of total load or next available size

ANSI/ACCA Manual S Residential Equipment Selection, and ANSI/ACCA 5–2010 QI HVAC Quality Installation Specification requirements or ASHRAE equivalents will be used for all residential equipment selection

ANSI/ACCA Manual CS Commercial Applications Systems and Equipment or ASHRAE equivalents will be used for all commercial equipment selection

Objective(s):
Ensure the equipment is able to heat, cool, and dehumidify the building

5.3001.4e

Desired Outcome:
Equipment sized properly and operating efficiently

Specification(s):
Use the lowest capacity heating equipment required to heat the building, utilizing the detailed capacity tables provided by the equipment manufacturer

Equipment will be selected to provide a changeover point, calculated using information from the detailed capacity tables provided by the equipment manufacturer, weather data, and utility cost

Objective(s):
Maximize the heating potential of the compressor

Minimize the use of auxiliary heat

5.3001.4f

Desired Outcome:
Equipment sized properly and operating efficiently

Specification(s):
The smallest capacity heating equipment will be selected that is capable of meeting the design heating load and providing the air movement required by the air conditioning

When an air-conditioning system is not designed with the furnace, the smallest capacity heating equipment will be selected that is capable of meeting the heating load

The lowest capacity cooling equipment required to cool the building will be used

Equipment will not be sized by more than 115% of total load or next available size

Objective(s):
Ensure equipment meets the heating load of the building

Ensure equipment moves required air for air conditioning, if applicable

5.3001.5a

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

Specification(s):
Ducts will be sized to deliver the appropriate amount of airflow (both supply and return) needed to satisfy the heating and/or cooling load of the building

Ducts will be sized using friction charts

ANSI/ACCA Manual D Residential Duct Systems or ASHRAE equivalents will be used for all residential ductwork sizing

ANSI/ACCA Manual Q Low Pressure, Low Velocity Duct System Design or ASHRAE equivalents will be used for all commercial ductwork sizing

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5b

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

Specification(s):
Return plenum will be designed in accordance with ANSI/ACCA Manual D or equivalent

Radius elbow fittings or square fittings with turning vanes will be used to direct return air when a 90° turn is required

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5c

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

Specification(s):
Supply plenum will be designed in accordance with ANSI/ACCA Manual D or equivalent

Radius elbow fittings or square fittings with turning vanes will be installed to direct supply air

Supply plenum will be the same size as the air handler supply opening

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5d

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

Specification(s):
Building cavities will not be used as ductwork in new systems

In existing systems, building cavities will be sealed and tested

Objective(s):
Maximize air flow

Minimize energy use

Safeguard indoor air quality

5.3001.5e

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

Specification(s):
Reducers between sections of different size ducts will be in accordance with existing standards based on duct material (SMACNA, NAIMA)

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5f

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

Specification(s):
Runs will be installed as short as possible

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5g

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

Specification(s):
If using flexible duct with straight boots, duct will be connected to boot with no bend

A rigid elbow will be used when a flexible duct changes direction

A rigid connector will be used when joining two pieces of flexible duct together

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5h

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

Specification(s):
Terminations will be selected based on ACCA Manual T Air Distribution Basics

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5i

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

Specification(s):
Terminations will be selected based on ACCA Manual T Air Distribution Basics

Grille gross area will be equal to or larger than return box

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5j

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

Specification(s):
Dampers will be installed as close to the trunk as possible while still being accessible to allow for adjustment after interior finishes are installed

Objective(s):
Minimize static pressure and noise

Maximize air flow

5.3001.5k

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

Specification(s):
Flexible ducts will not be bent more than 45° without rigid elbow

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5l

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

Specification(s):
Take-offs that create high turbulence will not be used (e.g., elbows with integrated dampers, scoops)

Take-offs will be installed onto the trunk in accordance with duct construction standards (SMACNA)

Objective(s):
Minimize static pressure

Maximize air flow

5.3001.5m

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

Specification(s):
Fire dampers shall be installed as required by applicable fire code

Objective(s):
Minimize static pressure

Maximize air flow

5.3002.2a

Desired Outcome:
Sequence of operation of the system verified

Specification(s):
The sequence of operation of the system will be verified in accordance with the manufacturer's installation, operation, and maintenance manuals

Objective(s):
Ensure system components function and operate in the correct sequence

5.3002.4a

Desired Outcome:
Existing equipment removed safely and in accordance with local ordinances

Specification(s):
A code-compliant walkway and service platform will be installed in attics as applicable, if not present

Walkway and platform will be above the level of insulation

Objective(s):
Ensure new equipment can be installed and serviced

Maintain adequate insulation level

5.3002.4b

Desired Outcome:
Existing equipment removed safely and in accordance with local ordinances

Specification(s):
If mold and/or asbestos-like substance is found to be present, it must be tested by a certified organization, and all system components and possible disturbed surrounding areas must be certified free of asbestos and/or mold by a licensed professional before equipment removal can begin

Objective(s):
Protect workers and occupants from injury

5.3002.4c

Desired Outcome:
Existing equipment removed safely and in accordance with local ordinances

Specification(s):
Electricity and fuel will be turned off

Objective(s):
Protect workers and occupants from injury

5.3002.4d

Desired Outcome:
Existing equipment removed safely and in accordance with local ordinances

Specification(s):
Refrigerant will be recovered in accordance with 40CFR 608 (EPA)

All work will be done by a licensed professional or qualified person

Objective(s):
Limit the release of ozone-depleting substances

Protect workers and occupants from injury

5.3002.4e

Desired Outcome:
Existing equipment removed safely and in accordance with local ordinances

Specification(s):
Refrigerant lines, plumbing, ducts, electric, control wires, vents, and fuel supply will be disconnected

All work will be done by a licensed professional or qualified person

Objective(s):
Ensure equipment can be removed

5.3002.4f

Desired Outcome:
Existing equipment removed safely and in accordance with local ordinances

Specification(s):
Equipment will be removed (e.g., furnace, air handler, evaporator, condensing unit)

Equipment will be removed from the space without damaging property and disturbing or compressing the insulation

Equipment will be disposed of in accordance with local ordinances and regulations

Objective(s):
Provide room to install new equipment and work safely

Comply with disposal laws in accordance with local ordinances

5.3002.7a

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be installed in a dry location within the conditioned space when feasible

Equipment will be properly isolated from pollutant sources (e.g., garages)

Equipment will be installed in a manner to provide ease of access for routine maintenance/service

All work will be done by a licensed professional or qualified person

Objective(s):
Prevent rust and corrosion

Protect equipment from bulk water and moisture

Prevent exposure to garage air pollutants

Ensure that equipment is maintained/serviced

5.3002.7b

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be installed with proper clearances in accordance with local codes and manufacturer specifications

Alternative locations will be considered for equipment when existing locations are not suitable

Objective(s):
Ensure equipment has proper clearances for fire risk and accessibility

Ensure equipment operates as designed

5.3002.7c

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be installed so connections allow proper operation of the equipment and accessibility (e.g., electrical service, condensation drains, ductwork, fuel, venting, refrigerant lines)

Equipment will be installed so the drain pan operates properly

Objective(s):
Ensure connections do not interfere with the operation and service of the equipment

5.3002.7d

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be supported with a nonwicking fireproof platform or suspended with a threaded rod in accordance with local codes and manufacturer specifications

Equipment will be placed on vibration pads

Objective(s):
Ensure equipment is stable, level, and does not transmit vibration

Avoid compressing or disturbing attic insulation

5.3002.7e

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be supported with a nonwicking, fireproof material or suspended with a threaded rod in accordance with local codes and manufacturer specifications

Equipment will be placed on vibration pads

Objective(s):
Ensure equipment is stable, level, and does not transmit vibration

Avoid compressing or disturbing insulation

5.3002.7f

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be supported on nonflammable material capable of supporting the weight of the equipment

Air handler opening will be free of obstructions

Equipment will be placed on vibration pads

Objective(s):
Properly support the equipment

Prevent a fire hazard

Ensure platform does not impede air flow

5.3002.7g

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Equipment will be supported on ductwork capable of supporting the weight of the equipment

Equipment will be supported on ductwork with rigid exterior insulation fastened to the ductwork

Objective(s):
Properly support equipment

Protect equipment from moisture damage

Reduce heat loss

5.3002.7h

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
Gaps larger than 1/4" between air handler and adjoining ductwork or equipment (e.g., evaporator coil, filter rack) will be bridged with sheet metal, and sealed with mastic and fiberglass mesh

All air handler joints will be sealed with mastic and fiberglass mesh

Air handler joints and non-service openings will be sealed to eliminate all gaps with NFPA 90A and B approved sealant

If unit is installed in a building cavity, the cavity must be sealed prior to the installation to eliminate any return air leaks from adjoining chases

Objective(s):
Ensure air handler does not leak air

Ensure the sealing is durable

Prevent increased resistance to air flow

5.3002.7i

Desired Outcome:
Air handler set properly in an appropriate place

Specification(s):
A secondary drain pan and drain line that provides proper pitch and a float switch will be installed beneath equipment located in areas where water damage may occur, such as attics and conditioned spaces

Float switch will be interlocked with the cooling circuit to disable AC when leak occurs

Objective(s):
Prevent water damage

5.3003.17a

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

Specification(s):
Equipment will be visually inspected

Information will be recorded from the indoor and outdoor equipment data plates

Information will be entered into the operations and management manual

Objective(s):
Ensure technician has equipment data necessary for commissioning and future service work

5.3003.18a

Desired Outcome:
Dangerous leaks detected before causing injury to the occupant or damage to the building

Specification(s):
Personal CO alarm will be worn in accordance with Building Performance Institute standards

Objective(s):
Protect workers and occupants from possible CO poisoning

5.3003.18b

Desired Outcome:
Dangerous leaks detected before causing injury to the occupant or damage to the building

Specification(s):
Gas pipes will be tested for leaks with an electronic combustible gas leak detector and verified with bubble solution

When installing new gas lines a code approved standing pressure test will be conducted to detect leaks

Objective(s):
Ensure gas lines do not leak

5.3003.18c

Desired Outcome:
Dangerous leaks detected before causing injury to the occupant or damage to the building

Specification(s):
Oil tank, piping and equipment will be visually inspected for oil leaks

Fuel oil tanks will be inspected for leaks and corrosion

Objective(s):
Ensure fuel oil lines and tanks do not leak

5.3003.19a

Desired Outcome:
Refrigerant lines properly installed

Specification(s):
All refrigerant lines will be insulated based on the equipment manufacturer's requirements in conformance with applicable code adopted by the jurisdiction

All installed insulation will be properly sealed

Objective(s):
Ensure refrigerant lines do not gain excessive heat

5.3003.19b

Desired Outcome:
Refrigerant lines properly installed

Specification(s):
If exposed to sunlight, refrigerant line insulation will be protected from UV degradation

Objective(s):
Install insulation so it does not degrade

5.3003.19c

Desired Outcome:
Refrigerant lines properly installed

Specification(s):
Refrigerant lines will be sized to meet manufacturer specifications for the installed equipment

Objective(s):
Ensure system moves the appropriate volume of refrigerant

5.3003.19d

Desired Outcome:
Refrigerant lines properly installed

Specification(s):
Refrigerant lines will be installed without kinks, crimps, or excessive bends

Refrigerant lines will be joined together using manufacturer-approved method(s)

Proper filter dryer(s) will be installed

Refrigerant lines will be checked for leaks following EPA Section 608 and verified leak free before refrigerant charging

Proper evacuation and dehydration techniques will be employed prior to refrigerant charging

Objective(s):
Ensure system moves the appropriate volume of refrigerant

Ensure contaminates to not harm the system

Ensure the system is durable

5.3003.19e

Desired Outcome:
Refrigerant lines properly installed

Specification(s):
Refrigerant lines will be routed, supported, and secured to the building in a manner that protects the line from damage by workers or occupants

Objective(s):
Ensure refrigerant lines do not move, vibrate, or sag

Protect lines from damage

5.3003.20a

Desired Outcome:
Electrical components properly tested

Specification(s):
Polarity of the equipment will be correct

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

5.3003.20b

Desired Outcome:
Electrical components properly tested

Specification(s):
Voltage will be in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

5.3003.20c

Desired Outcome:
Electrical components properly tested

Specification(s):
Wire size should be appropriate for the equipment installed

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

5.3003.20d

Desired Outcome:
Electrical components properly tested

Specification(s):
The proper service disconnect will be installed, and if fused, the correct fuses will be installed

Objective(s):
Ensure equipment operates safely

5.3003.20e

Desired Outcome:
Electrical components properly tested

Specification(s):
Voltage drop will be within acceptable range in accordance with manufacturer specifications

Objective(s):
Ensure contactor does not overheat

Ensure equipment operates as designed

5.3003.20f

Desired Outcome:
Electrical components properly tested

Specification(s):
Adequate grounding will be present

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

5.3003.20g

Desired Outcome:
Electrical components properly tested

Specification(s):
Amperage will be within original equipment manufacturer (OEM) specifications and/or code requirements

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment operates safely

5.3003.20h

Desired Outcome:
Electrical components properly tested

Specification(s):
Amperage will be within OEM specifications and/or code requirements

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment operates safely

5.3003.20i

Desired Outcome:
Electrical components properly tested

Specification(s):
Blower compartment safety switch operation will be verified

Objective(s):
Ensure blower does not operate during service

5.3003.20j

Desired Outcome:
Electrical components properly tested

Specification(s):
Emergency heat circuit functions will be verified

Amperage will be within OEM specifications and/or code requirements

Objective(s):
Ensure system delivers heat in case of a compressor failure

5.3003.21a

Desired Outcome:
Air flow is properly tested

Specification(s):
System will be checked for existence of specified system components

Objective(s):
Confirm installed system

Become familiar with system components

Verify system readiness for testing

5.3003.21b

Desired Outcome:
Air flow is properly tested

Specification(s):
Measurement equipment will be selected so that design value will be within the accurate range of the measuring device

Equipment will be capable of accurately measuring +/- 10% in general case

Measurement equipment will be calibrated and field checked in accordance with manufacturer recommendations

Objective(s):
Ensure accurate measurements of airflow rates

5.3003.21c

Desired Outcome:
Air flow is properly tested

Specification(s):
Equipment testing will check for:

- Proper operation (programmed schedule/sequence of operation)
- Proper rotation

All measured values will be recorded and compared against design specifications

Fan flow will be adjusted to meet design specification

Objective(s):
Verify performance of air handler system

5.3003.21d

Desired Outcome:
Air flow is properly tested

Specification(s):
Total system airflow will be measured in accordance with ANSI/ACCA Standard 5 or ANSI/ASHRAE Standard 111 and adjusted to meet design requirements

Examples of acceptable methods include the following:

- Temperature rise test
- Air flow plate (e.g., TrueFlow® Air Handler Flow Meter)
- Fan pressurization device (e.g., Duct Blaster®, DuctTester)
- Hot wire anemometer

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21e

Desired Outcome:
Air flow is properly tested

Specification(s):
External static pressure will be in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21f

Desired Outcome:
Air flow is properly tested

Specification(s):
Pressure drop across cooling coils will be in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21g

Desired Outcome:
Air flow is properly tested

Specification(s):
Pressure drop across filter will be in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21h

Desired Outcome:
Air flow is properly tested

Specification(s):
Airflow will be measured in accordance with ANSI/ACCA Standard 5 or ANSI/ASHRAE Standard 111 and adjusted to meet design requirements

Examples of acceptable methods include the following:

- Air flow will be measured at each register and compared to load calculation to ensure proper air flow delivery
- Adjustments will be made to fan speed, dampers, and registers until design specifications are met

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21i

Desired Outcome:
Air flow is properly tested

Specification(s):
Supply wet bulb and dry bulb air temperatures will be recorded

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21j

Desired Outcome:
Air flow is properly tested

Specification(s):
Return wet bulb and dry bulb air temperatures will be recorded

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21k

Desired Outcome:
Air flow is properly tested

Specification(s):
Temperature rise between the supply and return will be in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates efficiently

Ensure equipment provides comfort

Ensure equipment operates safely

Ensure equipment is durable

5.3003.21l

Desired Outcome:
Air flow is properly tested

Specification(s):
Final air flow and/or pressure will be measured, confirmed, and recorded at air handler and registers

Airflow will be measured in accordance with ANSI/ACCA Standard 5 or ANSI/ASHRAE Standard 111 and adjusted to meet design requirements

Objective(s):
Provide acceptable thermal comfort, energy efficiency, and indoor air quality

5.3003.21m

Desired Outcome:
Air flow is properly tested

Specification(s):
Occupant/property manager will be:

- Instructed on proper operation and maintenance procedures
- Educated on value and need for recommissioning requirements
- Property manager will complete a 30-hour OSHA safety education course

Objective(s):
Ensure continued operation of equipment at design performance levels

5.3003.22a

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Measurement equipment will be selected so that design value will be within the accurate range of the measuring device

Equipment will be capable of accurately measuring +/- 10% in general case

Measurement equipment will be calibrated and field checked in accordance with manufacturer recommendations

Objective(s):
Ensure accurate measurements of combustion by-products

5.3003.22b

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Combustion analysis will be performed in accordance with manufacturer specifications and ANSI/ACCA Standard 5

Objective(s):
Ensure accurate measurements of combustion by-products

5.3003.22d

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Burner orifice(s) size will be in accordance with manufacturer specification

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22e

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Combustion air setting will be in accordance with manufacturer's recommendations and modified based on combustion analysis testing

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22f

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Measurement will be verified in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22h

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Once burner has run for five to ten minutes, perform a SSE test with a properly calibrated combustion analyzer

Measurement will be verified in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22i

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Net stack temperature will be measured and verified in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22j

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Measurement will be verified in accordance with industry manuals (e.g., Testo, Bacharach) and manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22k

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Excess air will be calculated and shown in accordance with industry manuals (e.g., Testo, Bacharach) and manufacturer specifications

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22l

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
CO in the undiluted flue gas will be less than level specified in the applicable subsection of ANSI Z21

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.24a

Desired Outcome:
Evaporative cooler evaluated and maintained as needed

Specification(s):
The following system elements will be assessed:

- Pump
- Pan
- Spider
- Float
- Damper
- Roof jack, roof support
- Water line
- Water valve
- Electrical
- Pads
- Motor
- Fan

Elements will be repaired or replaced as needed

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.24b

Desired Outcome:
Evaporative cooler evaluated and maintained as needed

Specification(s):
Calcium deposits will be removed

Pads will be replaced

Any additional repairs or replacements will be made as necessary

System will be drained at the end of the cooling season

Objective(s):
Ensure evaporative cooler functions properly

Ensure system is durable

Prevent freezing

5.3003.24c

Desired Outcome:
Evaporative cooler evaluated and maintained as needed

Specification(s):
A regular service schedule will be recommended to occupant

Issues regarding multiple systems running will be discussed with occupant

Objective(s):
Ensure occupant understands basic operation and importance of regular maintenance

5.3003.34a

Desired Outcome:
Natural gas and propane delivered safely and in sufficient amounts

Specification(s):
An approved pipe type in accordance with NFPA will be installed and supported

Manual gas shut off valve, union joint, and drip leg will be verified or installed

All work will be done by a licensed professional or qualified person

Objective(s):
Prevent corrosion

Deliver fuel to the system

Ensure material does not sag or leak

5.3003.34b

Desired Outcome:
Natural gas and propane delivered safely and in sufficient amounts

Specification(s):
Gas pipes (building main and equipment drops) will be installed for the total connected load of all appliances in accordance with NFPA

All work will be done by a licensed professional or qualified person

Objective(s):
Provide sufficient gas flow and pressure to all of the appliances

5.3003.34c

Desired Outcome:
Natural gas and propane delivered safely and in sufficient amounts

Specification(s):
Pipes will be sealed with an approved fastening process and sealant in accordance with manufacturer specifications

Gas lines will be leak free when tested with an electronic combustible gas leak detector and verified with bubble solution

Gas lines will be leak free when tested by local code-approved standing pressure test

All work will be done by a licensed professional, or qualified person

Objective(s):
Install gas lines with no leaks

5.3003.34d

Desired Outcome:
Natural gas and propane delivered safely and in sufficient amounts

Specification(s):
A secondary gas valve safety detector will be installed for propane piping installed below grade

All work will be done by a licensed professional or qualified person

Objective(s):
Detect accumulation of dangerous levels of propane in areas that are below grade

5.3003.35a

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Combustion supply/exhaust air opening will be in compliance with applicable NFPA standards or local code

Objective(s):
Exhaust combustion products to the outdoors

Ensure work does not damage building

Protect workers and occupants from injury

5.3003.35b

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Flue vent material will be selected to prevent flue gas freezing and/or corrosion (using double wall, where necessary)

Cost-effective materials will be used when appropriate and allowable

Objective(s):
Ensure durability of flue vent system

Ensure selected material is appropriate and cost-effective

5.3003.35c

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Venting systems will be installed considering proper material, pitch, common venting, chimney liner, clearance, total equivalent length, and termination in accordance with NFPA 54, 31, 211

Category I venting systems will be installed in accordance with NFPA 54/ANSI Z223.1

Category III and IV venting systems will be installed in accordance with the manufacturer specifications

Terminations will be located away from windows, doors, and walkways

Aesthetics and noise will be considered

Venting will be routed in the shortest and most direct path possible

Vent joints will be airtight and watertight

Objective(s):
Exhaust combustion products to the outdoors

Ensure work does not damage building

Protect workers and occupants from injury

5.3003.35d

Desired Outcome:
Combustion products are properly vented to the outdoors

Specification(s):
Existing vent system or chimney will be resized or relined in accordance with the applicable NFPA standard when one or more common vented appliances are removed

Objective(s):
Exhaust combustion products to the outdoors

Ensure work does not damage building

Protect workers and occupants from injury

5.3003.36a

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Duct material will be installed with an R-value compliant with code

An appropriate vapor retarder will be installed

Objective(s):
Prevent condensation on the outside of the ductwork

5.3003.36b

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Duct material will be selected that meets the following criteria:

- An insulation level compliant with code
- Permeability that prevents condensation
- Permeability that reduces heat loss or gain from the ductwork

Objective(s):
Prevent condensation on the outside of the ductwork

Reduce thermal loss or gain from the ductwork

5.3003.36c

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
When viable building cavities used as ductwork will be replaced with properly sized conventional duct material

When replacement is not an option, building cavities used as ductwork will be sealed when accessible

Objective(s):
Safeguard indoor environmental quality

Maximize airflow

Minimize energy use

5.3003.36d

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Ducts will be installed in accordance with the fire rating of local codes

Objective(s):
Prevent a fire hazard

5.3003.36e

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Interior wall penetrations for ductwork will be sealed with a durable sealant (e.g., caulk, silicone, foam)

Penetrations through fire walls and floors will be sealed with a fire-rated material

Objective(s):
Prevent a fire hazard

5.3003.36f

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Ductwork will be supported in a manner that does not constrict ductwork or duct insulation per SMACNA duct construction standards (ADC for flexible duct or NAIMA for fiberglass duct)

Objective(s):
Ensure ducts do not sag, bend, trap water, or experience diminished air flow

5.3003.36g

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Ducts will be routed such that service and repair to the building and its systems does not damage the ducts

Objective(s):
Protect equipment from damage

Ensure equipment operates as designed

5.3003.36h

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Flexible duct-to-metal connections will be fastened with tie bands using a tie band tensioning tool

Beaded collars will be installed for all sheet metal to flexible duct connections

Mastic will be applied to interior flex lining to metal connection

Manufacturer specifications will be followed

Objective(s):
Ensure duct connections are durable

5.3003.36i

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Metal-to-metal connections will be fastened with equally spaced mechanical fasteners

Gaps larger than 1/4" will be bridged with sheet metal

Joints will be sealed with mastic

Joints smaller than 1/4" will be sealed with NFPA 90A and B approved sealant

Objective(s):
Ensure duct connections are durable

5.3003.36j

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Duct board to metal connections will be fastened with mechanical fasteners

Joints and connections will be sealed with UL 181A listed tapes or mastics

Objective(s):
Ensure duct connections are durable

5.3003.36k

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Boots will be fastened to the building with mechanical fasteners

Connection will be sealed with mastic, caulk, or gaskets

Objective(s):
Ensure duct connections are durable

Properly seal the boots to minimize air leakage

5.3003.36l

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Terminations capable of delivering air with proper speed and throw of 80-120% of the farthest wall, floor, or ceiling will be selected

Selections will be based on ANSI/ACCA Manual T Air Distribution Basics

Objective(s):
Deliver and properly mix air in the building

5.3003.36m

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Filter bypasses will be eliminated

Airtight filter slot covers will be installed to prevent return air leakage in combustion appliance zone

Filters will be changed

Filters with high static pressure drops will be avoided

A visual inspection for excessive dust and debris will be performed, and ducts will be cleaned accordingly

Objective(s):
Protect equipment from dirt and debris

Allow for proper airflow

5.3003.36n

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Ductwork, filter, and other equipment will be installed so total external static pressure does not exceed manufacturer specifications

Objective(s):
Ensure equipment operates as designed

5.3003.36o

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Measured air flow per ton will meet manufacturer specifications

Airflow will be established in accordance with ANSI/ACCA 5– 2010—QI HVAC Quality Installation Specification and ASHRAE Standards

Objective(s):
Ensure equipment operates as designed

5.3003.36p

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Temperature rise will be measured, and the result will be in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

5.3003.36q

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Registers, grilles, and diffusers will be blocked, masked, or otherwise sealed with a durable material

Use of system will not be allowed during renovation or construction

Contractor and occupant will be educated on necessity of protecting the equipment

Objective(s):
Protect equipment and occupants from debris in the system

5.3003.36r

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
An appropriate means of pressure balancing will be installed (e.g., transfer grilles, jumper ducts, individual room returns)

Room-to-room pressure differences shall not exceed +/- 3 pascals with the air handler running

Objective(s):
Ensure system has unrestricted airflow between supplies and returns

Minimize infiltration and exfiltration caused by system

Prevent interference with safe operation of combustion appliances

5.3003.36s

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Total system leakage (including air handler) will not exceed 20% of designed system airflow (cubic feet per minute) when tested at 25 pascals

For partial duct system replacement or improvement, existing ductwork specification will be applied

Objective(s):
Minimize system air leakage

5.3003.36t

Desired Outcome:
The duct system safely supports peak operation of the equipment

Specification(s):
Accessible joints, cracks, seams, holes, and penetrations will be sealed

Objective(s):
Minimize system air leakage

5.3003.37a

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Mercury-based thermostats will be removed safely and disposed of in accordance with EPA regulations

Objective(s):
Protect workers and occupants from injury

Protect the environment from damage

5.3003.37b

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Existing controls will be removed in accordance with EPA lead-safe work rules

Objective(s):
Protect workers and occupants from injury

Protect environment from damage

5.3003.37c

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Penetrations for control wiring will be sealed with a durable sealant (e.g., caulk, silicone, foam)

Penetrations through fire walls will be sealed with a fire-rated material

Objective(s):
Ensure controls operate as designed

Minimize infiltration and exfiltration from building

Prevent pest infestation

5.3003.37d

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
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, warm/cold walls, and drafts

Objective(s):
Ensure controls operate as designed

5.3003.37e

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Total airflow will be measured in accordance with ANSI/ACCA Standard 5 or ANSI/ASHRAE Standard 111 and adjusted to meet design requirements

Objective(s):
Ensure the equipment has correct air flow

5.3003.37f

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
A thermostat with equipment supplementary heat lockout that can interface with an outdoor temperature sensor will be selected

Objective(s):
Maximize the heating output of the compressor (heat pump mode eliminates supplementary heat) to achieve energy efficiency

5.3003.37g

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Thermal and economic balance point will be calculated and an optimum thermal balance point will be selected in accordance with ANSI/ACCA Manual S

The design of variable refrigerant flow systems are permitted to not require supplementary heat

Objective(s):
Maximize the heating output

Maximize the heating output of the compressor (heat pump mode eliminates supplementary heat) to achieve energy efficiency

5.3003.37h

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
An outdoor temperature sensor will be installed in accordance with manufacturer specifications

Objective(s):
Ensure equipment operates as designed

5.3003.37i

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Supplementary heat will be wired onto second stage heating terminal (W2)

Objective(s):
Do not operate supplementary heat in stage one heating

5.3003.37j

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
The installer options will be set to match the thermostat to the equipment and control board settings

Objective(s):
Ensure equipment operates as designed

5.3003.37k

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
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)

Objective(s):
Maximize the transfer of the heat without adversely affecting indoor humidity levels

5.3003.37l

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Humidistat will be installed to accurately reflect humidity of the zone in which it is installed

Objective(s):
Ensure controls operate as designed

5.3003.37m

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
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

Objective(s):
Ensure equipment and controls operate as designed

Provide comfort throughout building

5.3003.37n

Desired Outcome:
Heating and cooling controls installed and set properly

Specification(s):
Wiring and sensors will be installed in accordance with manufacturer specifications

Objective(s):
Educate building manager to monitor and control the entire building

5.3003.38a

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
Connections in condensate drain system will be watertight

Objective(s):
Ensure condensate drain connection does not leak

5.3003.38b

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
Condensate drain lines will be insulated with a minimum 1" of insulation with a vapor retarder when there is potential for condensation or freezing on the drain line

Objective(s):
Ensure condensate drain connections do not leak

5.3003.38c

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
Secondary drain pan and float switch will be installed when overflow could damage finished surfaces or up flow systems will have a float switch installed in the primary condensate drain when overflow could damage finished surfaces

Float switch will be interlocked with the cooling circuit and will break the circuit when a leak occurs

Objective(s):
Ensure condensate drain connections do not leak

5.3003.38d

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
Condensate drain pumps will be installed when condensate cannot be drained by gravity

Power source for pumps will be installed

Operation and drainage of pump will be verified

Objective(s):
Ensure condensate drain connections do not leak

5.3003.38e

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
Vents and traps will be installed on condensate drain lines, including condensing heating systems in accordance with manufacturer specifications

For combustion-heating equipment, trap supplied with the equipment will be used in accordance with manufacturer specifications

Objective(s):
Ensure condensate drain operates as designed

Ensure condensate drain does not leak

5.3003.38f

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
A secondary drain pan will be installed for all air conditioning, air handler, or evaporator coil installations where water damage may occur

The secondary pan will contain a drain, which will be ran separately from the primary condensate drain to a visible termination point

The secondary drain pan will be pitched toward the drain line to ensure that moisture is removed from the building

Objective(s):
Prevent water damage from a malfunctioning drain system

To alert building owner or maintenance staff that a problem exists

5.3003.38g

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
All secondary drain pans will have a water level detection device interlocked with the cooling control circuit that shuts down the unit when a leak occurs

Objective(s):
Prevent water from overflowing the pan and draining onto the ceiling below

5.3003.38h

Desired Outcome:
Equipment and condensate drain operate as designed

Specification(s):
Condensate drain will be terminated in accordance with local codes

Objective(s):
Ensure condensate does not leak into the building

Ensure condensate drain does not freeze

5.3088.2a

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Condensate line will be insulated

Verification of proper charge will be conducted when outdoor temperatures are suitable

Refrigerant charge evaluation will be done using proper evaluation techniques (subcooling/ superheat) depending on metering device in accordance with ANSI/ACCA Standard 5

Refrigerant will be weighed into heating, ventilation, and air-conditioning (HVAC) systems when outdoor temperatures do not facilitate accurate testing of system charge

Objective(s):
Prevent freezing

Ensure proper equipment operation

5.3088.2b

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Condensate line will be insulated

Verification of proper charge will be conducted when outdoor temperatures are suitable

Refrigerant charge evaluation will be done using proper evaluation techniques (subcooling/ superheat) depending on metering device in accordance with ANSI/ACCA Standard 5

Refrigerant will be weighed into HVAC systems when outdoor temperatures do not facilitate accurate testing of system charge

Objective(s):
Prevent freezing

Ensure proper equipment operation

5.3088.2c

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Refrigerant will be weighed into HVAC systems when outdoor temperatures do not facilitate accurate testing of system charge

Verification of proper charge will be conducted when outdoor temperatures are suitable

Refrigerant charge evaluation will be done using proper evaluation techniques (subcooling/ superheat) depending on metering device in accordance with ANSI/ACCA Standard 5

Heating and cooling refrigerant lines will be insulated

Objective(s):
Ensure proper equipment operation

Prevent energy loss and condensation

5.3088.2d

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Refrigerant will be weighed into HVAC systems when outdoor temperatures do not facilitate accurate testing of system charge

Verification of proper charge will be conducted when outdoor temperatures are suitable

Refrigerant charge evaluation will be done using proper evaluation techniques (subcooling/ superheat) depending on metering device in accordance with ANSI/ACCA Standard 5

Objective(s):
Ensure proper equipment operation

5.3088.2e

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Refrigerant will be weighed into HVAC systems when outdoor temperatures do not facilitate accurate testing of system charge

Verification of proper charge will be conducted when outdoor temperatures are suitable

Refrigerant charge evaluation will be done using proper evaluation techniques (subcooling/ superheat) depending on metering device in accordance with ANSI/ACCA Standard 5

Objective(s):
Ensure proper equipment operation

5.3088.2f

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Refrigerant will be weighed into HVAC systems when outdoor temperatures do not facilitate accurate testing of system charge

Verification of proper charge will be conducted when outdoor temperatures are suitable

Refrigerant charge evaluation will be done using proper evaluation techniques (subcooling/ superheat) depending on metering device in accordance with ANSI/ACCA Standard 5

Objective(s):
Ensure proper equipment operation

5.3102.2a

Desired Outcome:
Flue gases removed safely and cost-efficiently

Specification(s):
Flue vent material will be selected to prevent flue gas freezing and/or corrosion (double wall where necessary) in accordance with the appliance manufacturer's requirements

Objective(s):
Ensure the durability of flue vent system

Ensure selected material is appropriate and cost-effective

5.3102.2b

Desired Outcome:
Flue gases removed safely and cost-efficiently

Specification(s):
Termination will be located away from windows, doors, walkways, or any air intake opening in accordance with applicable codes and manufacturer's instructions

Aesthetics and noise should be considered

Objective(s):
Ensure vent termination does not create safety hazard

5.3102.2c

Desired Outcome:
Flue gases removed safely and cost-efficiently

Specification(s):
Venting will be routed in the shortest and most direct path possible in accordance with applicable codes and manufacturer's instructions

Objective(s):
Successfully remove flue gases and moisture

5.3102.2d

Desired Outcome:
Flue gases removed safely and cost-efficiently

Specification(s):
Vent joints will be airtight and watertight in accordance with applicable codes and manufacturer's instructions

Objective(s):
Ensure safe operation

5.3102.2e

Desired Outcome:
Flue gases removed safely and cost-efficiently

Specification(s):
Vent will be pitched back to the boiler for categories I, II, and III

Vent for category IV will be pitched in accordance with manufacturer specifications

Objective(s):
Ensure proper draft

Ensure proper condensate management

5.3102.14a

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Potential ACMs will be handled in accordance with SWS 2.0110.2 Potential Asbestos-Containing Materials

Objective(s):
Ensure a safe work environment

5.3102.14b

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Location of expansion tank and operational characteristics (system volume, operating temperature range, operating pressure range, and fluid type) will be used to determine size of tank

Objective(s):
Select an appropriately sized tank

5.3102.14c

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Nearest valves on either side of installation location will be closed

Objective(s):
Eliminate water supply to the installation location

5.3102.14d

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Tank will be connected to existing system piping in accordance with manufacturer specifications

Objective(s):
Properly install expansion tank

5.3102.14e

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Expansion tank will be pressurized in accordance with manufacturer specifications to the appropriate system operating pressure

System will be filled and air will be eliminated

Objective(s):
Pressurize the tank to the standard operating pressure

5.3102.14f

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Where insulation was removed, piping will be reinsulated with new insulation to IECC 2012 and ASHRAE 90.1-2010, at a minimum

Objective(s):
Reduce energy loss

Maintain safe surface temperature

5.3102.14g

Desired Outcome:
Accommodate the expansion and contraction of the system fluid

Specification(s):
Completed work will be reviewed with the building/property management team and operations staff

Building/property management team and operations staff will be educated on the safe and efficient operation and maintenance requirements of the installed item

Objective(s):
Ensure building/property management team and operations staff is informed of the safe, efficient operation and maintenance requirements of the installed item

5.3102.15a

Desired Outcome:
Allow for accommodation for the expansion and contraction of the system fluid

Specification(s):
Potential ACMs will be handled in accordance with SWS 2.0110.2 Potential Asbestos-Containing Materials

Objective(s):
Ensure a safe work environment

5.3102.15b

Desired Outcome:
Allow for accommodation for the expansion and contraction of the system fluid

Specification(s):
Expansion tank valve will be closed

Existing water will be drained from expansion tank

Objective(s):
Remove system pressure from expansion tank and drain tank

5.3102.15c

Desired Outcome:
Allow for accommodation for the expansion and contraction of the system fluid

Specification(s):
Expansion tank will be repressurized in accordance with manufacturer specification to appropriate system operating pressure

Expansion tank bladder will be replaced in accordance with manufacturer specifications or entire tank will be replaced if unable to maintain required air pressure

System will be refilled and air will be eliminated

Objective(s):
Pressurize the tank to standard operating pressure

5.3102.15d

Desired Outcome:
Allow for accommodation for the expansion and contraction of the system fluid

Specification(s):
Completed work will be reviewed with the building/property management team and operations staff

Building/property management team and operations staff will be educated on the safe and efficient operation and maintenance requirements of the installed item

Objective(s):
Ensure building/property management team and operations staff is informed of the safe, efficient operation and maintenance requirements of the installed item

5.3102.18a

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
All potential condensate collection (low) points in the flue system will be identified and adjusted to provide proper pitch as required by the manufacturer's requirements

All condensate piping will be pitched toward the drain (refer SWS 5.3102.2 Venting Sealed Combustion Appliance)

Objective(s):
Remove all flue gas condensation

Ensure that all potential points of condensation collection are drained

5.3102.18b

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Connections in condensate drain system will be watertight

Objective(s):
Ensure condensate drain connections do not leak

5.3102.18c

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
When approved by the local jurisdiction, 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

Objective(s):
Ensure condensate properly drains

5.3102.18d

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Vents and traps will be installed on condensate drain lines

Traps supplied with the equipment will be used in accordance with manufacturer specifications

Objective(s):
Ensure condensate drain operates as designed

Ensure condensate trap does not leak air

5.3102.18e

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Condensate drain will be terminated in accordance with local codes

Objective(s):
Ensure condensate does not leak to the building

Ensure condensate drain does not freeze

5.3102.18f

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Floor drains will be in working condition

Objective(s):
Ensure proper drainage of the room

5.3102.18g

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Boiler manufacturer-specified neutralization kit will be installed between the boiler and the drain in accordance with manufacturer specifications

Property manager/occupant will be educated on proper maintenance

Objective(s):
Neutralized flue gas condensate before it is discharged into a drain

Increase durability of equipment

5.3102.18h

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Piping material, located between boiler and neutralization kit, will be capable of withstanding acidic environments

Piping material, located after neutralization kit and before floor drain, will be hard piped to withstand crushing and kinking

Objective(s):
Ensure longevity of the piping

Protect piping

5.3102.18i

Desired Outcome:
Safe management of flue gas condensate

Specification(s):
Completed work will be reviewed with the building/property management team and operations staff

Building/property management team and operations staff will be educated on the safe and efficient operation and maintenance requirements of the installed item

Objective(s):
Ensure building/property management team and operations staff is informed of the safe, efficient operation and maintenance requirements of the installed item

5.3102.28a

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Inspections will be made based on ANSI/ASHRAE/ACCA Standard 180-2008 Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems for commercial applications and ANSI/ACCA 4 Maintenance of Residential HVAC Systems for residential applications

Examples of items to be addressed are as follows:

- A review of site conditions and verification of efficiency performance condition of burner shall be evaluated
- Safety issues will be addressed

Objective(s):
Determine if boiler replacement is needed

Confirm feasibility of the scope of work

Improve safety and efficiency

5.3102.28b

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Inspections will be made based on ANSI/ASHRAE/ACCA Standard 180-2008 Standard Practice for Inspection and Maintenance of Commercial Building HVAC Systems for commercial applications and ANSI/ACCA 4 Maintenance of Residential HVAC Systems for residential applications

Examples of items to be addressed are as follows:

- Combustion air intake dampers
- Fuel/air modulating
- Electronic ignition
- Linkage-less fuel/air control
- Oxygen trim
- Variable frequency drives
- Low nitrogen oxide (replacement burner)
- High turndown ratio burner

If not present or in scope of work, above upgrades will be considered

Short cycling will be eliminated

Objective(s):
Improve safety and efficiency

Identify opportunities for upgrades

5.3102.28c

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Undiluted flue gases will be checked with a calibrated flue gas analyzer in accordance with accepted protocol

If combustion is not occurring safely or with maximum efficiency, diagnostics and adjustments will be done in accordance with work order specifications

Fuel/air ratio will be adjusted to meet specified performance over a range of firing rates, when applicable

Objective(s):
Confirm that combustion occurs safely with maximum efficiency

5.3102.28d

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Contractor will demonstrate the burner modulates over the specified operating range (steam pressure and water temperature) and firing rates

Combustion efficiency will match work order specifications over specified firing rates or turndown ratios

Objective(s):
Engage and optimize modulation

5.3102.28e

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Building operations staff will be educated on burner capabilities and ongoing maintenance

Objective(s):
Maintain optimal performance

5.3102.28f

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Startup will be performed by "qualified person," as defined in NFPA 31, 3.3.50

Objective(s):
Ensure proper installation and setup

5.3102.28g

Desired Outcome:
Efficiencies safely maximized

Specification(s):
Where applicable, dual fuel systems will be recommended when replacing oil-fired burners

Dual fuel switch control operation will be confirmed

Objective(s):
Ensure fuel flexibility

5.3102.30a

Desired Outcome:
Install Energy Management Systems

Specification(s):
Materials containing asbestos will be handled in accordance with SWS 2.0110.2 Potential Asbestos-Containing Materials

Hazardous materials will be handled in accordance with applicable local laws and codes before work begins

Objective(s):
Ensure safe environment and work place

5.3102.30b

Desired Outcome:
Install Energy Management Systems

Specification(s):
Verify site conditions to assess whether the specified control system is compatible with the systems it will monitor and manage

Existing electrical service will be verified for adequacy

If electrical service is inadequate, the engineer will be notified and will only proceed after the engineer's approval and guidance of proper actions

Objective(s):
Determine if specified control can be installed at the site and is the correct control system for the site

5.3102.30c

Desired Outcome:
Install Energy Management Systems

Specification(s):
Control panel will be mounted at a safe location to prevent damage to the control panel from water and/or excessive heat

Location will be easily accessible and in close proximity of the door

At minimum, the following sensors will be installed (all sensor wiring will be in metal conduit; all conduits will be secured to wall or metal strut or other acceptable surfaces):

- Outside air temperature sensor
- Stack temperature
- Domestic hot water supply water temperature sensor
- Apartment space temperature (minimum 25% of the residential units)
- Boiler water temperature sensor
- New make-up water meter
- Boiler pressure sensor (steam boiler only)

Outside air temperature sensor will be installed on the building exterior, 10 feet above grade, 4" away from the wall, on the north façade, and in shade; the wall penetration made to run the conduit will be sealed airtight with fire-rated material in accordance with applicable codes; sensor will be wired to the control panel

Additional sensors and control points will be installed as required by the manufacturer to optimize system operation

Control panel will be mounted on the wall, and all connected sensors will be wired to the control panel in accordance with manufacturer specifications

Control panel will be energized, and all sensors will be checked for proper accuracy and communication

Objective(s):
Ensure the control is installed to achieve optimized savings and comfort

5.3102.30d

Desired Outcome:
Install Energy Management Systems

Specification(s):
Control panel will be exercised, sensors will be calibrated, remote communication will be confirmed, alarms will be set and tested, and entire system will be commissioned

A complete installation and operations and maintenance manual will be provided to the client

Objective(s):
Confirm system capabilities and functionalities

5.3102.30e

Desired Outcome:
Install Energy Management Systems

Specification(s):
Occupant will be involved in the initial programming of the control, control set points, remote login, monitoring, and control adjustment, and educated on common settings and programming

Objective(s):
Educate client on best use

5.3102.37a

Desired Outcome:
Thermostat replaced when appropriate

Specification(s):
Thermostats will be visually located

Replacement will be recommended if a digital, programmable thermostat is not present

(Note: High mass, radiant systems may or may not benefit from programmable thermostats)

Objective(s):
Determine if existing thermostats need to be replaced

5.3102.37b

Desired Outcome:
Thermostat replaced when appropriate

Specification(s):
Thermostats containing mercury will be identified and disposed of in accordance with EPA guidance

Objective(s):
Protect workers and occupants from mercury exposure

5.3102.37c

Desired Outcome:
Thermostat replaced when appropriate

Specification(s):
Location for new thermostat will be determined in accordance with applicable codes and manufacturer's instructions

The new thermostat will be located such that it is easily accessible for control without any need for step stool or ladder to comply with Federal Fair Housing Act

Compatibility of the existing system with new thermostat will be verified (e.g., voltage, wiring, condition, location)

New thermostat will be installed

Objective(s):
Achieve comfort and energy savings for the occupant

5.3102.37d

Desired Outcome:
Thermostat replaced when appropriate

Specification(s):
Heating system will be re-energized and cycled

Thermostat will be programmed to occupant's lifestyle choices

Objective(s):
Ensure safe and efficient operation

5.3102.37e

Desired Outcome:
Thermostat replaced when appropriate

Specification(s):
Removed thermostats will be disposed of in accordance with EPA guidelines

Objective(s):
Prevent mercury from entering the environment

5.3102.37f

Desired Outcome:
Thermostat replaced when appropriate

Specification(s):
Building/property management team and operations staff and occupants will be involved in the initial programming of thermostat and educated on common settings and programming

On new installs, building/property management team and operations staff and occupants will be encouraged to save the manual and keep it accessible

Objective(s):
Educate building/property management team and operations staff and occupant on best use

5.3102.38a

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
When full commissioning is warranted, the commissioning team will be identified, and include commissioning agent, owner, property manager, contractor, engineer, architect, and building operations staff

Scope of commissioning will be confirmed

Roles and responsibilities will be identified

For individual residential or light commercial installations, documentation, owner education, and training will be in accordance with procedures in ANSI/ACCA Standard 5

Objective(s):
Assign commissioning responsibilities

5.3102.38b

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Owner's project requirements and basis of design will be reviewed with commissioning team

Site assessment will be reviewed and verified

Objective(s):
Orient the installation contractor to the intent and design of the project

Orient the property manager to the intent and design of the project

5.3102.38c

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Control sequence will be reviewed with manufacturer, installation contractor, and building operations staff

Work scope and design elements will be reviewed to include at a minimum:

- Control sequence
- Instrumentation
- Coordination of controls and equipment

Objective(s):
Ensure specified design is optimal for project

5.3102.38d

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Submittals will be supplied to the commissioning team for review and approval

Objective(s):
Ensure specified materials are included for the project

5.3102.38e

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Checklist will be created and approved by commissioning agent

Checklist will be completed and submitted to commissioning team by installation contractor

Objective(s):
Verify installation and startup

5.3102.38f

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Functional test procedure will be developed and approved

Functional testing will be performed by a contractor and witnessed by commissioning agent

Functional test will demonstrate sequence of control

Contractor will correct any failures and retest

Objective(s):
Ensure equipment/materials are working together in proper sequence and coordination

Follow specified sequence of control

5.3102.38g

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Operations and maintenance manual will be customized for project by installation contractor

Operations and maintenance manual will be submitted to commissioning agent for approval

Multiple copies of operations and maintenance manual will be provided to property manager

Commissioning process binder will be provided to property manager by commissioning agent

Objective(s):
Provide documentation for optimal operation and maintenance of equipment

5.3102.38h

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Contractor will be responsible for conducting/providing onsite education to the building operations staff on the operation and maintenance of the installed equipment

Building operations staff education will be witnessed by designated commissioning team members

Objective(s):
Educate building operations staff to operate and maintain the system for optimal performance

5.3102.38i

Desired Outcome:
Control quality and optimize performance and safety

Specification(s):
Inspection will occur (approximately 9 months after install or final equipment acceptance) before the warranty ends

Contractor will resolve any outstanding issues before warranty ends

Objective(s):
Resolve equipment issues before warranty ends

5.3014.12d

Desired Outcome:
System does not leak

Specification(s):
Isolated section will be reconnected and repressurized

System will be filled and air will be eliminated from system

Repaired pipe, fitting, or device will be visually inspected

Objective(s):
Confirm system is safe for operation

5.3302.1a

Desired Outcome:
Energy used for air conditioning reduced

Specification(s):
Physical size of through-wall opening will be determined

Unit and electrical receptacle will meet requirements of NFPA 70 Article 440

Work order will be evaluated against site circumstances

Objective(s):
Determine and ensure appropriate device and location

5.3302.1b

Desired Outcome:
Energy used for air conditioning reduced

Specification(s):
Unit will match available voltage and not exceed current available voltage at the existing electrical outlet

Replacement unit will provide same or better functionality than existing unit, but smaller duty unit will be provided if existing is oversized

Replacement unit will be ENERGY STAR® qualified with Energy Saver Mode or better

Units with R22 refrigerant will not be used

Objective(s):
Ensure proper device function

Avoid adding additional load

Reduce energy use

Protect the environment

5.3302.1c

Desired Outcome:
Energy used for air conditioning reduced

Specification(s):
Extension cord will not be used (NFPA 70 Article 440)

Where applicable unit controls and thermostat shall comply with the operable parts provisions of ICC A117.1 when the dwelling unit is required to be accessible per ADA

Unit will be self-supporting or permanently installed

Perimeter of unit will be sealed with a durable material (ASTM C1193)

Egress will be addressed to be in accordance with ANSI/NFPA 101 and local laws

Objective(s):
Ensure integrity of building envelope

Ensure occupant comfort

Ensure occupant safety

Ensure continued savings

5.3302.1d

Desired Outcome:
Energy used for air conditioning reduced

Specification(s):
Units replaced will be recycled or disposed of in accordance with local ordinances

Refrigerant will be handled in accordance with Section 608 of Clean Air Act of 1990 and local ordinances

Objective(s):
Prevent reuse of inefficient equipment and components

Protect the environment

5.3302.1e

Desired Outcome:
Energy used for air conditioning reduced

Specification(s):
Building operations staff will be educated on strategies for winterizing cooling-only equipment

Window units will be removed and stored during long periods of cold and snow

When unit is not in use, it will be closed and covered in accordance with Envelope Wall Penetration Standard Work Specification (SWS, section 3.1102.1

Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):
Prevent energy loss

Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

5.3302.1f

Desired Outcome:
Energy used for air conditioning reduced

Specification(s):
Occupants will be provided with a manual and educated of new unit benefits

Education will be provided by building operations staff

Objective(s):
Educate occupants about new controls and benefits

Ensure continued savings

6.6004.2a

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Specifications will be field verified as appropriate to site conditions by installer

Objective(s):
Ensure appropriate design for installation

6.6004.2b

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
ASHRAE 62.2 and local code requirements should be followed for identifying design airflow rates within apartment dwelling units.

All other areas will follow local code requirements and/or ASHRAE 62.1-2010 requirements

Air flows will be measured in accordance with ANSI/ACCA Standard 5 or ANSI/ASHRAE Standard 111 and adjusted to meet design requirements

Objective(s):
Exhaust sufficient air from desired locations to the outdoors

6.6004.2c

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Outlet will be terminated outside of the building shell and will have a louvered cover and bird screen

Minimum distance of exhaust outlet from any doors, windows, or outside air intakes shall be in conformance with the applicable building code

Outlet will be sealed to prevent water intrusion and exhaust air leakage into building cavities

Objective(s):
Direct exhaust to the outdoors and prevent re-entry

Prevent entry of weather and pests into building shell

Ensure occupant health and safety

6.6004.2d

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Wiring will be installed by a properly licensed contractor

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Refer to NFPA 70: National Electrical Code for installation requirements

Objective(s):
Prevent an electrical hazard

6.6004.2e

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Fan and service switch will be accessible for maintenance

Objective(s):
Ensure unit and service switch are accessible for maintenance or replacement

6.6004.2f

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
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 and local code requirements (in terms of seismic restraints, vibration, and noise control)

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

Objective(s):
Ensure short duct runs to achieve optimum air flows

Ensure mounting is installed securely

Ensure fan housing or building framing does not shake, rattle, or hum when operating

Minimize noise

6.6004.2g

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
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)

Objective(s):
Prevent reverse air flow when the system is off

Prevent spread of contaminants between rooms

6.6004.2h

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
All individual intake ducts will be combined on the intake side of fan (e.g., Y-fitting, T-fitting, collector box)

Objective(s):
Exhaust air from desired locations to the outdoors

6.6004.2i

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Ducts will be connected and sealed to applicable intakes, collector box, fan, and termination fitting

Ducts will be connected and sealed in accordance with the applicable code adopted by the jurisdiction

Objective(s):
Exhaust air from desired locations to the outdoors

Preserve integrity of the duct system and building envelope

6.6004.2j

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
All components outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local codes

Objective(s):
Preserve integrity of the duct system

Prevent condensation in ductwork

Prevent heat loss

6.6004.2k

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Register boot will be sealed to interior surfaces with sealants compatible to their intended surfaces

Sealants will be continuous and meet fire barrier specifications

Boots will be connected and sealed in accordance with the applicable code adopted by the jurisdiction

Objective(s):
Prevent air leakage around boot

Ensure a permanent seal to the building air barrier

Prevent a fire hazard

6.6004.2l

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Walls, ceilings, and floors will be sealed to separate any occupied space from any unconditioned spaces and adjacent dwelling units

Refer to ASHRAE 62.2-2010 Section 6.1

Objective(s):
Ensure occupant health and safety

Prevent air leakage into the building from other spaces (e.g., adjacent dwelling units, garages, unconditioned crawl spaces, unconditioned attics)

6.6004.2m

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Air flows will be measured and adjusted to match to the design specification

Objective(s):
Achieve the desired air flows to and from the desired locations

6.6004.2n

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Objective(s):
Ensure safe operation of combustion appliances

6.6004.2o

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Fire dampers must be accessible for inspection and/or testing by the local authorities; if fire dampers are not accessible from a grill or register, an access door in the ductwork is required

Sealing activities will not interfere with the operation of fire dampers, balancing dampers, or backdraft dampers

Type B fire dampers will be used as required by fire code

Objective(s):
Ensure access to fire dampers for safe operation

Minimize static pressure

Maximize air flow

6.6004.2p

Desired Outcome:
Multiport fan system installed to provide required ventilation

Specification(s):
Occupant/property manager will be educated on purpose and value of system

Property manager will be instructed on all maintenance procedures

Objective(s):
Ensure occupant health and safety

Preserve integrity of system

6.6005.4a

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Specifications will be field verified as appropriate to site conditions by installer

Objective(s):
Ensure appropriate design for installation

6.6005.4b

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Wiring will be installed by a properly licensed contractor

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Refer to NFPA 70: National Electrical Code for installation requirements

Objective(s):
Prevent an electrical hazard

6.6005.4c

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Fans installed in range hoods over cooking appliances will be designed per Home Ventilation Institute 2100 specifications

Air flow rate will be a minimum of 100 cubic feet per minute (CFM)

Objective(s):
Provide adequate ventilation to remove odors and contaminants

6.6005.4d

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Kitchen range fans will be vented directly to the outside

Recirculating fans will not be used as a ventilating device

Objective(s):
Remove odors and cooking contaminants from the building

Preserve integrity of building envelope

6.6005.4e

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Kitchen range fans will be ducted directly to the outdoors

As short a run as practical of smooth wall metal duct will be used, following manufacturer specifications and IMC 2009 505

Ducting will be connected and sealed as described in exhaust duct details SWS 6.6004.1 Central/ Common Exhaust Fan Serving Multiple Dwelling Units via Common Duct(s) and Dwelling Unit Brances and SWS 6.6004.2 Individual Exhaust Fan Serving Multiple Rooms Within a Single Dwelling Unit (All 3 Building Types)

Objective(s):
Preserve integrity of building envelope

Effectively move air from range to the outdoors

6.6005.4f

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Termination fitting will be installed, including a backdraft damper, as described in termination fitting detail

Outlet will be terminated outside of the building shell and will have a louvered cover and bird screen

Minimum distance of exhaust outlets installed new from any doors or operable windows or outside air intakes will meet local code requirements or specifications of ASHRAE 62.1 Table 5-1 requirements

Outlet will be sealed to prevent water and air intrusion

Objective(s):
Ensure safe operation of combustion appliances

Ensure occupant health and safety

Direct exhaust to the outdoors and prevent re-entry

Prevent entry of weather and pests into building shell

6.6005.4g

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Makeup air will be provided for kitchen range fans exhausting more than 400 CFM

Objective(s):
Ensure safe operation of combustion appliances

Minimize air leakage between dwelling units

Ensure occupant health and safety

6.6005.4h

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Exhaust flow rates will be measured and documented to meet design requirements

Objective(s):
Ensure the performance of the ventilation system

Ensure occupant health and safety

6.6005.4i

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Pressure effects caused by fans will be assessed and corrected when found outside of combustion safety standards

Objective(s):
Ensure safe operation of combustion appliances

Ensure occupant health and safety

6.6005.4j

Desired Outcome:
Kitchen range fan installed to specification

Specification(s):
Occupant/property manager will be instructed to keep grease filters and termination fitting clean

Objective(s):
Effectively move air from kitchen range to the outdoors

6.6088.1a

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Ventilation terminations will either have no backflow dampers or will use backflow dampers that resist freezing

Soffit vents that contain a ventilation exhaust termination will be sealed within 6' of the termination

Objective(s):
Avoid ventilation flapper freezing

Prevent exhaust moisture from entering the attic

6.6088.1b

Desired Outcome:
Regional climatic variables are taken into consideration

Specification(s):
Exhaust ventilation will be terminated at the roof, gable end, or wall

Objective(s):
Prevent exhaust moisture from entering the attic

6.6102.6a

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

Specification(s):
Holes cut to accommodate the terminal fittings should be no more than 1/8" larger than the fitting itself

Objective(s):
Ensure a weather tight installation

6.6102.6b

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

Specification(s):
Intake fitting will have integrated collar at least the same diameter as the duct

The fitting will be appropriate for regional weather conditions and installation location on exterior of building

Objective(s):
Effectively draw the required volume of air from outside

Preserve integrity of the building envelope

Ensure durable installation

6.6102.6c

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

Specification(s):
Intake fitting will be labeled "ventilation air intake"

Occupant will be instructed to keep yard debris and other contaminants clear of the intake

Objective(s):
Ensure unrestricted air flow

6.6102.6d

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

Specification(s):
The damper will be installed to open in the direction of the desired flow

Damper will close when system is off

Objective(s):
Ensure unrestricted air flow

6.6102.6e

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

Specification(s):
Duct to intake fitting will be connected and sealed in accordance with supply duct detail

Ensure fasteners do not inhibit intake damper operation

Objective(s):
Preserve integrity of the building envelope

Ensure a weather tight and durable intake installation

Ensure unrestricted air flow

6.6102.6f

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

Specification(s):
Exterior termination fitting will be flashed or weather sealed

Water will be directed away from penetration

Installation will not inhibit damper operation

Weatherproofing will be in accordance with manufacturer specifications

Objective(s):
Preserve integrity of the building envelope

Ensure a weather tight and durable intake installation

Ensure unrestricted air flow

6.6102.6g

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

Specification(s):
Screen material no less than 1/4" and no greater than 1/2" hole size in any direction will be used

Screen will be installed so it does not inhibit intake damper operation

Objective(s):
Prevent pest entry

Ensure unrestricted air flow

6.6102.6h

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

Specification(s):
Intake will be installed in accordance with all applicable code requirements and/or the most current version of ASHRAE 62.2

Objective(s):
Prevent contaminants from entering building

Ensure unrestricted air flow

6.6202.4a

Desired Outcome:
Fan controls support ventilation strategy

Specification(s):
Specifications will be field verified as appropriate to site conditions by installer

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
- Any switch for ventilation system will be labeled

Objective(s):
Deliver intended air exchange

Ensure fan controls meet intended ventilation strategy

6.6202.4b

Desired Outcome:
Fan controls support ventilation strategy

Specification(s):
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

Objective(s):
Deliver intended air exchange

Ensure fan controls meet intended ventilation strategy

6.6202.4c

Desired Outcome:
Fan controls support ventilation strategy

Specification(s):
Wiring will be installed by a properly licensed contractor

Wiring will be installed in accordance with original equipment manufacturer specifications, and local and national electrical and mechanical codes

Refer to NFPA 70: National Electrical Code for installation requirements.

Objective(s):
Prevent an electrical hazard

Ensure fan controls meet intended ventilation strategy

6.6202.4d

Desired Outcome:
Fan controls support ventilation strategy

Specification(s):
Manual override will be present on all controls

Occupancy sensor and/or humidistat will be calibrated and commissioned effectively, and on a maintenance schedule

Manufacturer specifications will be followed

Objective(s):
Allow occupant control

Ensure fan controls meet intended ventilation strategy

Maintain performance of control device

6.6202.4e

Desired Outcome:
Fan controls support ventilation strategy

Specification(s):
Multispeed or variable frequency drive fan will be required

Sensors will be calibrated and commissioned effectively, and on a maintenance schedule

Manufacturer specifications will be followed

Objective(s):
Ensure fan controls meet intended ventilation strategy

Maintain performance of control device

6.6202.4f

Desired Outcome:
Fan controls support ventilation strategy

Specification(s):
When fan controls are present and controlled by occupant, a system operation guide designed for occupants (nonprofessionals) will be provided to explain how and why to operate system

Every six months, maintenance staff will verify timer systems are in place and are operating properly

Objective(s):
Educate occupants about system operation and importance

Deliver intended air exchange

7.8001.3a

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Unit and electrical receptacle will meet requirements of NFPA 70 Article 440

Objective(s):
Determine and ensure appropriate device and location

7.8001.3b

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Appliance shall be ENERGY STAR® rated

Appliance will fit in the available space without blocking access to light switches, cabinets, etc.

Appliance will carry a minimum 1-year warranty, which will provide a replacement appliance if repeated issues relating to health, safety, or performance occur

Objective(s):
Reduce energy use

Ensure device functions properly

Ensure product safety

Ensure occupant satisfaction

7.8001.3c

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Appliance will be installed in accordance with manufacturer specifications and local codes

Where applicable, appliance shall be accessible to the disabled as required by the Federal Fair Housing Act and ICC A117.1; the appliance shall not reduce required maneuvering clearances in the kitchen to less than that permitted by the AHJ

Any penetrations to the exterior created by the installation of the appliance will be sealed

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

Objective(s):
Ensure worker safety

Ensure occupant safety

Ensure continued savings

Achieve intended appliance function

Preserve food at low energy use

7.8001.3d

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Confirm appliance is operating in accordance with manufacturer specifications indicated in operation and maintenance manuals

Objective(s):
Ensure occupant satisfaction

Ensure occupant safety

7.8001.3e

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Appliances replaced by new units will be recycled or disposed of properly

Appliances infested with pests will be enclosed before moving

Objective(s):
Protect the environment

Prevent the reuse of inefficient components

7.8001.3f

Desired Outcome:
Energy efficient appliance installed

Specification(s):
All OSHA standard practices will be followed

Objective(s):
Ensure worker safety

Ensure occupant safety

7.8001.3g

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Warranty information, operation manuals, and installer contact information will be provided to building operations staff

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8001.3h

Desired Outcome:
Energy efficient appliance installed

Specification(s):
Specific information on the proper maintenance of the equipment will be provided to the occupant

Objective(s):
Educate occupants about appliance and benefits

Ensure continued savings

7.8003.11a

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be provided by lighting professional

Work order will be evaluated against site circumstances

Objective(s):
Determine and ensure appropriate device and location

7.8003.11b

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lamps will be compatible with existing fixtures

Lamps will meet the appropriate nationally recognized product standard (UL 542, UL 1570)

Outdoor lamps will be suitable for local climate conditions and in accordance with ANSI/UL product standards

Screw base lamp replacements will be ENERGY STAR® qualified or exceed EISA 2014 standard levels by at least 20%

Compact fluorescent lamps and light emitting diode lamps will be ENERGY STAR qualified

Linear fluorescent lamps will not be replaced with a T12, and T8 lamps will be minimum standard installed

Living space lamps will be a correlated color temperature of less than 3000 kelvin

Vandal-proof pin-based lamps will be used, if appropriate

Objective(s):
Reduce energy use

Ensure device functions properly

Ensure product safety

Ensure occupant satisfaction

7.8003.11c

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixture will be de-energized before beginning work

Worker will follow appropriate lockout procedures in accordance with OSHA 1910 Subpart S and ANSI/NFPA 70E

Lamps will be installed in accordance with manufacturer specifications

If fixture is broken, worker will refer to SWS 7.8003.14 Fixture Replacement

Lens and reflector will be cleaned

Objective(s):
Ensure worker safety

Ensure occupant safety

Ensure continued savings

Optimize fixture performance

7.8003.11d

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Relamping will be tested to meet IESNA protocol for appropriate light levels for certain tasks and emergency levels, as required by the applicable code

Lamps will not impact required egress lighting, as required by ANSI/NFPA 101

Objective(s):
Meet target light levels

Ensure occupant satisfaction

Ensure occupant safety

7.8003.11e

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lamps will be disposed of in accordance with EPA guidelines, local ordinances, or manufacturer specifications

Objective(s):
Protect the environment

Prevent the reuse of inefficient components

7.8003.11f

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Broken lamps containing mercury will be cleaned in accordance with EPA guidelines

Objective(s):
Ensure worker safety

Ensure occupant safety

7.8003.11g

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Building operations staff will be provided with warranty information, product specification, and installer contact information

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.11h

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Occupants will be educated of new lamp type and benefits

Occupant will be provided with lamp disposal procedure, as determined by building operations staff

If lamps containing mercury are used, occupants will be provided with lamp disposal procedure in accordance with EPA guidelines

Education will be provided by building operations staff

Objective(s):
Educate occupants about new lamps and benefits

Ensure continued savings

Protect the environment

Ensure occupant safety

7.8101.2a

Desired Outcome:
Safe and reliable hot water delivery system that meets the needs of the occupant/building management/building operations staff at the lowest possible life-cycle cost

Specification(s):
Work area will be dry

Care will be taken not to damage existing plumbing fixtures, finishes, and surroundings

Unusual pressure conditions will be noted and communicated to property manager (e.g., high, low, fluctuating)

Existing showerhead or aerator will be removed

Objective(s):
Ensure work area is safe

Prevent water damage to living unit

7.8101.2b

Desired Outcome:
Safe and reliable hot water delivery system that meets the needs of the occupant/building management/building operations staff at the lowest possible life-cycle cost

Specification(s):
Low-flow showerheads or aerators will be installed using a non-hardening thread sealant

Temperature-protected shutoff valves will be used

Showerheads with shut off valves will not be installed in buildings with central water heating systems

Objective(s):
Ensure safe and quality installation

Eliminate crossover

7.8101.2c

Desired Outcome:
Safe and reliable hot water delivery system that meets the needs of the occupant/building management/building operations staff at the lowest possible life-cycle cost

Specification(s):
Proper function at the fixture will be verified by turning water on to full flow

Notification should be given to tenants informing them not to remove low flow showerheads to maintain energy efficiency

Objective(s):
Verify the new end-use device is operating properly

7.8102.4a

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

Specification(s):
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 decommissioning and replacement (occupant is responsible for abatement or remediation)

Objective(s):
Remediate health hazards using EPA-certified contractors

7.8102.4b

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

Specification(s):
Accepted industry procedures and practices will be followed to:

- Remove old water heater and associated components
- Seal any unused chimney openings
- Remove unused oil tank, lines, valves, and associated equipment

Objective(s):
Ensure worker and occupant safety

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

7.8102.4c

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

Specification(s):
New water heater and associated components will be installed in accordance with local codes, accepted industry standards and practices, 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

Where earthquake loads are applicable, supports shall be designed and installed for seismic forces

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply

Objective(s):
Ensure worker and occupant safety

Preserve integrity of the building

Remove old equipment in a timely and efficient manner

7.8102.4d

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

Specification(s):
An emergency drain pan with a minimum depth of 1 1/2" and sufficient size and shape to receive all dripping or condensate if leakage would cause damage to the space should be installed.

A 3/4" drain line or larger will be connected to tapping on pan and run to an indirect drain or pumped to daylight

Objective(s):
Collect and safely dispose of water escaping from the storage tank

7.8102.4e

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

Specification(s):
A stainless steel bladder expansion tank will be installed on the cold water side

Expansion tank shall be installed in accordance with the manufacturer's installation instructions

A direct connection with no valves between the storage tank and expansion tank will be installed

Objective(s):
Protect the storage tank from expansion

7.8102.4f

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

Specification(s):
Correct temperature and pressure relief valve will be installed in accordance with manufacturer specifications

Temperature and pressure relief valve discharge tube will terminate within 6" of the floor, or as prescribed by local code

Objective(s):
Discharge excessive energy (pressure or temperature) from storage tank to safe location

7.8102.4g

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

Specification(s):
Dielectric unions (dielectric insulator) will be installed in accordance with manufacturer specifications

Objective(s):
Break the stray voltage electrical circuit through the storage tank

7.8102.4h

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

Specification(s):
Backflow prevention will be installed in accordance with manufacturer specifications and all applicable codes

Backflow devices shall be tested by a certified backflow assembly tester at the time of installation, repair, or relocation, and not less than on an annual schedule or more often where required by local code

Objective(s):
Protect water supply from contamination

7.8102.4i

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

Specification(s):
If additional tank insulation is installed, it will be rated a minimum of R-11 and 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

Pipe insulation must remain 3" from gas water heater vent

Heat traps will be installed on the inlet and outlet piping where not provided by manufacturer

Objective(s):
Reduce standby loss from near tank piping and storage tank

Ensure insulation does not make contact with flue gas venting

7.8102.4j

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

Specification(s):
Combustion air shall be calculated and provided in conformance with the applicable code adopted by the jurisdiction and manufacturer's installation requirements

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply

In absence of a local code, combustion air shall be calculated and provided in conformance with any of the following: NFPA 54, IFGC, or NFPA 31

Objective(s):
Ensure adequate combustion air for operation of the appliance

7.8102.4k

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

Specification(s):
Combustion byproducts shall be removed in accordance with the applicable code adopted by the jurisdiction and manufacturer's installation requirements

In instances where conflicts occur between the code and the manufacturer's installation instructions, the more restrictive provisions shall apply

In absence of a local code, combustion byproducts shall be removed in accordance with any of the following: NFPA 54, IFGC, or NFPA 31

Objective(s):
Ensure the safety and durability of the venting system

7.8102.4l

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

Specification(s):
Undiluted flue gases will be checked with a calibrated flue gas analyzer in accordance with accepted protocol

If combustion is not happening safely or to the appropriate combustion efficiency, diagnostics and adjustments will be done in accordance with manufacturer specifications and local codes

Objective(s):
Confirm that combustion is occurring safely with appropriate combustion efficiency

7.8102.4m

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

Specification(s):
Electric, natural gas, and oil supply components will be installed to accepted industry standards and codes in accordance with NFPA70 (NEC) for electric, NFPA 54 for gas, or NFPA 31 for oil

Energy input required by the appliance will be in accordance with manufacturer specifications (e.g., ensure gas pipe size and pressure are adequate)

Objective(s):
Provide sufficient fuel to the water heater, burner, or element

7.8102.4n

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

Specification(s):
Discharge water temperature at fixtures will not exceed 120 °F or as prescribed by local code

Install mixing valve when higher storage/generation temperatures are required

Objective(s):
Ensure safe hot water supply temperature to fixtures

7.8102.4o

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

Specification(s):
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 accordance with manufacturer specifications and relevant industry standards

Objective(s):
Ensure system functions safely

Keep cost of ownership as low as possible

7.8102.4p

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

Specification(s):
All spaces with combustion appliances will have a carbon monoxide (CO) alarm

Locations of CO alarms in the space shall be in accordance with state law and local codes

Ambient CO levels will be maintained under code-acceptable thresholds

Objective(s):
Ensure occupant health and safety

7.8102.4q

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

Specification(s):
Completed work will be reviewed

Completed work will be reviewed

Occupant/building operations staff/property manager will be educated on the safe and efficient operation and maintenance of the system, including:

- Adjustment of water temperature
- Operation of backflow preventer and pressure regulator
- Importance of keeping operating manuals accessible

Objective(s):
Educate occupant/building operations staff/property manager about the safe, efficient operation and maintenance of the system

7.8103.7a

Desired Outcome:
Minimize energy and water waste to the lowest possible life cycle cost

Specification(s):
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 decommissioning and replacement (occupant is responsible for abatement or remediation)

Objective(s):
Remediate health hazards using EPA-certified contractors

7.8103.7b

Desired Outcome:
Minimize energy and water waste to the lowest possible life cycle cost

Specification(s):
Check valve will be installed on the cold water supply to the water heating equipment

A thermal expansion tank will be installed, if not present

Objective(s):
Eliminate crossover

7.8103.7c

Desired Outcome:
Minimize energy and water waste to the lowest possible life cycle cost

Specification(s):
Water pressure downstream of the check valve will be verified

Expansion tank charge will be verified or set in accordance with SWS 7.8104.8 Domestic Hot Water Expansion Tank (Potable Water)

Objective(s):
Ensure proper operation

7.8104.8a

Desired Outcome:
Provide for adequate expansion of domestic hot water as it is heated to prevent damage to piping and equipment

Specification(s):
Unit will be hydraulically isolated and removed from piping and drain tank

Cap will be removed on bottom of tank

Pressure will be checked using a tire pressure gauge

Pressure will be closely matched to incoming water pressure

Objective(s):
Ensure that expansion tank is properly charged and operating

7.8104.8b

Desired Outcome:
Provide for adequate expansion of domestic hot water as it is heated to prevent damage to piping and equipment

Specification(s):
Collect necessary information to determine expansion tank size, including:

- Operating water pressure of water heater (a pressure gauge may need to be installed to verify)
- Water heater and tank volume
- Operating water temperature
- Relieve valve pressure setting
- Value of incoming street water pressure

Objective(s):
Ensure that the newly installed expansion tank will be properly sized for the system

7.8104.8c

Desired Outcome:
Provide for adequate expansion of domestic hot water as it is heated to prevent damage to piping and equipment

Specification(s):
Using a tire pressure gauge and a tire pump to adjust as necessary, pressure in potable water expansion tank will be set to match the incoming street water pressure

Objective(s):
Set correct air pressure for proper operation of tank

7.8104.8d

Desired Outcome:
Provide for adequate expansion of domestic hot water as it is heated to prevent damage to piping and equipment

Specification(s):
Expansion tank shall be installed in accordance with the manufacturer's installation instructions

The expansion tank will be located on the cold water inlet to the water heater

The expansion tank should be located between the water heating equipment and the required shut off

Objective(s):
Ensure correct location of tank

7.8801.1a

Desired Outcome:
Proper operation of elevator

Specification(s):
Inspection will be performed by a licensed elevator professional

Objective(s):
Ensure occupant safety

7.8801.1b

Desired Outcome:
Proper operation of elevator

Specification(s):
Evaluation will be performed by a licensed elevator professional in conjunction with energy efficiency professionals

Elevator room heating, ventilation, and air conditioning equipment will be installed with energy efficient components and proper controls

Objective(s):
Optimize energy performance

7.8801.1c

Desired Outcome:
Proper operation of elevator

Specification(s):
Any work will be performed to comply with ASME A17.1, ICC A117.1, and ANSI NFPA 70 Article 620

Objective(s):
Ensure occupant safety

Ensure proper installation