Retrofitting Maryland - 2018 MF

Standard Work Specifications

Field Guide for

Multifamily Homes

created by

Maryland Department of Housing and Community Development

2 Health and Safety

2.01 Safe Work Practices

2.0100 Safe Work Practices

2.0100.1 Global Worker Safety

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2.0101.1 Air Sealing Worker Safety

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2.0102.1 Insulation Worker Safety

2.0100.1 - Global Worker Safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

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

2.0100.1a - Prevention through design

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Design will be incorporated to eliminate or minimize hazards (e.g., material selection, access to equipment for installation and maintenance, placement of equipment, ductwork and condensate lines)

Objective(s):
Prevent worker injuries

Reduce risk exposure to toxic substances and physical hazards

2.0100.1b - Hand protection

Desired Outcome:
Work completed safely without injury or hazardous exposure

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

Objective(s):
Minimize skin contact with contaminants

Protect hands from hazards

2.0100.1c - Respiratory protection

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 2-component spray polyurethane foam, air purifying masks with an organic vapor cartridge and P-100 particulate filter will be used

When applying high-pressure SPF insulation, supplied air respirators (SARs) will be used

Consult MSDS 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)

2.0100.1d - Electrical safety

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

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

2.0100.1e - Carbon monoxide (CO)

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
All homes will have a carbon monoxide alarm

Ambient CO will be monitored during combustion testing and testing will be discontinued if ambient CO level inside the home or work space exceeds 35 parts per million (ppm)

Objective(s):
Protect worker and occupant health

2.0100.1f - Personal Protective Equipment

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
MSDS and OSHA regulations will be consulted for equipment and protective clothing would be worn if contaminants are present(e.g., insulation materials)

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

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

Minimize spread of contaminants

Provide eye protection

2.0100.1g - Confined space safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Spaces with limited ingress and egress and restricted work area will be considered confined space

Access and egress points will be located before beginning work

Inspection will be conducted for hazards, such as damaged or exposed electrical conductors, mold, sewage effluent, friable asbestos or fiberglass, pests, and other potential hazards

Adequate ventilation will be provided

Use of toxic material will be reduced

Objective(s):
Prevent build-up of toxic or flammable contaminants

Reduce risk to the workers in the confined space

Provide adequate access and egress points

Prevent electrical shock

2.0100.1h - Power tool safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Power tools will be inspected and used in accordance with manufacturer specifications and OSHA regulations to eliminate hazards such as those associated with missing ground prongs, ungrounded circuits, misuse of power tools, noise, and improper or defective cords or extension cords.All tools must be maintained in proper operating condition with all guards securely in place

All devices used will be verified as GFCI protected or double insulated

Exhaust gases from compressors and generators will be prevented from entering interior space

Objective(s):

Prevent power tool injuries

Prevent buildup of toxic or flammable contaminants

2.0100.1i - Chemical safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

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

Appropriate personal protective equipment (PPE) will be provided

Workers will be trained on how to use PPE

Workers will be expected to always use appropriate PPE during work

Objective(s):
Prevent worker exposure to toxic substances

2.0100.1j - Ergonomic safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

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

Proper equipment will be used for work

Proper lifting techniques will be used

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

2.0100.1k - Hand tool safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Hand tools will be maintained in safe working order and used for intended purpose

Objective(s):
Prevent injuries

2.0100.1l - Slips, trips, and falls

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Caution will be used around power cords, hoses, tarps, and plastic sheeting

Precautions will be taken when ladders are used, when working at heights, or when balancing on joists

Walk boards will be used when practical

When scaffolding is used, manufacturer set-up procedures will be followed

Appropriate footwear and clothing will be worn

Objective(s):
Prevent injuries due to slips, trips, and falls

2.0100.1m - Thermal stress

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Ensure staff is aware of risks during extreme weather including the symptoms of heat stroke, heat exhaustion, and hypothermia

Appropriate ventilation, hydration, rest breaks, and cooling equipment will be provided

911 will be dialed when necessary

Objective(s):
Prevent heat stroke, heat stress, and cold stress related injuries

2.0100.1n - Fire safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Ignition sources will be identified and eliminated (e.g., turn off pilot lights and fuel supply)

Use of flammable material will be reduced and fire-rated materials will be used

Objective(s):
Prevent a fire hazard

2.0100.1o - Asbestos-containing materials (ACM)

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 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

2.0100.1p - Lead paint assessment

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 Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rulemaking or any more stringent state or federal standards

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

2.0100.1q - Site security

Desired Outcome:
Work completed safely without injury or hazardous exposure

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

Temporarily disconnected eqipment will be locked up and tagged out

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

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

2.0100.1r - Crawl space safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
The source of all contaminants (e.g., sewage,dead animals,needles) will be corrected,repaired,or removed before performing inspections that require complete access to the crawl space

If appropriate, the contaminant will be neutralized and/or a protective barrier will be installed in the area

Objective(s):
Ensure work safety

Prevent worker exposure to hazards

2.0100.2 - Work Area Inspection and Stabilization

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

2.0100.2a - Inspect to confirm integrity of existing building assembly

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

Specification(s):
An inspection will be conducted for existing conditions that may hinder successful installation of proposed energy improvement

Objective(s):
Ensure the work area and associated building assemblies are suitable for the proposed work

2.0100.2b - Identify hazardous construction materials that may be disturbed or compromised by proposed work

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 known or presumed hazardous construction materials, including lead paint, asbestos, and in the case of window replacement, caulk, which may contain polychlorinated biphenyls

Where proposed work can be performed without disturbing suspect materials or under conditions consistent with applicable codes and regulations, a presumption of the presence of hazardous construction materials may be made without actual testing where such testing is not an integral part of the work to be performed

Objective(s):
Ensure known or presumed hazardous materials are treated in a manner consistent with all codes and regulations

2.0100.2c - Identify environmental conditions that may create or worsen unsafe or unstable building assembly conditions

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

2.0100.2d - Address and correct hazardous or adverse conditions

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

2.0101.1 - Air Sealing Worker Safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

2.0101.1a - Worker safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

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

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

Objective(s):
Prevent injury

Minimize exposure to health and safety hazards

2.0101.1b - Moisture precautions for crawl spaces and basements

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

2.0101.1c - Moisture precautions: living space

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

2.0101.1d - Moisture precautions for exterior water

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

2.0102.1 - Insulation Worker Safety

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

2.0102.1a - Worker safety

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

Specification(s):
Woker safety specifications will be followed in accordance with SWS 2.0100 Global Worker Safety

Objective(s):
Prevent injury

Minimize exposure to health and safety hazards

2.0102.1b - Asbestos containing materials (ACM)

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

Specification(s):
OSHA asbestos abatement protocol 29 CFR 1926.1101 will be followed if vermiculite insulation is present

Assess potential asbestos hazard; if unsure whether material contains asbestos, contact a qualified asbestos professional to assess the material, and to sample and test as needed

If suspected ACM is in good condition, do not disturb

If suspected ACM is damaged (e.g., unraveling, frayed, breaking apart), immediately isolate the area(s)

For suspected ACM that is damaged or that must be disturbed as part of the retrofit activity, contact an asbestos professional for abatement or repair, in accordance with federal, state, and local requirements; only a licensed or trained professional may abate, repair, or remove ACM

When working around ACM, do not:

- Dust, sweep, or vacuum ACM debris
- Saw, sand, scrape, or drill holes in the material
- Use abrasive pads or brushes to strip materials

Asbestos abatement or repair work should be completed prior to blower door testing; exercise appropriate caution when conducting blower door testing where friable asbestos or vermiculite attic insulation is present to avoid drawing asbestos fibers into the living space (i.e., use positively pressurized blower door testing) unless the material has been tested and found not to contain asbestos

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

2.0102.1c - Materials

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

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

Objective(s):
Eliminate hazards associated with incorrect, defective, or improperly used or installed materials

2.0102.1d - Lead paint assessment

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

The Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Program Rule (40 CFR Part 745) in pre-1978 homes and proposed changes to this rule (Federal Register/Vol. 75, No. 87/May 6, 2010) will be complied with, to be superseded by any subsequent final rule making or any more stringent state or federal standards

Objective(s):

Protect worker and occupant from potential lead hazards

2.0103.2 - Heating and Cooling Worker Safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

2.0103.2a - Worker safety

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Follow all worker safety specifications in SWS 2.0100 Global Worker Safety section

Objective(s):
Prevent injury

Minimize exposure to health and safety hazards

2.0103.2b - Mercury

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
When replacing existing thermostats, identify and dispose of any mercury containing thermostats in accordance with Environmental Protection Agency (EPA) guidance

Objective(s):
Protect worker and occupant from mercury exposure

2.0103.2c - Asbestos

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Suspected asbestos hazards will be identified in furnaces (e.g., gaskets), wood stoves, zonal heating devices, electrical wiring insulation, boilers, and pipe insulation and corrected in accordance

with EPA guidance

Workers will take precautionary measures to avoid exposure

Objective(s):
Protect worker and occupant from asbestos exposure

2.0103.2d - Personal protective equipment (PPE)

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Workers will wear personal protective equipment (PPE) as needed to protect themselves against exposure to hazards (e.g., pests, sewage, flooded duct work, mold, chemicals, scat, viruses)

Long sleeves and long pants should be worn as additional protection from liquid nitrogen and other hazardous materials

Objective(s):
Protect worker from exposure to hazards

Protect worker from skin contact with liquid nitrogen

2.0103.2e - Combustible gas detection

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Worker will check for presence of combustible gas leaks before work begins

Leaks will be repaired before work is performed

Objective(s):
Protect worker and occupant from exposure to hazards

2.0103.2f - Carbon monoxide (CO)

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Workers will check for presence of ambient CO before and during work

CO issues will be addressed before work is performed or continued

Objective(s):
Protect worker and occupant from exposure to hazards

2.0103.2g - Sealant

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
Pipes will be sealed by a certified professional with an approved fastening process and sealant in accordance with manufacturer specifications (International Fuel Gas Code)

Gas lines will be leak free when tested with an electronic combustible gas leak detector and verified with bubble solution

OR

Gas lines will be leak free when tested by a standing pressure test that meets the approval of the local code

Objective(s):
Install gas lines with no leaks

2.0103.2h - Safety devices

Desired Outcome:
Work completed safely without injury or hazardous exposure

Specification(s):
A secondary LP safety detector system (valve, exhaust fan, alarm light) will be installed by a

certified professional for propane piping installed below grade

When installing new equipment, a shut off valves will be installed by a certified professional at each gas appliance (ANSI Z21.15)

Objective(s):
Detect accumulation of dangerous levels of propane in below-grade areas

Isolate appliances from the rest of the system for emergencies, removal, or repairs

2.0105.1 - Baseload Worker Safety

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

2.0105.1a - Worker safety

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

Specification(s):
All worker safety specifications in SWS 2.0100 Global Worker Safety section will be followed

Objective(s):
Prevent injury

Minimize exposure to health and safety hazards

2.0105.2 - Licensed Electrical Professional

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

2.0105.2a - Worker safety

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 or as required by the authority having jurisdiction

All workers will comply with ANSI/NFPA 70E

All OSHA standard practices will be followed

Objective(s):
Prevent property damage

Ensure worker safety

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

Desired Outcome:
Occupant and worker risk from hazardous materials minimized

2.0106.1a - Material selection

Desired Outcome:
Occupant and worker risk from hazardous materials minimized

Specification(s):
Materials that do not create long-term health risks for occupants and workers will be used

Objective(s):
Improve indoor air quality in the living space

2.0106.1b - Material labels

Desired Outcome:
Occupant and worker risk from hazardous materials minimized

Specification(s):
Manufacturer specifications will be followed

Objective(s):
Reduce risk of exposure to harmful substances

Follow safety procedures

2.0106.1c - Material Safety Data Sheets (MSDSs)

Desired Outcome:
Occupant and worker risk from hazardous materials minimized

Specification(s):
MSDSs will be provided onsite and available during all work

Objective(s):

Assess exposure risk

Prepare a response in case of emergency

2.0106.2 - Potential Asbestos-Containing Materials

Desired Outcome:
Work with property managers to ensure Asbestos Containing Materials (ACMs) are treated properly

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

2.0106.2a - Determine if testing is necessary

Desired Outcome:
Work with property managers to ensure Asbestos Containing Materials (ACMs) are 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

2.0106.2b - If ACM may be present, educate property manager for need of testing

Desired Outcome:
Work with property managers to ensure Asbestos Containing Materials (ACMs) are treated properly

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

Objective(s):
Confirm presence of ACMs

2.0106.2c - Asbestos removal

Desired Outcome:
Work with property managers to ensure Asbestos Containing Materials (ACMs) are treated properly

Specification(s):
Property manager will arrange for asbestos removal by an asbestos professional in accordance with federal, state, and local requirements; only a licensed or trained professional may abate, repair, or remove ACM

Third-party air monitoring during abatement work will be provided in accordance with federal, state, and local requirements

At end of abatement process, documents will be provided to the property manager by the contractor that states ACMs were removed in accordance with all applicable federal, state, and local requirements, and no ACMs are present in the work area

Objective(s):
Safely remove asbestos from proposed work area

2.0203.3 - Combustion Air—Boilers

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

2.0203.3a - Combustion air

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.

Exception: Existing appliances that have passed combustion safety testing using the procedures of BPI 1200 are deemed to have sufficient combustion air.

Objective(s):
Meet burner combustion air requirements

2.0203.3b - Education

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

2.0204.2 - Isolating Combustion Appliance Rooms (e.g., Boiler Room, Furnace Room, and Generator Room)

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

Note:

2.0204.2a - Pre-inspection

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 - Identification of penetrations

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 - Preparation

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 - Sealant and materials selection

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 - Verification

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

2.0205.1 - Gas and Oil-Fired Equipment

Desired Outcome:
Combustion products are properly vented to the outdoors

Note:

2.0205.1a - Combustion air

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 - Installation

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 - Orphaned equipment

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

2.0301.1 - Smoke Alarm

Desired Outcome:
Properly installed smoke alarms

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

2.0301.1a - Smoke alarm (hardwired)

Desired Outcome:
Properly installed smoke alarms

Specification(s):
When installing hardwired smoke alarms, it will be listed and labeled in accordance with UL 217 and installed in accordance with the IRC or as required by the authority having jurisdiction

Objective(s):
Ensure proper installation

2.0301.1b - Smoke alarm (battery operated)

Desired Outcome:
Properly installed smoke alarms

Specification(s):
When installing battery operated smoke alarms, it will be installed in accordance with manufacturer specifications

Objective(s):
Ensure proper installation

2.0301.2 - Carbon Monoxide Alarm or Monitor

Desired Outcome:
Properly installed CO alarms or monitors

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

2.0301.2a - CO detection and warning equipment (hardwired)

Desired Outcome:
Properly installed CO alarms or monitors

Specification(s):
Hardwired CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 or as required by the authority having jurisdiction

Installation will be accomplished by a licensed electrician when required by the authority having jurisdiction

Objective(s):
Ensure proper installation

2.0301.2b - CO detection and warning equipment (battery operated)

Desired Outcome:
Properly installed CO alarms or monitors

Specification(s):
Battery-operated CO detection or warning equipment will be installed in accordance with the ASHRAE 62.2 and manufacturer specifications as required by the authority having jurisdiction

Objective(s):
Ensure proper installation

2.0302.1 - Locking Refrigerant Caps—Mid and High Rise

Desired Outcome:
Ensure the safety of worker/occupant/building operations staff/property manager

Note:

2.0302.1a - Installing refrigerant locking caps

Desired Outcome:
Ensure the safety of worker/occupant/building operations staff/property manager

Specification(s):
Where required by code, locking refrigerant caps will be installed on the refrigerant access ports

Objective(s):
Ensure worker and occupant safety

2.0401.1 - Air Sealing Moisture Precautions

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

2.0401.1a - Moisture precautions: attics/roofs

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

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

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

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

Objective(s):
Ensure durability of repairs

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

Prevent moisture from communicating from within the conditioned space into unconditioned attic space.

Increase durability of seal

Avoid moisture-related damage to the home

2.0401.1b - Moisture precautions for crawl spaces

Desired Outcome:

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

Specification(s):
Exposed earth will be covered with a continuous, durable, sealed Class 1 vapor retarder a minimum of 6 mils in thickness

Any vapor retarder shall not encapsulate wood building materials or spray foam

Holes between the crawl space and the living space will be sealed

Objective(s):
Ensure durability of repairs

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

2.0401.1c - Moisture precautions for the living space

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

Specification(s):
Moisture sources in the home will be identified and removed or reduced

Local ventilation will be installed where appropriate (e.g., baths, kitchens) and vented to outside according to ASHRAE 62.2

Unvented combustion appliances that are not listed to ANSI Z21.11.2 will be removed

Objective(s):
Ensure durability of repairs

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

2.0401.1d - Moisture precautions for exterior water

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

Specification(s):
Before air sealing basement or crawl space walls near wet areas, surface water pooling near the foundation will be addressed by:

- Repairing, modifying, or replacing gutters and downspouts
- Grading and subsurface drainage at critical locations (e.g., localized drain and grading beneath valleys) in accordance with EPA) Indoor airPLUS Construction Specifications Section 1.1
- Possible mitigation by waterproofing or installing draining plane with construction adhesive

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

2.0404.4 - Basements—Dehumidification

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

2.0404.4a - Dehumidifier

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

Specification(s):
A permanent, low-temperature, auto-restart, minimum ENERGY STAR® rated dehumidifier will be installed

Manufacturer specifications will be followed for size and use

Condensate will be drained to daylight or a condensation pump

Objective(s):
Maintain a dry basement

Reduce conditions conducive to mold growth, wood rot, and pests

2.0404.4b - Dehumidification for divided spaces

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

Specification(s):
Drying will be provided to all basement areas

Objective(s):
Maintain a dry basement

Reduce conditions conducive to mold growth, wood rot, and pests

2.0404.4c - Relative humidity

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

Specification(s):
All basement spaces will be maintained at a relative humidity that ensures condensation will not occur on cool surfaces

Objective(s):
Maintain a dry basement

Reduce conditions conducive to mold growth, wood rot, and pests

2.0404.4d - Condensing surfaces(e.g., cold water pipes)

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

Specification(s):
Condensing surfaces in basement will be insulated and sealed

Objective(s):
Maintain a dry basement

Reduce conditions conducive to mold growth, wood rot, and pests

2.0404.4e - Dehumidification (option for dry climates and heating- dominated climates seasonally)

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

Specification(s):
Ventilation in the basement will be controlled to maintain relative humidity that ensures condensation will not occur on cool surfaces

Objective(s):
Maintain a dry basement

Reduce conditions conducive to mold growth, wood rot, and pests

2.0404.4f - Occupant education

Desired Outcome:
Basement humidity controlled with supplemental dehumidification

Specification(s):
Occupant will be educated on how and when to change filter and clean condensate drain of the dehumidifier in accordance with manufacturer specifications

Objective(s):
Ensure occupant health

Preserve integrity of system

2.0502.1 - Radon Testing and Evaluation

Desired Outcome:
Work completed without increasing occupant exposure to radon

Note:

2.0502.1a - Radon testing and mitigation

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

2.0702.2 - Occupant Education

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

2.0702.2a - System operation

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 - System controls (e.g., thermostat, humidistat)

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 - System disconnects

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 - Combustion air inlets

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 - Blocked air flow

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 - Routine maintenance

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 - Occupant service requests

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 - Carbon monoxide (CO)

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

Specification(s):
Occupant will be informed about CO alarms

Objective(s):
Protect occupants from injury

2.0702.2i - Warranty and service

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

2.0702.3 - Building Operations Staff Education

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

2.0702.3a - Systems operation, maintenance, and sustainability

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

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

Operation and maintenance manual will be provided and updated to building operations staff

Objective(s):
Ensure building operations staff has an understanding of the equipment's capability

Provide long-term resource for maintenance reference

2.0702.3b - System controls (e.g., thermostat, humidistat)

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):
Building operations staff will be educated on the sequence of the building systems and their controls

Building operations staff will be provided with training that leads to a building operations certification where a competent authority provides such training

Objective(s):
Ensure building operations staff and property manager can operate system controls and recognize maintenance requirements

2.0702.3c - System disconnects

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):
Indoor and outdoor electrical disconnections and fuel shut offs will be demonstrated to building operations staff

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

2.0702.3d - Combustion safety awareness

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):
Location of combustion air inlets and gas vents will be identified for building operations staff

Importance of not blocking inlets will be explained to building operations staff

Building operations staff will understand that flammable material will not be stored in the combustion appliance zone

Objective(s):
Ensure building operations staff understands combustion fuel and the associated safety requirements

2.0702.3e - System air flow

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):
Importance of cleaning dust and debris from returns grilles will be explained to building operations

staff

Proper placement of interior furnishings with respect to registers will be explained to building operations staff

Negative consequences of closing registers will be explained to building operations staff

Importance of leaving interior doors open as much as possible will be explained to building operations staff

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

2.0702.3f - Routine maintenance

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):
Proper filter selection (minimum MERV 6 rating) and how to change filter will be explained to building operations staff

Importance of keeping outdoor unit clear of debris, vegetation, decks, and other blockages 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., belts, filters), repair and replace

Objective(s):
Ensure equipment operates as designed

2.0702.3g - Occupant service requests

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):

Situations 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
- Thermal comfort issues
- Unusual noises
- Unusual odors

Building operations staff will be informed of situations where they must call outside resources:

- Flooding
- Odors
- Electrical issues

Objective(s):
Educate building operations staff on the occupant's expectations with comfort, efficiency, and indoor environmental quality

Ensure building operations staff does not negatively impact equipment

2.0702.3h - Carbon monoxide (CO) detector

Desired Outcome:
Building operations staff understands their role and responsibility in the safe, effective, and efficient operation of the equipment

Specification(s):
Building operations staff will be educated on function, location, operation, and service of detector

Objective(s):
Maintain detector in operational condition

2.0702.3i - Warranty and service

Desired Outcome:
Building operations staff understands 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

Labor warranty will be explained and the building operations staff/property manager will be given a phone number to call for warranty service

Objective(s):
Building staff have manuals and warranties for future servicing

2.0703.1 - Sealing/Isolating Exposed Fibrous Insulation in Areas with Routine Human Activity

Desired Outcome:
Occupants protected from insulation particulate exposure

Note:

2.0703.1a - Fibrous Insulation Isolation

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

3.1001.5 - Penetrations and Chases

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

Note:

3.1001.5a - Pre-inspection

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 - Backing and infill

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 - Sealant selection

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 - High temperature application

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

3.1001.6 - Firewall in Unconditioned Attic

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

Note:

3.1001.6a - Pre-inspection

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 - Backing and infill

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 - Sealant selection

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 - Joint seal

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

3.1001.7 - Firewall in Conditioned Attic

Desired Outcome:
Firewalls sealed to prevent air leakage, moisture movement, and spread of fire between the conditioned attic and roof assembly

Note:

3.1001.7a - Pre-inspection

Desired Outcome:
Firewalls sealed to prevent air leakage, moisture movement, and spread of fire between the conditioned attic and roof assembly

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

Air sealing locations will be identified between the firewall and the roof assembly

Objective(s):
Repair breaches in the firewall

Ensure a continuous air and fire-resistance-rated assembly will be appropriately located between conditioned attic and roof assembly

3.1001.7b - Backing and infill

Desired Outcome:

Firewalls sealed to prevent air leakage, moisture movement, and spread of fire between the conditioned attic and roof assembly

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

3.1001.7c - Sealant selection

Desired Outcome:
Firewalls sealed to prevent air leakage, moisture movement, and spread of fire between the conditioned attic and roof 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

3.1001.7d - Joint seal

Desired Outcome:
Firewalls sealed to prevent air leakage, moisture movement, and spread of fire between the conditioned attic and roof assembly

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

- The intersection between firewall and roof assembly
- 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

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

Desired Outcome:
Combustible materials kept away from combustion sources

Note:

3.1001.8a - Pre-Inspection

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 - Verify attic prep

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 - Isolate high-temperature elements

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 - Sealant selection

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 - Safety

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 - Building operations staff education

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

3.1001.9 - Sealing Access Doors and Similar Intentional Penetrations

Desired Outcome:
Attic access door properly sealed and insulated

3.1001.9a - Worker safety

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 - Occupant safety

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 - Pre-inspection

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 - Sealant selection

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 - Sealing

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 - Installation

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, rigid 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 - Attachment

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 - Quality assurance

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 - Durability

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 - Building operations staff/occupant education

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

3.1102.1 - Wall Penetration Sealing

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

Note:

3.1102.1a - Pre-inspection

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 - Backing and infill

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 - Sealant selection

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 - High-temperature application

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 - Penetration seal

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

3.1201.7 - Repair, Maintenance, and Weather Stripping of Windows

Desired Outcome:
Windows are airtight and weathertight

Note:

3.1201.7a - Worker safety

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 - Occupant safety

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 - Pre-inspection

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 - Operable glazing system operation and fit

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 - Fixed glazing system adjustment and seal

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 - Sealant selection

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 - Frame sealing

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 - Weather stripping

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 - Quality assurance

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

3.1201.8 - Repair, Maintenance, and Weather Stripping of Doors

Desired Outcome:
Doors operable, airtight, and weathertight

Note:

3.1201.8a - Worker safety

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 - Occupant safety

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 - Pre-inspection

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 - Door operation and fit

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 - Sealant selection

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 - Frame sealing

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 - Weather stripping

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 - Quality assurance

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

3.1601.6 - Preparation and Mechanical Fastening—Low Rise

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

Note:

3.1601.6a - Preparation

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 - Metal to metal

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 - Flex to metal

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 - Duct board to duct board

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 - Duct board to flexible duct

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 - Metal plenum to air handler cabinet

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 - Duct board plenum to air handler cabinet

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 - Terminal boot to wood

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 - Terminal boot to gypsum

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 - Duct board to flex

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 - Replacement of insulation

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

3.1601.7 - Support—Low Rise

Desired Outcome:
Ducts and plenums are properly supported

Note:

3.1601.7a - Support of duct types (applies to all duct types)

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

3.1602.15 - Ventilation Existing Duct Sealing (All Building Types)

Desired Outcome:
Improved effectiveness and efficiency of ventilation distribution system

Note:

3.1602.15a - Pre-inspection

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 - Health and safety

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 - Identification of leakage locations

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 - Identify and prioritize leakage locations to be sealed

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 - Temporary access

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 - Preparation

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 - Material selection

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 - Duct sealing

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 - Verification

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 - Combustion appliance zone testing

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 - Occupant/property manager education

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

3.1602.16 - Forced Air—Air Sealing System—Low Rise

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Note:

3.1602.16a - New component to new component sealant selection

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 - New component to existing component

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 - Existing component to existing component

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

3.1602.17 - Forced Air—Air Sealing System Components—Low Rise

Desired Outcome:
Ducts and plenums are sealed to prevent leakage

Note:

3.1602.17a - Duct boot to interior surface

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 - Wooden plenums and building cavities

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 - Air handler cabinet

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 - Filter slot

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

3.1901.1 - General Compartmentalization Techniques

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

Note:

3.1901.1a - Pre-inspection

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 - Identification of penetrations

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 - Preparation

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 - Sealant and materials selection

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 - Verification

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

3.1901.2 - Performance-Based Air Sealing of Dwelling Units and Corridors

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

Note:

3.1901.2a - Pre-inspection

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 - Work coordination among trades

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 - Preparation

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 - Identification of penetrations

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 - Installation, sealant, and materials selection

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 - Verification

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 - Property manager/occupant education

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

4.1005.8 - Loose Fill Over Existing Insulation on Accessible Attic Floors

Desired Outcome:
Insulation controls heat transfer through ceiling

4.1005.8a - Preparation

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 - Installation

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 - Safety

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 - Onsite documentation

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

4.1088.7 - Insulating Inaccessible Attics

Desired Outcome:
Insulation installation does not compromise building durability

Note:

4.1088.7a - Worker safety

Desired Outcome:
Insulation installation does not compromise building durability

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.

4.1088.7b - Pre-inspection

Desired Outcome:
Insulation installation does not compromise building durability

Specification(s):
Attics that cannot be air sealed will not be filled with blown insulation

At no time will dense pack insulation products be considered an appropriate air barrier material for an inaccessible attic

Where attic spaces are inaccessible for air sealing, top of building thermal boundary may be insulated using methods and techniques outlined in SWS 3.1801.1 Above Roof Deck Air Sealing

Objective(s):
Avoid catastrophic moisture issues in the attic cavity

5.3001.4 - Equipment Selection—Low Rise

Desired Outcome:
Equipment sized properly and operating efficiently

5.3001.4a - Load calculation: heat loss or gain

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 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 - Load calculation: design conditions of single stage or single speed equipment

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 - Load calculation: design conditions for multistage, variable speed equipment

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 - Equipment selection: air conditioning and heat pumps

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 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 - Equipment selection: auxiliary heat for heat pumps

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 - Equipment selection: furnaces

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

5.3001.5 - Ductwork and Termination Design—Low Rise

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

Note:

5.3001.5a - Sizing

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 - Air handler to return plenum

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 - Air handler to supply plenum

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 - Building cavities used as ductwork

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 - Reducers

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 - Supply branch run outs

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 - Boots

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 - Supply terminations

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 - Return grille sizing

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 - Manual volume dampers

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 - Flexible ducts

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 - Take-offs

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 - Fire dampers

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

5.3002.4 - Preparation for New Equipment—Low Rise

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

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

5.3002.4a - Access

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 - Environmental hazards

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

Specification(s):
If suspected mold is found, determine the source and cause, repair issues and remove the suspected mold

If a friable asbestos-like substance is found to be present in an area that will be disturbed by work, it must be tested by a certified organization, and all system components and possible disturbed surrounding areas will be certified free of asbestos by a licensed professional before equipment removal can begin

Objective(s):
Protect workers and occupants from injury

Remediate health hazards using certified contractors

5.3002.4c - Disconnection of utilities

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 - Refrigerant recovery

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 - Disconnection of equipment

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 - Removal

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

5.3002.7 - Setting of Air Handler—Low Rise

Desired Outcome:
Air handler set properly in an appropriate place

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

5.3002.7a - Location

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 - Clearance

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 - Connections

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 - Support: horizontal air flow, attic

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 - Support: horizontal air flow, basement, or crawl space

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 - Support: up flow on a platform

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 - Support: down flow

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 - Sealing

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 - Drainage

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

5.3003.17 - Data Plate Verification—Low Rise

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

Note:

5.3003.17a - Data plate verification

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

5.3003.18 - Leak Detection—Low Rise

Desired Outcome:
Dangerous leaks detected before causing injury to the occupant or damage to the building

Note:

5.3003.18a - Carbon monoxide (CO) detection

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 - Gas leak detection

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 - Fuel oil leak detection

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

5.3003.19 - Refrigerant Line Inspection—Low Rise

Desired Outcome:
Refrigerant lines properly installed

Note:

5.3003.19a - Insulation

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 - Ultraviolet (UV) protection of insulation

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 - Sizing

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 - Installation quality

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 - Support

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

5.3003.20 - Electrical Service—Low Rise

Desired Outcome:
Electrical components properly tested

Note:

5.3003.20a - Polarity

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 - Voltage: incoming power

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 - Wire size

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 - Service disconnect

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 - Voltage: contactor

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 - Grounding

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 - Blower amperage

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 - Compressor amperage

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 - Door switch operation

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 - Heat pump: emergency heat

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

5.3003.21 - Air Flow—Low Rise

Desired Outcome:
Air flow is properly tested

Note:

5.3003.21a - Validate air distribution system installation

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 - Testing equipment selection

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 - Test air handler unit

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 - Total air flow

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 - External static pressure

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 - Pressure drop: coil

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 - Pressure drop: filter

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 - Balance of room flow: new ductwork

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 - Supply wet bulb and dry bulb

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 - Return wet bulb and dry bulb

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 - Temperature rise: gas and oil furnaces only

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 - Final balance

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 - Occupant/property manager education

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

5.3003.22 - Combustion Analysis—Low Rise

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Note:

5.3003.22a - Testing equipment selection

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 - Combustion analysis protocol

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

5.3003.22c - Oil system: nozzle size

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Nozzle size/spray angle/spray pattern will be correct for design input and within equipment firing rate of the heating system manufacturer

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

5.3003.22d - Natural gas/propane system: burner orifice(s) size

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 - Combustion air adjustment

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 - Fuel pressure/gas pressure

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

5.3003.22g - Oil system: smoke test (this test must be conducted before any combustion testing has started)

Desired Outcome:
Analysis on critical components and operations is completed to industry and manufacturer specifications

Specification(s):
Smoke spot reading will be in accordance with burner manufacturer specifications

If smoke spot test is higher than manufacturer specifications, a steady state efficiency test will not be performed until the unit has been cleaned and tuned

Objective(s):
Ensure equipment operates as designed

Ensure equipment operates safely

Ensure equipment operates efficiently

Ensure equipment is durable

Ensure testing equipment is not damaged

5.3003.22h - Steady state efficiency (SSE)

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 - Net stack temperature

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 - Carbon dioxide and oxygen

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 - Excess air

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 - Carbon monoxide (CO) in flue gas

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

5.3003.36 - Ductwork System—Low Rise

Desired Outcome:
The duct system safely supports peak operation of the equipment

5.3003.36a - Location: indoor (supply ducts) duct section located completely within the thermal boundary of the building

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 - Location: outdoors duct section located outside of the thermal boundary of the building or in quasi-conditioned spaces

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 - Building cavities used as ductwork

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 - Fire rating

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 - Penetrations

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 - Support

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 - Protection

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 - Fastening: metal to flexible duct

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 - Fastening: metal to metal

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 - Fastening: duct board to metal

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 - Fastening: boot to building connection

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 - Terminations

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 - Filtration

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 - External static pressure

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 - Air flow: cooling and heat pump systems

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 QI HVAC Quality Installation Specification and ASHRAE Standards

Objective(s):
Ensure equipment operates as designed

5.3003.36p - Temperature rise: heating-only systems

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 - System protection during construction and renovation

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 - Room pressure balancing

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 - Sealing: new ductwork

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 - Sealing: existing ductwork

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

5.3003.37 - Heating and Cooling Controls—Low Rise

Desired Outcome:
Heating and cooling controls installed and set properly

Note:

5.3003.37a - Removal of mercury-based thermostats

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 - Removal of existing controls

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 - Penetrations

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 - Thermostat location

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 - Blower speed

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 - Thermostat selection: heat pump

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 - Heat pump: supplementary heat

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 - Heat pump: outdoor temperature sensor

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 - Heat pump: supplementary heat control wiring

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 - Thermostat: installer programming

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 - Time delay settings

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 - Humidistat: location

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 - Occupant education

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 - Central controller

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

6.6005.3 - Clothes Dryer (All Building Types)

Desired Outcome:
Dryer air exhausted efficiently and safely

Note:

6.6005.3a - Pre-inspection

Desired Outcome:
Dryer air exhausted efficiently and safely

Specification(s):
Specifications will be field verified as appropriate to site conditions by installer

Objective(s):
Ensure appropriate design for installation

6.6005.3b - Clothes dryer ducting

Desired Outcome:
Dryer air exhausted efficiently and safely

Specification(s):
Clothes dryers exhaust will be ducted to the outdoors

As short a run as practical of smooth wall metal duct will be used, following manufacturer specifications and the applicable code adopted by the jurisdiction

Dryer ducts exceeding the manufacturer's recommended maximum length or the maximum length specified by the applicable code adopted by the jurisdiction shall have a dryer booster fan installed, and shall have a safety interlock with the dryer(s) so they will not operate if the fan is not operating properly

When multiple dryers vent into a common plenum or stack, the system will be engineered by a design professional and installed with a terminal exhaust fan

Ducting will be connected and sealed as described in exhaust details SWS 6.6004.1 Centra/ Common Exhaust Fan Serving Multiple Dwelling Units via Common Duct(s) and Dwelling Unit Branches and SWS 6.6004.2 Individual Exhaust Fan Serving Multiple Rooms Within a Single

Dwelling Unit (All 3 Building Types)

Fasteners that obstruct the exhaust flow will not be used

Condensing dryers will be plumbed to a drain that leads to an approved sanitary disposal system

Objective(s):
Preserve integrity of building envelope

Effectively move air from clothes dryer to the outdoors

Meet code requirements

Remove moisture, lint, and excess heat from laundry area

6.6005.3c - Termination fitting

Desired Outcome:
Dryer air exhausted efficiently and safely

Specification(s):
Termination fitting manufactured for use with dryers will be installed

A backdraft damper will be included as described in termination fitting detail

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):
Preserve integrity of building envelope

Effectively move air from clothes dryer to the outdoors

Direct exhaust to the outdoors and prevent re-entry

Prevent entry of weather and pests into building shell

Ensure occupant health and safety

6.6005.3d - Makeup air

Desired Outcome:
Dryer air exhausted efficiently and safely

Specification(s):
When dryer(s) are installed in a single room, makeup air will be designed following the applicable code adopted by the jurisdiction

Objective(s):
Preserve integrity of building envelope

Effectively move air from clothes dryer to the outdoors

6.6005.3e - Verification

Desired Outcome:
Dryer air exhausted efficiently and safely

Specification(s):
Visual inspection of installation and air flow out of the building will be completed

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

Ensure occupant health and safety

6.6005.3f - Combustion zone testing

Desired Outcome:
Dryer air exhausted efficiently and safely

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

6.6005.3g - Occupant/property manager education

Desired Outcome:
Dryer air exhausted efficiently and safely

Specification(s):
Occupant/property manager will be instructed to keep lint filter and termination fitting clean

Objective(s):
Effectively move air from clothes dryer to the outdoors

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

Desired Outcome:
Kitchen range fan installed to specification

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

6.6005.4a - Pre-inspection

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 - Wiring

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 - Fan selection/specification

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 - Fan venting

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 - Fan ducting

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 - Termination fitting

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 - Makeup air

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 - Verification

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 - Combustion zone testing

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 - Occupant/property manager education

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

6.6102.6 - Intakes

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

Note:

6.6102.6a - Hole in building shell

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 - Intake fitting

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 - Occupant education

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 - Damper (if applicable)

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 - Connection to intake fitting

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 - Weatherproofing

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 - Pest exclusion

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 - Intake location

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

6.6102.7 - Ducts for Supply

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

Note:

6.6102.7a - Duct design and configuration

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

Specification(s):
Duct shall be designed in accordance with the applicable codes adopted by the jurisdiction

Objective(s):
Effectively move the required volume of air

6.6102.7b - Duct insulation

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

Specification(s):
Ducts installed outside of the thermal envelope will be insulated to a minimum of R-8 or equivalent to local codes

Objective(s):
Prevent moisture condensation

6.6102.7c - Duct support

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

Specification(s):
Ducts will be supported as required by the applicable code adopted by the jurisdiction for the type of duct used

Objective(s):
Effectively move the required volume of air

Preserve integrity of the duct system

6.6102.7d - Duct connections

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

Specification(s):
Metal-to-metal or metal-to-PVC connections will be fastened with a minimum of three equally spaced screws

Flexible duct-to-metal or flexible duct-to-PVC connections will be fastened with tie bands using a tie band tensioning tool

Flexible duct between the cable tie and end of metal or PVC duct will be screwed

PVC-to-PVC materials will be fastened with approved PVC cement

Supply ducts attached to the return side of forced air systems will be:

- Attached as close to the heating, ventilation, and air conditioning (HVAC) system's fan as possible while remaining in compliance with manufacturer specifications
- Set up to provide filtration of outdoor ventilation air before reaching the HVAC system
- Attached via a mechanically fastened take off collar

In addition to mechanical fasteners, air seal duct connections will be fastened with UL 181B or 181B-M listed material

All other duct connections shall be in conformance with the applicable code adopted by the jurisdiction

Objective(s):
Effectively move the required volume of air

Preserve integrity of the duct system and building envelope

6.6102.7e - Duct materials

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

Specification(s):
Flexible duct materials will be UL 181 listed or Air Diffusion Council approved

Objective(s):
Effectively move the required volume of air

Preserve integrity of the duct system and building envelope

6.6102.7f - Outdoor air intake location

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

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):
Reduce opportunity for contaminants to enter the building through the ventilation system

6.6104.1 - Outdoor Supply Air Handling Unit Serving Multiple Dwelling Units or Corridors (All Building Types)

Desired Outcome:
Air handling unit system installed to provide required ventilation

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

6.6104.1a - Pre-inspection

Desired Outcome:
Air handling unit 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

6.6104.1b - Air flow

Desired Outcome:
Air handling unit 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 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):
Provide sufficient outdoor air to desired locations

6.6104.1c - Fan specification

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Motors 1 horsepower or larger will meet NEMA premium efficiency standards

Fan will be capable of maintaining a minimum operating static pressure of .25 inches of water column

Objective(s):
Ensure proper flow rate of outdoor air fans

Ensure energy efficient delivery of outdoor supply air

6.6104.1d - Intake location

Desired Outcome:
Air handling unit system installed to provide required ventilation

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):
Ensure occupant health and safety

Prevent entry of contaminants

Ensure unrestricted airflow

6.6104.1e - Intake fitting

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Intake fitting will have an integrated collar at least the same diameter as the duct

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

6.6104.1f - Weatherproofing

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Exterior termination fitting will be flashed or weather sealed

Water will be directed away from penetration

Weatherproofing will be in accordance with manufacturer specifications

Objective(s):
Prevent entry of weather into building shell

6.6104.1g - Pest exclusion

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Screen material no less than 1/4" and no greater than 1/2" hole size in any direction will be used

Objective(s):
Prevent entry of pests into building shell

6.6104.1h - Damper (if applicable)

Desired Outcome:

Air handling unit system installed to provide required ventilation

Specification(s):
Damper will close when system is off

Damper will be installed to open in the direction of the desired flow

Objective(s):
Ensure unrestricted air flow

Prevent unintended airflow

6.6104.1i - Wiring

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Wiring will be installed by a licensed contractor

Wiring will be installed in accordance with original equipment manufacturer (OEM) 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

6.6104.1j - Access

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Fan, service switch, filter, and conditioning coils will be accessible for cleaning, maintenance, and repair

Objective(s):
Allow for maintenance or replacement

6.6104.1k - Outdoor/fresh air makeup air handling unit mounting

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Air handling unit outlet will be oriented toward the final termination location

Air handling unit will be oriented so the equivalent length of the duct run is as short as possible

Air handling unit will be mounted securely in accordance with manufacturer specifications and local code requirements (in terms of seismic restraints)

Air handling unit will be isolated from the building framing unless specifically designed to be directly attached

Objective(s):
Ensure short duct runs to achieve optimum air flows

Ensure mounting is installed securely

Ensure air handling unit housing or building framing does not shake, rattle, or hum when operating

Minimize noise

6.6104.1l - Air handling unit/duct riser connection

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Duct will be sealed to the top of the curb (for roof-mounted systems)

Ductwork will be attached via a flexible connection, and will be installed in accordance with OEM and duct design minimum sizing requirements

Objective(s):
Provide the most efficient air transfer from outdoor air to supply termination

Prevent noise and vibration

6.6104.1m - Duct connections

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
All ducts, including intake fitting, will be connected and sealed in accordance with supply duct sealing

Objective(s):
Deliver outdoor air to desired locations

6.6104.1n - Insulation

Desired Outcome:
Air handling unit 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

All exposed ductwork outside of the building will be insulated to a minimum R-12, protected from weather exposure, and sealed at all penetrations into building shell

Objective(s):
Preserve integrity of the duct system

Prevent heat and energy loss

Prevent condensation in ductwork

6.6104.1o - Register boot to interior surface seal

Desired Outcome:
Air handling unit 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

Objective(s):
Prevent air leakage around boot

Ensure a permanent seal to the building air barrier

Prevent a fire hazard

6.6104.1p - Preventing air leakage caused by air pressure differences between spaces

Desired Outcome:
Air handling unit 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 Addendum J

If system design calls for supply air to enter dwelling units from pressurized corridor to under the door, then door will not be weatherstripped

Objective(s):
Ensure occupant health and safety

Prevent unintentional air leakage into the building and dwelling units from other spaces (e.g., adjacent dwelling units, garages, unconditioned crawl spaces, unconditioned attics)

6.6104.1q - Balance and flow

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Air flows will be measured and adjusted in accordance with ANSI/ACCA Standard 5 or ANSI/ ASHRAE Standard 111 and documented to meet design requirements

Objective(s):

Achieve the desired air flows to and from the desired locations

6.6104.1r - Fire dampers

Desired Outcome:
Air handling unit 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

6.6104.1s - Occupant/property manager education

Desired Outcome:
Air handling unit system installed to provide required ventilation

Specification(s):
Intake fitting will be labeled "ventilation air intake"

Occupant/property manager will be instructed on purpose and value of system, and instructed to keep underside of door unobstructed (in pressurized corridor designs)

Property manager will be instructed on the maintenance and procedures of maintaining system

Objective(s):
Ensure unrestricted air flow

Ensure the durability of the ventilation system

6.6201.4 - Balancing—Makeup/Outside Air (All Building Types)

Desired Outcome:
Ventilation equipment operates as designed

Note:

6.6201.4a - Validate air distribution system installation

Desired Outcome:
Ventilation equipment operates as designed

Specification(s):
System will be checked for existence of specified system components

Objective(s):
Confirm installed system

Familiarize with system components

Verify system readiness for testing

6.6201.4b - Testing equipment selection

Desired Outcome:
Ventilation equipment operates as designed

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

If design flow is less than 100 cubic feet per minute (CFM), equipment will be capable of accurately measuring down to 10 CFM (+/- 5%)

Static pressures will be measured using manometers capable of measuring +/- 1 pascal

Measurement equipment will be calibrated and field checked in accordance with manufacturer recommendations

Objective(s):
Ensure accurate measurements of ventilation rates

6.6201.4c - Test main fan or air handler unit

Desired Outcome:
Ventilation equipment operates as designed

Specification(s):
Equipment testing will check for:

- Proper operation (programmed schedule/sequence of operation)
- Proper rotation
- Filter condition
- Total flow at fan

Air flows will be measured in accordance with ANSI/ACCA Standard 5 or ANSI/ASHRAE Standard 111; 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

6.6201.4d - Measure air flow and static pressure at terminals

Desired Outcome:
Ventilation equipment operates as designed

Specification(s):
Air flow and static pressure will be measured and recorded

Measurements will be taken with terminals as found, with no adjustments made to the grille fins

All measured values will be recorded and compared against design specifications

The terminal with the lowest flow will be identified and recorded

Objective(s):
Verify distribution system

Identify potential adjustments

Establish baseline air flow rates

6.6201.4e - Adjustment of system

Desired Outcome:
Ventilation equipment operates as designed

Specification(s):
Adjustments will be made to fan speed, dampers, and registers until design specifications are met

Objective(s):
Balance system utilizing least resistance and energy

6.6201.4f - Final balance

Desired Outcome:
Ventilation equipment operates as designed

Specification(s):
Final air flow and/or pressure will be measured, confirmed, and recorded at fan and terminals

Objective(s):
Provide acceptable thermal comfort, energy efficiency, and indoor air quality

6.6201.4g - Occupant/property manager education

Desired Outcome:
Ventilation equipment operates as designed

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

6.6207.1 - Passive Ventilation (All Building Types)

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

Note:

6.6207.1a - Pre-inspection

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

Specification(s):
Specifications will be field verified as appropriate to site conditions by installer (e.g., presence of operating exhaust system, specified location, and type of trickle vent specifications)

Access to all affected dwelling units will be ensured by installer

Objective(s):
Ensure appropriate design for installation

6.6207.1b - Intake location

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

Specification(s):
Intake will be installed in accordance with the following:

- A minimum of 6" above grade
- A minimum of 6' from exhaust outlets and will meet specifications of ASHRAE 62.1 Table 5-1 for all other contaminant sources
- Above local snow or flood line
- A minimum of 18" above an asphalt based roof

Objective(s):
Ensure occupant health and safety

Prevent entry of contaminants

Ensure unrestricted air flow

6.6207.1c - Equipment selection

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

Specification(s):
A system that provides a proper amount of air flow in accordance with ASHRAE 62.2 will be selected that minimizes potential occupant discomfort and/or drafts

Objective(s):
Ensure proper equipment

Ensure conditions for thermal comfort

6.6207.1d - Material selection

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

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

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)

6.6207.1e - Installation

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

Specification(s):
Install in accordance with manufacturer specifications

Inlet will be sealed to prevent water intrusion and air leakage into building cavities

Objective(s):
Prevent entry of weather and pests into building shell

Ensure occupant health and safety

6.6207.1f - Verification

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

Specification(s):
Verification of the passive inlet device will be performed and documented

Air will flow through the device in the correct direction

Ventilation system operation will be tested to confirm it is not causing pressure imbalances

Room-to-room pressure differential within the dwelling unit will be no greater than 3 pascals

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

Ensure occupant health and safety

6.6207.1g - Occupant/property manager education

Desired Outcome:
Passive ventilation system installed to provide effective and efficient ventilation

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

Occupant/property manager will be educated on how to inspect passive intake device upon unit turnover

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

7.8001.3 - Refrigerator and Freezer Replacement

Desired Outcome:
Energy efficient appliance installed

Note:

7.8001.3a - Assessment

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 - Selection

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 - Installation

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 - Commissioning

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 - Decommissioning

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 - Safety

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 - Staff education

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 - Occupant education

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

7.8003.2 - Exit Sign Replacement

Desired Outcome:
Energy used for lighting reduced

Note:

7.8003.2a - Assessment

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be developed to meet applicable life safety requirements (IBC 1011 or NFPA 101)

Work order will be evaluated against site circumstances

Objective(s):
Ensure occupant safety

Determine and ensure appropriate device and location

7.8003.2b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Exit signs will meet all applicable codes (UL 924, NFPA 70, and/or IBC and IFC, as appropriate) and shall be selected from the NEMA Premium Exit Sign List

Existing battery backup signs will be replaced with new battery backup signs in accordance with NEC 70 Section 700.12(F)

Exit signs will be capable of being attached to existing outlet box

Battery backup exit signs will indicate system failure with visual and audible alarm

Exit signs will be rated for a maximum of 5 watts per illuminated side

Exit signs will carry at least a 1-year warranty

Objective(s):
Ensure occupant safety

Ensure low energy use

Provide quality exit sign

7.8003.2c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixture will be de-energized before beginning work

Appropriate lockout procedures will be followed in accordance with OSHA 1910 Subpart S and ANSI/NFPA 70E

Exit signs will be installed in accordance with all applicable codes (NFPA 70) and manufacturer specifications

All penetrations will be sealed per ANSI/NFPA/ICC Building Code or applicable local code

Any penetrations created will be patched and painted

Objective(s):
Ensure proper equipment operation

Protect integrity of building envelope and exit sign

Ensure worker safety

Ensure integrity of fire barrier

7.8003.2d - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Battery backup exit signs will be tested to meet NEC 70 Section 700.12(F)

Battery backup exit signs will be tested to simulate loss of power

Exit signs will be tested in accordance with local ordinances and manufacturer specifications

Exit sign placement will be in accordance with ANSI/NFPA 101

Objective(s):
Ensure sign visibility and correct operation

Ensure occupant safety

7.8003.2e - Decommissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Exit signs 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

7.8003.2f - Safety

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Broken lamps containing mercury will be cleaned up in accordance with EPA guidelines

Objective(s):
Ensure worker safety

Ensure occupant safety

7.8003.3 - Emergency Lighting

Desired Outcome:
Energy used for lighting reduced

Note:

7.8003.3a - Assessment

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

7.8003.3b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Emergency light fixtures will meet the appropriate nationally recognized product standard (UL 542, UL 1570)

Emergency lighting will include battery backup capable of operating for 90 minutes and will comply with NFPA 70 section 700.12

Outdoor lamps will be suitable for local climate conditions and in accordance with ANSI/UL product standards

Linear fluorescent lamps will not be replaced with T12 lamps, and T8 lamps will be installed as minimum standard

Lamps in luminaires with emergency ballasts shall be replaced with a appropriate type of lamp

Vandal-proof fixtures will be used, if appropriate

Objective(s):
Reduce energy use

Ensure device functions properly

Ensure product safety

Ensure occupant satisfaction

Ensure adequate lighting during emergency situations

7.8003.3c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixture will be de-energized before work begins

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

7.8003.3d - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Emergency lighting will not inhibit required egress lighting, as required by ANSI/NFPA 101

Battery backup will be tested to meet NEC 70 Section 700.12(F)

Battery backup emergency lighting will be tested to simulate loss of power

Emergency lighting will be tested in accordance with local ordinances and manufacturer specifications

Exit sign placement will be in accordance with NFPA 110

Objective(s):
Meet target light levels

Ensure occupant satisfaction

Ensure occupant safety

7.8003.3e - Decommissioning

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

7.8003.3f - Safety

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

7.8003.3g - Staff education

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

7.8003.3h - Occupant education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Education regarding emergency lighting will be provided by building operations staff

Objective(s):
Ensure occupant safety

7.8003.4 - Remove Common Area Lamps

Desired Outcome:
Electrical use and demand reduced

Note:

7.8003.4a - Assessment

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Delamping strategy will be provided by lighting professional and follow IESNA protocol for appropriate light levels for certain tasks

Objective(s):
Determine relevant lamp removal

Determine appropriate strategy

7.8003.4b - Removal

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Lamps will be removed based on the strategy provided by assessment

Objective(s):
Reduce energy use and demand

7.8003.4c - Safety

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Final lighting levels will be in accordance with ASHRAE 90.1 or 90.2

Final egress lighting will be in accordance with NFPA 70 and NFPA 101

Objective(s):
Ensure that occupant egress lighting safety has not been compromised

7.8003.4d - Decommissioning

Desired Outcome:
Electrical use and demand reduced

Specification(s):
If operational, lamps will be stored and reused if the lamps meet retrofit standards

If nonoperational, lamps will be disposed of in accordance with local ordinances or manufacturer specifications

Disposal manifests will be filed and available to building representatives

Objective(s):
Use resources efficiently

Reduce cost of lamp replacement

Protect the environment

7.8003.4e - Occupant safety

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Delamping will not impact required egress lighting, as required by ANSI/NFPA 101

Objective(s):
Ensure occupant safety

7.8003.4f - Staff education

Desired Outcome:

Electrical use and demand reduced

Specification(s):
Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.4g - Occupant education

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Occupants will be educated of new lighting levels and benefits

Education will be provided by building operations staff

Objective(s):
Educate occupants about new lighting levels and benefits

Ensure continued savings

7.8003.5 - Remove Common Area Fixtures

Desired Outcome:
Electrical use and demand reduced

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

7.8003.5a - Assessment

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Delamping strategy will be provided by lighting professional in consultation with licensed electrician

Remaining fixtures will follow IESNA protocol for appropriate light levels for certain tasks

Objective(s):
Determine relevant fixture removal

Determine appropriate strategy

7.8003.5b - Decommissioning

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Fixtures will be removed or disconnected by a licensed electrician or qualified contractor based on the strategy provided by assessment

Removal or disconnection will be in accordance with ANSI/NFPA 70 and ANSI/NFPA 70E

Any penetrations caused by fixture removal will be patched, sealed, and painted with equivalent material (ANSI/NFPA/ICC Fire Code)

If operational, lamps will be stored and reused if the lamps meet retrofit standards

Fixtures, lamps, and ballasts will be disposed of in accordance with local ordinances or

manufacturer specifications

Disposal manifests will be filed and available to building representatives

Objective(s):
Reduce energy use and demand

Ensure occupant safety

Ensure worker safety

Preserve integrity of building envelope

Ensure integrity of fire barrier

Use resources efficiently

Reduce operational budget costs

Protect the environment

7.8003.5c - Safety

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Final lighting levels will be in accordance with ASHRAE 90.1 or 90.2

Final egress lighting will be in accordance with ANSI/NFPA 70 and ANSI/NFPA 101 or in compliance with local codes

Objective(s):
Ensure occupant egress lighting safety has not been compromised

7.8003.5d - Occupant safety

Desired Outcome:
Electrical use and demand reduced

Specification(s):

Delamping will not impact required egress lighting, as required by ANSI/NFPA 101

Objective(s):
Ensure occupant safety

7.8003.5e - Staff education

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.5f - Occupant education

Desired Outcome:
Electrical use and demand reduced

Specification(s):
Occupants will be educated of new lighting levels and benefits

Education will be provided by building operations staff

Objective(s):
Educate occupants about new lighting levels and benefits

Ensure continued savings

7.8003.6 - Occupancy Sensors for Indoor Common Areas and Offices

Desired Outcome:
Energy used for lighting reduced

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

7.8003.6a - Assessment

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be provided by lighting professional

Objective(s):
Determine appropriate device, settings, and location

Determine existing electrical conditions

7.8003.6b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Sensors will be compatible with existing wiring

Sensors will meet UL 60730-1

Objective(s):
Ensure device functions appropriately

Ensure product safety

7.8003.6c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Work will be performed by licensed electrical professional

Sensor will be installed in accordance with ANSI/NFPA 70, ANSI/NFPA 70E, and manufacturer specifications

All penetrations will be sealed (ANSI/NFPA/ICC Fire Code)

Objective(s):
Ensure worker safety

Ensure occupant safety

Preserve integrity of building envelope

Ensure integrity of fire barrier

7.8003.6d - Settings

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Settings will match the intended use of the space in accordance with lighting plan

Objective(s):
Reduce energy use

7.8003.6e - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Settings will be verified and tested to meet lighting design criteria

For certain tasks, lighting levels will follow IESNA protocol for appropriate light levels

Objective(s):
Optimize system performance

Ensure occupant safety

7.8003.6f - Occupant safety

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Occupancy sensors will not inhibit required egress lighting, as required by ANSI/NFPA 101

Occupancy sensors will not be installed in electrical and mechanical rooms

Objective(s):
Ensure occupant safety

Ensure worker safety

7.8003.6g - Staff education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.6h - Occupant education

Desired Outcome:

Energy used for lighting reduced

Specification(s):
Occupants will be educated of new lighting controls and benefits

Education will be provided by building operations staff

Objective(s):
Educate occupants about new controls and benefits

Ensure continued savings

7.8003.7 - Stand-Alone Timers in Outdoor and Common Areas

Desired Outcome:
Energy used for lighting reduced

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

7.8003.7a - Assessment

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be provided by lighting professional

Safety and crime prevention will be considered as part of the strategy

Objective(s):
Determine appropriate device, settings, and location

Determine existing electrical conditions

Prevent property damage

Ensure occupant safety

7.8003.7b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Timer will be compatible with existing wiring

Timer will be in accordance with UL 917 where applicable

Timer will have a minimum of 10 hours of battery backup time

Timer will have a minimum of two programmable schedules

Objective(s):
Reduce energy use

Ensure device functions appropriately

Ensure product safety

7.8003.7c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Work will be performed by licensed electrical professional

Timer will be installed in accordance with ANSI/NFPA 70, ANSI/NFPA 70E, and manufacturer specifications

Timer will be positioned in a secure location

Objective(s):
Ensure worker safety

Ensure occupant safety

Ensure continued savings

Prevent tampering

7.8003.7d - Settings

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Timer will be set in accordance with the assessment

Exterior fixtures will be turned off when there is sufficient day light (civil twilight) or when lighting is no longer needed at night per ASHRAE 90.1 or 90.2, and tested to meet IESNA protocol for appropriate light levels for certain tasks

Interior fixtures will be turned off when light is no longer needed

Objective(s):
Reduce energy use

Reduce light pollution

Prevent property damage

Ensure occupant safety

7.8003.7e - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Settings will be verified and tested to meet lighting design criteria

Objective(s):
Optimize system performance

Ensure occupant safety

7.8003.7f - Occupant safety

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Timer will not impact egress lighting, as required by ANSI/NFPA 101

Timer will not impact minimum light level, as required by codes or local ordinances

Fixtures will be on when spaces are occupied, per ASHRAE 90.1 or 90.2 or local codes, and tested to meet IESNA protocol for appropriate light levels for certain applications

Appropriate override switch shall be provided

Objective(s):
Ensure occupant safety

7.8003.7g - Staff education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.7h - Occupant education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Occupants will be educated of new lighting controls and benefits

Education will be provided by building operations staff

Objective(s):
Educate occupants about new controls and benefits

Ensure continued savings

7.8003.8 - Outdoor Motion Control

Desired Outcome:
Energy used for lighting reduced

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

7.8003.8a - Assessment

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be provided by lighting professional

Safety and crime prevention will be considered as part of the strategy

Objective(s):
Determine appropriate device, settings, and location

Determine existing electrical conditions

Prevent property damage

Ensure occupant safety

7.8003.8b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Motion sensor will be compatible with existing wiring

Motion sensor will meet UL 60730-1

Objective(s):
Reduce energy use

Ensure device functions appropriately

Ensure product safety

7.8003.8c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Work will be performed by licensed electrical professional

Motion sensor will be installed in accordance with ANSI/NFPA 70, ANSI/NFPA 70E, and manufacturer specifications

Motion sensor will be located in a secure location and not subject to physical damage

Motion sensor will be installed to minimize false starts

Objective(s):
Ensure worker safety

Ensure occupant safety

Prevent tampering

Ensure continued savings

7.8003.8d - Settings

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Motion sensor will be set in accordance with the assessment

Objective(s):
Reduce energy use

Reduce light pollution

Prevent property damage

Ensure occupant safety

7.8003.8e - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Settings will be verified and tested to meet lighting design criteria

Objective(s):
Optimize system performance

Ensure occupant safety

7.8003.8f - Occupant safety

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Motion sensor will not impact egress lighting, as required by ANSI/NFPA 101

Motion sensor will not impact minimum light level, as required by codes or local ordinances

Objective(s):
Ensure occupant safety

7.8003.8g - Staff education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.8h - Occupant education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Occupants will be educated of new lighting controls and benefits

Education will be provided by building operations staff

Objective(s):
Educate occupants about new controls and benefits

Ensure continued savings

7.8003.9 - Outdoor Photo Sensors

Desired Outcome:
Energy used for lighting reduced

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

7.8003.9a - Assessment

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be provided by lighting professional

Safety and crime prevention will be considered as part of the strategy

Objective(s):
Determine appropriate device, settings, and location

Determine existing electrical conditions

Prevent property damage

Ensure occupant safety

7.8003.9b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Photo sensor will be compatible with existing wiring

Photo sensor will be UL certified

Photo sensor will meet the requirements of the lighting design

Fixture will allow for replacement of photo sensor

Objective(s):
Reduce energy use

Ensure device functions appropriately

Ensure product safety

Ensure continued savings

7.8003.9c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Work will be performed by licensed electrical professional

Photo sensor will be installed in accordance with ANSI/NFPA 70, ANSI/NFPA 70E, and manufacturer specifications

Photo sensor will be positioned in a secure location and not subject to physical damage

Photo sensor will not be obstructed from natural light

Objective(s):
Ensure worker safety

Ensure occupant safety

Ensure continued savings

Prevent tampering

7.8003.9d - Settings

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Photo sensor and aperture will be set in accordance with the assessment

Objective(s):
Ensure sensor performance

7.8003.9e - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Settings will be verified and tested to meet lighting design criteria

Objective(s):
Optimize system performance

Reduce light pollution

7.8003.9f - Occupant safety

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Photo sensor will not impact required egress lighting, as required by ANSI/NFPA 101

Photo sensor will not impact required minimum light level, as required by codes or local ordinances

Objective(s):
Ensure occupant safety

7.8003.9g - Staff education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Building operations staff will be provided with warranty information, operation manuals, and installer contact information

Objective(s):

Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8003.11 - Lamp Replacement

Desired Outcome:
Energy used for lighting reduced

7.8003.11a - Assessment

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 - Selection

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 / ULproduct standards

Screw base lamp replacements will be ENERGY STAR® qualified or at least as energy efficient

Compact fluorescent lamps and light emitting diode lamps will be ENERGY STAR qualified or at lease as energy efficient

Linear fluorescent lamps will not be replaced with a T12, and T8 lamps will be minimum standard installed

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 - Installation

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 - Commissioning

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 - Decommissioning

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 - Safety

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 - Staff education

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 - Occupant education

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

7.8003.13 - Ballast Replacement

Desired Outcome:
Energy used for lighting reduced

Note:

7.8003.13a - Assessment

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lighting strategy will be provided by lighting professional

Assessment will identify magnetic ballast location

If the ballast is known to contain polychlorinated biphenyls (PCBs), does not have "No PCBs" on the ballast, or if the manufacturer cannot determine if the ballast contains PCBs, assume the ballast contains PCBs and dispose of ballast in an EPA-approved facility

Work order will be evaluated against site circumstances

Objective(s):
Determine and ensure appropriate device and location

7.8003.13b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Ballasts will be compatible with new or existing fixture

Ballasts will meet the appropriate nationally recognized product standards (ANSI C82.1, ANSI C82.4, UL 924, UL 1029, NEMA)

Pulse start, high-efficiency electronic ballast will be used

Ballast factor will be a minimum of 0.85

Objective(s):
Reduce energy use

Ensure device functions appropriately

Ensure product safety

7.8003.13c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixture will be de-energized before work begins

Worker will follow appropriate lockout procedures in accordance with OSHA 1910 Subpart S and ANSI/NFPA 70E

Ballasts will be installed in accordance with manufacturer specifications

If fixture is broken, worker will refer to Fixture Replacement Standard Work Specifications, Section 7.8003.14.

Lens and reflector will be cleaned

Objective(s):
Ensure worker safety

Ensure occupant safety

Ensure continued savings

Optimize fixture performance

7.8003.13d - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixture will be tested to meet IESNA light levels for certain tasks

Fixture will not impact required egress lighting, as required by ANSI/NFPA 101

Objective(s):
Meet target light levels

Ensure occupant satisfaction

Ensure occupant safety

7.8003.13e - Decommissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Ballast manufacture date will be determined, if possible

If the ballast is known to contain PCBs, does not have "No PCBs" on the ballast, or if the manufacturer cannot determine if the ballast contains PCBs, assume the ballast contains PCBs and dispose of ballast in an EPA-approved facility

Ballasts manufactured in 1979 and after will be disposed of in accordance with local ordinances or manufacturer specifications

Disposal manifests will be filed and available to building representatives

Objective(s):
Protect the environment

Prevent the reuse of inefficient components

7.8003.13f - Staff education

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

7.8003.14 - Fixture Replacement

Desired Outcome:
Energy used for lighting reduced

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

7.8003.14a - Assessment

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

7.8003.14b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Hard-wired indoor fixtures will be in accordance with ANSI/UL 1598

Plug-in indoor fixtures will be in accordance with ANSI/UL 153

Hard-wired outdoor fixtures will be suitable for local climatic conditions and in accordance with ANSI/UL product standards

Fixture will be capable of being attached to existing wiring

Fixture will carry at least a 1-year warranty

Test existing emergency fixtures and repair or replace if necessary

In-unit replacement fixtures will be ENERGY STAR® qualified

Fixture will comply with selection criteria of SWS 7.8003.11 Lamp Replacement and SWS 7.8003.13 Ballast Replacement

Objective(s):
Reduce energy use

Ensure device functions appropriately

Ensure product safety

Ensure occupant safety

7.8003.14c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Work will be performed by licensed electrical professional or a qualified contractor

Fixture will be de-energized before work begins

Appropriate lockout procedures will be followed in accordance with OSHA 1910 Subpart S and ANSI/NFPA 70E

Fixture will be installed in accordance with ANSI/NFPA 70, ANSI/NFPA 70E, and manufacturer specifications

All penetrations will be sealed (ANSI/NFPA/ICC Fire Code)

Egress fixtures will be installed in accordance with applicable codes (NFPA 101)

Lighting fixtures will be installed and secured as specified NECA/IESNA 500

Objective(s):
Ensure worker safety

Ensure occupant safety

Preserve integrity of building envelope

Ensure integrity of fire barrier

Ensure quality installation

7.8003.14d - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixtures will be tested to meet IESNA light levels for certain tasks

Fixtures will not impact required egress lighting, as required by ANSI/NFPA 101

Objective(s):
Meet target light levels

Ensure occupant satisfaction

Ensure occupant safety

7.8003.14e - Decommissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixtures, lamps, and ballasts will be disposed of in accordance with local ordinances or manufacturer specifications

Ballast manufacture date will be determined, if possible

If the ballast is known to contain PCBs, does not have "No PCBs" on the ballast, or if the manufacturer cannot determine if the ballast contains PCBs, assume the ballast contains PCBs and dispose of ballast in an EPA-approved facility

Ballasts manufactured in 1979 and after will be disposed of in accordance with local ordinances or manufacturer specifications

Objective(s):
Protect the environment

Prevent the reuse of inefficient components

7.8003.14f - Safety

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

7.8003.14g - Staff education

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

7.8003.14h - Occupant education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Occupants will be educated on new fixtures and benefits

Occupants 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 fixtures and benefits

Ensure continued savings

Protect the environment

Ensure occupant safety

7.8003.15 - Security Lighting

Desired Outcome:
Energy used for lighting reduced

Note:

7.8003.15a - Assessment

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

7.8003.15b - Selection

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Security light fixtures 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

Security cameras will be considered

Security lighting shall be configured to be switched off unless motion is detected

Lighting shall remain on for no more than 30 minutes if continued motion is not detected

Photo and motion sensors will be included

Vandal proof fixtures will be used

Objective(s):
Reduce energy use

Ensure device functions properly

Ensure product safety

Ensure occupant satisfaction

Ensure adequate lighting during emergency situations

7.8003.15c - Installation

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Fixture will be de-energized before work begins

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

7.8003.15d - Commissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Security lighting will be tested in accordance with local ordinances and manufacturer specifications

To limit light pollution, aiming of light fixtures shall minimize light emitted above the horizontal

Security lighting shall not shine light directly beyond the perimeter of the development, and shall not shine light directly into any window of any residence

Objective(s):
Meet target light levels

Ensure occupant satisfaction

Ensure occupant safety

7.8003.15e - Decommissioning

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Lamps will be disposed of in accordance with local ordinances or manufacturer specifications

Objective(s):
Protect the environment

Prevent the reuse of inefficient components

7.8003.15f - Safety

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

7.8003.15g - Staff education

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

7.8003.15h - Occupant education

Desired Outcome:
Energy used for lighting reduced

Specification(s):
Education regarding security lighting will be provided by building operations staff

Objective(s):
Ensure occupant safety

7.8004.3 - Clothes Dryer Replacement

Desired Outcome:
Reduce energy and environmental impact for drying clothes

7.8004.3a - Assessment

Desired Outcome:
Reduce energy and environmental impact for drying clothes

Specification(s):
Unit and electrical receptacle will meet requirements of NFPA 70 Article 422

Objective(s):
Determine and ensure appropriate device and location

7.8004.3b - Selection

Desired Outcome:
Reduce energy and environmental impact for drying clothes

Specification(s):
Total energy use will be factored into the selection process if fuel switching is being considered

Dryer will be equipped with moisture sensor

Equipment will be selected with energy features that reduce both peak electric demand and absolute energy use

Standby losses for equipment will be 1 watt or less

Appliance will be covered by a minimum 1-year warranty

Objective(s):
Reduce energy use

Avoid increasing total energy use (gas and electric) when fuel switching

Ensure product safety

Ensure occupant satisfaction

7.8004.3c - Installation

Desired Outcome:
Reduce energy and environmental impact for drying clothes

Specification(s):
Appliance will be installed according to manufacturer specifications (e.g., leveling, plumbing connection, electrical connection, interior lighting) and meet all applicable codes

If existing venting does not meet the following criteria (as well as manufacturer specifications and applicable codes), new venting will be installed using the following specifications:

- Appliance will be vented to the outdoors using rigid metal-to-metal venting
- Venting design will meet standards for optimal venting, including demand control venting
- Venting will not be constricted or blocked
- Only clamps, not screws, will be used on vents
- Pest screen will be installed at the termination
- At least 3' of the vent closest to the exterior of the house will be insulated

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

If a combustion appliance is used, the building must pass a combustion appliance zone test upon completion of installation

Any penetrations to the exterior created by the installation of the appliance will be sealed

Objective(s):
Ensure worker safety

Ensure occupant safety

Ensure continued savings

Achieve intended appliance function

7.8004.3d - Commissioning

Desired Outcome:
Reduce energy and environmental impact for drying clothes

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

7.8004.3e - Decommissioning

Desired Outcome:
Reduce energy and environmental impact for drying clothes

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

7.8004.3f - Safety

Desired Outcome:
Reduce energy and environmental impact for drying clothes

Specification(s):
All OSHA standard practices will be followed

Objective(s):
Ensure worker safety

Ensure occupant safety

7.8004.3g - Staff education

Desired Outcome:
Reduce energy and environmental impact for drying clothes

Specification(s):
Warranty information, operation manuals, and installer contact information will be provided to the building operations staff

All equipment controls will be demonstrated to the building operations staff

Objective(s):
Educate building operations staff about operation and maintenance of equipment

Ensure continued savings

7.8004.3h - Occupant education

Desired Outcome:
Reduce energy and environmental impact for drying clothes

Specification(s):
Specific information on the proper maintenance of the equipment will be provided to the occupants

All equipment controls and proper operation will be demonstrated to the occupants

Operators of clothes dryers will be provided with information on using the clothes dryers safely and effectively; this will include information on items that are prohibited to be placed in the clothes dryer (Refer to the Association of Home Appliance Manufacturers recommendations)

Objective(s):
Educate occupants about appliance and benefits

Ensure continued savings

7.8101.2 - Low-Flow Retrofit Devices

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

7.8101.2a - Removal

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 - Installation

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 - Commissioning

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