WELCOME TO THE BASIS OF DESIGN

THE RIGHT CHOICES MATTER:

The **Basis of Design (BOD)** specifies performance criteria based on durability + maintenance requirements, availability, and energy + water efficiency and provides sample products. By standardizing building performance across the portfolio, we can ensure quality-built homes for our residents.

The products in the BOD have been vetted by POAH and are shown as examples that meet our standards. Alternates are welcome, however they must be brought to POAH's attention and approved by POAH if they are to be used in the project.

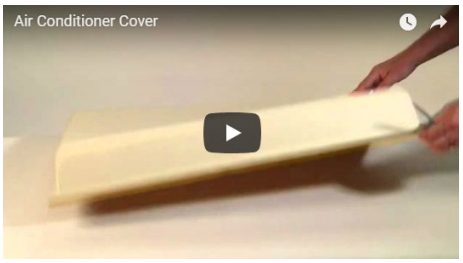
The Basis of design is a product specification/selection resource, not a product purchasing platform.

TABLE OF CONTENTS:

AIR CONDITIONER COVERS

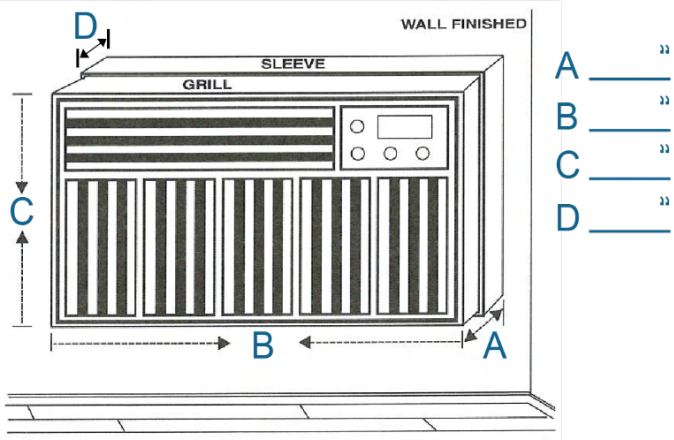
PRODUCT DEFINITION:

In locations with permanently installed window or through wall air conditioners, a plastic hard cover should be installed on the interior of the air conditioner unit during the winter months. Air conditioner covers reduce cold air infiltration into the units/ building, save on heating costs, and make units more comfortable. For use on the interior of the unit only.



http://www.parksupplyofamerica.com
Mid States Plastics Chill Stop'r Air Conditioner Cover.

PRODUCT ORDERING INFORMATION:



Record the size of your existing air conditioners in the diagram:

The following dimensions are required:

- Depth of air conditioner and sleeve (A)
- Width of air conditioner (B)
- Height of air conditioner (C)
- Depth of sleeve (D)

This information can then be used by the architect, contractor, product representative, or Project Manager coordinating the installation. Contact manufacturer directly for specific measurements required.

BASIS OF DESIGN

SAMPLE PRODUCT:

Battic Door Energy Conservation Products / Universal Air Conditioner Indoor Cover

- (A) Cover Depth: 6”
- (B) Cover Width: 30”
- (C) Cover Height: 21”
- High impact hard cover
- R-Value R5

ORDER HERE

LOOKING FOR INFORMATION ON AC UNITS?

Take a look at the AC Unit Spec:

CLICK HERE FOR AC UNIT SPEC

https://www.poahbod.org/appliances#appliances-index-range-ac-unit

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ADDITIONAL INFORMATION:

REQUIRED DETAILS:

- At sites where residents provide their own air conditioner, the depth of the cover may vary. If possible, select one depth that will fit all existing depths.
- Some minor modifications to the existing wall or the installation of trim may be required to accommodate the air conditioner cover. If recommended product is not conducive to existing conditions, please contact Design + Building Performance Dept. for assistance.

BASIS OF DESIGN

CONTACT DESIGN + BUILDING PERFORMANCE DEPT.

https://www.poahbod.org/contact

BASIS OF DESIGN

APPLIANCES

REFRIGERATOR

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- Volume:
  - Non-family Units: 17.5 cubic feet minimum or match existing.
  - Family Units: 21 cubic feet or match existing.
- Width: 30” minimum width or match existing.
- Energy Star Rated: Required.
- Self-Defrosting: Required.
- No water/ice dispensers.
- No ice makers.
- No side-by-side doors.
- Reversible hinges required.
- Refrigerators in ADA units must be ADA approved.
  - 100% of the fresh food space below 54 inches
  - 50% of the freezer space below 54 inches
  - Controls must be below 54 inches

SAMPLE PRODUCTS:

Whirlpool
30-inch Wide
18.2 cu. ft.
Top Freezer
Manufacturer Number:
WRT108FFDM

- ADA Compliant

BASIS OF DESIGN

RANGE

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- Volume: 4.5 cubic feet minimum or match existing.
- Width: 30” minimum width or match existing.
- Knobs on front face of range for ease of use.
- Electric ranges preferred.
    - Gas ranges are a fire hazard and introduce harmful fumes into the dwelling unit.
- When replacing gas ranges, confirm possibility of converting to electric.
- Do not use "self-cleaning" ranges.

SAMPLE ELECTRIC RANGES (PREFERRED):

GE
30-inch
Manufacturer Number:
JBS460DMWW

- ADA Compliant

SAMPLE GAS RANGES:

Whirlpool
30-inch
Gas Range
Manufacturer Number:
WFG320M0BW

- ADA Compliant

BASIS OF DESIGN

SPLASH PLATE TO BE INSTALLED ON WALL BEHIND RANGE:

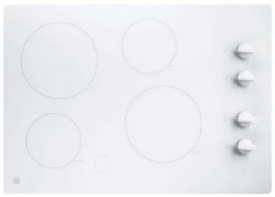
Broan
Reversible Backsplash
Almond
EP300108
(Install with Almond finish facing out)

COOKTOP

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- Width: 30” minimum width or match existing.
- Coordinate cabinetry shop drawings with product choice.
- Product to meet ADA standards; Architect to verify mounting height/ location meets ADA standards.
- Electric cooktops preferred.

SAMPLE ELECTRIC COOKTOP (PREFERRED):



GE
30-inch
Built-in Electric Cooktop
Manufacturer Number:
JP3030TJWW

- ADA compliant if installed per ADA guidelines.

SAMPLE GAS COOKTOPS:

Whirlpool
30-inch
Gas Cooktop
Manufacturer Number:
W3CG3014XW

- ADA compliant if installed per ADA guidelines.

BASIS OF DESIGN

RANGE HOOD

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- If at all possible, range hood should vent to exterior:
  - In new construction, drawings should show the range hood exhausting to the exterior.
  - In rehabs, this should be designed and bid as an add alternate.
- Width: 30" minimum or match existing.
- All range hoods must receive StoveTop FireStop® Rangehood Fire Extinguishers.
  - Extinguishers must fit within the depth of rangehood without being noticeably visible.

SAMPLE VENTED RANGE HOOD (PREFERRED):

Air King
30” Vented Range Hood
3-1/4” x 10” Vent
100/250 CFM
Manufacturer Number:
ESQZ2308

Broan
30" Vented Range Hood
7" Round Vent
190 CFM
Manufacturer Number:
423001

SAMPLE NON-VENTED RANGE HOOD:

Broan
Non-Vented Range Hood
Manufacturer Number:
413001

BASIS OF DESIGN

RANGE HOOD

SAMPLE FIRE EXTINGUISHERS (MANDATORY):

StoveTop
FireStop Rangehood
Height: 3.5"
Diameter: 3.4"
Manufacturer Number:
675-3

- Attaches under range hoods.

StoveTop
FireStop Microhood
Height: 2.2"
Width: 3.9"
Length: 13.9"
Manufacturer Number:
677-1 (Black), 677-2 (White)

- Attaches under microwave.

EXAMPLE OF **NON-CONFORMING** FIRESTOP INSTALLATION:

Firestops should be concealed within depth of range hood and be hidden in plain sight.

BASIS OF DESIGN

MICROWAVE (OVER-THE-RANGE)

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- If at all possible, microwave should vent to exterior:
- In new construction, drawings should show the microwave exhausting to the exterior.
- In rehabs, this should be designed and bid as an add alternate.
- Width: 30" minimum or match existing.
- All over-the-range microwaves must be able to receive StoveTop FireStop® Microhood Fire Extinguishers without the unit being noticeably visible.

SAMPLE OVER-THE-RANGE MICROWAVES:

Whirlpool
30" Vented Microwave
1.7 Cubic Feet
220 CFM
Exhaust vented to exterior (preferred) or recirculated
Manufacturer Number:
MH1170XSQ

Frigidaire
30" Vented Microwave
1.8 Cubic Feet
300 CFM
Exhaust vented to exterior (preferred) or recirculated
Manufacturer Number:
FFMV1846VW

SAMPLE OVER-THE-RANGE MICROWAVES:

StoveTop
FireStop Microhood
Height: 2.2"
Width: 3.9"
Length: 13.9"
Manufacturer Number:
677-1 (Black), 677-2 (White)

- Attaches under microwave.

BASIS OF DESIGN

BACK-UP POWER

WHEN TO USE THIS BASIS OF DESIGN SECTION

This section should be used for both new construction projects and rehab project when considering back-up power generation. The objective is to guide the design and installation of back-up power to cover the loads required by local building codes, important site-specific loads (i.e. septic system pumps) and if possible an area of refuge. The area of refuge (see graphic 2) is a location in the building residents can inhabit in case of a prolonged power outage. The requirements listed in this section are intended to serve as minimum standards. Projects may exceed these requirements as circumstances allow.

REQUIREMENTS:

BACK UP POWER OPTIONS:

Existing Generators:

For properties with an existing generator: evaluate the capacity and loads covered by the existing back-up power system. When replacing the back-up power system increase the size (if necessary) to add resilient loads as described below.

Existing Buildings without Generators:

For properties without back-up power: evaluate the feasibility of adding an Energy Storage System (ESS) as the source of back-up power. If it is not feasible, install a generator sized to cover all code related loads and the resilient loads listed below. The gas or electric service will need to be evaluated to determine if upgrades are necessary to support the fuel or service needed to power the generator.

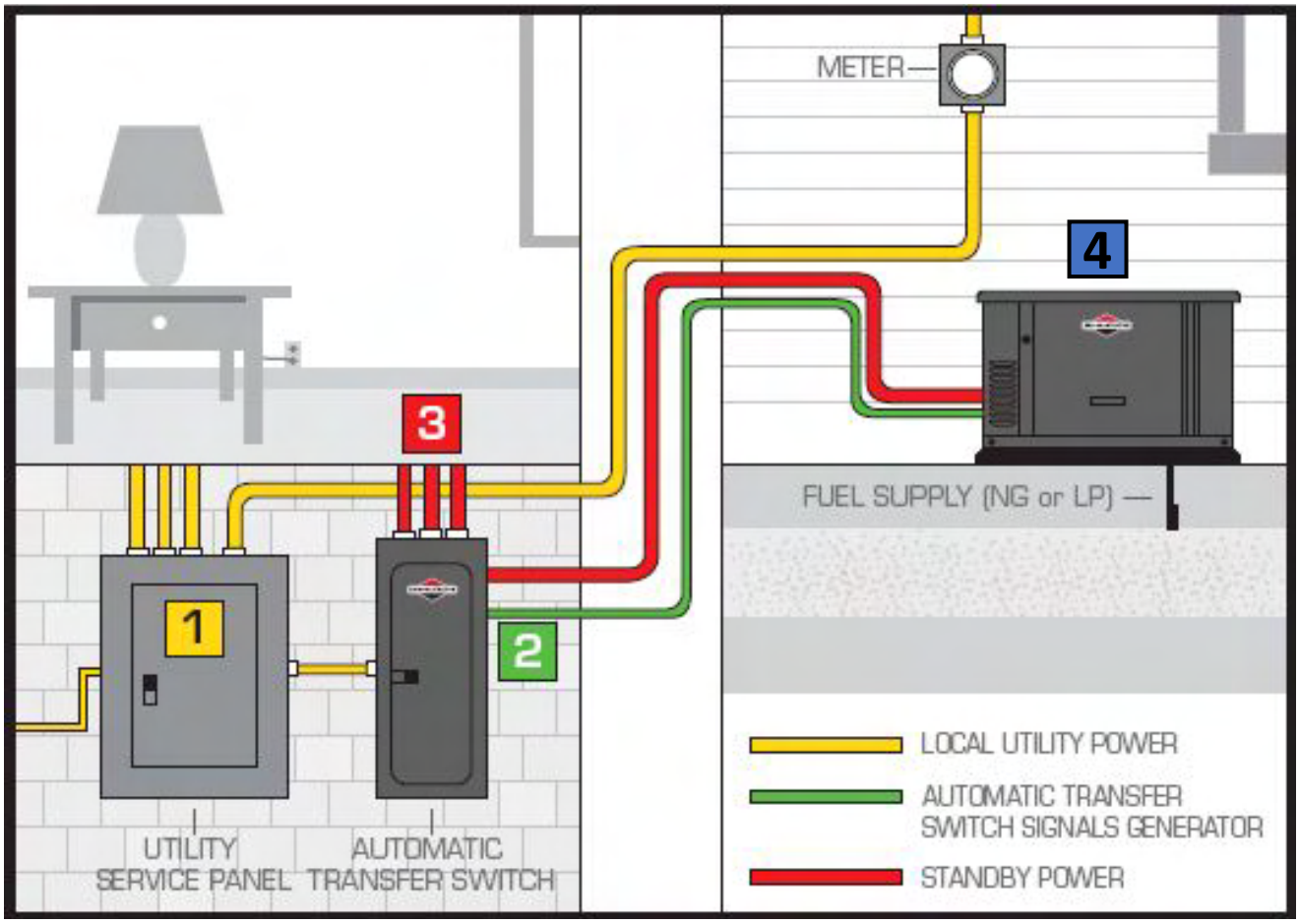
New Construction Buildings

All new construction projects should include a back-up power system capable of accommodating code required loads and resilient loads.

BASIS OF DESIGN

REQUIRED DETAILS:

- **Code regulations:** Follow all national, state, and local codes for the design and location of all generators. New and updated back-up power will likely require an electrical permit.
- **Automatic standby:** All generators should include an automatic transfer switch to activate the back-up power in an outage to prevent service disruption. Each meter included on the generator will need its own transfer switch. The transfer switch is connected to the utility panel(s) where the critical loads are located. See graphic below.



Graphic 1: Simplified diagram of a back-up power system. When power is disrupted the automatic transfer switch (2) signals generator (4) to activate standby power (3) and carry the loads on the utility panel (1).

- **Fuel Source:** Local codes may dictate the required fuel source. Diesel fueled generators are preferred as diesel engines are more reliable. Any generator larger than 100 kW should only use diesel fuel.
    - **Diesel:** Any diesel tank greater than 500 kW need to be certified by the fire chief. Only use #2 off-road diesel fuel. Do not use any type of bio fuel with a diesel tank. Weekly testing of the generator is imperative to ensure the fuel is constantly moving in the tank. The diesel tank should also be checked once a year to maintain the quality of the fuel. If the generator is diesel fueled and located on a roof, work with an engineer to design a flow pump system to pump diesel from a ground level tank to the roof level tank.

BASIS OF DESIGN

  - **Natural Gas:** If natural gas is used and pressure is an issue, a generator with low pressure capability will be needed. Be aware that in some power outages caused by a natural disaster, the utility company will shut off natural gas service, rendering the generator unusable. Most plumbing codes will require flexible connections between the gas supply and the gas inlet of the generator.
  - **Battery:** If local building and fire department codes allow, consider an Energy Storage System (ESS) or battery for back-up power. This applies to new construction and rehab projects, especially if a solar PV system is in place or planned for the future.
- **Emissions regulations:** Some states regulate generator exhaust emissions. Regardless of regulations, specify a generator with a catalytic converter.
- **Run Time:** The run time will vary based on the loads the generator is designed to carry and the duration the loads need to be accommodated.
- **Location:** The generator must be installed in a location that allows proper exhaust. Consult any local zoning regulations that may dictate minimum distances from the generator to property lines or other nearby structures. Distance from windows, fresh air intakes, patios and balconies and outdoor amenity space should also be reviewed as part of the building permit. Generators should also be in a location away from potential water intrusion from gutters and sprinklers.
- **Support structure:** Steel should be used for any/all generator structural supports. Wood is not permitted.
- **Housing/ enclosure:** Check local noise ordinances and design the back-up power system enclosure to mitigate sound while allowing proper airflow and exhaust.
- **Code required emergency loads:** Electrical engineer to size back-up power to accommodate any building code requirements. These loads may include the following:
  - Fire alarm panel*
  - Elevators
  - Fire pump (sprinkler system)
  - Lighting (corridors/ stairwells)*
  - ADA devices (door openers)

  **These items can include integral back up power. POAH's preference is for them to include integral batteries.*
- **Additional loads to consider:**
  - Electric door strikes/ latch at building entrances (if not on back-up power the doors need to go to fail-safe mode)
  - Garage Ventilation
  - Domestic Water booster pump
- **Resilient loads:** Generators should be sized appropriately to address resilient loads as follows:
  - Septic/ sewer ejector pumps
  - Community space lights and plugs
  - Community space kitchenette and refrigerator (for medication)
  - Community space HVAC
  - Community space DHW
  - Offices lights and plugs
  - Heating system pumps if heat is provided in a hydronic system powered by fossil fuel
- **Testing:** Follow any local codes or utility regulations for testing and run time log documentation. NFPA 99 and 110 provide regulations for this testing in certain building types and is considered good practice for all building types. To ensure back-up power system is operating properly, all generators must be tested weekly for 20-30 minutes.

BASIS OF DESIGN

- **Service contracts:** All generators must have a service contract in place for routine testing and maintenance. Diesel powered generators should be inspected and cleaned (if necessary) on an annual basis.
- **Remote monitoring:** Any remote monitoring should use cell-based monitoring which is more reliable in the event of a power outage.
- **Preventative maintenance:** Generators should be test run once a week for 20-30 minutes to ensure performance. Diesel powered generators should be serviced no less than annually to inspect and clean if necessary. Ensure that no debris (i.e. leaves, grass, branches) is allowed to collect around the generator.
- **Climate considerations:** Properties located in areas prone to snow should ensure back-up power systems are part of the snow removal plans to confirm exhaust isn't blocked. Properties located in a flood zone or area of increased flooding need to ensure generators are installed on structures above the designated flood level. If the property is in a coastal climate with exposure to harsh salt air, consult a generator technician about the best coating or protection for the generator and support structure to prevent rust from forming.

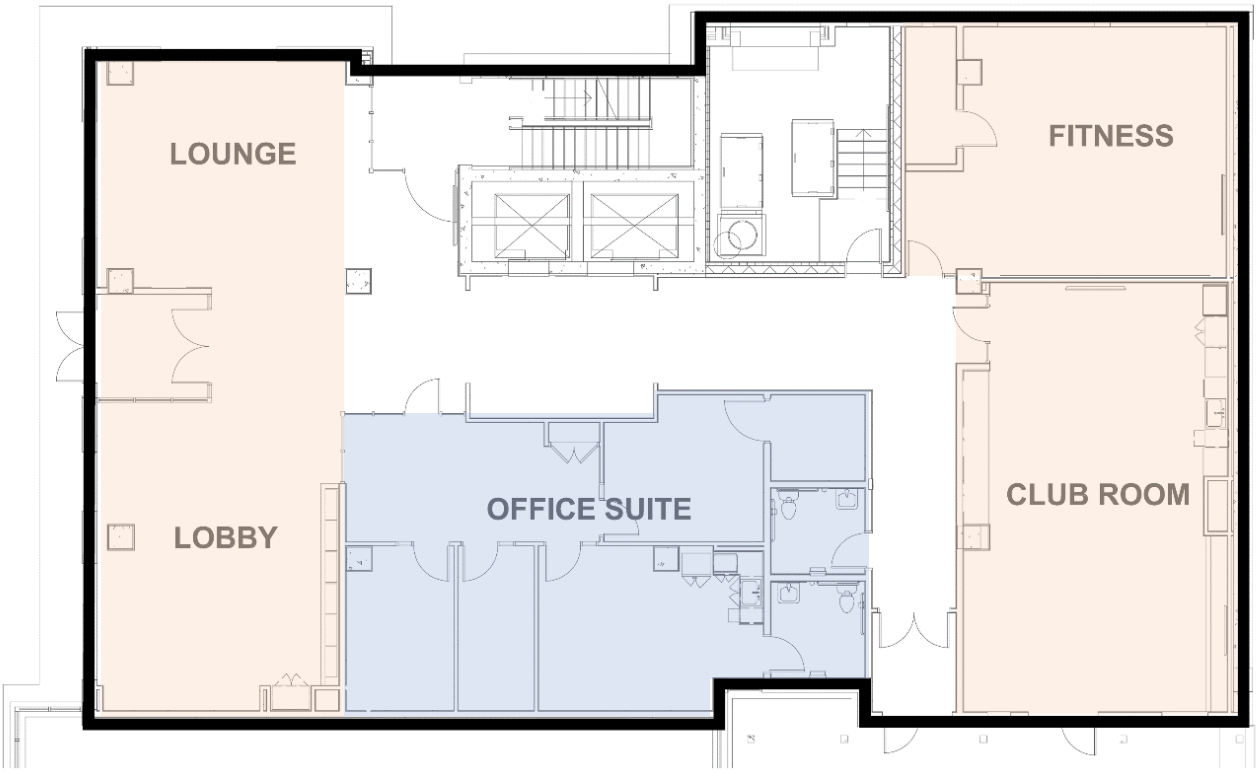
BASIS OF DESIGN

AREA OF REFUGE:

An area of refuge is a climate-controlled location at the property for residents to use during power outages. Typically located in resident amenity spaces and the property management offices, the electric load for HVAC, DHW, and lights and plugs will be tied to a generator or other back-up power source. During any new construction project, major rehab, or when upgrading the back-up power system, the feasibility of creating an area of refuge should be evaluated. Creating an area of refuge is not required by building codes but provides residents an element of resiliency during power outages.

REQUIRED DETAILS:

- **Design:** This space should include the property management office suite and a community space for residents. The space should include a bathroom and kitchenette.
- **Electric loads required:** The HVAC and DHW systems, lighting, and all plugs should be powered by a generator. These loads are imperative to maintain comfort levels, power devices and provide refrigeration for resident medications.



Graphic 2: This plan highlights the common spaces in a building which are included in its area of refuge. All plugs, lighting, heating, cooling, ventilation and DHW for this area (typically on the first floor) are powered by the generator. This includes the refrigerator for resident medication.

BASIS OF DESIGN

WALL OVEN

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- Volume: Minimum 4 cubic feet or match existing.
- Coordinate cabinetry shop drawings with product choice.
- Product to meet ADA standards; Architect to verify mounting height/ location meets ADA standards.
- Electric wall oven preferred.

SAMPLE ELECTRIC WALL OVEN (PREFERRED):

GE
27-inch width
Electric Single Standard Wall
Manufacturer Number:
JK3000DNWW

SAMPLE GAS WALL OVEN:

Whirlpool
27-inch width
Single Wall Oven
Manufacturer Number:
WOS51EC7AW

BASIS OF DESIGN

DISHWASHER

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White or Black; Color to be determined by architect, POAH Design + Building Performance Dept., or match existing. All appliances must match.
- Width: 24” minimum width or match existing.
- Energy Star Rated: Required.
- All dishwashers to be built-in to cabinetry/ counter assembly.
- Coordinate cabinetry shop drawings with product choice.

SAMPLE DISHWASHERS:

Whirlpool
24-inch
Built-in Dishwasher
Manufacturer Number:
WDF550SAFW

GE
24-inch
Built-in Dishwasher
Manufacturer Number:
GSD3300DWW

BASIS OF DESIGN

AIR CONDITIONING UNIT

(WINDOW OR THROUGH-WALL)

GENERAL INFORMATION & REQUIRED DETAILS:

- Confirm electrical supply can accommodate new air conditioning unit.
- Energy Star: Required.
- AC unit must fit through-wall sleeve.
- Through-wall sleeve to slope to exterior.
- All through-wall AC Units should be covered in Winter w/ interior plastic cover. See **AC Cover Spec** for more information:
- AC Unit should be sized appropriately per energy star's guidelines:

Area To Be Cooled (square feet)	Capacity Needed (BTUs per hour)
100 up to 150	5,000
150 up to 250	6,000
250 up to 300	7,000
300 up to 350	8,000
350 up to 400	9,000
400 up to 450	10,000
450 up to 550	12,000
550 up to 700	14,000
700 up to 1,000	18,000
1,000 up to 1,200	21,000
1,200 up to 1,400	23,000
1,400 up to 1,500	24,000
1,500 up to 2,000	30,000
2,000 up to 2,500	34,00

SAMPLE PRODUCT:

LG
12,000 BTU, 115 Volt
Window Air Conditioner
Energy Star
Manufacturer Number:
LW1216ER

WASHER

GENERAL INFORMATION & REQUIRED DETAILS:

- Front loaded for easy ADA accessibility.
- Energy Star Rated: Required.

SAMPLE PRODUCT:

Samsung
4.5 Cu Ft
Full Size Front Load Washer
ENERGY STAR
Manufacturer Number:
WF45T6000AW

DRYER

GENERAL INFORMATION & REQUIRED DETAILS:

- Front loaded for easy ADA accessibility.
- High Efficiency: Required.

SAMPLE PRODUCTS:

GE
7.8 Cubic Foot Vented
High-Efficiency **Gas** Dryer
Manufacturer Number:
GFD55GSSNWW

LG
4.2 Cubic Foot Heat Pump
High-Efficiency **Electric** Dryer
Manufacturer Number:
DLHC1455W

BASIS OF DESIGN

BATH ACCESSORIES (UNIT)

GENERAL INFORMATION & REQUIRED DETAILS:

DO NOT INSTALL:

- Toothbrush holders.
- Soap dishes at bathroom sinks.

MEDICINE CABINETS

GENERAL INFORMATION & REQUIRED DETAILS:

- If possible, all medicine cabinets should:
  - be recessed into wall (eliminates shadow from vanity light).
  - have beveled edge mirror. No metal frames.
- Rust-resistant steel body.
- Adjustable steel shelves (No Glass Shelves).
- In ADA units, install medicine cabinet on side wall and mirror over sink. Confirm heights with architect or building code for ADA compliance.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE RECESSED MEDICINE CABINET (PREFERRED):

HD Supply
16W x 26”H Recessed Beveled Edge Mirrored Medicine Cabinet
Steel Body
Metal Shelves
Manufacturer Number:
189813

SAMPLE SURFACE MOUNTED MEDICINE CABINET:

HD Supply
16W x 26”H Surface Mount Mirror Medicine Cabinet
Steel Body
Metal Shelves
Manufacturer Number:
404469

BASIS OF DESIGN

MIRRORS

GENERAL INFORMATION & REQUIRED DETAILS:

- In ADA units, install mirror over sink, and medicine cabinet on side wall. Confirm heights with architect or building code for ADA compliance.
- Wall-mounted Mirror.
- 24” x 36” Stainless Steel Channel Frame Mirror.
- Frame: Stainless Steel, roll-formed one-piece construction.
- Glass: ¼” thick, No. 1 quality, plate/float glass, silver coated and hermetically sealed with a uniform copper plating.
- **Installation:**
    - **Install per manufacturer's instructions.**
    - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCT:

Bobrick
Framed Mirror 24 x 36" Stainless Steel
Manufacturer Number:
165 2436

TOILET TISSUE HOLDERS

GENERAL INFORMATION & REQUIRED DETAILS:

- Surface mounted holder for standard core roll tissue.
- Unit to be fabricated stainless steel.
- Finish: Satin Stainless Steel, roller to be chrome-plated high impact resistant ABS plastic.
- **Installation:**
    - **Install per manufacturer's instructions.**
    - **Install on wood stud or add blocking; do not install directly to sheetrock.**

BASIS OF DESIGN

SAMPLE PRODUCT:

Franklin Brass
Stainless Steel Toilet Paper Holder Concealed Mount
Manufacturer Number:
819400

TOWEL BARS

GENERAL INFORMATION & REQUIRED DETAILS:

- Square Towel Bar to be fabricated of stainless steel.
- Bar shall be square tubing and shall be held in receiver holes in support posts.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCTS:

Franklin Brass
Futura 3/4 x 18" Chrome Towel Bar Set
Manufacturer Number:
818725

Franklin Brass
Futura 3/4 x 24" Chrome Towel Bar Set
Manufacturer Number:
818740

Franklin Brass
Futura 3/4 x 24" Century Towel Bar Set
Manufacturer Number:
819350

BASIS OF DESIGN

ROBE HOOKS

GENERAL INFORMATION & REQUIRED DETAILS:

- Fabricated of stainless steel.
- Install in solid wood or use appropriate anchors to support weight.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Wall: install on wood stud or add blocking; do not install directly to sheetrock.**
  - **Door: install in solid wood, not to hollow core.**

SAMPLE PRODUCT:

Symmons
Dia Chrome Robe Hook
Manufacturer Number:
459079

SHOWER CURTAIN RODS

GENERAL INFORMATION & REQUIRED DETAILS:

- Heavy Duty with flanges fabricated from alloy stainless steel.
- Tubing shall be 1” diameter.
- Flanges shall be provided and have dimpled holes for exposed fasteners.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCT:

HD Supply
60” Chrome Shower Rod Set
Manufacturer Number:
822450

BASIS OF DESIGN

GRAB BARS

GENERAL INFORMATION & REQUIRED DETAILS:

- Grab Bars with Snap-on flange covers for concealed mounting shall be fabricated of stainless steel.
- Tubing shall be 1 ½" O.D. (outside diameter).
- End flanges shall have two 3/8" diameter mounting holes, center/intermediate supports shall have 2 keyhole slots for easy access.
- All exposed surfaces to be satin stainless-steel finish.
- All grab bar tubing to have **peened, non-slip finish**.
- Provide in configurations and mounting heights as required by Federal, State and Local Accessibility Codes and Fair Housing Guidelines.
- **Installation:**
    - **Install per manufacturer's instructions.**
    - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCTS:

Bobrick
Concealed Mount Grab Bar
Nonslip Griping
1-1/2" Diameter, 18" Length
Manufacturer Number:
B6806.99x18

Bobrick
Concealed Mount Grab Bar
Nonslip Griping
1-1/2" Diameter, 24" Length
Manufacturer Number:
B6806.99x24

BATHING FIXTURE SEATS

SHOWER GENERAL INFORMATION & REQUIRED DETAILS:

- "L-shaped" fold-up padded shower seat. To meet or exceed ADA requirements.
- Shall be of adequate strength to support a load of 250 pounds and shall conform to the size and edge clearances as diagrammed in ADA.

BASIS OF DESIGN

- Tube: 18 gauge (0.48 in thick) type 304 stainless steel, 1" diameter and 1 ¼" square. Unitized all welded construction. Exposed surfaces are satin finish. Edges and Corners are radius-ed and burr free.
- Flange: 3/16" type 304 stainless steel. Exposed surfaces have satin finish. Edges and Corners are radius-ed and burr free.
- Bracket: 16 gauge (0.06 in thick) type 304 stainless steel. Exposed surfaces to have satin finish. Edges and corners are radius-ed and burr free.
- Bracket: 16 gauge (0.06 in thick) type 304 stainless steel. Exposed surfaces to have satin finish. Edges and corners are radius-ed and burr free.
- Spring: Stainless steel type 304, O.D. 27/32" coils x 2 ¼" body length x .085" wire diameter.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

BATHTUB INFORMATION

- The bathtub seat meets or exceeds ADA requirements.
- If a permanent bathtub seat is not provided, a removable seat is required.
- Top of Seat: Between 17" minimum and 19" maximum above the bathroom finish floor.
- Seat Depth: Between 15" minimum and 16" maximum.

SAMPLE PRODUCTS:

Bobrick
Shower Seat 32" Ivory
Manufacturer Number:
5181

Freedom Showers
Portable ADA Bathtub Seat
- 26.5"W x 15"D
- Legs Adjustable Between 16" – 17.5"
- Solid Phenolic White
- Manufacturer Number:
  APFSHPQ-265150PWS

BASIS OF DESIGN

BATH ACCESSORIES (COMMON)

GENERAL INFORMATION & REQUIRED DETAILS:

DO NOT INSTALL:

- Soap dishes at bathroom sinks.

MIRRORS

GENERAL INFORMATION & REQUIRED DETAILS:

- Wall-mounted Mirror.
- 24” x 36” Stainless Steel Channel Frame Mirror.
- Frame: Stainless Steel, roll-formed one-piece construction.
- Glass: ¼” thick, No. 1 quality, plate/float glass, silver coated and hermetically sealed with a uniform copper plating.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCT:

Bobrick
Framed Mirror 24 x 36" Stainless Steel
Manufacturer Number:
165 2436

TOILET TISSUE HOLDERS

GENERAL INFORMATION & REQUIRED DETAILS:

- Surface mounted holder for standard core roll tissue.
- Unit to be fabricated stainless steel.
- Finish: Satin Stainless Steel, roller to be chrome-plated high impact resistant ABS plastic.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

BASIS OF DESIGN

SAMPLE PRODUCT:

Franklin Brass
Stainless Steel Twin Toilet Paper Holder Concealed Mount
Manufacturer Number:
819425

GRAB BARS

GENERAL INFORMATION & REQUIRED DETAILS:

- Grab Bars with Snap-on flange covers for concealed mounting shall be fabricated of stainless steel.
- Tubing shall be 1 ½" O.D. (outside diameter).
- End flanges shall have two 3/8" diameter mounting holes, center/intermediate supports shall have 2 keyhole slots for easy access.
- All exposed surfaces to be satin stainless-steel finish.
- All grab bar tubing to have **peened, non-slip finish**.
- Provide in configurations and mounting heights as required by Federal, State and Local Accessibility Codes and Fair Housing Guidelines.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCTS:

Bobrick
Concealed Mount Grab Bar
Nonslip Griping
1-1/2" Diameter, 18" Length
Manufacturer Number:
B6806.99x18

Bobrick
Concealed Mount Grab Bar
Nonslip Griping
1-1/2" Diameter, 24" Length
Manufacturer Number:
B6806.99x24

BASIS OF DESIGN

SOAP DISPENSORS

GENERAL INFORMATION & REQUIRED DETAILS:

- To be installed in Common Bathrooms only.
- Stainless steel construction.
- Satin finish.
- ADA compliant.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**
  -

SAMPLE PRODUCT:

Bobrick
Soap Dispenser Vertical
Mount Tall Stainless Steel
Manufacturer Number:
2111

HAND DRYERS

GENERAL INFORMATION & REQUIRED DETAILS:

- Stainless steel cover.
- **Installation:**
  - **Install per manufacturer's instructions.**
  - **Install on wood stud or add blocking; do not install directly to sheetrock.**

SAMPLE PRODUCT:

XLERATOR
No Heat Hand Dryer
With Noise Reduction,
Brushed Stainless
Manufacturer Number:
XL-SB-ECO-1.1N

BASIS OF DESIGN

BUILDING ENCLOSURE: NEW CONSTRUCTION

WHEN TO USE THIS BASIS OF DESIGN SECTION

This BOD section should be used for new construction projects. A high-performance building enclosure will minimize loads on heating/cooling systems and is essential to building durability, resident comfort, and energy efficiency at POAH properties. This section is intended to outline criteria for high performance building enclosure in new construction projects.

HIGH PERFORMANCE BUILDING ENCLOSURES: CONTROL FUNCTIONS

POAH expects its design consultants to design and contractors to construct high performance building enclosures for all new construction projects. POAH's requirements in this regard may – and most likely do – exceed minimum code requirements.

A high-performance enclosure will excel at providing the following 5 critical control functions:

- **Water Control**
- **Air Control**
- **Thermal Control**
- **Vapor Control**
- **Critter Control**

Requirements relative to these enclosure control functions are outlined below. Note that the outline is not exhaustive. Additional measures beyond those listed may be required to achieve performance objectives. Some of these measures may not apply to specific projects (e.g. step flashing would not apply to a membrane roof). Consult with POAH Design + Performance regarding deviations or questions of applicability.

GENERAL DESIGN REQUIREMENT

DESIGN DOCUMENT REQUIREMENTS:

- Building enclosure **details** in design documents **must clearly designate the components providing these control functions**.
  Note: Color coding of control layers in details is required.
- Provide building sections that demonstrate continuity of Water, Air and Thermal control layers.
  Note: Color coding of control layers in sections is required.

BASIS OF DESIGN

WATER CONTROL REQUIREMENTS:

ROOF

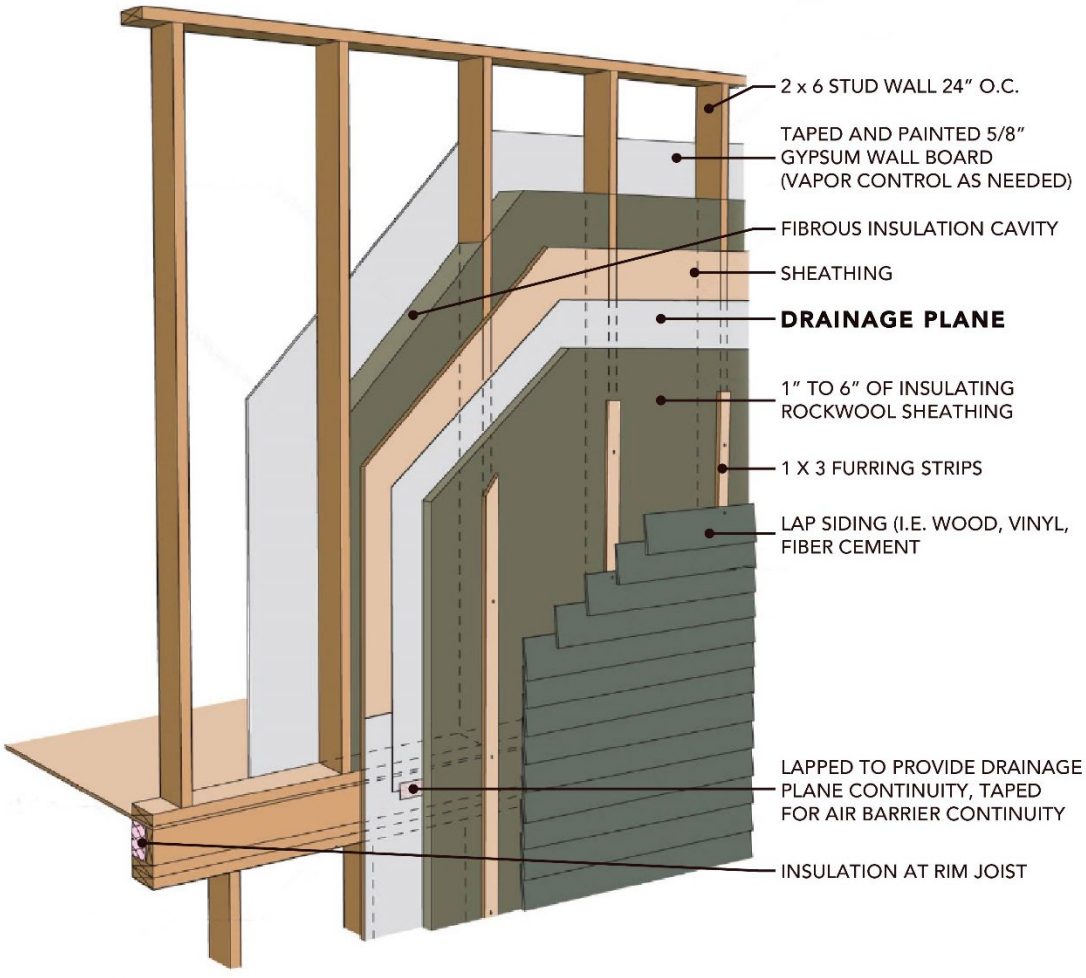
Refer to:

BOD ROOFING SECTION https://www.poahbod.org/roofing

WALL – WATER CONTROL LAYER:

- Provide a continuous water control layer (a.k.a. drainage plane, weather-resistive barrier or WRB) at all exterior walls. The water control layer could be comprised of shingle-lapped building wrap, shingle-lapped building felt, a fully-adhered sheet membrane, a fluid-applied membrane, rigid insulation with taped seams, or structural panels with integral water control membrane and taped seams.

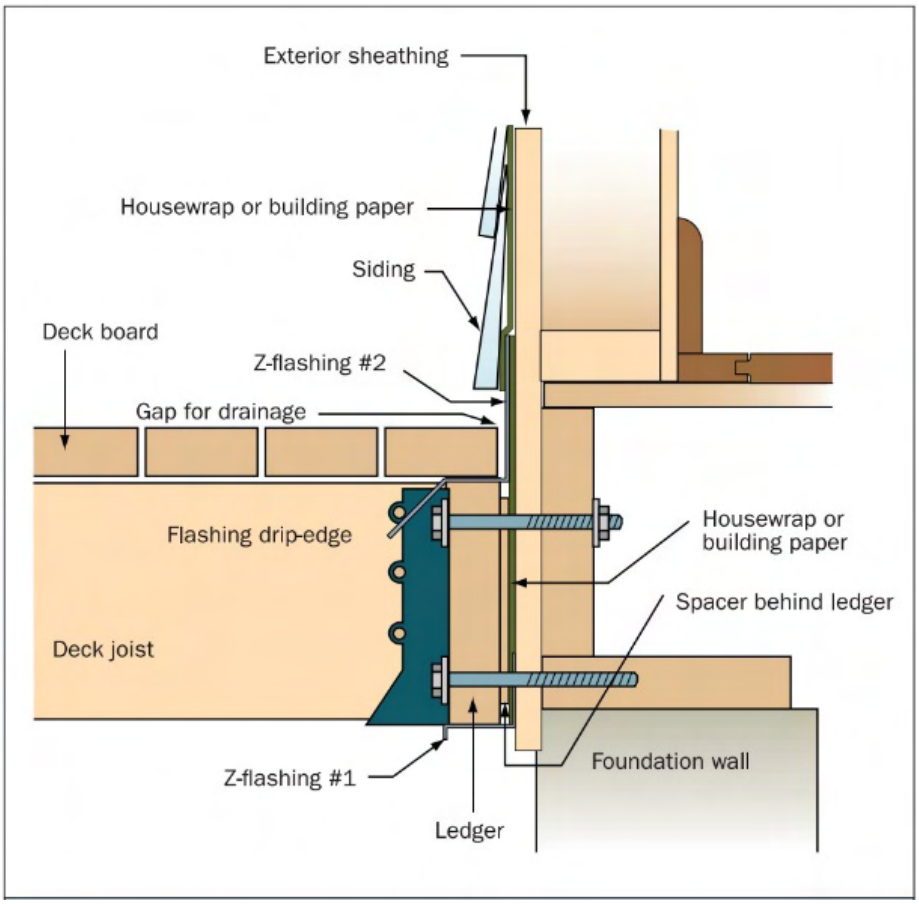
Fluid-applied membrane



Detail showing water control layer

BASIS OF DESIGN

- Provide self-sealing water control membrane between wall sheathing and ledger boards or other structural attachments.

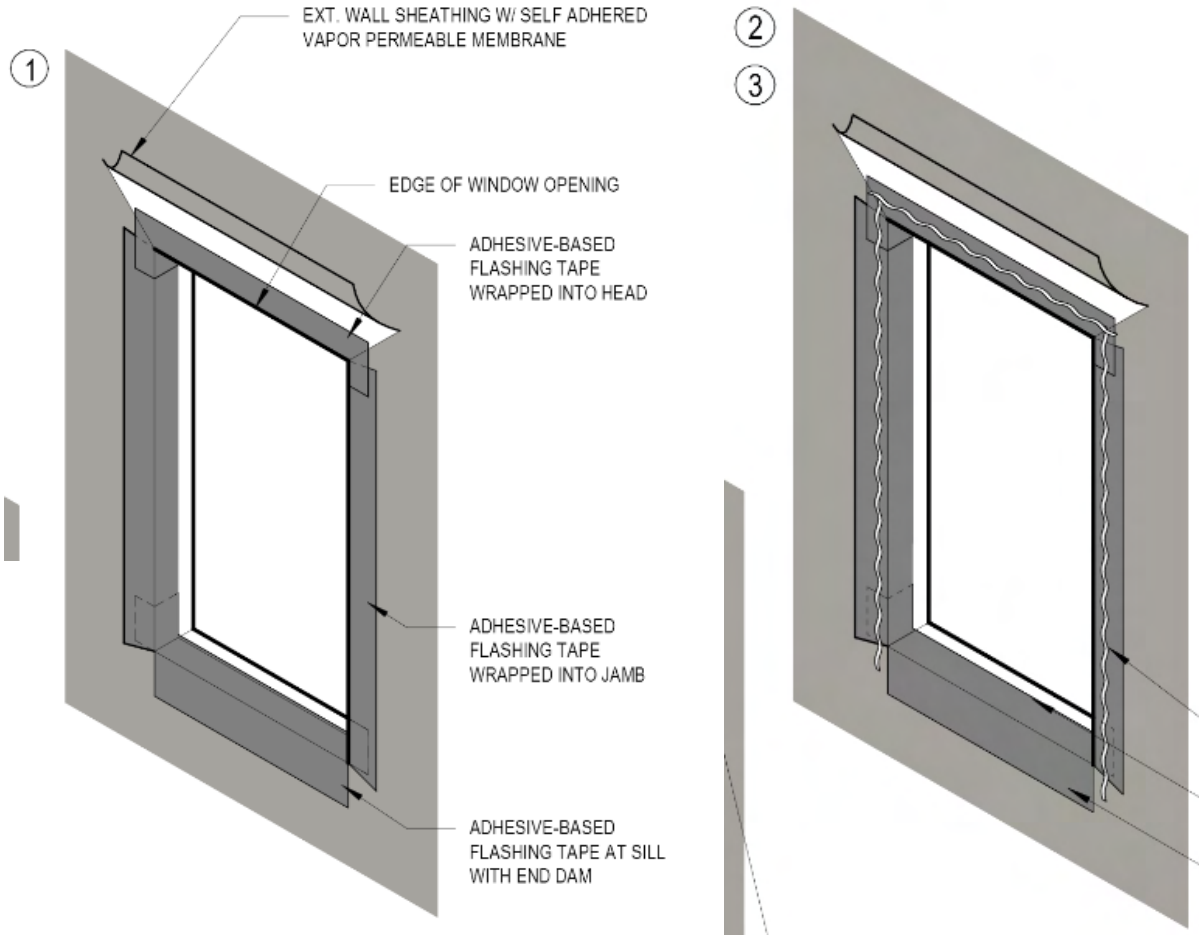


Water control layer between ledger board and wall

- Provide robust flashing at all wall openings such as window and door openings.
    1. Sill flashing drains to the OUTSIDE (use slope and back dam) over the water control layer or cladding.
    2. Jamb flashing continuous up full height of jamb.
    3. Head flashing diverts water away from the opening.

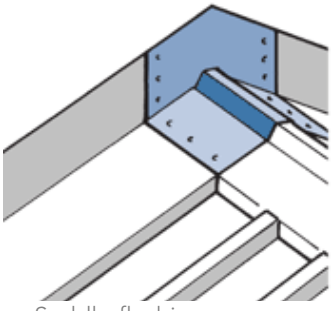
WINDOW INSTALLATION STEPS:

1. FASTEN WALL SHEATHING TO THE WOOD FRAME AND INSTALL SELF ADHERED VAPOR PERMEABLE MEMBRANE AS SPECIFIED BY MANUFACTURER
2. APPLY ADHESIVE-BASED FLASHING TAPE, ENSURING THAT FLASHING EXTENDS UP JAMBS AT LEAST 6" & OVERHANGS SHEATHING AT LEAST 2".
3. APPLY A 3/8" NOM. DIA. BEAD OF SEALANT TO THE BACKSIDE (INTERIOR) OF THE WINDOW MOUNTING FLANGE AT THE TOP AND SIDES ONLY. PLACE BEAD IN LINE WITH ANY PRE-PUNCHED HOLES.
4. IMMEDIATELY INSTALL WINDOW USING MANUFACTURER RECOMMENDED FASTENERS.
5. APPLY BEAD OF SEALANT ACROSS THE FACE OF THE MOUNTING FLANGE AT HEAD.
6. APPLY JAMB FLASHING, EXTENDING TO 1/2" BELOW TOP OF HEAD FLASHING. ONCE IN PLACE USE TAPE GUN OR ROLLER TO SEAL THE FLASHING TO THE SHEATHING.
7. APPLY HEAD FLASHING, OVERLAPPING JAMB FLASHING BY 1" MINIMUM. ONCE IN PLACE USE TAPE GUN OR ROLLER TO SEAL THE FLASHING TO THE SHEATHING.
8. TAPE HOUSE WRAP OVER HEAD FLASHING.



Provide diverter flashing and opening protection at all penetrations through the water control layer, such as pipes, conduits or structural members.

1. Saddle flashing over penetration
2. If using sealant, sealant laps over and adheres to (check compatibility) water control layer.
3. Apply two-stage joint where appropriate/feasible.



Saddle flashing

Saddle flashing (black flashing on joists)

Flashing and sealing around penetrations

- Provide proper flashing at all roof-wall intersections
    1. A self-adhering polymer-modified bitumen sheet shall be installed at roof-wall intersections behind step flashing and extending at least 12 inches up the vertical face of the wall sheathing and 12 inches under the roof membrane layer.
    2. Step flashing integrated with roof cladding
- Top edge of flashings to be terminated with compatible tape or mastic or lapped shingle-fashion by a water control membrane.

For additional details applicable to roofs windows and doors, see their corresponding BOD sections:

BOD ROOFING SECTION https://www.poahbod.org/roofing

BOD DOOR SECTION https://www.poahbod.org/doors

BOD WINDOW SECTION https://www.poahbod.org/windows

WALL – CLADDING:

- Install all wall cladding and trim in a back-drained or "rain screen" configuration.
    - Brick veneer to have 1" clear drainage space behind
        1. Through-wall flashing to be supported if not a rigid material (unsupported membranes can form troughs that inject water at open seams).
        2. Provide weep openings 16" o.c. at base of wall and above through-wall flashings.
    - Fiber-cement or wood siding to have minimum 3/8" drainage/ventilation gap behind
        1. Furring or spacers strips to be installed in vertical orientation only.
        2. Do not caulk lap joints of lapped siding.
    - Vinyl siding without insulation backing is considered a vented and back-drained cladding.
- Maintain a separation of at least 2" clearance between wall cladding and roof surface or horizontal surface such as decks or paving.

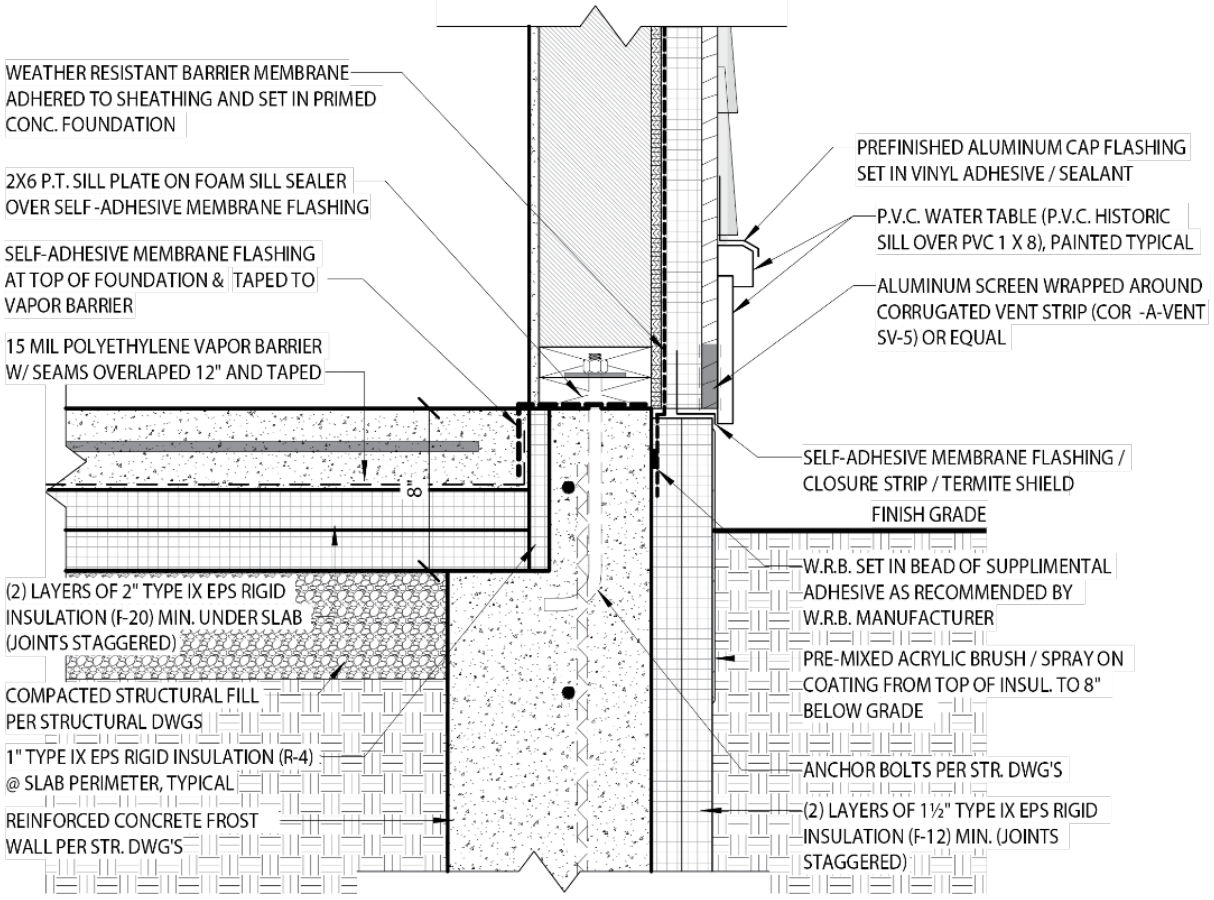
Wood furring strips provide drainage gap (rainscreen)

FOUNDATION/SLAB:

- Use the slope of grade to divert surface water away from the foundation.
- Provide a capillary break membrane between concrete and ANY wood member regardless of whether the wood is pressure treated. Wood shall not be in direct contact with concrete.
- Provide a drainage layer/capillary break of at least 4" washed gravel beneath slabs
- Provide a vapor control/capillary break membrane in direct contact with the underside of the slab.
- Provide a capillary break between footing and foundation wall or between the footing and soil.

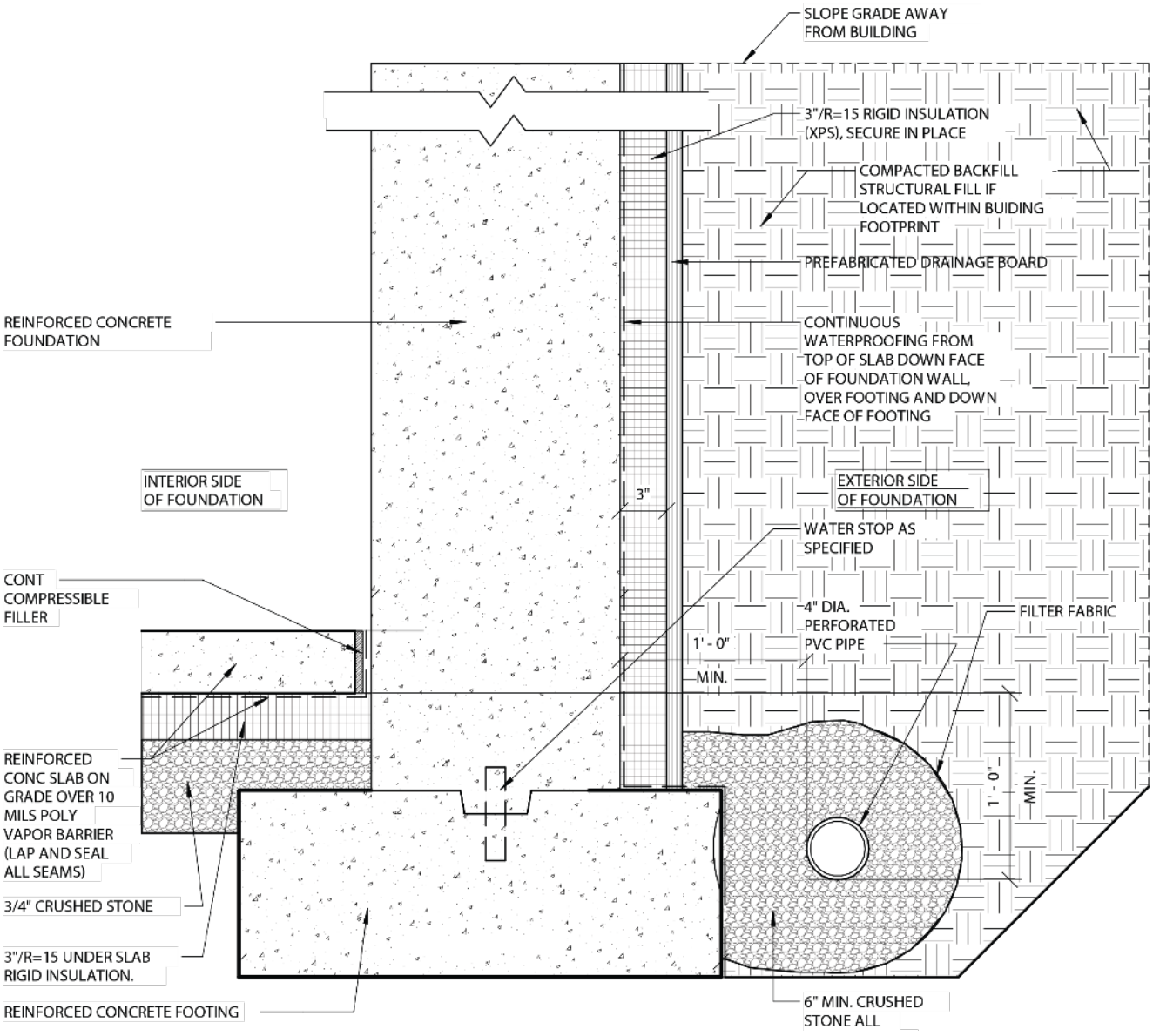
BASIS OF DESIGN

- Provide protected damp-proofing at below-grade, ground-contact foundation surfaces.



Typical exterior wall assembly at foundation

- If using a foundation drain, direct water to daylight or to sump/drywell around perimeter of footings.
  - Protect foundation drain with layer of clean gravel wrapped in filter fabric.
  - Back fill above perimeter drain with free-draining backfill.



Typical exterior wall assembly at foundation

BASIS OF DESIGN

AIR CONTROL AND INSULATION REQUIREMENTS

POAH has adopted the PHIUS+ standard to guide building enclosure thermal and air control of new construction project. POAH has found that the R-values for opaque assemblies in a Passive House enclosure are not far beyond current IECC requirements, although POAH acknowledges that the R-values required may be beyond current local practice standards.

PHIUS

Source: phius.org

PHIUS+ certification for the project is encouraged, but not required unless otherwise directed. The thermal performance (R-value and U-value) parameters listed below are provided for guidance. Refer to the Passive House Institute US (PHIUS) website (https://www.phius.org/phius-certification-for-buildings-products) for specific information.

EXTERIOR ENCLOSURE AIR CONTROL REQUIREMENT

- Provide a continuous air barrier around the entire building enclosure to meet a tested performance of no more than 0.06 cfm air leakage per sf enclosure when tested at a pressure of 50 Pascals.
    - Note: If areas of the building are excluded from the whole-building air barrier (e.g. compactor rooms, commercial space, etc.) the separation between the residential program and these spaces must meet the air tightness requirement.
- Airtightness is sometimes regarded as a proxy for overall construction quality. The airtightness of a building and of apartments within buildings are properties that can be measured.
- The common method for testing and verifying the airtightness is through the use of a calibrated fan and pressure measuring gauges. In the construction industry the common term for this testing apparatus is “blower door”. The widespread availability of **blower door equipment** and qualified technicians allows for quantitative airtightness targets to be established for new construction and renovation projects.
- See **Compartmentalization** section of the Basis of Design for in-unit air control measures.

Example of blower door test

BASIS OF DESIGN

THERMAL CONTROL – OPAQUE COMPONENTS (R-VALUE)

- **Thermal bridge-free.** Minimize thermal bridging through the insulation layer. Note that insulation between metal girts cannot be considered continuous insulation. Any insulation layer that is subject to thermal bridging must be discounted accordingly.
- **High-R-Value Assemblies.** Provide a building enclosure (including the integrated performance of the whole enclosure) capable of meeting Passive House heating and cooling performance requirements. The table below is provided for guidance. A Passive House analysis can be used to refine the specific requirements for the project.

Climate Zone	**1**	**2**	**3**	**4 Except Marine**	**5 and Marine 4**	**6**
Roofs						
Insulation entirely above roof deck	R-40ci	R-40ci	R-40ci	R-49ci	R-49ci	R-55ci
Vented Attic and other	not recommended	not recommended	R-45	R-60	R-60	R-70
Walls						
Mass Walls (ie load-bearing masonry, stone, cast concrete)	R-10ci interior	R-12ci (in hurricane zones, insulation should be to interior)	R-15ci	R-20ci	R-20ci	R-24ci
Metal framed	R-10ci	R-13 + R-10ci	R-13 + R-12ci	R-13 + R-15ci	R-13 + R-20ci	R-13 + R-24ci
Wood framed and other	R-13 + R-5ci or R-20	R-13 + R-5ci or R-20	R-13 + R-8ci or R-20 + R-4 ci	R-13 + R-12 ci or R-20 + R-8 ci	R-13 + R-16 ci or R-20+ R-12 ci	R-13 + R-20 ci or R-20 + R-16 ci
Below grade walls/foundation walls	NR	NR	NR	R-10 ci	R-7.5ci	R-7.5ci
Floors over Unconditioned Space						
Mass Floors (concrete slab)	R-5 ci	R-8.3ci	R-10ci	R-10 ci	R-12.5ci	R-12.5ci
Joist/framing	R-13	R-15	R-20	R-30	R-38	R-40
Unheated slabs	NR	NR	NR	R-10 for 24" vertical, R-5 below	R-10 for 24" vertical, R-8 below	R-15 for 48" vertical, R12 below
Opaque Doors	R-4.75	R-4.75	R-4.75	R-4.75	R-6	R-8

Fenestration						
Windows	U-≤ 0.40, SHGC≤ 0.25	U-≤ 0.40, SHGC≤ 0.25	U-≤ 0.30, SHGC≤ 0.25	U-≤ 0.28, SHGC≤ 0.25	U-≤ 0.27, SHGC≤ 0.35	U-≤ 0.25, SHGC≤ 0.40

For additional requirements for windows and doors, see their corresponding BOD sections:

BOD DOOR SECTION https://www.poahbod.org/doors

BOD WINDOW SECTION https://www.poahbod.org/windows

VAPOR CONTROL

Vapor retarders are classified according to their vapor permeability.

Vapor Retarder Class	Definition	Examples
I	≤ 0.1 perm	Sheet polyethylene, sheet metal, non-perforated aluminum foil, foil-faced insulating sheathing, glass
II	>0.1 perm ≤1.0 perm	Kraft-faced fiberglass batts or vapor retarder paint, unfaced expanded polystyrene, fiber-faced polyisocyanurate
III	> 1.0 perm	Latex or enamel paint (on gypsum wallboard)

- Avoid use of low permeability (i.e. Class I vapor retarder such as polyethylene) vapor retarders or wallpaper to the interior side of any wall assembly.
- In Warm climates (climate zone 3 and below) using a Class II or Class III vapor retarder to the exterior of the sheathing is recommended. Many weather-resistive barriers (WRB) or air-and-water barriers are also vapor retarders, check product data sheet.
- In all climate zones, provide sufficient insulation to the exterior of the sheathing to allow the use of Class III vapor retarder (gypsum wallboard with latex paint) at the interior side of framed wall assemblies. Generally, this will mean that from 30% (in warmer climates) to 45% (in cold climates) of the total wall assembly R-value is located exterior to the sheathing.

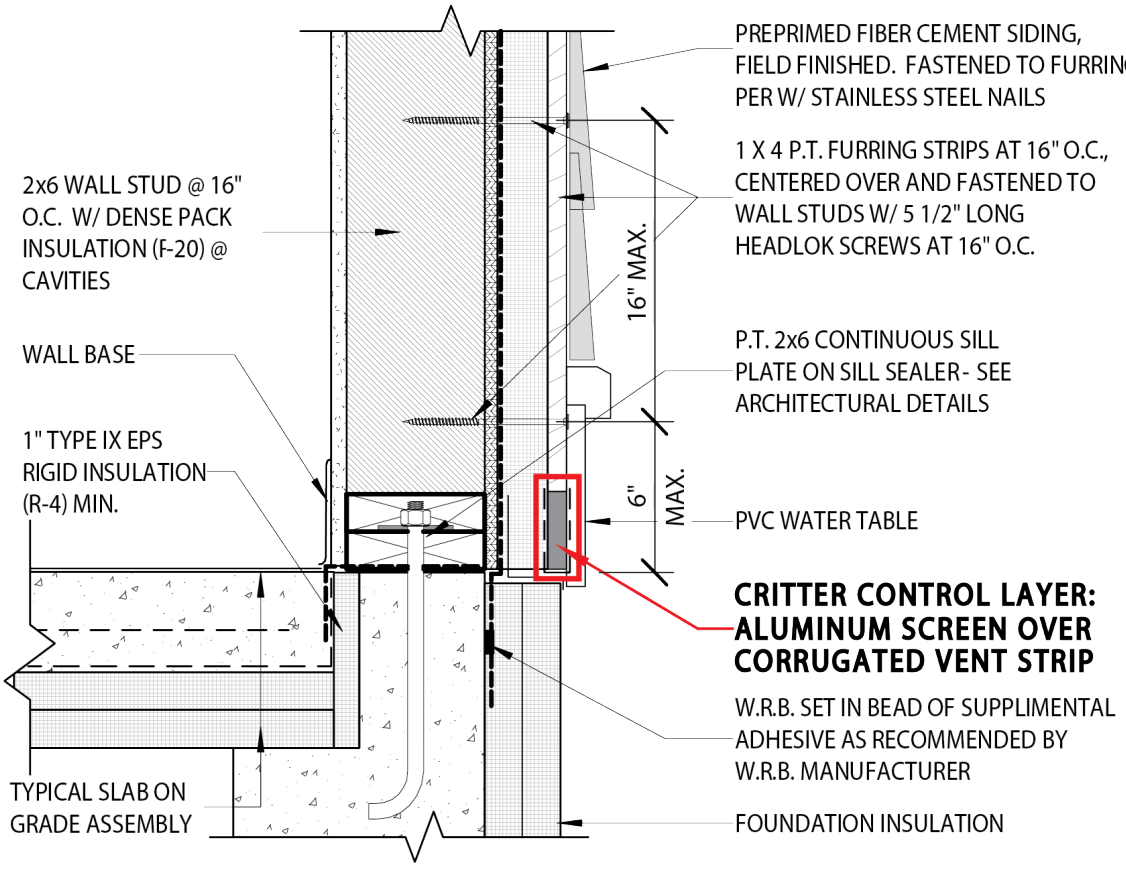
BASIS OF DESIGN

CRITTER CONTROL (PEST CONTROL)

Necessary measures for pest control depend on local conditions and local pest pressures. Follow recommended pest practices for the locality.

General requirements (all locations):

- Provide a robust termite barrier between any below grade insulation and non-concrete building components.
- Do not plant vegetation such that, when mature, it will be within 1' of the building.
- Provide screening or metal closure at the bottom of exterior wall assemblies such that exterior insulation and ventilation cavities of exterior walls are not exposed.
- Seal around all penetrations through foundations. Pack larger gaps (wider than 3/8") with copper mesh before applying sealant.
- Use a flashing membrane to seal the bottom of sheathing to the foundation wall. Bituminous flashing membrane with aggressive adhesive works best. Prime the foundation wall as needed for effective adhesion.



BASIS OF DESIGN

CABINETRY

GENERAL INFORMATION & REQUIRED DETAILS:

- All cabinetry to be plywood construction (no particleboard).
- 180 degree hinges, wrap hinge.
- No blind corners:
- All space below the corner of a kitchen countertop must be accessible from either of the adjacent cabinets, or by a special corner cabinet door.
- No drawers larger than 18”.
- KCMA certification preferred.
- Hardware (pull) to be included in all cabinetry.
- The cabinetry products in this section are shown as reference. Other cabinetry products that meet the requirements of the spec may be used.
- **Seal with foam all plumbing and electrical penetrations behind cabinetry.**

BOX CONSTRUCTION REQUIRED DETAILS:

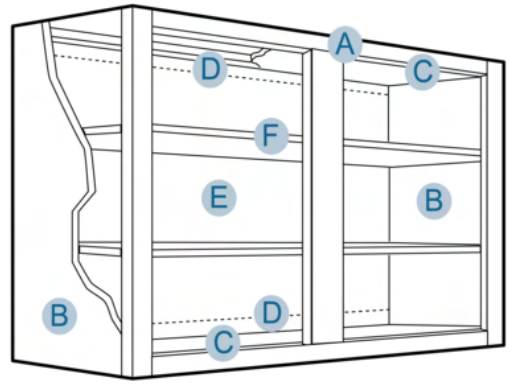
A) FRONT FRAME: 3/4” solid hardwood or thermo-foil vinyl wrapped solid finger jointed lumber or LVL linear veneer lumber Bore and dowel/pocket screw construction frame joinery reinforced with glue/nails. Stiles 1 1/2” wide. Mulls 3” wide. Rails 1 3/4” wide. Stile and top and bottom rails dadoed to receive ends, tops, and bottoms.

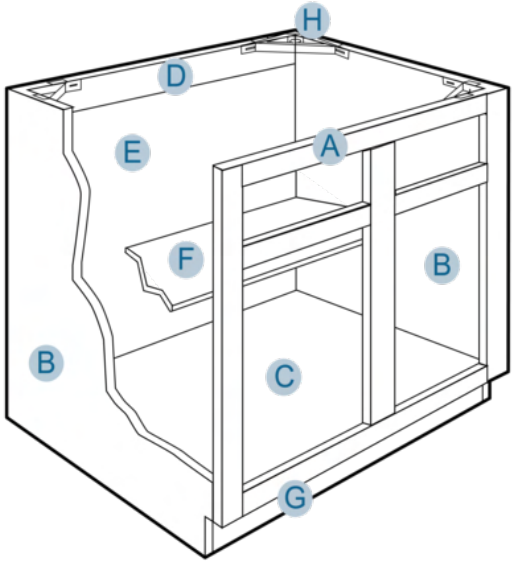
B) END PANELS: Standard: Nominal 1/2” thick multi-ply birch veneer plywood dadoed to receive tops and bottoms, with wood grained or laminate on interior/exterior surfaces. All end panels are inserted into dado in face frame and recessed 3/16”.

C) TOP/BOTTOM PANELS: 1/2” thick multi-ply hardwood plywood. Tops and bottoms are set into grooved end panels and front rails glued and stapled. Bottoms are supported by 1/2” thick wood base composite panel.

D) HANGING RAILS: Wall cabinets have 1/2” thick x 2 7/8” multi-ply plywood hanging rail, running full cabinet width at top and bottom. Base cabinets have 1/2” thick x 2 7/8” wood based composite panel hanging rail running full cabinet width at top. Hanging rails are captured between end panels recessed behind.

E) BACK PANEL: 1/8” thick hardwood plywood Securely glued/stapled to end panels and hang rails. Back panels are fully captured on wall cabinets.





F) SHELVES: 5/8” thick multi-ply hardwood plywood, with hardwood veneer banded front edge. Shelves are adjustable in all standard wall and base cabinets.

G) TOE KICK: 4” high and recessed 3 3/8”.1/2” thick unfinished wood based composite panel captured between end panels. Finish should be covered with infill panel to match finish.

H) BASE CORNER BRACES: High impact, injection molded plastic.

I) DRAWERS: Nominal 1/2” thick multi-ply hardwood front, back, and sides. Drawer bottoms are nominal 1/4” thick multi-ply hardwood inserted into dado in front back and sides. All drawer parts glued and stapled together.

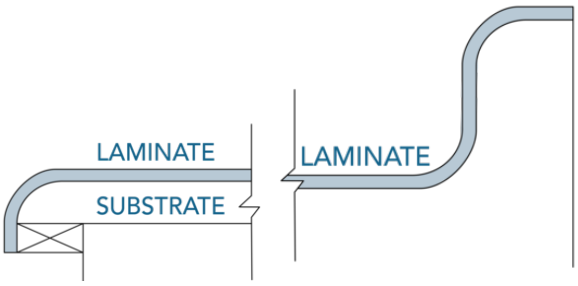
J) DRAWER GUIDES: High-quality epoxy coated steel, Cushion-Tec, side mounted guides, self-adjusting in mounting brackets. Built-in stop, self-closing and stay-closed features with a 100 lb. rated load capacity.

COUNTERTOP REQUIRED DETAILS:

PLASTIC LAMINATE (KITCHEN ONLY):

- Suggested Laminate Manufacturers: Wilsonart or Formica.
- NEMA LD 3 compliant, HGP Grade, and minimum 1.0mm thickness.
- **Countertop Construction:**
    - Post form (continuous, no visible joints).
    - Front Edge - Continuous, Double Round Over, 1 3/8" high (See Section Below).
    - Backsplash - Continuous one piece raises up wall with 1 1/8" return to wall (See Section Below).
    - Side splash - square edged loose, installed between wall and counter, height to match back splash height.
    - Substrate: Comply with ASTM D 1037.
        - At Sink: Exterior grade plywood or phenolic resin.
        - Particleboard: Compliance with ANSI A208.1 (Grade M-2 exterior glue), 45-lb density and minimum 3/4” thick.
        - MDF: Compliance with ANSI A208.2 and minimum 3/4" thick.
    - Provide BK-20 Backer Sheet if unsupported countertop area.

GRAPHIC OF POST FORM COUNTERTOP:



SOLID SURFACE/ VANITY TOP WITH INTEGRAL SINK (BATHROOMS ONLY):

- Suggested Manufacturers: Swanstone.

BASIS OF DESIGN

- Coordinate size with cabinetry manufacturer.
- Coordinate product with faucet. No open holes or plugs to be used.
- 2 gallon bowl capacity.

DOOR REQUIREMENTS:

- Family properties: 3/4” thick solid wood door frames and drawer fronts.
- Senior Properties: MDF center panels acceptable.
- Standard reveal doors and drawer fronts.

SAMPLE DOOR PRODUCTS:

The cabinetry products in this section are shown as reference. Other cabinetry products that meet the requirements of the spec may be used.

- 3/4” Thick solid birch door frames and drawer fronts.
- Veneered MDF recessed flat center panel.
- Assembled with five-piece mortise and tenon joinery.
- Square design for all cabinets; offered with slab drawer heads.
- Standard reveal doors and drawer fronts.
- Eased edge profile on outside door frame.

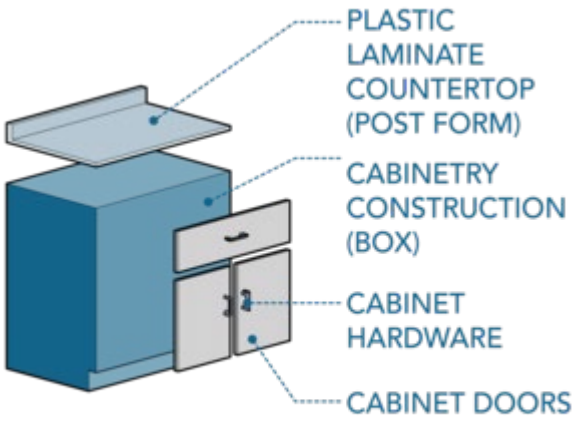
- 3/4” Thick plantation hardwood door frames and drawer fronts.
- Solid routed raised panel.
- Square design for all cabinets; offered with slab drawer heads.
- Standard reveal doors and drawer fronts.
- Double rolled edge on outer and inner door profile.

- 3/4” thick solid birch door frames and drawer fronts.
- Genuine birch wood veneer flat center panel.
- Square design for all cabinets; offered with slab drawer heads.
- Assembled with five-piece mortise and tenon joinery.
- Standard reveal doors and drawer fronts.
- Double rolled edge on outer and inner door profile.

BASIS OF DESIGN

ADDITIONAL INFORMATION

VOCAB



BASIS OF DESIGN

COMPARTMENTALIZATION: OPPORTUNITIES IN NEW CONSTRUCTION, UNIT TURNS OR REHABS

WHEN TO USE THIS BASIS OF DESIGN SECTION

This BOD section should be used during **new construction, unit turns or rehab** projects that involve the construction or modifications at the interior of a building. Even appliance replacement projects represent an opportunity for compartmentalization.

This section is intended to provide examples of **unit turn and rehab** projects and associated compartmentalization opportunities. It is acknowledged that this document cannot be exhaustive of either renovation projects or compartmentalization opportunities. Project managers should become familiar with the examples in this document and learn to recognize compartmentalization opportunities present in each project.

COMPARTMENTALIZATION MEASURES AND MAINTENANCE:

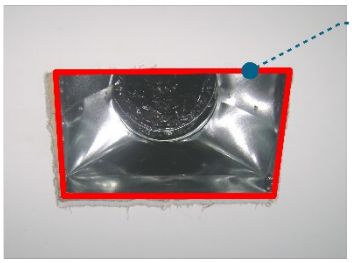
Measures to improve compartmentalization should be incorporated into any interior rehab scope. This is particularly important in occupied buildings because the opportunity to make improvements within occupied spaces is rare. Even regular maintenance activities can be leveraged to improve compartmentalization of apartments. Examples of typical renovation or maintenance scopes and associated opportunities for airtightness improvement are lists below. See end of this section for a full description of **compartmentalization**.

A note regarding pest control: it is a good practice to use backing or blocking that will discourage pests. Copper mesh backing should be used for sealing around wires, pipes and conduits when the gap is more than 3/8". An "L" bend of sheet metal solidly attached to substrate and sealed at seams can be an effective pest barrier at the wall to floor joint behind cabinets and other such areas hidden from view. Elastomeric sealants, asphaltic sealants and bituminous membranes tend to discourage most pests (just be careful to avoid excessive VOC or products with objectionable odors).

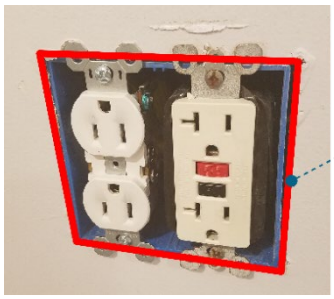
- Flooring replacement:
  - Seal the wallboard to the floor at the base of the wall (full perimeter of the floor).

BASIS OF DESIGN

- Painting:
  - Slide plumbing escutcheons away from the wall and seal around pipe penetrations.
  - Remove ventilation and heating/cooling register grilles. Seal the register boot ductwork to the wallboard or ceiling. If the register boot does not reach the wallboard, extend it so that it does.



  - Seal the wallboard to the ceiling at the top of the wall (full perimeter of the ceiling).
  - If using a dropped ceiling, ensure the demising walls are continuous and seal to the underside of the floor deck above.
  - Temporarily remove switch plate and outlet covers, caulk between electric box and wallboard.

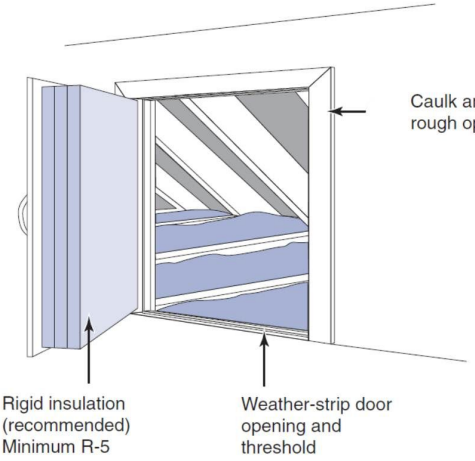


- Plumbing repairs and maintenance:
  - Use elastomeric sealant and, where necessary, backing, to seal pipe penetrations behind toilets, shower heads, hot water heaters and under bathroom vanities and kitchen sinks.
  - Slide escutcheons away from the wall and seal around pipe penetrations.

- Electrical renovations and repairs:
  - Seal electrical penetrations at all walls and ceilings: electrical panel box, data boxes (i.e. phone), outlets, and switches, behind oven/fridge, telephone box, intercom, in closet ceilings/floors with caulk, foam or with a gasket. *(See image above in painting section.)*

BASIS OF DESIGN

  - Foam penetrations made by electrical fixtures and wiring in attic.
  - Seal ceiling penetrations at light fixtures with foam. When possible switch to surface mounted LED fixtures.
  - When replacing ceiling-recessed fixtures use only Insulation Contact (IC) and Airtight (AT) rated fixtures.
- Duct cleaning and HVAC maintenance:
  - Clean supply and exhaust registers on an annual basis. When cleaning registers ensure the duct boot is sealed to the wallboard or ceiling. *(See image above in painting section.)* Every 3 - 5 years all ductwork should be cleaned.
- Bathroom renovation:
  - Tub replacement: ensure that the tilebacker, cement board or other non-moisture-sensitive substrate surrounding the tub is continuous to the floor behind the tub.
  - Use elastomeric sealant and, where necessary, backing, to seal pipe penetrations behind toilets, shower heads, and under bathroom vanities. *(See image above in plumbing section.)*
  - Use surface mounted medicine cabinets or mount recessed cabinets in an airtight enclosure.
  - Seal at base of bathtubs, toilets and top of shower tile with caulk.
- Unit entry door maintenance, painting or replacement:
  - Replace entry door weather stripping if necessary; use metal V-seal if possible.
  - Caulk door frame to wall and floor.
  - Foam inside door latches making sure foam fills cavity above, below, and sides of latch opening. Cut any foam that interferes with latch operation.
- Stair tread replacement or stair renovation:
  - Caulk gaps around risers, treads, and stringers.
  - Caulk between stringers and walls.
- Attic hatch installation:
  - Glue 2 layers of 2-inch rigid foam to back of hatch and seal use gasket or weather stripping to provide a good around the hatch when it is closed.
  - Ensure the hatch engages gasket or weather stripping when placed in opening.



Attic hatch insulation

- Kitchen renovation:
  - Repair drywall (ensure it is continuous) and seal all holes and cracks in the drywall behind cabinets and appliances.
  - Seal the wallboard to the floor. *(See image above in flooring section.)*
  - Seal all penetrations through the wallboard and use a metal mesh backer for openings wider than 3/8".
  - If the kitchen includes a dropped soffit, ensure that wallboard at the back of the soffit is continuous to the underside of the floor above.
  - Seal around the range hood exhaust duct penetration through the ceiling/wallboard with appropriate sealant.

BASIS OF DESIGN

WHAT IS COMPARTMENTALIZATION?

Besides being a long word that is difficult to say, compartmentalization is providing a robust separation between different spaces within a building including a separation between living or occupied spaces and interstitial spaces like framing cavities and shafts. Compartmentalization is important to controlling the flow of odors, air, smoke, airborne contaminants, and pests between units and between units and other spaces within the building.

An airtight enclosure around an apartment unit is needed to prevent airborne contaminants, smoke and odors in one apartment from spreading to neighboring apartments. Likewise, and airtight enclosure around an apartment (or other space) will also prevent the ingress of airborne contaminants, smoke and odors from other parts of the building and building cavities. With an airtight enclosure it is easier to control odors and other airborne contaminants within an apartment using ventilation. Compartmentalization, therefore, is very important to **indoor air quality**.

An effective air barrier also supports **pest control**. Generally, if air can't leak through an enclosure, then it would be hard for pests to gain access to the space. Holes at the base of a wall behind appliances and around pipes that penetrate through a wall provide opportunities for pest entry. These also allow air, and anything carried in the air, to leak into the apartment.

The airtightness of individual apartments is also key to controlling air leakage for the overall building. This is because compartmentalization prevents accumulation of forces acting on a building that move air into or through the building. For example, the ground floor of a multi-story building would be less subject to drafts, and out-swinging doors would be easier to open in cold weather, if a building is well compartmentalized. In this way, compartmentalization impacts **comfort** and **energy performance**.

Airtight enclosures also support the operation of conditioning and ventilation systems by making it easier to control the pressures and direction of air flow between spaces. For example, if we want a corridor to be slightly pressurized relative to apartments so that odors from apartments do not migrate into the corridor, then it helps to have an airtight enclosure of that corridor space. The more airtight an enclosure the less airflow is needed to pressurize or depressurize the space with the enclosure. Therefore, with better airtightness it is possible to maintain the desired pressure relationships while using less energy and installing smaller ducts and equipment. **Ventilation, heating, cooling and dehumidification systems are more effective** and are better able to meet set points within spaces if those spaces are well compartmentalized.

What about Make-up air?

But wait a minute! Don't we need to allow fresh air into apartments so people can breathe!?

Exactly. We want fresh, clean, good quality air to be delivered to people in our buildings. That means we cannot allow the air to be leaking in from building cavities where rodents may live or have lived (expired), from under sinks, through maintenance closets with harmful chemicals and pesticides, from the apartment of neighbor who smokes, from the trash room... To be able to have good quality, fresh air, we need to know where it is coming from.

BASIS OF DESIGN

COMPARTMENTALIZATION AND QUALITY ASSURANCE

Airtightness is sometimes regarded as a proxy for overall construction quality. The airtightness of a building and of apartments within buildings are properties that can be measured.

The common method for testing and verifying the airtightness is through the use of a calibrated fan and pressure measuring gauges. In the construction industry the common term for this testing apparatus is a "blower door". The widespread availability of blower door equipment and qualified technicians allows for quantitative airtightness targets to be established for new construction and renovation projects.

POAH encourages establishing a pre-renovation baseline airtightness for apartments and then measuring achievement at improving airtightness as various stages of the project.

Blower door diagnostics can also be used to evaluate specific air sealing measures and pin-point those which are most effective. Thus, in a project involving repetitive scope or renovation work in a large number of similar apartments, it would be worthwhile to use blower door diagnostics to refine the compartmentalization scope to be included with the renovation project.

Example of a blower door test

BASIS OF DESIGN

COOLING: EXISTING CONTRUCTION

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be used for 1) rehab projects to guide Architects, Engineers, and Development staff, and 2) during system replacement to guide maintenance staff. Modifications to existing cooling equipment present significant and uncommon opportunities to increase cooling system efficiency and reduce utility costs.

REQUIREMENTS FOR ALL COOLING SYSTEM TYPES DURING REHAB:

When planning a major rehabilitation, it is important to assess the condition of the existing heating and cooling equipment and distribution systems. If the existing systems are failing, the possibility of converting to heat pump technology should be considered.

A. **EVALUATE CONVERSION TO HEAT PUMPS:**
Projects shall evaluate removing existing cooling systems and installing a new central heat pump system with heat recovery (VRF-HR). For requirements on heat pumps, see the **Heating + Cooling: New Construction** section of the Basis of Design.

If converting to heat pumps is not possible, proceed with the following requirements, as well as those listed for specific system types (below):

Central VRF System

B. **IF NO COOLING SYSTEM CURRENTLY EXISTS:**
Where there is no cooling provided presently, and converting the property to a heat pump system is not possible, the project development team should investigate the provision of cooling through the following options:

I. **If the building has baseboard heating: install new through-wall AC units** in a panel fixed within the window frame. See the **AC Units** and **AC Cover** sections of the Basis of Design for more information.

II. **If the building has forced hot air heating: install new AC compressors** that can supply existing heating ductwork with cooling during summer months.

III. Incorporate cooling (and dehumidification and off-season heating) through an integrated in-unit ventilation system e.g. Minotair.

through-wall AC units in a panel fixed within the window

AC compressor

BASIS OF DESIGN

C. **USE PROGRAMMABLE THERMOSTATS:**

I. See the Thermostat section of the Basis of Design for more information.
Note: Through-wall ACs and PTAC units will not include separate thermostats.

A. **INCLUDE SPECIFICATIONS FOR COMMISSIONING (CX):**
The following specification sections are required in all projects. Commissioning specifications to be reviewed, updated to reflect the current project, and included within the design specification. The HVAC Section (Division 23) must reference the following specifications:

I. **Section 019013 – General Commissioning Specification**
Section includes general and specific requirements that apply to the implementation of commissioning process for HVAC&R systems, assemblies, and equipment.

II. **Section 019013.01 Sample Commissioning (CX) Plan:**
Provide a sample Cx Plan. This document outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. Each commissioning plan should include:

a) Commissioning Objectives
b) Systems to be Cx.
c) Project team contact list, Cx roles and responsibilities of team, general management plan, communication protocols.
d) Summary of Cx process, schedule for Cx activities.
e) Documentational requirements. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
f) Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
g) Certifications: installation, prestart checks, and startup procedures have been completed. Ready for testing.
h) Verification of testing, adjusting, and balancing (TAB) reports.
i) Sample Issues Log and Corrective Action document.

III. **Section 230800 - Commissioning of HVAC**
Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

a) If a Building Automation System (BAS/BME/EMS) is to be installed, the Integrated Automation Cx specifications within Section 23 HVAC will also require the following specification. All Cx specifications will also need to reference this specification.
    a. **Section 250800 - Commissioning of Integrated Automation**
    Section includes commissioning process requirements for BAS.
b) The Cx specifications within Section 23 HVAC must also reference the following specifications, as applicable to the project:
    a. **Section 220800 - Commissioning of Plumbing**
    Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.

b. **Section 260800 - Commissioning of Electrical**
Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

REQUIREMENTS FOR SPECIFIC COOLING SYSTEM TYPES DURING REHAB:

A. **FURNACES WITH AC COMPRESSORS OUTSIDE (SPLIT SYSTEM):** *(listed in order of preference)*

I. **Replace the outdoor condenser with a heat pump:**
Convert AC compressor to a heat pump compressor. Take into account the reduced loads (building enclosure upgrades) resulting from the renovation. Compressors should be placed away from windows and outdoor patios, and should be easily accessed by maintenance. Compressors should be installed on stands a minimum of 18 inches off the ground or roof. Any/all refrigerant lines should be covered/protected. Landscape plans should include a visual barrier of compressors without interfering with operation or access by maintenance.

Heat Pump Compressor

1. Confirm the electrical panel has adequate amperage available to serve the new heat pump. If amperage is limited, the system will be duel-fuel and the heat pump heating capacity will be determined by the available amperage. If the system is duel-fuel, the heat pump will lock-out at low temperatures (based on available amperage), at which point the furnace will turn on.

II. **Replace the condenser with a more efficient model**
SEER and HSPF as required to meet ENERGY STAR requirements.

B. **HYDRONIC FAN-COIL SYSTEMS:**

I. **Replace central chiller according to ANSI/ASHRAE/ACCA Standard 183:**
Calculate heating and cooling loads according to ANSI/ASHRAE/ACCA Standard 183 and size equipment not greater than these loads.

Fan Coil

C. **THROUGH-WALL OR WINDOW MOUNTED AC UNITS WITH BASEBOARD OR RADIATORS:**

I. See the following BOD sections:
1. **Appliances (subsection "AC Units"):** for information on AC units
2. **AC Covers**: for information on insulated, hard-plastic AC covers
3. **Windows (subsection "AC Sleeve in Window Sash")**: for information on AC sleeves.

through-wall AC units in a panel fixed within the window

D. **IF PTACS EXIST:**

I. See the **Heating: Existing Construction** section of the Basis of Design.

PTAC unit

BASIS OF DESIGN

DOMESTIC HOT WATER: EXISTING CONSTRUCTION

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be used for 1) rehab projects to guide Architects, Engineers, and Development staff, and 2) during system replacement to guide maintenance staff. Modifications to existing DHW equipment present significant and uncommon opportunities to increase heating system efficiency and reduce utility costs.

DURING REHAB AND REPLACEMENT OF DHW SYSTEMS AND EQUIPMENT:

Packaged Heat Pump Water Heater

A. **EVALUATE CONVERTING TO ELECTRIC HEAT PUMP WATER HEATERS:**
Engineers shall provide a high-level evaluation for the removal of existing DHW plants and the installation of new heat pump water heaters (either split systems or a packaged systems).

I. **COMPRESSOR PLACEMENT** *(only if water heater has outdoor compressor)*:
Compressors should be placed away from windows and outdoor patios, and should be easily accessed by maintenance. Compressors should be installed on stands a minimum of 18 inches off the ground or roof. Any/all refrigerant lines should be covered/protected. Landscape plans should include a visual barrier of compressors without interfering with required clearances, operation, or access by maintenance.

Split system outdoor compressor

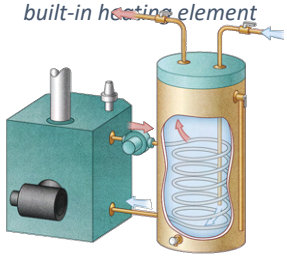
If converting to heat pumps is not possible or practical, proceed with the following requirements:

B. **USE A GAS FIRED DHW SYSTEM**
If a heat pump water heater is not possible or practical, a gas-fired water heater may be used. Combustion equipment must be "condensing", and be capable of operating in both condensing and non-condensing modes.

Water heater with built-in heating element

I. Use either:

1. **Water heater(s) with built-in heating element:** a direct-fired, power direct-vent water heater may be used. The water heater must have a thermal efficiency above 90 and an EF or UEF above 0.8. The water heater must be ENERGY STAR.
2. **Or, water storage tank(s) with adjacent boiler(s) (2 options):**
   a) **Option 1: Boiler(s) provides heat for heating and DHW (combined system):**
   In most situations it is ideal to separate the DHW from the space heating boilers. In some buildings, the DHW may be produced by the space heating boilers, with indirect tanks, but only when the boiler(s) output and controls are suitable for DHW operations. Criteria for using space heating boilers to produce DHW:



Water storage tank with adjacent boiler

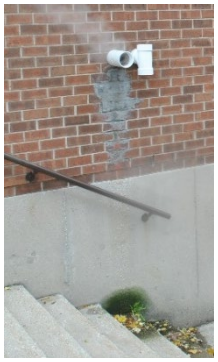
BASIS OF DESIGN

1. **Capacity:** The boiler capacity must be able to carry the DHW load. If the project involves providing a new combination boiler, it must be sized to effectively and efficiently carry the DHW load; I.E. not oversized.
2. **Controls:** The boiler controls must allow for DHW priority. In larger buildings with larger heating loads, the heating plant may include a bank of boilers. On top of the controls to operate these with suitable modulation and lead/lag for space heating, such heating plants will also require controls for DHW priority.
3. Boilers must be low-mass (short recovery time for reheating) and direct vent.

DHW priority controls

b) **Option 2: boiler(s) provides heat for DHW only (independent system):** if a dedicated condensing, low-mass (short recovery time for reheating), direct vent boiler is provided for DHW heating, an indirect, storage-type water heater may be used. The indirect water heater tank should be constructed of 316L stainless steel (or better), with stainless steel or copper-nickel heat exchanger, rated thermal loss of less than 1°F per hour.

II. **Properly vent the combustion exhaust:**
Boilers and direct-fired DHW water heaters must be direct vented. That is, both supply (combustion air) and exhaust vents shall be piped directly to the exterior from the combustion appliance. The exhaust vent must be located away from ventilation intakes, operable windows, etc. Refer to the International Mechanical Code (IMC) or the manufacturer's installation instructions.


This boiler vent deposits condensate on the wall of the buildings and on the stairs leading to a shared laundry facility.

1. Inlet and outlet need to be located above anticipated snow load. Clearances above grade must account for not just average snowfall, but also snowdrifts and piles made from snow plowing/blowing.
2. Configure the exhaust vent such that condensate will not fall upon any building surfaces or walks.

III. **Demolish unused flue/vent and patch the vent penetrations:** When converting the hot water heating to either electric heat-pump or direct-vent combustion, the existing exhaust vent that is no longer needed should be removed. Abandoned exhaust vents should be demolished and the ceilings, floors, roofs and/or walls that the vent went through should be patched and made good. The abandoned shaft must be closed and sealed at the floor of the attic.


This abandoned exhaust vent provides a direct air leakage path to the exterior. It requires patching.

1. Where the vent penetrated a roof and or wall, the water control of must be restored with the water control layer properly sealed (made intact).
2. Any penetrations in the ceiling of the boiler room must be patched and sealed.
3. Floor penetrations that are accessible or can be accessed as part of the renovation work should be sealed air tight and as required for fire safety.
4. If the vent cannot be fully demolished – e.g., the flue chase is in occupied apartments with no provision for work in those apartments – then the accessible portions of the vent should be demolished with the chase and vent sealed at the top and bottom.

BASIS OF DESIGN

5. If using the vent chase for new vent or intake pipes, or refrigerant lines, or ventilation ductwork, electrical service, etc. be sure to seal around the pipes and wires where they enter the chase. The top and bottom of the chase should be closed and sealed.

C. **SIZE ALL REPLACEMENT EQUIPMENT BASED ON LOAD CALCULATIONS:**
Calculate the load and size the system based on the current and anticipated use. Do not rely upon the existing equipment size as a determinant of the current load since the existing equipment might have been improperly sized or sized for a different configuration. Equipment should also be sized based on any building enclosure work that will occur during rehab. Engineers shall submit system designs with corresponding calculations or justification for the proposed sizing. Engineers shall establish the required capacity of the water-heating equipment and the general type of system to be used by accounting for the following:

I. The building's estimated load profile and peak demands.
II. The programmatic demands of each space, the building type, fixture and equipment information, and any project-specific POAH requirements.
III. Consumption based on end-use
IV. Water heater manufacturer sizing guidelines

Mixing valve

D. **MIXING VALVE FOR SCALD PROTECTION**
Unless there is a working anti-scald valve at every point of use, provide an approved mixing valve to control the temperature of water delivered to the building. DHW should be delivered to the building no hotter than 120F.

E. **HEAT TRAPS**
Hot water storage tanks not supplied with integral heat traps and serving noncirculating systems shall be provided with heat traps on the supply and discharge piping.

Heat trap

F. **PIPING AND DISTRIBUTION:**

I. **Pipe Insulation**: Insulate all accessible hot water piping per IECC:

Pipe Location	Pipe Diameter	R-Value	Minimum Tubular Insulation Thickness
between the water heater and fixtures	up to 1 ½"	R-4	1"
	greater than 1 ½"	R-4	1 ½"
between a boiler and the water heater	up to 1 ½"	R-4	1 ½"
	greater than 1 ½"	R-4	2"

G. **DHW CIRCULATION**

BASIS OF DESIGN

I. **Pumps:** use premium efficiency recirculation pumps: The recirculation pump will have significant run time and should, therefore be a premium efficiency pump. It is not necessary to use a variable frequency drive on the recirculation pump as it will be operated as on/off. The pump should be sized for high flow rate. The pump selection must also take into account the frequent stop-start operation of modern, code-compliant recirculation control.

Premium efficiency recirculation pump

1. All pumps 1/4 HP and larger shall include a soft start

I. **Controls:** Controls for DHW circulation system pumps shall start the pump on demand for hot water within the connected fixtures (i.e., a flow switch is required). The controls shall also automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The temperature sensor for the recirculation loop shall be located as close to the furthest fixture as feasible. This may necessitate an access panel located in an apartment.

Soft start controls

DHW controls

H. **INCLUDE SPECIFICATIONS FOR COMMISSIONING (CX):** The following specification sections are required in all new construction projects. Commissioning specifications to be reviewed, updated to reflect the current project, and included within the design specification. The Plumbing Section (Division 22) must reference the following specifications:

I. **Section 019013 – General Commissioning Specification**
Section includes general and specific requirements that apply to the implementation of commissioning process for Plumbing systems, assemblies, and equipment.

II. **Section 019013.01 Sample Commissioning (CX) Plan:**
Provide a sample Cx Plan. This document outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. Each commissioning plan should include:

a) Commissioning Objectives
b) Systems to be Cx.
c) Project team contact list, Cx roles and responsibilities of team, general management plan, communication protocols.
d) Summary of Cx process, schedule for Cx activities.
e) Documentational requirements. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
f) Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
g) Certifications: installation, prestart checks, and startup procedures have been completed. Ready for testing.
h) Verification of testing, adjusting, and balancing (TAB) reports.
i) Sample Issues Log and Corrective Action document.

III. **Section 220800 - Commissioning of Plumbing**

Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.

a) If a Building Automation System (BAS/BME/EMS) is to be installed, the Integrated Automation Cx specifications within Section 22 Plumbing will also require the following specification. All Cx specifications will also need to reference this specification.

   a. **Section 250800 - Commissioning of Integrated Automation**
      Section includes commissioning process requirements for BAS.

b) The Cx specifications within Section 22 Plumbing must also reference the following specifications, as applicable to the project:

   a. **Section 230800 - Commissioning of HVAC**
      Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

   b. **Section 260800 - Commissioning of Electrical**
      Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

BASIS OF DESIGN

DOMESTIC HOT WATER: NEW CONSTRUCTION

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be used for new construction projects to guide Architects, Engineers, and Development staff toward efficient domestic hot water solutions.

REQUIREMENTS:

A. **EVALUATE THE USE OF ELECTRIC HEAT PUMP WATER HEATERS:**
Engineers shall provide a high-level evaluation for the installation of new heat pump water heaters (either split systems or a packaged systems)**.**

Packaged Heat Pump Water Heater

I. **COMPRESSOR PLACEMENT** *(only if water heater has outdoor compressor)***:**
Compressors should be placed away from windows and outdoor patios, and should be easily accessed by maintenance. Compressors should be installed on stands a minimum of 18 inches off the ground or roof. Any/all refrigerant lines should be covered/protected. Landscape plans should include a visual barrier of compressors without interfering with required clearances, operation, or access by maintenance.

Split system outdoor compressor

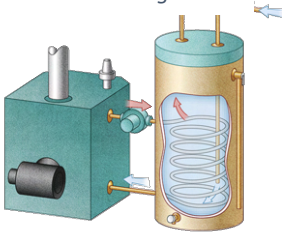
If the use of heat pump water heaters is not possible or practical, proceed with the following requirements:

B. **USE A GAS FIRED DHW SYSTEM**
If a heat pump water heater is not possible or practical, a gas-fired water heater may be used. Combustion equipment must be "condensing", and be capable of operating in both condensing and non-condensing modes.

Water heater with built-in heating element

I. Use either:

1. **Water heater(s) with built-in heating element**: a direct-fired, power direct-vent water heater may be used. The water heater must have a thermal efficiency above 90 and an EF or UEF above 0.8. The water heater must be ENERGY STAR.
2. **Or, water storage tank(s) with adjacent boiler(s) (2 options):**
   a) **Option 1: boiler(s) provides heat for heating and DHW (combined system):**
   In most situations it is ideal to separate the DHW from the space heating boilers. In some buildings, the DHW may be produced by the space heating boilers, with indirect tanks, but only when the boiler(s) output and controls are suitable for DHW operations. Criteria for using space heating boilers to produce DHW:



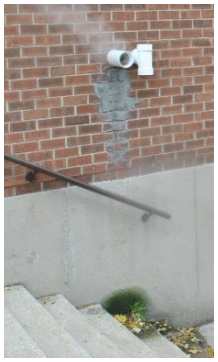
Water storage tank with adjacent boiler

1. **Capacity:** The boiler capacity must be able to carry the DHW load. If the project involves providing a new combination boiler, it must be sized to effectively and efficiently carry the DHW load; I.E. not oversized.

2. **Controls:** The boiler controls must allow for DHW priority. In larger buildings with larger heating loads, the heating plant may include a bank of boilers. On top of the controls to operate these with suitable modulation and lead/lag for space heating, such heating plants will also require controls for DHW priority.
3. Boilers must be low-mass (short recovery time for reheating) and direct vent.

a) **Option 2: boiler(s) provides heat for DHW only (independent system):** if a dedicated condensing, low-mass (short recovery time for reheating), direct vent boiler is provided for DHW heating, an indirect, storage-type water heater may be used. The indirect water heater tank should be constructed of 316L stainless steel (or better), with stainless steel or copper-nickel heat exchanger, rated thermal loss of less than 1°F per hour.

II. **Properly vent the combustion exhaust:**
Boilers and direct-fired DHW water heaters must be direct vented. That is, both supply (combustion air) and exhaust vents shall be piped directly to the exterior from the combustion appliance. The exhaust vent must be located away from ventilation intakes, operable windows, etc. Refer to the International Mechanical Code (IMC) or the manufacturer's installation instructions.



This boiler vent deposits condensate on the wall of the buildings and on the stairs leading to a shared laundry facility.

1. Inlet and outlet need to be located above anticipated snow load. Clearances above grade must account for not just average snowfall, but also snowdrifts and piles made from snow plowing/blowing.
2. Configure the exhaust vent such that condensate will not fall upon any building surfaces or walks.

C. **SIZE ALL REPLACEMENT EQUIPMENT BASED ON LOAD CALCULATIONS:**
Calculate the load and size the system based on the anticipated use. Engineers shall submit system designs with corresponding calculations or justification for the proposed sizing. Engineers shall establish the required capacity of the water-heating equipment and the general type of system to be used by accounting for the following:

I. The building's estimated load profile and peak demands.
II. The programmatic demands of each space, the building type, fixture and equipment information, and any project-specific POAH requirements.
III. Consumption based on end-use
IV. Water heater manufacturer sizing guidelines

D. **MIXING VALVE FOR SCALD PROTECTION**
Unless there is a working anti-scald valve at every point of use, provide an approved mixing valve to control the temperature of water delivered to the building. DHW should be delivered to the building no hotter than 120F.

E. **HEAT TRAPS**
Hot water storage tanks not supplied with integral heat traps and serving noncirculating systems shall be provided with heat traps on the supply and discharge piping.

Heat trap

F. **PIPING AND DISTRIBUTION:**

I. **Pipe Insulation**: Insulate all accessible hot water piping per IECC:

BASIS OF DESIGN

Pipe Location	Pipe Diameter	R-Value	Minimum Tubular Insulation Thickness
between the water heater and fixtures	up to 1 ½"	R-4	1"
	greater than 1 ½"	R-4	1 ½"
between a boiler and the water heater	up to 1 ½"	R-4	1 ½"
	greater than 1 ½"	R-4	2"

II. **Distribution Layout:** shorter recirculating loops are preferred since they reduce the amount of heat able to escape though the pipe length. In large buildings with multiple wings, separate recirculation loops should be used for each wing.

G. **DHW CIRCULATION**

DHW circulation systems shall be provided with a pump or pumps. The pumps shall have appropriate controls.

Premium efficiency recirculation pump

I. **Pumps:** Use premium efficiency recirculation pump(s). The recirculation pump will have significant run time and should, therefore be a premium efficiency pump. It is not necessary to use a variable frequency drive on the recirculation pump as it will be operated as on/off. The pump should be sized for high flow rate. The pump selection must also take into account the frequent stop-start operation of modern, code-compliant recirculation control.

1. All pumps 1/4 HP and larger shall include a soft start

Soft start controls

II. **Controls:** Controls for DHW circulation system pumps shall start the pump on demand for hot water within the connected fixtures (i.e., a flow switch is required). The controls shall also automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The temperature sensor for the recirculation loop shall be located as close to the furthest fixture as practical. This may necessitate an access panel located in an apartment.

DHW controls

H. **INCLUDE SPECIFICATIONS FOR COMMISSIONING (CX):** The following specification sections are required in all new construction projects. Commissioning specifications to be reviewed, updated to reflect the current project, and included within the design specification. The Plumbing Section (Division 22) must reference the following specifications:

I. **Section 019013 – General Commissioning Specification**
Section includes general and specific requirements that apply to the implementation of commissioning process for Plumbing systems, assemblies, and equipment.

II. **Section 019013.01 Sample Commissioning (CX) Plan:**
Provide a sample Cx Plan. This document outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. Each commissioning plan should include:

BASIS OF DESIGN

a) Commissioning Objectives
b) Systems to be Cx.
c) Project team contact list, Cx roles and responsibilities of team, general management plan, communication protocols.
d) Summary of Cx process, schedule for Cx activities.
e) Documentational requirements. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
f) Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
g) Certifications: installation, prestart checks, and startup procedures have been completed. Ready for testing.
h) Verification of testing, adjusting, and balancing (TAB) reports.
i) Sample Issues Log and Corrective Action document.

III. **Section 220800 - Commissioning of Plumbing**

Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.

a) If a Building Automation System (BAS/BME/EMS) is to be installed, the Integrated Automation Cx specifications within Section 22 Plumbing will also require the following specification. All Cx specifications will also need to reference this specification.
    a. **Section 250800 - Commissioning of Integrated Automation**
    Section includes commissioning process requirements for BAS.
b) The Cx specifications within Section 22 Plumbing must also reference the following specifications, as applicable to the project:
    a. **Section 230800 - Commissioning of HVAC**
    Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
    b. **Section 260800 - Commissioning of Electrical**
    Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

BASIS OF DESIGN

DOORS

EXTERIOR DOORS:

LOCATIONS INCLUDE:

Lobby entries, corridors, town homes units, community rooms, mechanical closets, and management offices.

ALL EXTERIOR DOORS SHOULD INCLUDE:

- Install thresholds on silicone type water repellent proper to installation.
- Pan flashing.
- Doors must have VYCOR brand or equal, self adhered flashing installed to all perimeters and sills for protection against air, water and moisture.
- Weather-stripping: vinyl foam compression type or equal around perimeter; vinyl sweep at door bottoms; and aluminum with vinyl seal strip threshold with thermal brake at all exterior doors.
- Preferred: Aluminum Storefront with sidelight and power door operator preferred.

PERFORMANCE REQUIREMENTS OF ALL EXTERIOR DOORS:

- Minimum STC rating of 35
- Exterior doors must be **energy star rated**, and comply with the following:

DOORS			
GLAZING LEVEL	U-FACTOR[1]	SHGC[2]	
Opaque	≤ 0.17	No Rating	
≤ ½-Lite	≤ 0.25	≤ 0.25	
> ½-Lite	≤ 0.30	Northern North-Central	≤ 0.40
		Southern South-Central	≤ 0.25

Air Leakage for Sliding Doors ≤ 0.3 cfm/ft2
Air Leakage for Swinging Doors ≤ 0.5 cfm/ft2

BASIS OF DESIGN

STOREFRONT SYSTEMS:

FOR USE AT LOBBY ENTRIES

- May have an automatic opener/closer.
- Insulated glazing.
- Thermally broken framing system and door.

SAMPLE PRODUCT:

Kawneer
Storefront System 451T
2 3/4" x 5" Thermal Exterior Frame System
Field Glazed.

UNIT EXTERIOR DOORS:

FOR USE AT TOWNHOUSES & UNITS WITH DIRECT ACCESS TO EXTERIOR

- Door unit may include sidelight, transom, or lite integral to the door itself.
- Minimum 1-3/4", 20-gauge six-raised panel steel insulated doors with 26 gauge steel frame.
- Use vinyl exterior jambs instead of wood jambs to prevent rot.
- Preferred: Endura PVC door jambs
- All doors to have peephole. See Door Hardware section below.

SAMPLE PRODUCT:

Jeld-Wen
6-Panel
Pre-Hung Door
Insulated Core
Energy Star
Manufacturer Number:
957077

BASIS OF DESIGN

INTERIOR DOORS:

LOCATIONS INCLUDE:

Unit entries, closets, bedroom, bathroom, mechanical closets, etc.

GENERAL INFORMATION AND REQUIRED DETAILS:

- Minimum 1-3/8" wood or solid/ semi-solid core high-density fiberboard (HDF).
- Use flush thresholds for ease of tenants.
- Do not silicone / caulk metal frames to wall board because it affects future shimming as building settles.
- **New Construction:**
  - Solid doors should be used at family properties.
  - Hollow core doors are acceptable at senior properties.
- **Rehab:**
  - Replace doors in-kind (hollow or solid core depending on tenancy type), unless resident damage warrants upgrade to solid core.

UNIT ENTRY DOOR FROM CORRIDOR:

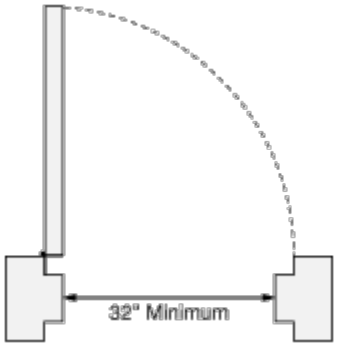
- Preferred: Jeld-Wen or Mohawk smooth core wood door.
  - Alternate: Six panel solid core wood door with paint finish. If replacing individual units, finish TBD by Property Manager.
- Corridor doors must have adjustable (knock down) frames for future adjustments.
- Doors must comply with fire rating required by code.
  - Fire rating information should be included in door label. Contact basisofdesign@poah.org with questions.
- All doors to have peephole. See Door Hardware section below.
- Clear width of a door opening must be 32 inches minimum to satisfy Fair Housing Act Regulations
  - 32 inch clear width is achieved with a 36 inch wide door
- Weatherstrip all unit entrance doors using:

Q-Lon
Door Weatherstripping at Head and Jamb
Polyethylene-clad urethane foam secured to a PVC carrier.
Available at:
Conservation Mart

Pemko
Door Weatherstripping at Sill
36" Fire-Rated Door Sweep Aluminum
Manufacturer Number:
307AV36

SAMPLE PRODUCT:

Jeld-Wen
1-3/4" Thick Flush
Legacy Tru-Oak
Solid Core Slab Door
Manufacturer Number:
984124



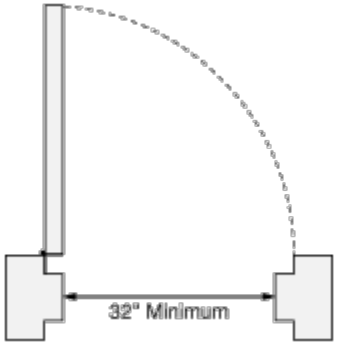
UNIT INTERIOR DOORS:

BEDROOM:

- Preferred: Jeld-Wen or Mohawk 1-3/4" hinged solid core doors
- Clear width of a door opening must be 32 inches minimum to satisfy Fair Housing Act Regulations
    - 32 inch clear width is achieved with a 36 inch wide door

SAMPLE PRODUCT:

Jeld-Wen
1-3/4" Thick Flush
Legacy Tru-Oak
Solid Core Slab Door
Manufacturer Number:
984124



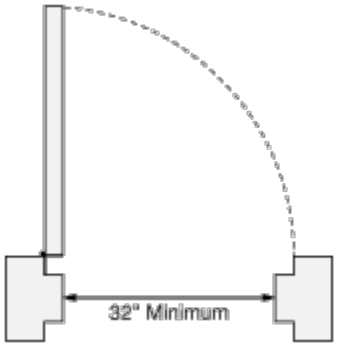
BASIS OF DESIGN

BATHROOM:

- Clear width of a door opening must be 32 inches minimum to satisfy Fair Housing Act Regulations
  - 32 inch clear width is achieved with a 36 inch wide door
- No raised threshold at bathroom doors. If possible, create a flush transition from hallway floor to bathroom floor.

SAMPLE PRODUCT:

Jeld-Wen
1-3/4" Thick Flush
Legacy Tru-Oak
Solid Core Slab Door
Manufacturer Number:
984124



CLOSET:

- MAGIGLIDE Bifold Closet Door System.
  - MAGIGLIDE Bi-Fold Closet Door is the ONLY bi-fold closet door available today that meets the HUD Specification for “Heavy Duty Bi-Fold Closet Doors.”

MAGIGLIDE
Bi-folding closet door
Flat Panel
Solid Core

BASIS OF DESIGN

DOOR ACCESSORIES

PEEP HOLES:

- To be provided at building entry doors and unit doors. Handicapped units shall be provided with two (2) peep holes, one at the regular height and one in accordance with the ADA standards.

SAMPLE PRODUCT:

HD Supply
190 Diameter
Fire Rated Door Viewer
Satin Chrome
Manufacturer Number:
874140

HARDWARE:

GENERAL INFORMATION AND REQUIRED DETAILS:

- All public, common area and handicap unit doors shall be equipped with lever type hardware or hardware that meets ADA/UFAS design standards.
- Floor mounted door stops to be installed at all doors
- Finish: all hardware to be brushed aluminum, or satin chrome.
- Anti-pick latches with single action lever.
- Keying for common spaces and unit entries:
- Key tree to be reviewed by POAHC.
- No grand master key for dwelling units.
- Include 4-5 cores as additional stock for unit entry doors to accommodate unit turns.
- Site staff to use HandyTrac key control system.
- Main building entries to be equipped with Knox Box rapid entry system for local fire department.

UNIT ENTRANCE (FROM EXTERIOR + FROM CORRIDOR):

- Doors shall be equipped with interlocking mortise lock sets. Operation of the lock set shall include to following features:
    - From exterior of unit entrance, key unlocks both dead latch and deadbolt.
    - From interior of unit entrance, turning knob disengages both dead latch and deadbolt at the same time.

SAMPLE PRODUCT:

Schlage
Mortise Storeroom Lockset
06 Lever
Interconnected Lock
Manufacturer Number:
L9080L 07A 626

UNIT BEDROOMS, CLOSETS & PASSAGE DOORS:

- Use levered handles; no knobs.
- No locks.

SAMPLE PRODUCT:

Schlage
Manhattan Passage Lever
Satin Chrome
Manufacturer Number:
F10MNH

UNIT BATHROOM DOORS:

- Use levered handles; no knobs.
- Required: lock with "pin-hole" reset.

SAMPLE PRODUCT:

Schlage
Manhattan Privacy Lever
Satin Chrome
Manufacturer Number:
F40MNH

BASIS OF DESIGN

UNIT MECHANICAL CLOSETS:

- Use levered handles; no knobs.
- Required: lock with key for site personnel only.
- **Need to be secured and accessed by site personnel only.**

SAMPLE PRODUCT:

Schlage
Manhattan Entry Lever
Satin Chrome
Manufacturer Number:
F51MNH

ATTIC HATCHES:

- Access to attic areas for maintenance and/or inspection shall be outside of the dwelling unit, where possible.
    - If inside, access doors will be insulated and furnished with key locks and fire rated where required.

STORM DOORS:

- Unit entrance doors, which open directly to the exterior of the building, shall be equipped with storm doors with screens.
    - Storms and screens must be stored within the door and require no storage of panels during winter or summer.
    - Preferred: Larson Duratech surface - window and screen.

SAMPLE PRODUCT:

Larson
Life Core
Storm Door White
DuraTech® Surface
Manufacturer Number:
37050032

BASIS OF DESIGN

COMMON FLOORING

CONTACTS:

- POAH has negotiated pricing with select manufacturers and wholesalers. When purchasing and installing new flooring please contact the following representatives. See the **Manufacturer Contacts** section of the BOD for more information.

NEW CONSTRUCTION:

- Architect to provide common area floor design for all spaces in building.
- Follow **compartmentalization/ air sealing** per architect's details. If not included in details, highlight for architect.

REHABS:

- Architect to provide common area floor design for all spaces in building.
- Moisture testing is required in basement or slab on grade units.
- All new flooring requires a level subfloor free from cracks, bumps and excessive adhesive residue from former floors.
    - **Subcontractor must evaluate existing subfloor condition and include associated costs for necessary repairs in their bid.**

PROPERTY MANAGEMENT:

- Contact Design + Building Performance Dept. for design support.

VINYL PLANK & VINYL TILE OPTIONS:

Locations: corridor, offices, community spaces, elevator lobbies
Size: Size: 4" x 36", 6" x 36", 6" x 48" planks, 1/8" thickness.

GLUE DOWN PLANK OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 8" x 48" planks, 2.0mm thickness.

Mohawk
Dodford 20 Db
Fawn Brindle
Glue-down

Mohawk
Dodford 20 Db
Bordeaux Oak
Glue-down

Mohawk
Dodford 20 Db
Suede Oak
Glue-down

Mohawk
Dodford 20 Db
Dorian Oak
Glue-down

BASIS OF DESIGN

Mohawk
Dodford 20 Db
Chinchile Oak
Glue-down

Mohawk
Dodford 20 Db
Mochochino Pine
Glue-down

Mohawk
Dodford 20 Db
Chateau Brown
Glue-down

GLUE DOWN TILE OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 12” x 24” planks, 2.0mm thickness.

Mohawk
Dodford 20 Db
Keystone
Glue-down

Mohawk
Wanderers Loop
Bavarian Cream
Glue-down

BASIS OF DESIGN

FLOATING / CLICK OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 6” x 48” or 7” x 48” planks, 3.2mm thickness.

Mohawk
Founder’s Trace
Cathedral Grey
Uniclic

Mohawk
Discovery Ridge
Lamb’s Ear
Uniclic

Mohawk
Discovery Ridge
Richmond Gold
Uniclic

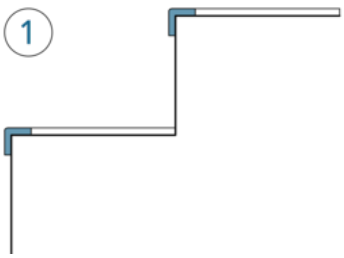
Mohawk
Discovery Ridge
Brushed Beige
Uniclic

Mohawk
Discovery Ridge
Granite Valley
Uniclic

STAIRS

RUBBER OR VINYL

BASED ON STAIR TRAFFIC, PICK FROM THE SOLUTIONS BELOW.



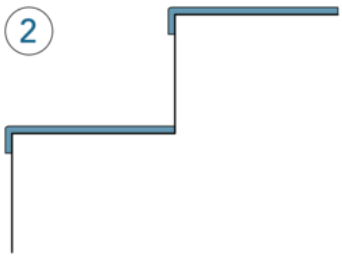
LIGHT TRAFFIC

NOSING

Nosing: Rubber or Vinyl
Tread: Flooring Material
Riser: Painted

BASIS OF DESIGN

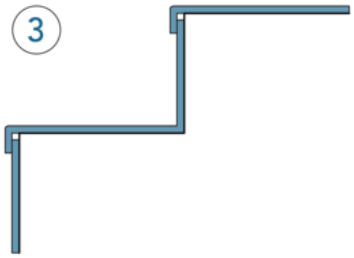
MEDIUM TRAFFIC



TREAD

Nosing/Tread: Rubber or Vinyl
Riser: Painted

HEAVY TRAFFIC

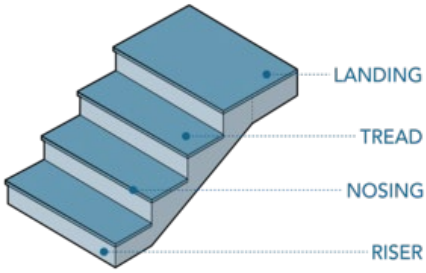


TREAD + INTEGRATED RISER

All rubber or All Vinyl

APPROVED PRODUCT:

ARMSTRONG
Rubber Stair Solutions
Square Pattern
1/8" Thickness



WALK-OFF MAT

APPROVED LOCATIONS:

- Main entry vestibules.
- Area just inside door if no vestibule.
- Inside elevator cabs if elevator is near main entry.
- **New construction:**
  - Work with architect to provide recessed floor to accommodate thickness of mat.
- **Rehab:**
  - It is likely the existing flooring will need to be removed to install new walk-off mat.
  - Confirm any anticipated threshold changes or issues caused
  - by new walk-off mat.

BASIS OF DESIGN

APPROVED PRODUCTS:

Shaw
Succession II
Size: 24” x 24“ tiles
or 12'-0" wide roll;

Mannington
Ruffian II
Size: 24” x 24“ tiles;
5/32” thickness
Backing: Vinyl

Mats Inc.
Cocoa Mat
Size: 6’-7” x 39’-4“ roll;
5/8” thickness
Backing: Vinyl

CARPET

APPROVED LOCATIONS:

- **Carpet only to be installed if approved by POAHC Director of Maintenance.**
- **Carpet may be installed in certain instances but after pricing is secured for all flooring options.**

APPROVED PRODUCT:

J + J Flooring

Kinetex

Size: Varies, Modular Tiles
0.205” thickness

CARPET SPECS

Tile or Broadloom Carpet:

- Construction: Textured graphic loop, Fiber: Branded Nylon 6,6 or Solution Dyed Nylon
- Protective treatment: Soil Protection
- Stitched per inch: 10-13, Gauge: 1/10 - 1/12, Tufted weight: 28.0 to 32 oz
- Secondary backing: Moisture barrier backing
- Environmental: Green Label Plus
- Warrantee: Lifetime warrantee against edge ravel and delamination
- Methane Pill Test (ASTM-D-2859): Passes
- Flooring Radiant Panel Test (ASTM-E-648): Class I
- NBS Smoke Chamber Test (ASTM-E-662): <450
- Electrostatic Propensity test (AATCC): <3.5 KV

BASIS OF DESIGN

RUBBER BASE

APPROVED LOCATIONS

- Corridor, Offices, Community spaces, Elevator lobby

APPROVED RUBBER BASE PRODUCTS:

- Suggested Manufacturers: Armstrong, Mannington, Johnsonite
- Type TV (vinyl thermoplastic); Group I (solid, homogeneous)
- Length: **Coil stock ONLY**, in manufacturer's standard length
- Size: 4 inches in height, 0.125" min. thickness, and Cove style

CORNER INSTALLATION:

Factory Made Outside Corners:
Install factory made outside corners before installing wall base.
Field-Made Inside Corners:
Use a utility knife to score the back and notch out the base for inside core

BASIS OF DESIGN

UNIT FLOORING

CONTACTS:

- POAH has negotiated pricing with select manufacturers and wholesalers. When purchasing and installing new flooring please contact the following representatives. See the **Manufacturer Contacts** section of the BOD for more information.

REQUIRED DETAILS FOR ALL FLOORING TYPES:

- **UNIT TURNS:**
  - To achieve **unit compartmentalization**, seal joint from new flooring to existing wall with manufacturer approved joint sealant.
  - All new flooring requires a level subfloor free from cracks, bumps and excessive adhesive residue from former floors.
    - **Subcontractor must evaluate existing subfloor condition and include associated costs for necessary repairs in their bid.**
- **REHABS:**
  - Moisture testing is required in basement or slab on grade units.
  - To achieve **unit compartmentalization**, seal joint from new flooring to existing wall with manufacturer approved joint sealant.
  - All new flooring requires a level subfloor free from cracks, bumps and excessive adhesive residue from former floors.
    - **Subcontractor must evaluate existing subfloor condition and include associated costs for necessary repairs in their bid.**
- **NEW CONSTRUCTION:**
  - Follow **compartmentalization/ air sealing** per architect's details. If not included in details, highlight for architect.

BASIS OF DESIGN

VINYL PLANK OPTIONS:

Location: Kitchen, Living, Bedroom, Entry/Corridor.
Wear Layer: 12 mil

GLUE DOWN PLANK OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 8” x 48” planks, 2.0mm thickness.

Mohawk
Leighton
Merino
Glue-down

Mohawk
Leighton
Ashen Tan
Glue-down

Mohawk
Leighton
Sequoia
Glue-down

FLOATING / CLICK OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 6” x 48” planks, 4.5 mm thickness.

Mohawk
Discovery Ridge
Coffee House Tan
Uniclic

Mohawk
Discovery Ridge
Rustic Taupe
Uniclic

CARE & MAINTENANCE

https://www.mohawkflooring.com/luxury-vinyl-tile/guides/luxury-vinyl-care-maintenance

BASIS OF DESIGN

SHEET VINYL OPTIONS:

Location: Bath.
Size: 12'-0" wide rolls, 65 gauge thickness

Mohawk
Gateway
Almond Spice

Mohawk
Gateway
Silver Screen

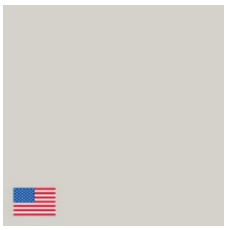
REQUIRED DETAILS:

All seams must be **chemically welded.**

CARE & MAINTENANCE

https://www.mohawkflooring.com/luxury-vinyl-tile/guides/luxury-vinyl-care-maintenance

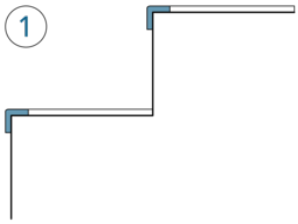
STAIRS:



Tarkett
Vinyl Stair Treads
Service Weight
22 Pearl CB

BASIS OF DESIGN

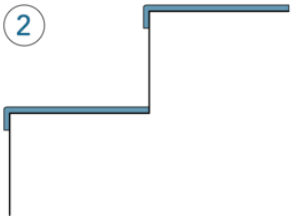
Based on the amount of stair traffic, pick one of the following solutions:



LIGHT TRAFFIC

NOSING

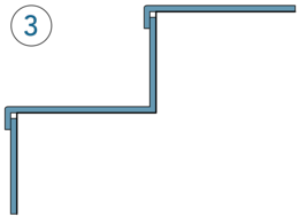
Nosing: Vinyl
Tread: Flooring Material
Riser: Painted



MEDIUM TRAFFIC

TREAD

Nosing/Tread: Vinyl
Riser: Painted



HEAVY TRAFFIC

TREAD + INTEGRATED RISER

All vinyl

RUBBER BASE

- Suggested Manufacturers: Armstrong, Mannington, Johnsonite
- Type TV (vinyl thermoplastic); Group I (solid, homogeneous)
- Length: **Coil stock ONLY**, in manufacturer's standard length
- Size: 4 inches in height, 0.125" min. thickness, and Cove style

Tarkett
Baseworks
Toe 4"
34 Almond

Tarkett
Baseworks
Toe 4"
09 Clay

Tarkett
Baseworks
Toe 4"
280 Shoreline

BASIS OF DESIGN

CORNER INSTALLATION:

Factory Made Outside Corners: Install factory made outside corners before installing wall base.

Field-Made Inside Corners:
Use a utility knife to score the back and notch out the base for inside corners.

BASIS OF DESIGN

HEATING: EXISTING CONSTRUCTION

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be used for 1) rehab projects to guide Architects, Engineers, and Development staff, and 2) during system replacement to guide maintenance staff. Modifications to existing heating equipment present significant and uncommon opportunities to improve performance, increase heating system efficiency and reduce utility costs.

REQUIREMENTS FOR ALL HEATING SYSTEM TYPES DURING REHAB:

When work to upgrade or replace the existing heating system is being considered, the following requirements should be reviewed by the project team:

Central VRF System

A. **EVALUATE CONVERSION TO HEAT PUMPS:**
POAH's preferred approach is to remove existing heating systems and to install new central heat pump systems with heat recovery (VRF-HR). For requirements on heat pumps, see the **Heating + Cooling: New Construction** section of the Basis of Design.

If converting to heat pumps is not possible, proceed with the following requirements, as well as those listed for specific system types (below):

B. **ALL NEW EQUIPMENT (HEAT PUMP OR NOT) MUST BE SIZED USING ACCA MANUAL J AND S, OR ANSI/ASHRAE/ACCA STANDARD 183:** New heating and cooling equipment shall be sized to meet calculated loads for the specific building or space served. Rule-of-thumb sizing is not acceptable. For buildings 3 stories or less in height use ACCA Manual J to calculate building loads and ACCA Manual S to size equipment. For buildings over 3 stories in height calculate heating and cooling loads according to ANSI/ASHRAE/ACCA Standard 183 and size equipment not greater than these loads.
   I. **When calculating heating and cooling loads use the following interior conditions:**
      1. Maximum of 74F for heating (*this satisfies HUD's requirement of 68F*)
      2. Minimum of 72F for cooling

C. **PREDICTIVE MODELING FOR ENERGY CONSUMPTION AND COST:**
POAH desires to have an estimate of energy consumption and cost for operation of the new building. Engineers shall provide estimates of energy use and cost for each of the following, broken out by common-meter energy use vs. resident-meter energy use:
   I. Heating energy use for primary heating fuel
   II. Heating electrical energy use (for fossil fuel systems, this would capture the electrical associated with pumps and fans)
   III. Cooling energy use
   IV. DHW energy use for primary water heating fuel
   V. DHW electrical energy use (as for heating, this would capture electrical use associated with pumps and burner/vent fans)
   VI. Ventilation energy use

VII. Ventilation thermal energy use (e.g., gas if/as applicable)
VIII. Lighting
IX. Plug loads

D. **USE PROGRAMMABLE THERMOSTATS:**
   I. See the **Thermostat** section of the Basis of Design for more information.
   Note: PTAC units will not include separate thermostats.

E. **INCLUDE SPECIFICATIONS FOR COMMISSIONING (CX):**
The following specification sections are required in all projects. Commissioning specifications to be reviewed, updated to reflect the current project, and included within the design specification. The HVAC Section (Division 23) must reference the following specifications:

X. **Section 019013 – General Commissioning Specification**
Section includes general and specific requirements that apply to the implementation of commissioning process for HVAC&R systems, assemblies, and equipment.

XI. **Section 019013.01 Sample Commissioning (CX) Plan:**
Provide a sample Cx Plan. This document outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. Each commissioning plan should include:

a) Commissioning Objectives
b) Systems to be Cx.
c) Project team contact list, Cx roles and responsibilities of team, general management plan, communication protocols.
d) Summary of Cx process, schedule for Cx activities.
e) Documentational requirements. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
f) Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
g) Certifications: installation, prestart checks, and startup procedures have been completed. Ready for testing.
h) Verification of testing, adjusting, and balancing (TAB) reports.
i) Sample Issues Log and Corrective Action document.

XII. **Section 230800 - Commissioning of HVAC**
Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

a) If a Building Automation System (BAS/BME/EMS) is to be installed, the Integrated Automation Cx specifications within Section 23 HVAC will also require the following specification. All Cx specifications will also need to reference this specification.
   a. **Section 250800 - Commissioning of Integrated Automation**
   Section includes commissioning process requirements for BAS.
b) The Cx specifications within Section 23 HVAC must also reference the following specifications, as applicable to the project:

a. **Section 220800 - Commissioning of Plumbing**
Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.

b. **Section 260800 - Commissioning of Electrical**
Section includes commissioning process requirements for electrical systems, assemblies, and equipment.

REQUIREMENTS FOR SPECIFIC HEATING SYSTEM TYPES DURING REHAB:

A. **CENTRAL BOILERS WITH HYDRONIC DISTRIBUTION:**
Evaluate the possibility of converting the system to an air-source heat pump, VRF system. The electrical system should be evaluated for capacity to carry heat pumps. If the electrical system does not have capacity, consider upgrading the electrical system. If a VRF system is not feasible and a gas boiler is to remain, proceed with upgrade of the plant and distribution as follows:

Central Boilers with Hydronic Distribution

I. **Determine Water Quality**:
When replacing boilers, determined if the boiler failed prior to its expected service life. Collect data on any previous water quality tests and premature system failures. Corrosion due to hard-water, chemical imbalances, oxygen in the system are typical culprits. A water treatment conditioning device may need to be installed within the boiler plant to minimize future corrosion. Water strainers need to be inspected for debris and materials within the system. On all existing systems, at the design exploration phase, perform a test of water hardness and chemistry. Check all pump strainers for debris and indications of distribution deterioration.

II. **Determine if system includes galvanized piping:**
Galvanized piping over time corrodes from the inside, reducing flow rates through the piping and causing costly leaks inside concealed walls and floors. If galvanized pipes are found, the project team must evaluate replacing the entire piping system (this applies to both the heating and plumbing system).

Galvanized piping

III. **Inspect pipes embedded in concrete.**
Leaks will degrade concrete, in turn the concrete will increase the speed of metal pipe corrosion.

IV. **Boiler Plant:**
1. **Boiler:** use modulating condensing boilers
2. **Boiler Controls:** use Outdoor Air Temperature (OAT) Reset that modulates based on change in outdoor temperature (ΔT). The OAT sensor for the OAT reset controller must be:
   a. located on the exterior face of the building.
   b. located on the North side of the building; I.E. it should not be affected by changing temperatures caused by the sun. Alternative shaded locations may be suitable, subject to POAHs approval, where direct sunlight does not reach within 3' of the OAT sensor and the surface that it is mounted to does not fluctuate with sunlight.
   c. OAT sensor must be away from any devices that may affect its temperature reading, such as dryer or bathroom exhausts vents or AC/heat pump compressors.

Modulating condensing boiler

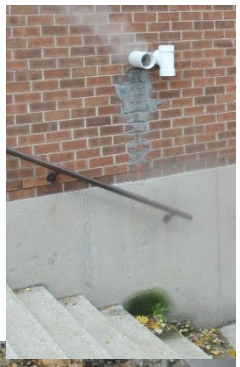
Outdoor Air Temperature (OAT) Reset

BASIS OF DESIGN

3. **Piping Configuration:** If replacing distribution piping, utilize primary-secondary configuration. Use tertiary if needed for wings or auxiliary loads.
4. **Building Loop Pumps:** use lead lag, VFD pumps.
5. **Building Loop Pump controls:** control by pressure, or pressure and ΔT
   a. Pressure sensor 2/3 along building loop
   b. ΔT between loop supply leaving boiler room and loop return entering boiler room
6. **Pipe Insulation:**
   a. Pipes up to 1 ½" diameter: use minimum 1 ½" thick tubular insulation
   b. Pipes greater than 1 ½" diameter: use minimum 2" thick tubular insulation.

Pipe insulation

7. **Combustion Exhaust Venting:**
   The exhaust vent must be located away from ventilation intakes, operable windows, etc. Refer to the International Mechanical Code (IMC) or the manufacturer's installation instructions.
   a. Inlet and outlet need to be located above anticipated snow load. Clearances above grade must account for not just average snowfall, but also snowdrifts and piles made from snow plowing/blowing.
   b. Configure the exhaust vent such that condensate will not fall upon any building surfaces or walks.



This boiler vent deposits condensate on the wall of the buildings and on the stairs leading to a shared laundry facility.

8. **Demolish unused flue/vent and patch the vent penetrations:**
   When converting the hot water heating to either electric heat-pump or direct-vent combustion, there typically will be an existing exhaust vent that is no longer needed. Abandoned exhaust vents should be demolished and the ceilings, floors, roofs and/or walls that the vent went through should be patched and made good. The abandoned shaft must be closed and sealed at the floor of the attic.
   a. Where the vent penetrated a roof and or wall, the water control of must be restored with the water control layer properly shingle lapped.
   b. The ceiling of the boiler room must be patched and sealed.
   c. Floor penetrations that are accessible or can be access as part of the renovation work should be sealed air tight and as required for fire safety.
   d. If the vent cannot be fully demolished – e.g., the flue chase is in occupied apartments with no provision for work in those apartments – then the accessible portions of the vent should be demolished with the chase and vent sealed at the top and bottom.
   e. If using the vent chase for new vent or intake pipes, or refrigerant lines, or ventilation ductwork, electrical service, etc. be sure to seal around the pipes and wires where they enter the chase. The top and bottom of the chase should be closed and sealed.

This abandoned exhaust vent provides a direct air leakage path to the exterior. It requires patching.

9. **Heat Exchanger (HX):** Evaluate history of HX seal replacement, dates and reasons for replacement; evaluate if the HX requires premature seal replacement. If HX requires disassembly and new seals, check water quality as previously discussed within this BOD section. Check condition of HX, are the chambers "plugged" with debris, scaling, or water hardness, indication (symptoms) of distribution system issues. Ensure strainers (filters) on both supply sides to the HX, in locations that are easily accessed by maintenance. If there is a debris or water quality issue, DO NOT replace HX or seals without addressing water issues.

Heat exchanger (HX)

V. **Distribution using fintube/baseboard radiators**
   1. **Insulate accessible piping**
   2. **Zone piping:**
      a. provide isolation valves for zone piping if not already present. Use ball valves, do not use gate valves. Gate valves typically wear faster and will require replacement, they are more prone to corroding in a position. They have a higher tendency to leak. Ball Valves last longer and are less prone to leaking.
      b. provide a bypass if needed to allow for individual zone control
   3. **Radiators:** when replacing radiators, replace with high-output radiators capably of meeting the space load with 120F water
   4. **Zone Valves:** provide mechanical zone valves controlled by a zone thermostat
      a. Low voltage zone valves for compatibility with thermostats and safety

Fintube/baseboard radiators

Ball Valves

VI. **Distribution using fan coils: Images**
   1. Change filters
   2. Wherever possible and where not already present, provide zone valve and bypass so heating output can be controlled

Fan Coil

B. **INDIVIDUAL APARTMENT FURNACE WITH DUCTED DISTRIBUTION:**

Replacing a ducted furnace system may present an opportunity to convert to an air-source heat pump system. If the furnace is part of a split system with an outdoor compressor, the electrical system should be evaluated for capacity to carry heat pumps. If the electrical system does not have capacity, consider upgrading the electrical system. If an air-source heat pump system is not feasible and a gas furnace is to remain, proceed with the following:

I. **Furnace:** use condensing furnace with variable speed for higher efficiency
II. **Blower motors:** use ECM or variable speed
III. **Ductwork insulation and sealing:** Insulate and seal all accessible ductwork (Evaluate comprehensive duct sealing, e.g., Aeroseal)

ECM blower motor

IV. **Combustion Exhaust Venting**: see Combustion Exhaust Venting Section listed above under "**Central Boilers with Hydronic Distribution**".

V. **Investigate adding cooling to existing system:** If not already provided, provide an evaporator coil and exterior condenser to provide air-conditioning capability to the existing system.

Condensing Furnace with Variable Speed

Seal all accessible ductwork

C. **PTAC SYSTEMS:**

Investigate removing all PTAC units and installing new air-source heat pumps. If upgrading to air-source heat pumps is not feasible and PTAC units are to remain, consult with Building Design and Performance to determine the appropriate approach. The following measures apply to systems that will remain as PTAC:

I. **PTAC types:**
   a. **For Heat Pump PTAC units with electric resistance "back-up" heating:** The controls for the PTAC unit must allow Heat Pump only heating down to a change-over temperature of no more than 40F.

PTAC unit

II. **EER rating of AC function must be 10 or higher**

III. **Thu-wall Sleeves:**
   a. The wall opening in which the PTAC sleeve is installed must be fully flashed and treated like a window opening (fully flashed, able to drain, continuously sealed at inside perimeter)
   b. Cold climates: Line the wall opening with rigid foam insulation (min. compressive strength of 15 psi) to control condensation on the outside of the sleeve in the wall cavity.
   c. Insulate and seal the perimeter of the wall sleeve to avoid drafts.

PTAC thru-wall sleeve

IV. **Multiple speed fans:** use models with 2-speeds, or more.

V. **Thermostats:** do not use remote thermostats.

VI. **Transfer Ducts to adjoining rooms:**
   a. Duct connecting the PTAC unit with the distribution duct/plenum must be sealed to the PTAC unit discharge. Verify that supply air does not leak and is supplied at supply grilles only.
   b. Provide a manual balancing damper in the ductwork.
   c. Balance system supply air.

VII. **Ventilation through PTAC Units:**
   a. **Warm, humid climates zones 1 and 2:** Ventilation may be provided through the PTAC unit only if the PTAC unit provides dehumidification of the ventilation air. Dehumidification of ventilation supply air is also recommended for PTAC units in humid climate zones 3 and 4.
   b. **Mixed humid climates zones 3 and 4:** Ventilation may be provided through the PTAC unit only if the PTAC unit provides either dehumidification of the ventilation air or ERV with a latent efficacy of at least 50%.
   c. **Cold climates, zones 5 and higher:** Ventilation may be provided through the PTAC unit only if the PTAC unit provides energy recovery or heat recovery ventilation with a total recovery efficiency of not less than 65%.

BASIS OF DESIGN

LANDSCAPE + HARDSCAPE

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be used in new construction and rehab projects as a guide for Landscape Architects, Civil Engineers and in ongoing property maintenance for landscape and hardscape. When installing any new plants, landscape contractors should guarantee plants for one year and should be responsible for all watering and fertilizers necessary for establishing the plant materials. The guarantee should cover replacement plants and removal of dead materials.

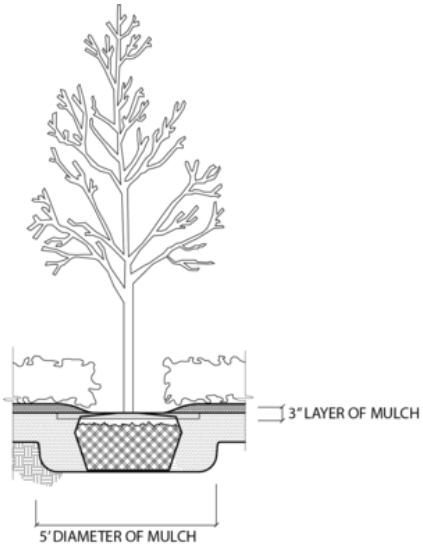
LANDSCAPING

A. SOD

- Use regionally appropriate seed mixes.
- Consider low maintenance, shade and drought tolerant species.
- Refer to irrigation section on how to water effectively.
- Metal edging is only required between crushed granite or gravel and sod/plants.
- Mowing:
    - Mowing blades should be set at 2.5-3 inches.
    - Make sure landscape contractors do not mow or manicure any “nature-scaping” zones which are intentionally overgrown to benefit wildlife.

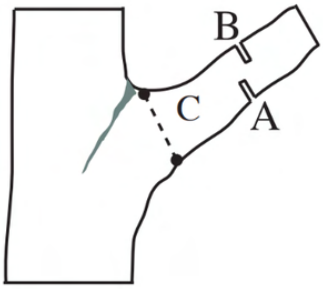
B. TREES

- Planting:
    - Plant trees minimum 3 feet from any curb or sidewalk and 6 feet from any building or structure.
    - Do not plant trees in an area where it will obstruct visibility to the building, signage, lighting or street traffic.
    - Trees planted in turf areas should install a 5 feet diameter mulch ring to allow for proper turf maintenance without disturbing the tree.
    - Install a minimum 3 inches layer of hardwood bark mulch around all trees and in all planting areas. Create a natural spaded edge where planting beds meet turf areas.
    - Consider size of tree at maturity when planting in relation to structures and pavement.
    - Use a mix of deciduous, semi-evergreen, and coniferous trees.

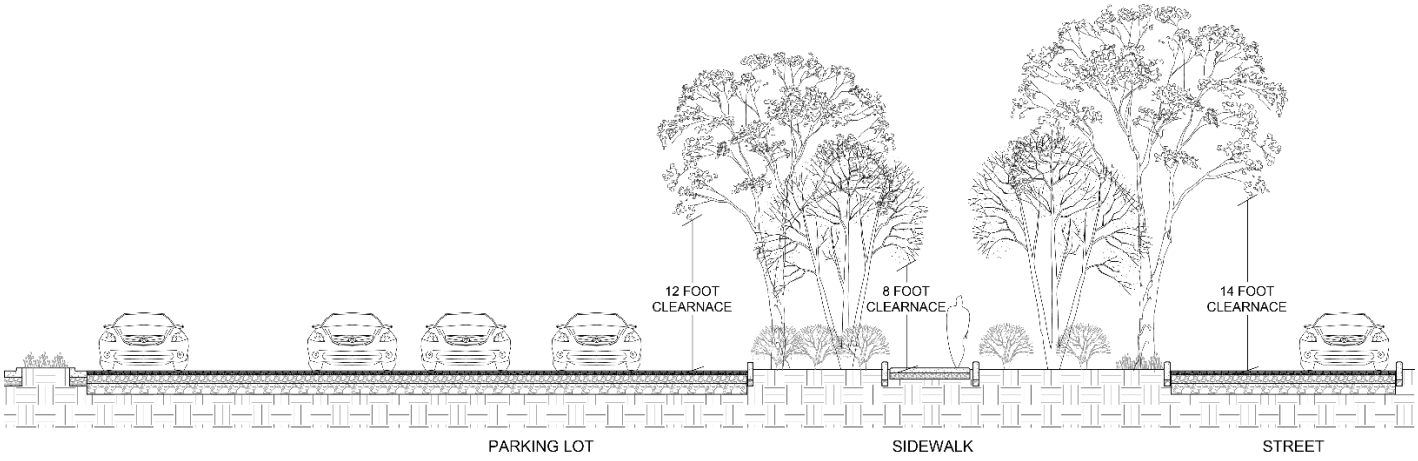


BASIS OF DESIGN

- Pruning:
  - For extensive pruning across a property, hire a local arborist.
  - Prune in late winter before any new leaf buds have formed.
  - Never remove more than ¼ of a tree's canopy in a season.
  - Remove broken, dead, dying, diseased, or damaged branches.
  - Never leave stubs when pruning. Cut along line C when trimming branches. For large branches, make cut A and then cut B to remove the bulk of the branch before making a clean cut at line C.



- Maintain the following clearances from ground to lowest branches:
  - Trees along streets: 14 feet
  - Trees along sidewalks: 8 feet
  - Trees along parking lots: 12 feet
  - Trees in landscape: no clearance requirements



- Leaves:
  - Leaves on lawn/grass: mulch/shred leaves using a mower rather than collecting them and removing them from the property. Mulching the leaves return nutrients back to the soil and helps a healthy lawn return in the spring. If a landscape contractor is hired to conduct the work, mulching should also save on removal fees.
  - Leaves elsewhere: collect leaves and mulch/shred them. Spread mulched leaves in planting areas around the property.

For specific options refer to:

BOD REGIONAL PLANT RECOMMENDATIONS

BASIS OF DESIGN

C. SHRUBS + PERENNIAL PLANTS

- Use drought resistant, shade tolerant and low maintenance plants.
- Use native species, do not use invasive species. See **website** for list of invasive species in your area.
- If installing new plantings, obtain a minimum one-year warranty from the nursery or provider to replace or maintain if something happens to the plants.
- Where possible, use perennials, not annuals. Annuals require more rigorous maintenance and should only be used in discrete locations.
    - Perennials are plants that bloom for a short time each year and do not need to be replanted every year. While most perennials last many years, it is also typical for them to be replaced every three to five years if they stop performing well. Use manufacturer or landscaper recommendations for perennials.
    - Annuals are plants that bloom for a longer season and need to be replanted every spring. These require more maintenance. Be selective about areas to plant them, such as in front of the management or leasing office. Consider groundcover as a low maintenance option in lieu of turf. Groundcover is defined as low-lying, creeping or spreading perennials which cover large ground sections.
- Consider groundcover as a low maintenance option in lieu of shrubs and flowering plants. Groundcover is defined as low-lying, creeping or spreading perennials which cover large ground sections.
- Groundcover is also suggested for areas such as planting beds, low or no traffic areas, near service areas, inside parking islands, shady areas, and steep slopes where grass will not grow well.
- Groundcover should be kept 18 inches from building edge.
- Spacing between groundcover plants will vary based on species but in general 12 - 24 inches apart will be sufficient. The objective is for neighboring plants to overlap enough to keep the ground shaded and discourage weed growth.
    - Consider the plant's maximum width at maturity to determine the spacing.
    - Allow extra spacing for fast growing species, less spacing for slower species.
    - Be sure to use regionally appropriate species, as some are invasive or aggressive in certain areas and native in others.
- Groundcover should be properly maintained so as to not become overly dense or protrude onto walkways, paths of travel, or parts of the building and other structures on site.

For specific options refer to:

BOD REGIONAL PLANT RECOMMENDATIONS

BASIS OF DESIGN

D. REGIONAL PLANT RECOMMENDATIONS

- See **website** for a full list of native plants by region, see below for specific recommendations/suggestions. It is important to buy plants native to the region you are planting in. This allows plants to thrive, use less water and require less maintenance.
- Midwest
  - Trees

Autumn Blaze Maple

Northern Pine Oak

English Oak

  - Shrubs

Grow Low Sumac Shrub

Hicks Yew

Highbush Cranberry

  - Groundcover

Broadmore Juniper

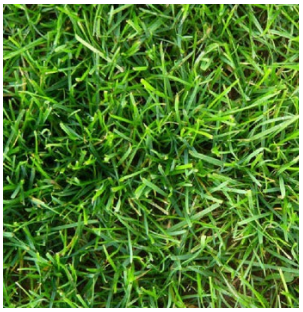
Hosta Francee

Asarum Canadense

BASIS OF DESIGN

- Sod + Grasses (grass seed or sod may be provided as a mixture of these types or others)

Kentucky Bluegrass



Ryegrass

Buffalo Grass

- Perennials

Black Eyed Susan

Purple Sensation

Graceful Beauty

- Northeast
  - Trees

American Sweetgum

Leyland Cypress

Eastern White Pine

  - Shrubs

Lacecap Hydrangea

Dwarf Cranberry Viburnum

PJM Rhododendron

BASIS OF DESIGN

- Groundcover

English Ivy

Pennsylvania Sedge

Pachysandra

- Sod + Grasses (grass seed or sod may be provided as a mixture of these types or others)

Kentucky Bluegrass

Ryegrass

Fescue Grass

- Perennials

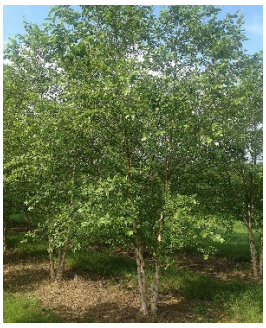
Black Eyed Susan

Shasta Daisy

Hemerocallis Daylily

BASIS OF DESIGN

- Mid Atlantic
  - Trees



River Birch

Eastern White Pine

American Sweetgum

  - Shrubs

Red Sprite Winterberry

Virginia Sweetspire

Hummingbird Sweet Pepperbush

  - Groundcover

Tussock Sedge

Blue Mist Flower

Tufted Hairgrass

  - Sod + Grasses (grass seed or sod may be provided as a mixture of these types or others)

Kentucky Bluegrass

Ryegrass

Fescue Grass

BASIS OF DESIGN

- Perennials

Butterfly Milkweed

Cutleaf Coneflower

Golden Fleece Goldenrod

- Southeast
  - Trees

Florida Elm

River Birch

Pond Cypress

  - Shrubs

Saw Palmetto

American Beautyberry

Crepe Jasmine

  - Groundcover

Wiregrass

Cast Iron Plant

Purple Lovegrass

BASIS OF DESIGN

- Sod + Grasses (grass seed or sod may be provided as a mixture of these types or others)

Cartpetgrass

Centipede Grass

St Augustine Grass

- Perennials

Pink Pinxter Azalea

Camellia Japonica

Swamp Sunflower

E. MULCH

- Product:
  - Use a regionally specific, single processed brown hardwood mulch.
  - Hardwood bark mulch is defined as at least 85% lignin (bark) and generally produced from the debarking of logs at a sawmill or papermill.
  - Mulch should pass chemical testing for CCA treated wood contaminants.
  - Do not use mulch that is dyed (i.e. red), or mulch that contains cypress, pine, recycled content or green waste.

Single-processed brown hardwood mulch

- Installation and maintenance:
  - When installing near trees:
    - Do not mound up near tree base.
    - Install a minimum 3 inches layer of hardwood bark mulch around all trees and in all planting areas. Create a natural spaded edge where planting beds meet turf areas.

Plant bed with natural edge created by a spade

  - When installing near the building edge:
    - Mulch should be kept 18 inches from building edge, and any other wood, vinyl or deck areas as a fire prevention measure.

BASIS OF DESIGN

- Use non-combustible materials such as rock or pea stone in between building edge and mulch as well as around gas meters or other combustible portions of the structure.
- Create and maintain a slope away from the building.
- Do not install mulch near smoking receptacles or designated smoking areas.
- To prevent deep smoldering, do not pile mulch layers more than 3 inches.
- Landscape beds adjacent to walkways shall be graded to prevent wash out of mulch into walkways.

  - Metal edging is only required between crushed granite or gravel and sod/plants.
  - No edging is required for landscape beds adjacent to concrete drives, walkways or curbs. Landscape beds adjacent to walkways shall be graded to prevent wash out of mulch into walkways.

F. IRRIGATION

- If possible, use plants that are drought resistant that won't require an irrigation system.
- Contact local water municipality to determine if your site can install a separate water meter (deduct meter) for your irrigation system. This will remove the sewer charge for the water consumption used by the irrigation system.
- Consider using well water for the irrigation system. There will be upfront costs to dig the well and install the pump but it should have a quick payback. If a well exists at the site, review any documentation on the well capacity and pump performance. You will need the following:
  - the capacity of the well in gallons.
  - the gallons per minute (gpm) the pump can provide at a steady flow. (Not just the initial rate which is typically higher if there is accumulated water.)
- If an irrigation system exists at your site or you are considering installing one, follow these guidelines:
  - Must include an irrigation controller with cycle and soak settings to prevent waste from runoff and over-watering.
  - Must include a sensor to automatically shut off during rain events. (Rain sensor will override any pre-programmed water schedule in the case of a weather event.)
  - Install a back-flow preventer per local code regulations.
  - Use Water Sense certified components (sprinkler heads, controllers, etc.) whenever possible.
  - Consider using a drip irrigation system or soaker hoses in planter beds.
  - Minimize slopes in the landscape due to potential erosion and excessive runoff. If slopes are already present, use plants with deeper roots such as native ground covers and shrubs to stabilize and prevent erosion and unnecessary water waste from runoff.
  - Set up a watering schedule with zones based on the plant type and their recommended water schedule. Periodically test effectiveness of water schedule.
  - Installing high efficiency sprinkler heads and reduced pipe diameters for the irrigation lines increase the efficiency and reduce water consumption.

BASIS OF DESIGN

- Space sprinkler head bodies for proper head-to-head coverage to avoid dry patches or large areas of overlap.
- Make sure sprinklers are not positioned to spray onto non-landscaped areas such as sidewalks or parking lots.
- Avoid watering too close to obstructions such as light poles, fences signs, etc.
- Set sprinklers to water early in the morning (before sunrise) to prevent high evaporation rates.
- Use sprinkler heads that regulate the pressure so it won't cause overuse through misting, fogging or uneven coverage.
- Replace sprinkler heads that operate at or above 60psi with Water Sense spray sprinklers to save water use.
- Always use sprinkler heads with flexible connections.
- At sites where clay soil is predominant (dense and absorbs water slowly), implement a low flow watering schedule.

- Preventative maintenance:
  - Once a month run your system manually to check for leaks or breaks.
  - Adjust the water schedule based on plant type, soil type, sun exposure, site grading, climate, and the change in season to maintain efficiency.
  - Require a full audit of the irrigation system every 3 years to ensure it continues to perform efficiency.
  - In climate zones experiencing freeze cycles, winterize the irrigation system:
    - Drain the system to prevent pipes from freezing.
    - Blow out the line with compressed air.

- Recommended Products:
  - Hunter
    - Pro-C Irrigation Controller
    - Optional Solar Sync feature for WaterSense certification
    - Rain/ freeze sensor compatible

Hunter Pro-C Irrigation Controller

BASIS OF DESIGN

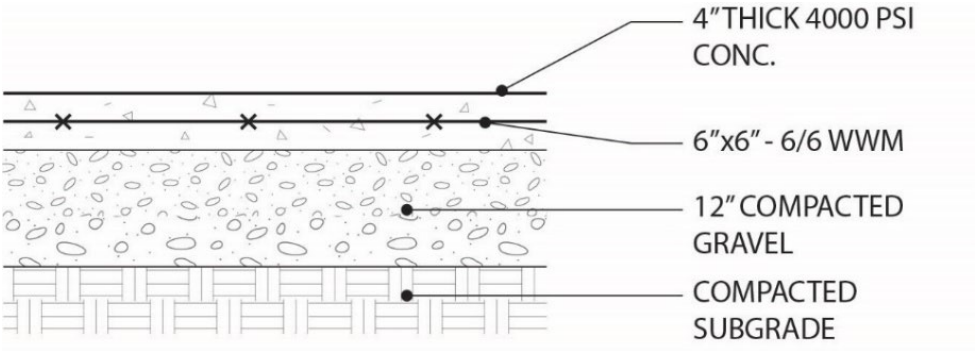
- Rain Bird
  - WR2-48 Series Wireless Rain/Freeze Sensors

Rain Bird Wireless Rain/Freeze Sensor

HARDSCAPE

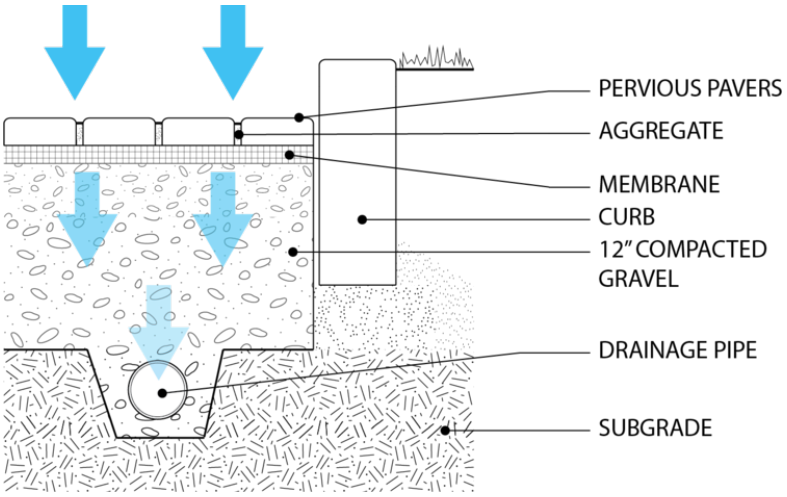
A. **SIDEWALKS:**

- Concrete is the preferred material for all sidewalks due to light color and durability. To properly maintain and make effective repairs, constantly inspect for cracks, spalling or large changes in elevation.
  - Concrete should be placed over a **12-inch** bed of gravel to minimize heaving during freeze/thaw cycles.
  - Avoid deicers with salt on concrete, especially new concrete as it will cause pits to form on the surface.



BASIS OF DESIGN

B. **PARKING**



- Asphalt is the most prevalent parking area material. Other options for parking areas are pervious pavers or pervious asphalt. These should be considered when installing new parking and/or the parking area contributes to stormwater management at the site. To properly maintain and make effective repairs, constantly inspect for cracks, sinking, potholes and changes in elevation.
    - Pervious asphalt contributes to onsite stormwater management by allowing the water to slowly infiltrate into the subgrade and groundwater supply, reducing the demand on the sewer system. It can also help improve the water quality since contaminants are filtered as the water infiltrates into the subgrade.
    - During construction, take measures to prevent stone reservoir and pavement from getting clogged with runoff and construction dust/materials.
        - Preventative maintenance for pervious asphalt includes:
            - Inspect infiltration rates annually during rain storms to make sure the asphalt is still effective.
            - Vacuum or power wash (for silt/sand/fine materials) as needed, no less than once a year.
            - Never sealcoat or crack seal to patch like regular asphalt.
        - Winter maintenance includes:
            - There are no special requirements for plowing.
            - This asphalt reduces the need for deicers since water can drain quickly after a storm.
            - Never use sand on pervious asphalt. It clogs the surface and prevents infiltration.

C. **ICE MELT + DEICERS**

- When selecting an ice melt (deicing product) consider the following:
    - Select products where the main ingredient is calcium chloride (CaCl) or magnesium chloride (MgCl). These ingredients are the least damaging to concrete and landscape.
    - Products should be effective at temperatures below 0˚F.
    - Products containing mostly rock salt (NaCl) or any amount of urea (carbonyl diamide) or glycols should never be used.
    - Pet friendly deicer products are available for sites with pets.
- Careful practices when applying the product should be followed in order to maximize effectiveness and minimize waste:
    - Some products are designed specifically for larger areas, like a parking lot, while others are more effective for smaller walkways. Site staff should coordinate with any outside contractors they may use for parking areas to ensure the proper product is being used.

  - Except in cases where permeable pavers or pervious asphalt are present, use sand in addition to the product to improve traction.
  - Clear product quickly after storm ends and ice melts to prevent damage to plants or landscaping. Do not sweep or shovel remaining product into planter beds.
  - Use of mechanical spreaders allows for greater accuracy and less waste during application.

- Recommended Product:
  - Road Runner Blended Ice Melt
    - MgCl + CaCL blend
    - 50 lbs bag

Road Runner blended ice melt

SITE FURNISHINGS

A. **BIKE RACKS + SHELTERS**

- Most cities have codes that dictate the quantity and configuration (sheltered, stacked, racking, etc.) of bike parking.
  - All new construction should follow the code.
  - For discrete rack installations consider a shelter to provide cover if outdoors and provide a rack that allows the bike to be locked in at least two points.

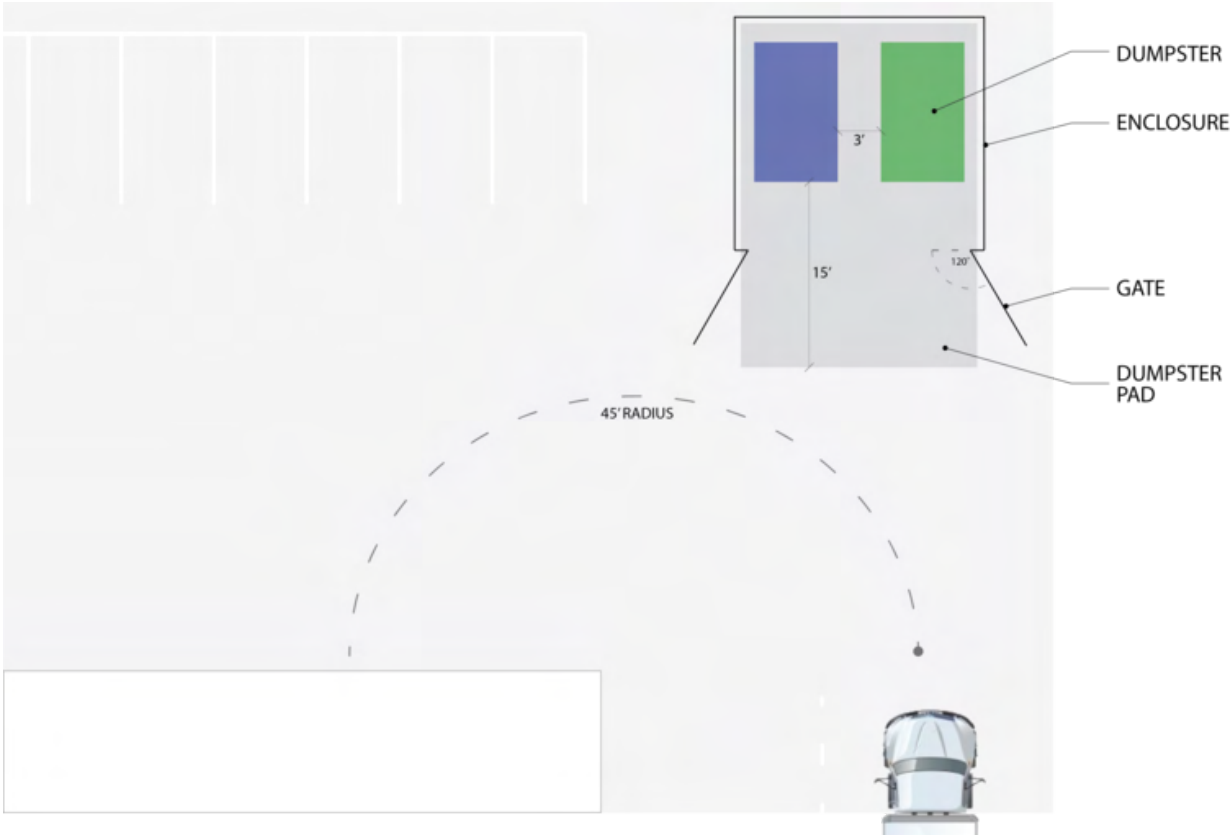
B. **DUMPSTER ENCLOSURES**

- All dumpsters should be located in an enclosure.
- Use CMU, chain link fence, or steel structure with fencing material for the enclosure. Do not use wood for the structure of the enclosure.
- Enclosure walls should be a minimum of 1 foot higher than dumpster heights.
- If multiple containers are in one enclosure, they should be spaced a min of 36 inches from each other. In addition, all containers should be a min of 12 inches from enclosure walls.
- Include a visual buffer such as landscaping or screening if enclosure area is visible from the public right of way or street.
- If dumpsters are used by tenants, they need to include a safe and accessible route to the dumpster enclosure area, so that no resident is required to travel more than 250 feet to reach it. This distance is reduced to 150

BASIS OF DESIGN

feet if accessed by residents at a senior building. It may be necessary to add an out-swinging man gate so that residents can access the dumpster.

- If dumpsters are only accessed by site staff, they should include a locked gate only to be unlocked for staff access or on collection days.
- If a gate is included as part of the enclosure:
  - The gates need to open at an angle wider than 90 degrees, preferably 120 degrees.
  - Provide a hold-open to keep gates open when the dumpster is being unloaded during collection.
- All enclosures should include a reinforced concrete pad. The pad should be the full size of the enclosure and extend in front of the enclosure by at least half the depth of the enclosure pad.
- The pad surface cannot have a slope in any direction greater than 2%.
- A minimum height clearance of 25 feet above the enclosure is required.
- A turning radius of 45' is needed near the enclosure so the collection truck can drive forward to access the dumpster, turn and exit the area moving forward, not backing up.



C. **DESIGNATED SMOKING AREAS**

- Any smoking shelter or designated smoking area needs to be at least 25 feet from the main building and entry points.
- The smoking shelters needs to follow ADA guidelines and include an accessible walkway or ramp as necessary.
- The structure should be partially enclosed with cover from the elements, adequate lighting and some sort of seating option.

BASIS OF DESIGN

- The shelter should include proper cigarette disposals containers.
- The structure needs to be at least 18 inches from any mulch or landscaped area.
- Follow all manufacturer's instructions for any installation and assembly on site.
- Recommended Products:
    - Alpine Industries
        - Black Steel Wall-Mounted Cigarette Disposal
            - Note: Install on shelter structure, not building wall
    - Global Industrial
        - Outdoor Smoking Shelter

Wall-mounted cigarette disposal

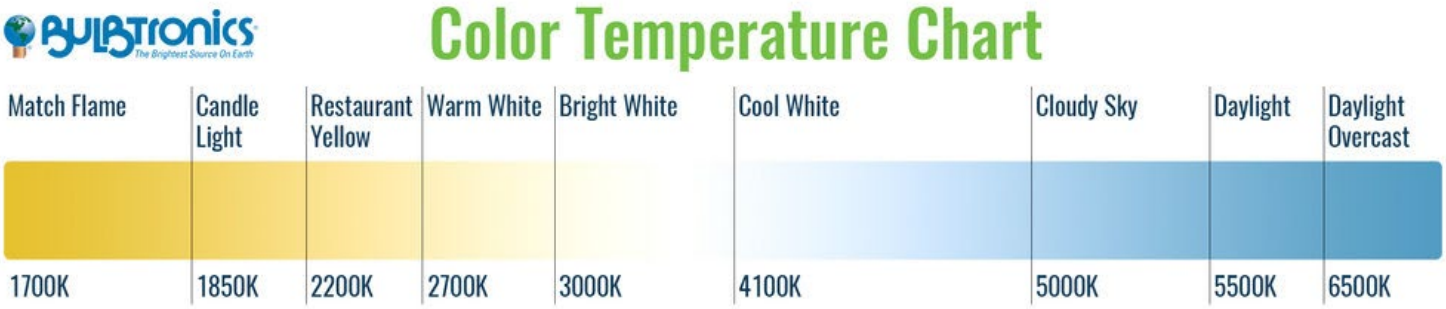
Outdoor smoking shelter

BASIS OF DESIGN

LIGHTING

GENERAL INFORMATION & REQUIRED DETAILS:

- All fixtures can be purchased through HD Supply, unless noted.
- All lenses must be acrylic; No glass.
- If replacing fixture in same location use LED w/ same lumens or higher to provide effective lighting.
- Energy Star rating Required unless LED fixture.
    - (Note: some LED fixtures are not Energy Star rated).
- Confirm if Energy Star rated fixtures are a requirement by lender or local building code (ex: Chicago properties require task lighting at kitchen sink).
- The project parameters (i.e. size of kitchen, integrated bathroom light and fan, etc.) should be established and architect/ engineer must confirm required light levels will be met with approved fixtures provided and required power will be provided.
- Bulbs should be available at local stores and can be affordably purchased by residents.
- Check with local utility for lighting rebates.
- Do not install exterior fixtures that shine light upwards or into residential unit windows.
- All exterior lighting should be controlled by photocell, not timers.
- All LED fixtures in units to be within 2700-3000 Kelvin color temperature.
    - Fixtures greater than 3000 Kelvin color temperature are acceptable in common areas only.



BASIS OF DESIGN

SURFACE MOUNTED ROUND

APPROVED LOCATIONS:

- Use in locations with hard (non-dropped) ceiling.
- **In-Unit:** All rooms.
- **Common Areas:** Offices, Corridors, Community Rooms, and Lobbies.

SAMPLE PRODUCT:

Feit Electric LED Ceiling Mount
Wattage/Voltage: 22 Watt – 120 Volt
Finish: White Trim
Bulb Type: Integrated LED
Kelvin: 4000
Diameter: 15”
Manufacturer Number: 7678315

SURFACE MOUNTED – LINEAR

APPROVED LOCATIONS:

- Use in locations with hard (non-dropped) ceiling.
- **Units:** Avoid using in units unless replacing in kind.
    - Linear lights typically are above 3000 Kelvin, and have a very blue/white color.
- **Common Areas:** Offices, Corridors, Community Rooms, and Lobbies.

BASIS OF DESIGN

SAMPLE PRODUCT:

Lithonia Lighting / Futra LED
Wattage/Voltage: 24 / 42 Watt – 120 Volt
Finish: Brushed Nickel
Bulb Type: Integrated LED
Kelvin: 4000

2'-0" Length
Manufacturer Number: FMLFUTL 24 840 BN

4'-0" Length
Manufacturer Number: FMLFUTL 48 840 BN

BASIS OF DESIGN

RECESSED CAN

APPROVED LOCATIONS:

- Use in locations with hard (non-dropped) ceiling.
- **In-Unit:** All rooms.
- **Common Areas:** Offices, Corridors, Community Rooms, and Lobbies.
- Must use airtight product or sealant if installed in top floor ceiling or in ceilings between units.

SAMPLE PRODUCTS:

Cordelia / Retrofit Trim
Wattage/Voltage: 9 / 11 watt - 120 Volt
Finish: Plastic
Bulb Type: Integrated LED
Kelvin: 2700

4" Diameter Retrofit
Manufacturer Number: EVL4730MWH27

5" or 6" Diameter Retrofit
Manufacturer Number: EVL673MWH27

BASIS OF DESIGN

PENDANT

If pendant lighting is requested, please contact Design + Building Performance Dept. with the following information:

- Location of proposed pendant.
- If proposed pendant is replacing an existing pendant fixture.

BATH VANITY

APPROVED LOCATIONS:

- **In-Unit:** Bathroom Vanity, above medicine cabinet or mirror.

SAMPLE PRODUCTS:

Brushed Nickel LED Vanity Light Bar with White Acrylic Shade
Wattage/Voltage: 18 watt - 120 Volt
Finish: Brushed Nickel
Bulb Type: Integrated LED
Kelvin: 3000
Length: 2'-3/4”
Manufacturer Number: NBWL1023-24LED

WALL SCONCE

APPROVED LOCATIONS:

- **In-Unit:** Hallways.
- **Common Areas:** Offices, Corridors, Community Rooms, and Lobbies.

SAMPLE PRODUCTS:

Luminance ADL Lumin Bright Satin Nickel Indoor LED Wall Sconce
Wattage/Voltage: 10 watt - 120 Volt
Finish: Satin Nickel
Bulb Type: Integrated LED
Kelvin: 3000
Width: 7"
Manufacturer Number: 35-54225

BASIS OF DESIGN

CEILING FANS

APPROVED LOCATIONS:

- **In-Unit:** Living Room, Bedrooms.
- **Common Areas:** Offices, Corridors, Community Rooms, and Lobbies.

SAMPLE PRODUCTS:

Home Decorators 52” Indoor Ceiling Fan, LED Light Kit
Wattage/Voltage: 9.5 watt
Finish: Brushed Polished Nickel
Bulb Type: Integrated LED
Dimensions: 52"D
Manufacturer Number: 35-73219

CLOSET LIGHTING

APPROVED LOCATIONS:

- **Units:** Closets.
- **Common Areas:** Closets.
- Do not use products that protrude far off ceiling down into the closet. Such products are prone to damage while storing items in high areas of closet.

SAMPLE PRODUCTS:

Feit Electric LED
Wattage/Voltage: 12 Watts
Finish: White Trim
Glare-Free Acrylic Diffuser
Bulb Type: Integrated LED
Kelvin: 4000
Dimensions: 12” Round x 1” Profile
Manufacturer Number: 74206/CA/V2

Commercial Electric LED Flush Mount Ceiling Light
Wattage/Voltage: 14.5 Watts
Finish: White Trim
Glare-Free Acrylic Diffuser
Bulb Type: Integrated LED
Kelvin: 4000
Dimensions: 12” Round x 3” Profile
Manufacturer Number: 54074441

BASIS OF DESIGN

DROPPED CEILING LIGHTING

(CEILINGS WITH GRIDS AND CEILING TILES)

APPROVED LOCATIONS:

- **Common Areas:** Offices, Corridors, Community Rooms, Lobbies, Mechanical Rooms.

SAMPLE PRODUCTS:

Lithonia Lighting / LED 2'x2' Recessed
Wattage/Voltage: 39 Watts – 120/277 Volt
Finish: White Enameled Steel Base Prismatic Acrylic Diffuser
Bulb Type: Integrated LED
Kelvin: 3500
Dimensions: 24"L x 24"W x 3.25"D
Manufacturer Number: 2GTL2 LP 835

Lithonia Lighting / LED 2'x4" Recessed
Wattage/Voltage: 39 Watts – 120/277 Volt
Finish: White Enamel Steel Base Prismatic Acrylic Diffuser
Bulb Type: Integrated LED
Kelvin: 3500
Dimensions: 48"L x 24"W x 3.25"D
Manufacturer Number: 2GTL4 LP835

BASIS OF DESIGN

UTILITY LIGHTING

APPROVED LOCATIONS:

- **Common Areas:** Mechanical Rooms, Maintenance Shops, & Other Back-Of-House Spaces.
- SAMPLE PRODUCTS:

Lithonia Lighting / LED Wrap Fixture
Wattage/Voltage: 50 watt - 120/277 Volt
Finish: White Enamel Steel Base
Acrylic Prismatic Diffuser
Bulb Type: Integrated LED
Kelvin: 3500
Dimensions: 48L x 10W x 3"D
Manufacturer Number:
LBL4 LP835

EMERGENCY LIGHTING

GENERAL INFORMATION & REQUIRED DETAILS:

- **Emergency lighting to comply with local Building, Fire, & Egress codes**
- The fixture must include a back-up battery within the fixture or be powered by the building's back-up system.
- If replacing in-kind, the fixture has to be located in same location or reviewed by the Fire Department.

SAMPLE PRODUCTS:

Lithonia Lighting / Green LED Exit
Wattage/Voltage: 120/277 Volt
Finish: White Thermoplastic Housing
Bulb Type: Integrated LED
Dimensions: 7-3/16”H x 11-5/8”W x 1-5/8”D
Battery Back Up: 6 Volt Sealed Lead Calcium Battery
Manufacturer Number:
EXG LED EL M6

Lithonia Lighting / Two-Light Emergency Unit
Wattage/Voltage: 120/277 Volt
Finish: White Thermoplastic Housing
Bulb Type: Integrated LED
Dimensions: 4-1/4"H x 10-1/4"W x 3-5/8"D
Battery Backup: NiCad Battery
Manufacturer Number:
ELM2 LED M12

- Use in stairways & corridors.

BASIS OF DESIGN

LIGHTING CONTROLS

APPROVED LOCATIONS:

- **Common Areas:** corridors, public bathrooms, offices, community rooms.

RECOMMENDATIONS:

- Use occupancy or daylight sensors.
- Emergency lighting **cannot** be controlled with daylight or occupancy sensors.
- All exterior lighting should operate on photocells, no timers.

SAMPLE PRODUCTS:

Lithonia
Passive Infrared Switch Wall Occupancy Sensor
White
Manufacturer Number: 184LCT

HD Supply / Photocell Wall Pack
Wattage/Voltage: 27 watt - 120 Volt
Finish: Bronze
Polycarbonate Housing
Frosted Prismatic Acrylic Lens
Bulb Type: Integrated LED
Kelvin: 4100
Dimensions: 10-3/4H x 6-1/4W x 5-1/2"D
Manufacturer Number: HDS 326111

BASIS OF DESIGN

EXTERIOR WALL MOUNTED

APPROVED LOCATIONS:

- **Exterior:** at unit and building entry.

SAMPLE PRODUCTS:

Mission LED Wall Fixture w/ Photocell
Wattage/Voltage: 9 watt - 120 Volt
Finish: Black Aluminum Housing
White Acrylic Diffuser
Bulb Type: Integrated LED
Kelvin: 5000
Dimensions: 9-1/2H x 7-3/4W x 4-1/2"D
Manufacturer Number:
BSSW8700L30BK

EXTERIOR CEILING MOUNTED

APPROVED LOCATIONS:

- **Exterior:** at unit and building entry.

SAMPLE PRODUCTS:

Lithonia / LED Versi Lite
Wattage/Voltage: 28 watt - 120 Volt
Finish: Textured Bronze w/
White Acrylic Diffuser
Bulb Type: Integrated LED
Kelvin: 3000k
Dimensions: 13" Diameter
Manufacturer Number:
FMML 13 830 WL DDBT

BASIS OF DESIGN

EXTERIOR POLE

GENERAL INFORMATION & REQUIRED DETAILS:

- If replacing in-kind, use at least the same watt bulb.
- For new construction electrical engineer should provide lighting plan that provides the appropriate lumens for design.

APPROVED LOCATIONS:

- **Exterior:** at unit and building entry.

SAMPLE PRODUCTS:

HD Supply / LED Post-Top Lanterns
Wattage/Voltage: 22 watt - 120 Volt
Finish: Compression Molded Noncorrosive Resin
Bulb Type: Integrated LED
Kelvin: 4000k
Dimensions: 13”H x 22-3/8”W x 10-1/16"D
Manufacturer Number: 504439

BASIS OF DESIGN

EXTERIOR FLOOD LIGHTS (WALL PACKS)

GENERAL INFORMATION & REQUIRED DETAILS:

- If replacing in-kind, use at least the same watt bulb.

APPROVED LOCATIONS:

- **Exterior:** typically building mounted.

SAMPLE PRODUCTS:

HD Supply / Photocell Wall Pack
Wattage/Voltage: 27 watt - 120 Volt
Finish: Bronze
Polycarbonate Housing
Frosted Prismatic Acrylic Lens
Bulb Type: Integrated LED
Kelvin: 4100
Dimensions: 10-3/4H x 6-1/4W x 5-1/2"D
Manufacturer Number: HDS 326111

Lithonia / LED Wall Pack
Wattage/Voltage: 39 watt - 120/277 Volt
Finish: Bronze Cast Aluminum
Bulb Type: Integrated LED
Dimensions: 15-3/4”H x 16-1/4”W x 8"D
Manufacturer Number: 223859

BASIS OF DESIGN

MANUFACTURER CONTACTS

Development General Contractors and Property staff should use the following contacts to receive POAH's negotiated pricing.

DURING NEW CONSTRUCTION AND REHABS:

FLOORING:

A. MOHAWK FLOORING

General Contractors shall contact Mohawk Flooring to receive discounted pricing:

I. **Paul Woolverton**
Mohawk Industries
paul_e_woolverton@mohawkind.com
(314) 250-2503

B. SHERWIN WILLIAMS FLOORCOVERING

General Contractors shall contact Sherwin Williams to collect flooring installation bid for review among other bids:

I. **Andrew Flippin**
National Accounts
andrew.flippin@sherwin.com
(404) 304-3835

PAINT:

A. SHERWIN WILLIAMS PAINT

General Contractors shall contact Sherwin Williams to receive discount pricing on paint products and collect painting installation bid for review among other bids:

I. **Andrew Flippin**
National Accounts
andrew.flippin@sherwin.com
(404) 304-3835

DURING ONGOING PROPERTY MAINTENANCE:

FLOORING:

A. SHERWIN WILLIAMS FLOORCOVERING

Property staff shall contact their local Sherwin Williams Floor Covering Store to either:

I. purchase flooring from Sherwin Williams and have Sherwin Williams install new flooring
II. or, purchase flooring from Sherwin Williams and have 3rd party flooring contractor install new flooring
III. or, purchase flooring from Sherwin Williams and have property maintenance staff install new flooring

BASIS OF DESIGN

PAINT:

B. SHERWIN WILLIAMS PAINT

Property staff shall contact their local Sherwin Williams Paint Store to either:

I. purchase flooring from Sherwin Williams and have Sherwin Williams install new flooring
II. or, purchase flooring from Sherwin Williams and have 3rd party flooring contractor install new flooring
III. or, purchase flooring from Sherwin Williams and have property maintenance staff install new flooring

BASIS OF DESIGN

PAINT

PRODUCTS + APPLICATION

CONTACTS:

- POAH has negotiated pricing with select manufacturers and wholesalers. When purchasing and installing new flooring please contact the following representatives. See the **Manufacturer Contacts** section of the BOD for more information.

PRIME COAT

- **Sheetrock substrate:** Sherwin Williams- ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
- **Concrete/ concrete block substrate:** Sherwin Williams- S-W PrepRite Block Filler, B25W25, at 100 to 200 sq. ft. per gal (2.4 to 4.9 sq. m per l).
- **Wood substrate:** Sherwin Williams- PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry
- **Metal substrate:** Sherwin Williams- S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry

TOP COAT

- **Units + Low Traffic Common Areas:**
  - All Substrates, except metal:
    - Sherwin Williams- ProMar 200 Zero VOC Latex, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.
- **High Traffic Common Areas + Metal Substrates:**
  - All elevator walls, handrails, and doors in common areas.
    - Sherwin Williams- Pro Industrial Waterbased Alkyd Urethane Enamel, B53-115- Series, at 1.4-1.7 dry, per coat.

PREPARATION:

- Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted.
- Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulates.
- Using a damp sponge or cloth, wipe to remove the surface dirt and marks and any excess cleaner. For difficult stains, some scrubbing may be necessary.
- Do not allow the cleaner to dry on the surface.
- **Review hazardous material O&M for locations of lead paint or asbestos-containing substrate. Any work on these surfaces must follow directions in O&M.**

BASIS OF DESIGN

APPLICATION:

- Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F
- **Brush:** Use a nylon/polyester brush.
- **Roller:** Use a 3/8" - 3/4" nap synthetic cover.
- **Spray—Airless:**
  - Pressure: 2000 psi
  - Tip: 017"-.021"

UNIT PAINT COLORS

WALLS:

Sherwin Williams
6378
Crisp Linen
Eggshell

CEILINGS:

Sherwin Williams
7002
Downy
Flat

TRIM:

Sherwin Williams
7102
White Flour
Semi-Gloss

DOORS:

Sherwin Williams
7102
White Flour
Semi-Gloss

COMMON AREA PAINT

NEW CONSTRUCTION + REHAB:

- Architect to provide paint design for all interior common areas.
  - Paint design should include colored floor plan.

PROPERTY MANAGEMENT:

- Contact Design + Building Performance Dept. for design support.

BASIS OF DESIGN

PLUMBING

GENERAL INFORMATION & REQUIRED DETAILS:

- These products are chosen based on their ability to conserve water, and their availability at HD Supply Solutions.

AERATORS

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: Chrome or Stainless.
- Water Flow:
  - **Bathroom Faucets**: 0.5 gpm maximum.
  - **Kitchen Faucets:** 1.5 gpm maximum.
- Aerator to be flushed yearly or if resident complains of weak flow.
  - Aerators help control water usage, so it is important they are maintained.
  - Removal of aerator will result in higher water bills.

BATHROOM FAUCET AERATOR:

Neoperl
Low Flow Dual Thread Chrome
Aerator 1.2 GPM
Manufacturer Number:
24-98491

BASIS OF DESIGN

If residents are removing aerators, use the following vandal-proof aerator and key:

Neoperl
Dual Thread Vandal Proof Faucet Aerator 1.0 GPM 6pk
Manufacturer Number:
24-88259

Neoperl
Vandal Proof Aerator Wrench
Manufacturer Number:
51-2097

KITCHEN FAUCET AERATOR:

Neoperl
Dual Thread Aerator 1.5 GPM 6pk
Manufacturer Number:
24-88252

BASIS OF DESIGN

BATHROOM FAUCETS

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: Chrome or Stainless.
- Water Flow: Maximum of 0.5 gpm.
- Aerator to be flushed yearly or if resident complains of weak flow.
    - Aerators help control water usage, so it is important they are maintained.
    - Removal of aerator will result in higher water bills.
- Single tap/ lever is preferred.
- Coordinate faucet selection with sink holes (No holes can be empty).
- Required: pop-up drain.
- Faucets in ADA units must be ADA compliant.
- Faucets in common bathrooms must be ADA compliant.

SAMPLE PRODUCTS (UNIT):

Cleveland Faucet Group
Single-Handle Bathroom Faucet
- 1.2 GPM
- Chrome
- Single Handle
- ADA Compliant

Manufacturer Number:
35-58447

Delta
Foundations 4” Centerset 2-Handle Bathroom Faucet
- 1.2 GPM @ 60 PSI
- Chrome
- Two Handle
- ADA Compliant

Manufacturer Number:
206503636

BASIS OF DESIGN

SAMPLE PRODUCT (COMMON):

Delta
Metering Faucet
- 0.5 GPM @ 60 PSI
- Chrome
- Single Handle
- ADA Compliant

Manufacturer Number:
87T105

KITCHEN FAUCETS

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: Chrome or Stainless.
- Water Flow: Maximum of 1.5 gpm.
- Aerator to be flushed yearly or if resident complains of weak flow.
    - Aerators help control water usage, so it is important they are maintained.
    - Removal of aerator will result in higher water bills.
- Single tap/ lever is preferred.
- Coordinate faucet selection with sink holes.
- Sprayers: Not permitted.
- Faucets in ADA units must be ADA compliant.
- Faucets in common bathrooms must be ADA compliant.

BASIS OF DESIGN

SAMPLE PRODUCTS (UNIT + COMMON):

Moen
Kitchen Faucet
- 1.5 GPM @ 60 PSI
- Chrome
- Single Handle
- ADA Compliant

Manufacturer Number:
24-76338

CFG
Cornerstone Kitchen Faucet
- 1.5 GPM @ 60 PSI
- Chrome
- Single Handle
- ADA Compliant

Manufacturer Number:
CA40512

TUB/SHOWER FIXTURES

GENERAL INFORMATION & REQUIRED DETAILS:

- Water Flow: Maximum of 1.5 gpm and Water Sense Certified.
- Finish: Chrome coating over brass.
- Diverter integral to shower valve.

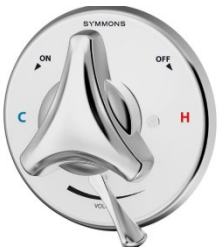
SAMPLE PRODUCTS:

Niagara
Earth Showerhead
- 1.5 GPM @ 80 PSI
- Chrome

Manufacturer Number:
N2915CH

Symmons
Hand Shower
- 1.5 GPM @ 60 PSI
- Chrome
- Use in ADA Units and for reasonable accommodations.

Manufacturer Number:
512HSA-1.5



Symmons
Origins Temptrol Tub-Shower Trim with Valve
- Chrome

Manufacturer Number:
S-9600-P

HD ProPlus
Tub Spout
- Chrome

Manufacturer Number:
HDS424800

BASIS OF DESIGN

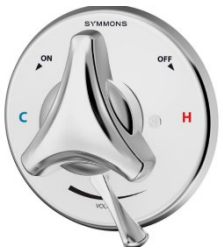
SAMPLE SHOWER VALVE REMODEL PLATES:

CFG
Tub-Shower Chrome Remodel Cover Plate

- Chrome Finish
- Converts 2 & 3 Handle applications into a single handle.
- 13-1/4”L x 7-3/16”OD

Manufacturer Number:
40913

SAMPLE SHOWER TRIM REPLACEMENTS:



Symmons
Replacement Temptrol Trim

- Chrome

Manufacturer Number:
S-9600-P-TRM

BASIS OF DESIGN

TOILETS

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White.
- Water Flow: Maximum of 0.86 GPF required.
- Comfort Height Toilets: Required.
- Two-Piece Toilets: Preferred.
- Bowl Type: Elongated Bowl Required.
    - For rehabs: Verify elongated bowl can fit within existing bathroom and maneuverability is not compromised.
- Note Rough-In Size and if **Rear/ Wall Discharge** vs. **Floor-Mounted** (Rehabs only).

SAMPLE PRODUCTS:

Niagara
Stealth Back Outlet
- Elongated Toilet Bowl
- ADA Compliant

Manufacturer Number: N7799

Niagara
Stealth Floor Outlet
- Elongated Toilet Bowl
- ADA Compliant

Manufacturer Number: N7717

Niagara
Stealth 0.8 GPF Toilet Tank
- 12” Rough-In
- Floor or Back Outlet

Manufacturer Number: N7714T

Niagara (ADA)
Stealth ADA Button
- Use in ADA Units.

Manufacturer Number: C7715-ADA

BASIS OF DESIGN

URINALS

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: White Porcelain.
- Water Flow: Maximum of 0.5 GPF required.
- Acceptable Manufacturers: American Standard, Toto, Kohler, Gerber, and Seasons.

SAMPLE PRODUCTS:

TOTO
Modern Urinal
- 0.125 GPF

Manufacturer Number: UT105U

American Standard
Flushometer Valve Manual Urinal
- 0.125 GPF

Manufacturer Number: 6045013.002

KITCHEN SINKS

GENERAL INFORMATION & REQUIRED DETAILS:

- Finish: Type 302, 18 gauge Stainless Steel.
- Bowl Number: Double Bowl Preferred.
- Depth: 8” for standard unit; Maximum of 6.5” in ADA units.
- Drain Size: 3.5” Minimum.
- Holes: 3 holes or less, no plugs permitted.
- Sprayers: Not permitted.
- Required Mounting Details: Self-rimming.

BASIS OF DESIGN

SAMPLE PRODUCTS:

Moen
33” x 22” Double Bowl Kitchen Sink
- Stainless Steel
- 3-Hole
- 8” Depth

Manufacturer Number: G182133

Just Manufacturing
33” x 22” Double Bowl Kitchen Sink
- Stainless Steel
- 3-Hole
- 8” Depth

Manufacturer Number: DL-1933-A-3

Dayton
25” x 22” Single Bowl Kitchen Sink
- Stainless Steel
- 3-Hole
- 8” Depth

Manufacturer Number: DXR25223

GARBAGE DISPOSALS

GENERAL INFORMATION & REQUIRED DETAILS:

- **New Construction + Rehab:** garbage disposals are not permitted.
- **Property Management:** remove garbage disposals when they warrant repair or replacement.

WALL HUNG SINKS

GENERAL INFORMATION & REQUIRED DETAILS:

- Must be ADA compliant.
- Finish: White Porcelain.
- Size: 2 gallon min. capacity.
- Holes: 3 holes or less, no plugs permitted.
- Integral Wall Bracket Supports required with assembly.
- Insulation/padding required for exposed pipes.
- Pop-up drain required at unit bathroom sinks, but not in common area sinks.

BASIS OF DESIGN

- All sinks to have overflow drain.

SAMPLE PRODUCTS (UNIT + COMMON):

American Standard
Lucerne Wall Hung Lavatory Sink
- White China

Manufacturer Number: 0356.015

Gerber
Monticello II Wall Hung Lavatory Sink
- White China

Manufacturer Number: G0012654

VANITY SINKS

GENERAL INFORMATION & REQUIRED DETAILS:

- Use solid surface vanity tops (sink integral with countertop).
- Width: 37" min or match existing.
- Holes: 3 holes or less, no plugs permitted.
- Pop-up drain required at bathroom sink.

BASIS OF DESIGN

PREFERRED PRODUCTS (UNIT):

Premier Vanity Tops
Solid White Cultured Marble Vanity Top and Bowl

- 37”W x 22”D
- 4” Faucet Centers
- Integrated Backsplash
- Fits 36”W x 21”D Bathroom Vanities

Manufacturer Number: 112007

Swanstone
Solid Surface Lavatory with Integral Sink

- Color: Bisque (018) or match existing.

EXAMPLE VANITY BASE CABINET:

Seasons
36”W x 32-1/2”H x 21”D White Bath Vanity Base Cabinet

- ¾” Solid Wood Face Frame
- ½” Plywood Construction

Manufacturer Number: 283759

BASIS OF DESIGN

BATHTUBS

GENERAL INFORMATION & REQUIRED DETAILS:

- Materials: White porcelain enameled steel tub.
- Size: 60” minimum length or match existing.
- Wall Surround: See Tub/Shower Surround Spec.

SAMPLE PRODUCTS:

Bootz
Aloha Bathtub
- Right Hand Drain
- Enameled Steel

Manufacturer Number:
011-2364-00

Bootz
Maui Bathtub
- Right Hand Drain
- Enameled Steel
- Deep Soaker

Manufacturer Number:
011-2340-00

APPROVED TUB RETROFIT PRODUCTS:

To be installed upon resident reasonable request.

Cleancut
Step-In Kit
- Converts Bathtub to Step-In Shower
- White
- Medium Width

Manufacturer Number:
S-W-M

BASIS OF DESIGN

ROLL-IN SHOWERS

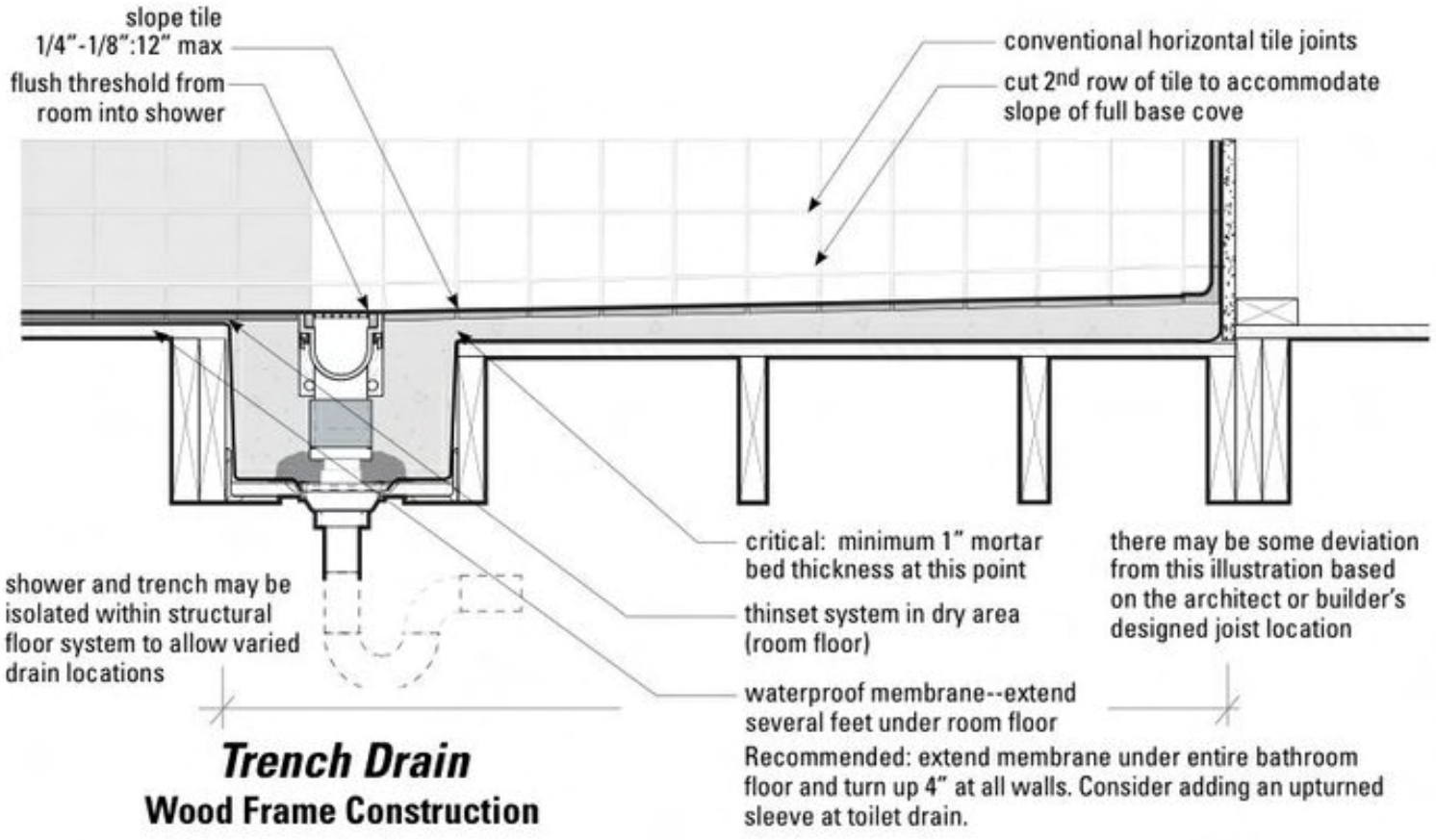
GENERAL INFORMATION & REQUIRED DETAILS:

- Accessories: Folding shower seat and hand-held shower head.
- Trench Drain: Required at shower threshold.
- Wall Surround: See Tub/Shower Surround Spec.
- At senior properties where ADA units are being built (new construction) or rehabbed, as many bathrooms as possible should be converted to roll-in showers.

APPROVED PRODUCTS:

- Swanstone in Bisque (018).
- Porcelain 12”x12” tiles in natural or light color.

TRENCH DRAIN DETAIL:



Trench Drain
Wood Frame Construction

SAMPLE WATER MANAGEMENT PRODUCTS:

BASIS OF DESIGN

At locations where a trench drain installation is not feasible, the follow products are recommended to keep water inside the shower. These collapsible water retainers keep water within the shower, but compress under a wheelchair or foot:

Swan
Collapsible Shower Floor Water Barrier

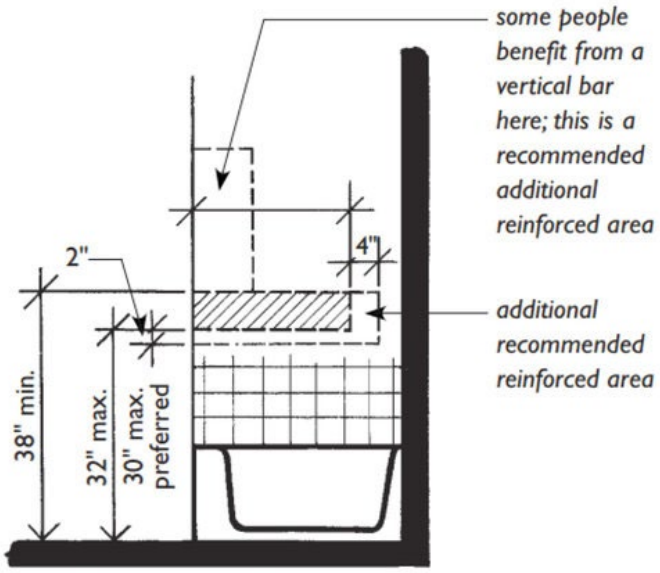
Best Bath Systems
Rubber WaterStopper Kit

TUB/SHOWER SURROUNDS

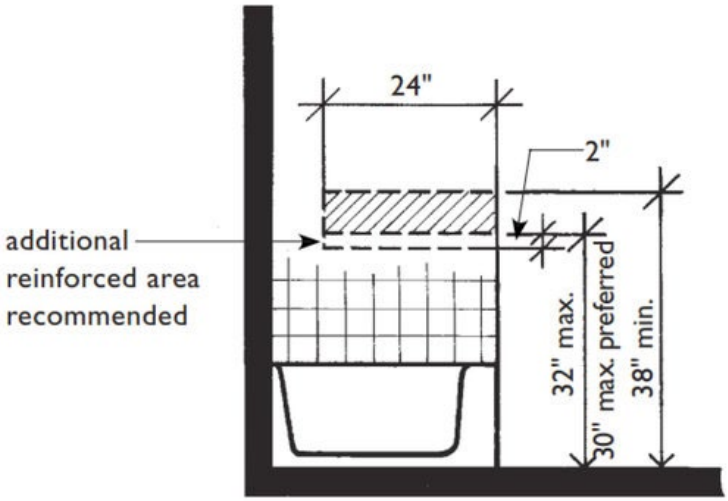
GENERAL INFORMATION & REQUIRED DETAILS:

- Wall Surround: Solid surface or tiled tub surround.
    - Acceptable manufacturers and finishes:
        - Swanstone in Bisque (018).
        - Porcelain Tile - white 12”x12” tiles.
- Required Details: One of the following details must be incorporated into the shower design to accommodate the introduction of grab bars or other reasonable accommodation requests in the future.
    - Install 3/4” plywood continuously on all shower walls between studs and waterproof backerboard.
    or
    - According to the Fair Housing Act Design Manual, install blocking in the following locations:

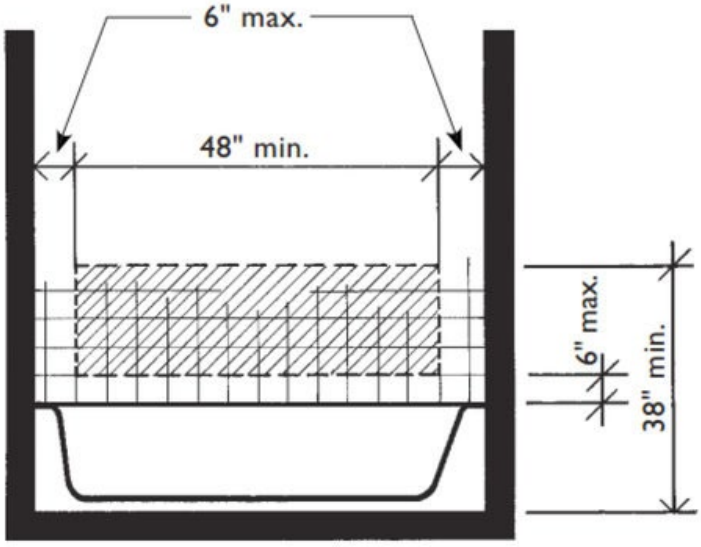
BASIS OF DESIGN



Foot (Control Wall)



Head



Back Wall

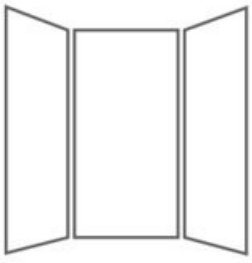
SAMPLE PRODUCTS:

BASIS OF DESIGN

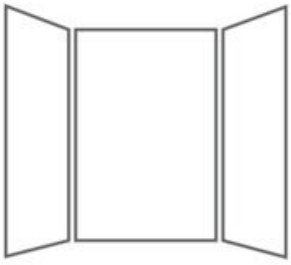
Swanstone
3-piece tub surround.

- Color: Bisque (018), or match existing

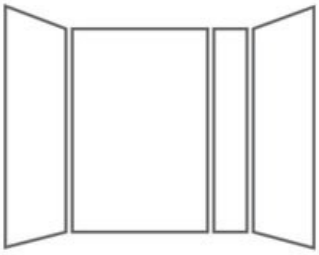
SAMPLE SHOWER KIT SIZES:



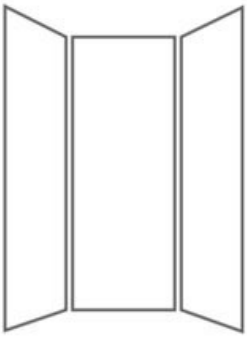
36"D x 36"W x 72"H kit with 2 shelves



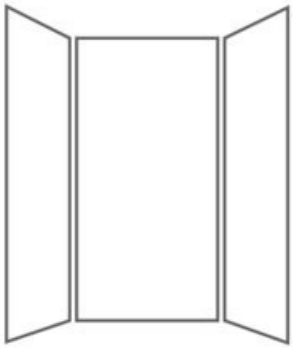
36"D x 48"W x 72"H kit with 2 shelves



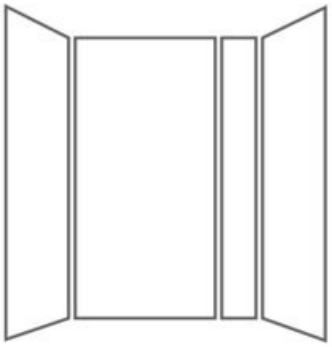
36"D x 60"W x 72"H with 11-3/4"W x 72"H overlap panel



36"D x 36"W x 96"H kit with 2 shelves



36"D x 48"W x 96"H kit with 2 shelves



36"D x 60"W x 96"H with 11-3/4"W x 96"H overlap panel

BASIS OF DESIGN

ROOFING – SLOPED ROOFS

WHEN TO USE THIS BASIS OF DESIGN SECTION

This BOD section should be used for both new construction projects and re-roofing of existing buildings. The objective is to guide the design and installation of roofing systems that will offer a high level of performance. See the **Building Enclosure** section for performance requirements of roofs related to compartmentalization and insulation. Roofing systems that perform well will protect building durability as well as the maintainability of POAH properties. The requirements listed in this BOD section are intended to serve as minimum standards. Projects may exceed these requirements as circumstances allow.

REQUIREMENTS:

ROOF STRUCTURE:

All new roofs need to be engineered to support a future PV or Solar Thermal system.

ROOF PENETRATIONS:

All new roof design and construction projects must coordinate with plumbing and mechanical design/trades to locate vents on the north slope such that roof surfaces facing south or within 90 degrees of south are maintained clear of obstructions.

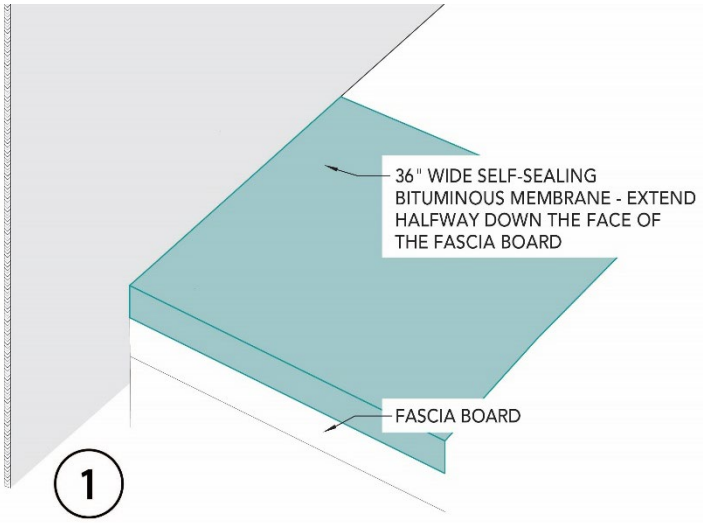
All re-roofing projects must thoroughly pursue moving plumbing vents and other obstructions as part of the re-roofing project. Project managers should consult with POAH Design + Building Performance for cases where moving the penetrations is not immediately feasible.

REQUIRED DETAILS:

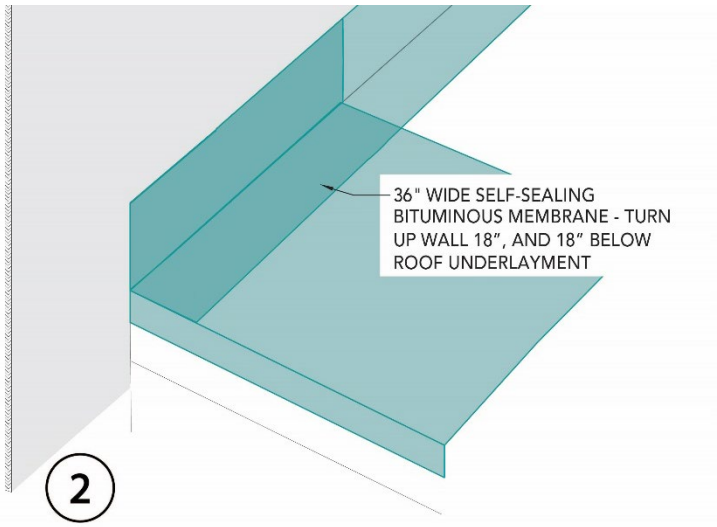
- **Roof edge membrane:** Install a self-sealing bituminous membrane or the equivalent at the roof edge prior to the drip edge. Install the membrane to extend halfway down the face of the fascia (see detail below).
- **Drip edge:** A metal drip edge shall be provided along the entire roof perimeter. The metal drip edge should have a drip leg that extends at least 1” below the sheathing, ½” from adjacent fascia or rake trim and at least 2” into the gutter. Install a shadow board per the detail below to ensure the rain is directed into the gutter. The top edge of the drip edge shall be covered with a minimum 12” self-sealing bituminous membrane or the equivalent.
- **Kick-out flashing:** Install an aluminum flashing (kick-out) to divert water away from where a sloped roof edge intersects a vertical sidewall. The vertical leg of the kick-out flashing shall extend at least 4” on the wall surface above the roof deck and shall be integrated with the drainage plane of the wall. The kick-out flashing is required regardless of the type of wall cladding. A kick-out/diverter flashing should also be installed at the

BASIS OF DESIGN

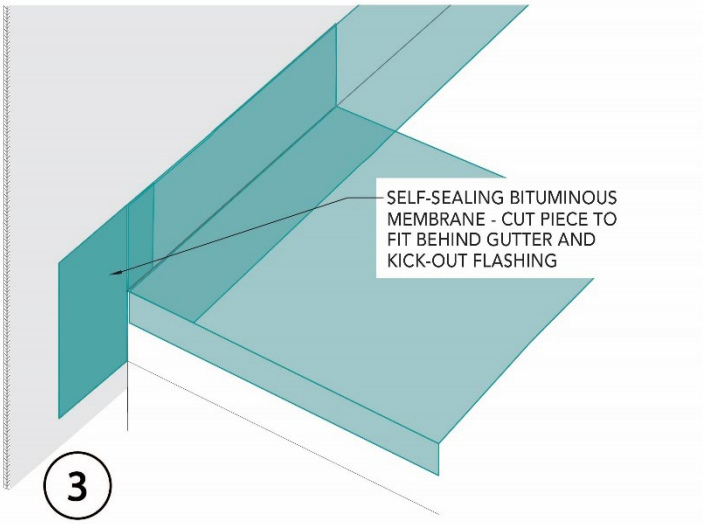
end of eaves where a gutter is installed at the eave and the gutter does not extend past the end of the eave. See the sequence diagram below for proper installation.



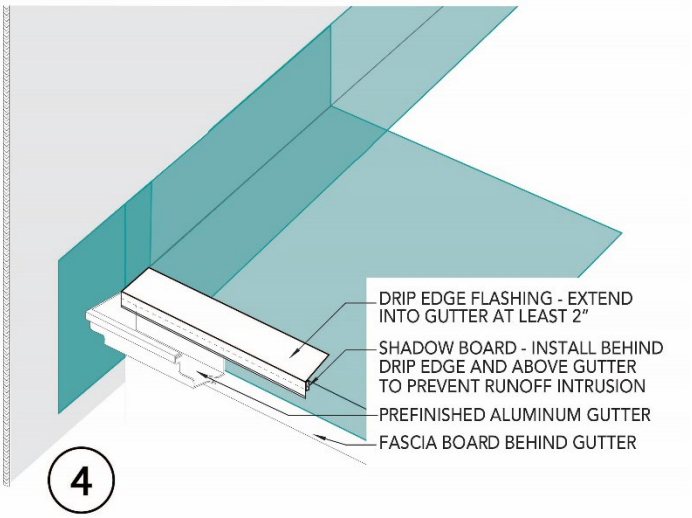
SELF-SEALING BITUMINOUS MEMBRANE INSTALLED ON ROOF EDGE TO EXTEND DOWN PAST GUTTER



SELF-SEALING BITUMINOUS MEMBRANE - TURN UP WALL 18", 18" BELOW ROOF UNDERLAYMENT

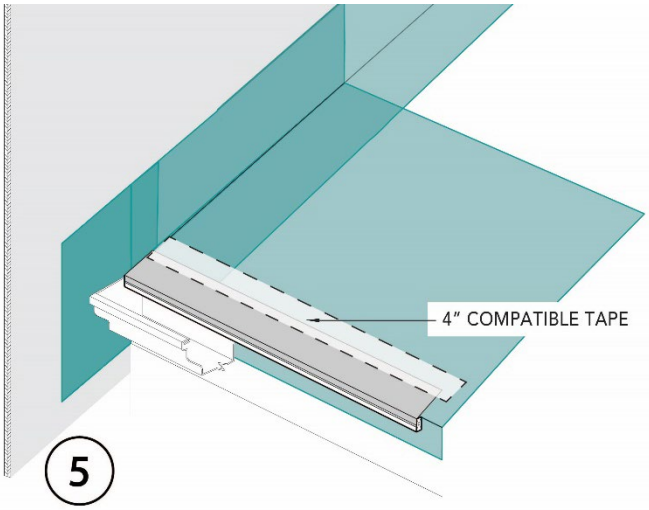


SELF-SEALING BITUMINOUS MEMBRANE - INSTALL SECTION BEHIND KICK OUT FLASHING

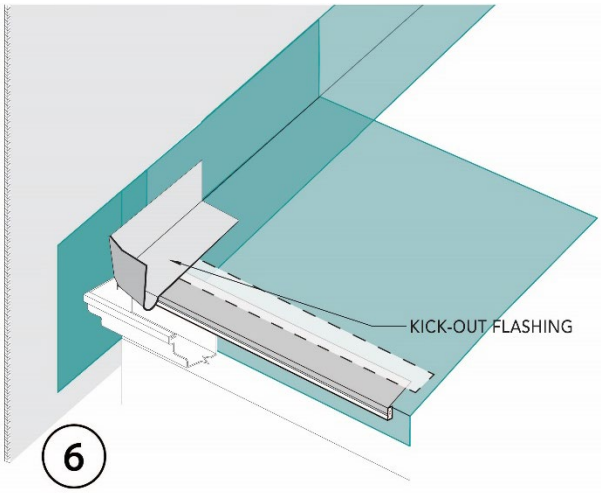


INSTALL GUTTER AND DRIP EDGE - DRIP EDGE TO EXTEND INTO GUTTER AT LEAST 2"

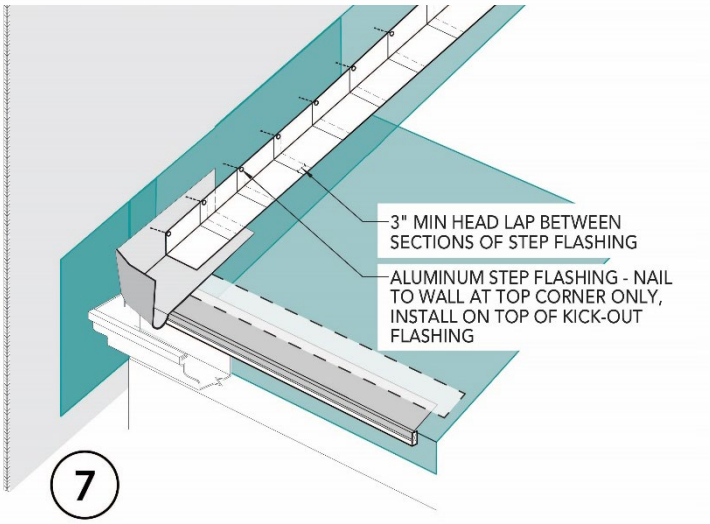
BASIS OF DESIGN



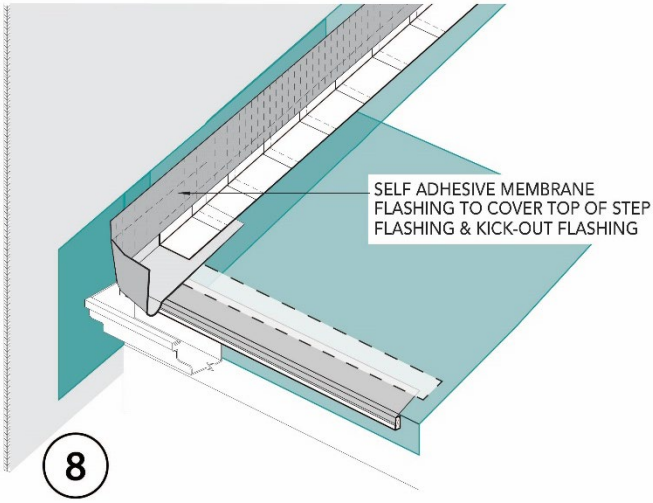
INSTALL 4" COMPATIBLE TAPE TO ADHERE DRIP EDGE



INSTALL KICK OUT FLASHING AT ROOF - WALL INTERSECTION

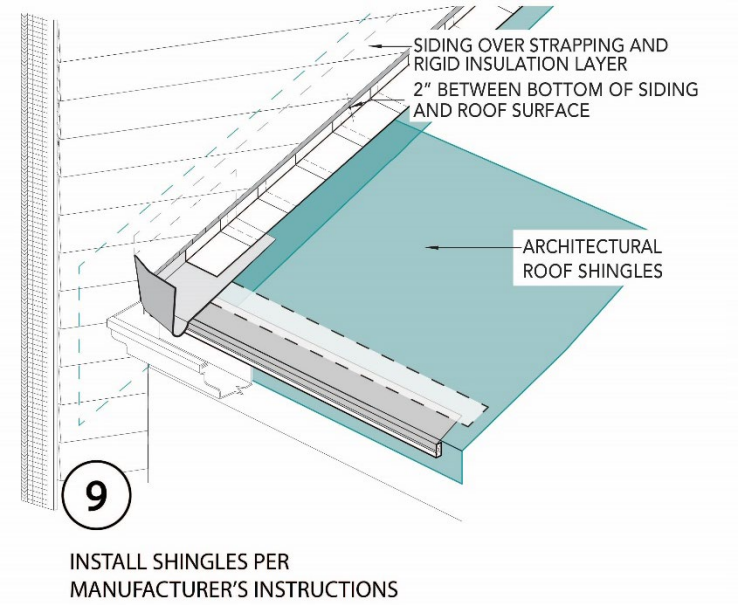


INSTALL STEP FLASHING AT ROOF-WALL INTERSECTION AND ON TOP OF KICK-OUT FLASHING

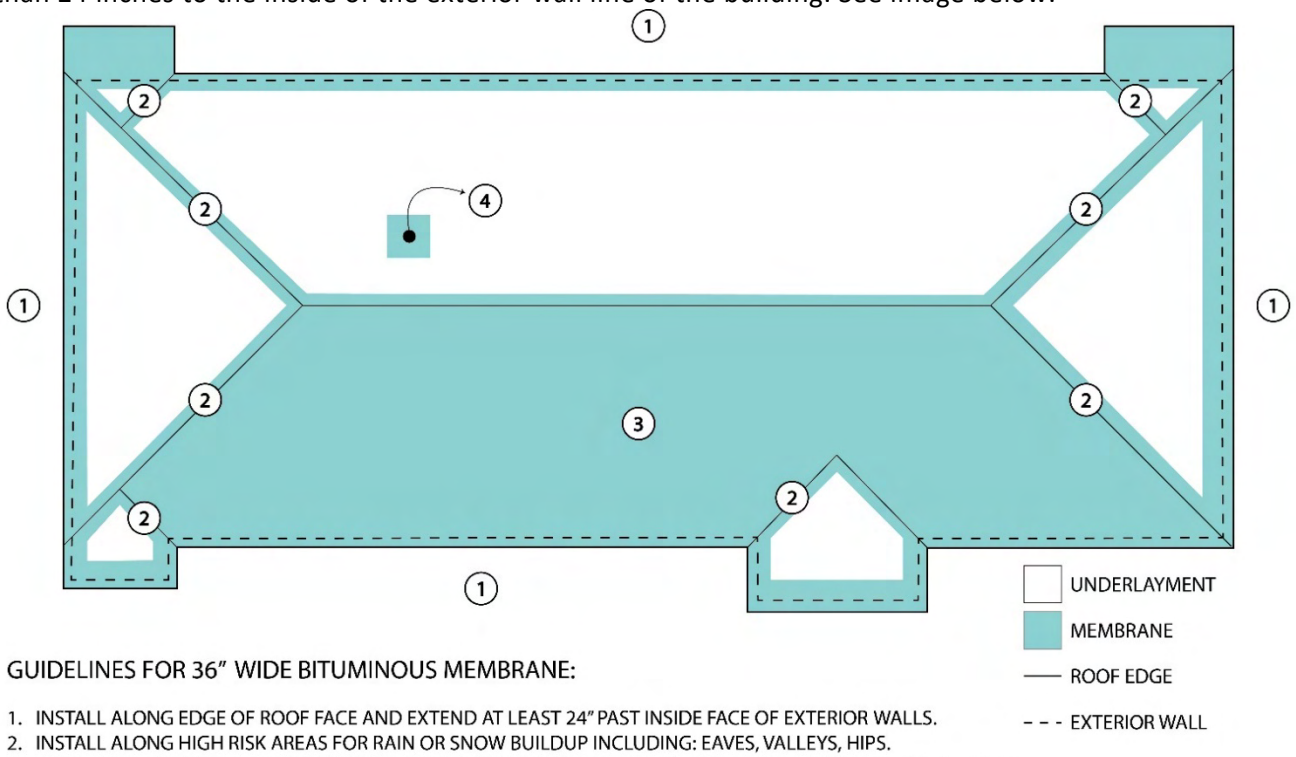


INSTALL SELF ADHESIVE MEMBRANE FALSHING TO SECURE STEP FLASHING AND KICK-OUT FLASHING TO WALL

BASIS OF DESIGN



- **Ice and Water barrier:** In locations that experience snow fall, a self-sealing bituminous membrane, or the equivalent shall be installed at the roof edge and extend from the edge of the roof deck to a point not less than 24 inches to the inside of the exterior wall line of the building. See image below.



GUIDELINES FOR 36" WIDE BITUMINOUS MEMBRANE:

1. INSTALL ALONG EDGE OF ROOF FACE AND EXTEND AT LEAST 24" PAST INSIDE FACE OF EXTERIOR WALLS.
2. INSTALL ALONG HIGH RISK AREAS FOR RAIN OR SNOW BUILDUP INCLUDING: EAVES, VALLEYS, HIPS.
3. INSTALL ON ANY SOUTH FACING ROOF SLOPES TO PREPARE ROOF FOR FUTURE INSTALLATION OF A SOLAR ARRAY.
4. INSTALL AROUND ANY ROOF PENETRATIONS: PLUMBING RISERS, EXHAUST, ROOF FANS, ETC.
5. ALL AREAS NOT RECEIVING MEMBRANE WILL RECEIVE ROOF UNDERLAYMENT. OVERLAP ONTO MEMBRANE PER MANUFACTURER'S INSTRUCTIONS.

Roof plan showing ice and water barrier locations

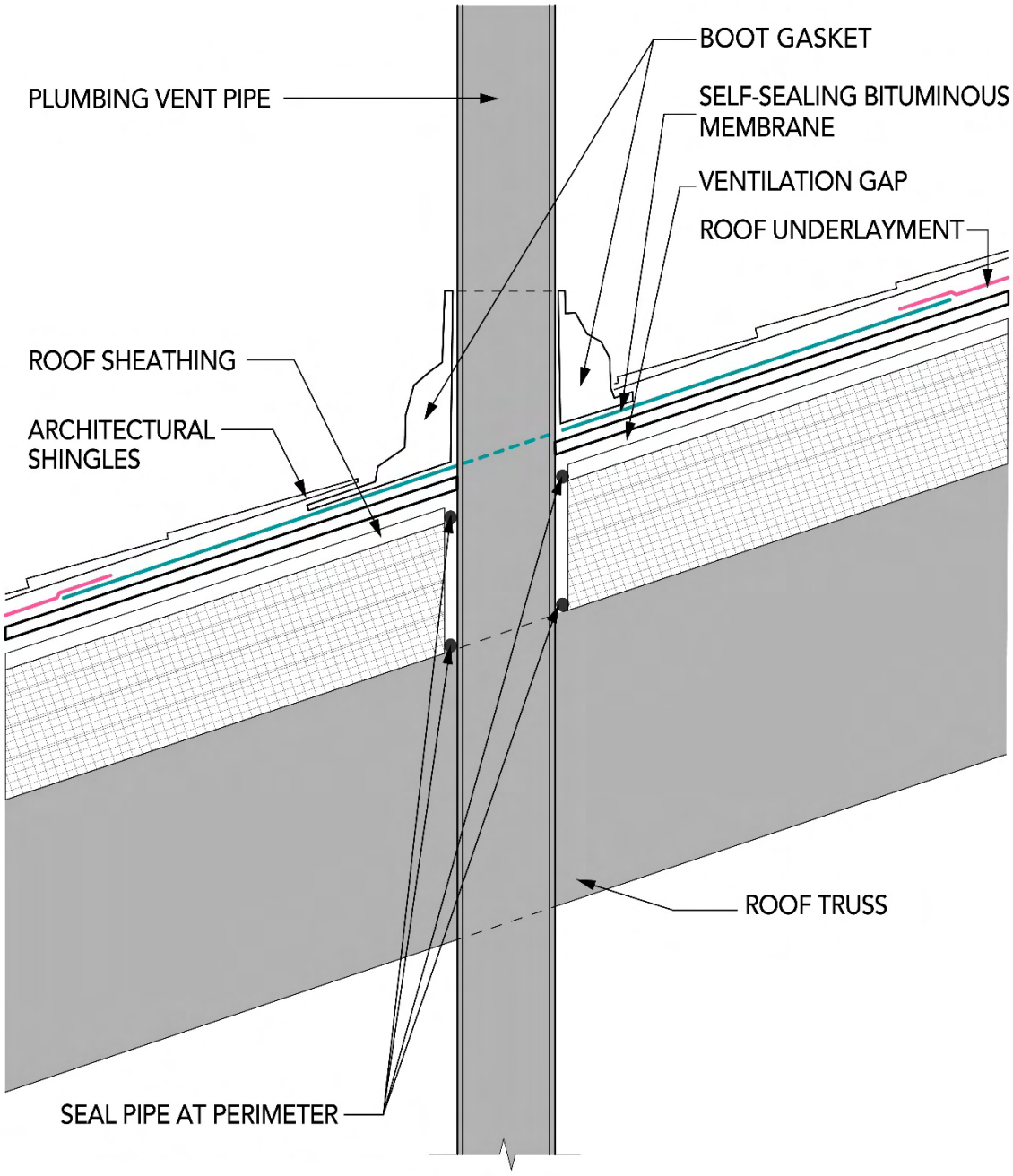
BASIS OF DESIGN

- **Roof-to-wall intersections**:
  - **Shingled roofs:** Step flashing shall be installed at wall and roof intersections. A self-sealing bituminous membrane or the equivalent shall be installed at roof-wall intersections behind step flashing and extending at least 12" up the vertical face of the wall sheathing. The top edge of this adhered water control membrane shall be taped to the sheathing with compatible tape. See **Building Enclosure** section for wall assembly details.
  - **Metal and Membrane roofs:** Install a continuous flashing (with separate pieces lapped shingle fashion), between the roof and wall sheathing. The continuous flashing shall be self-sealing bituminous membrane or the equivalent at least 36" wide. It shall be installed to extend at least 18" onto the roof sheathing and 18" onto the wall sheathing.
- **Roof Valleys and Changes in Slope:** Install a self-sealing bituminous membrane or the equivalent at all valleys and all changes in roof slope. Note that this water protection membrane must not obstruct intentional roof vent openings.

Self-sealing bituminous membrane installed at roof valley

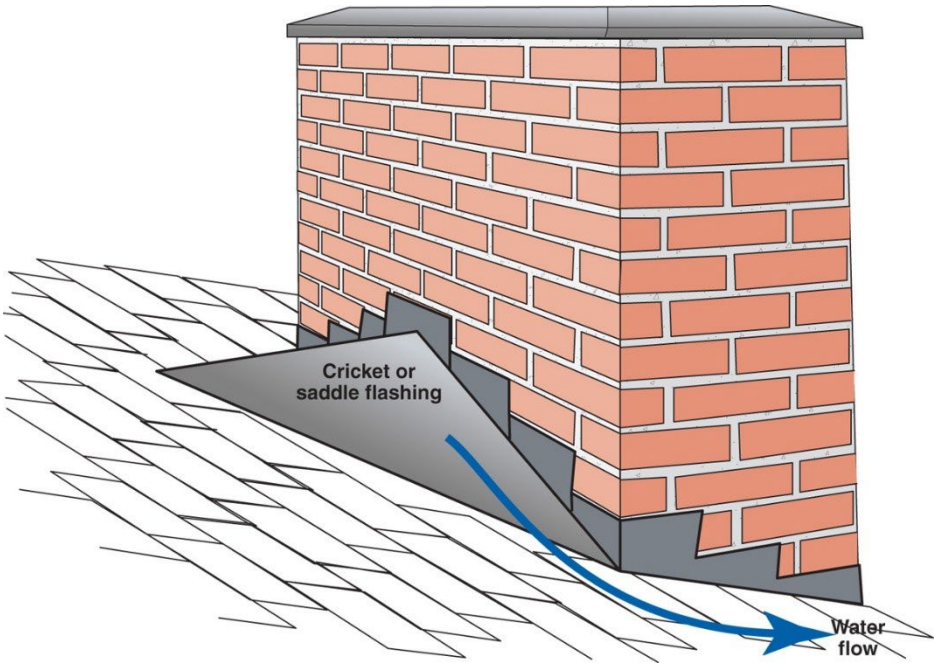
- **Roof Penetrations:** Fully flash all roof penetrations.

Flashing at roof penetration



Flashing at roof penetration

- **Roof cricket:** Provide a roof cricket for each chimney, skylight curb or other such penetrations or obstruction with a face perpendicular to the roof slope.



Roof cricket at chimney

- **Zinc Roof Strips:** Use zinc strips to kill moss, algae, and lichen growth on the roof. These types of vegetation with shorten the life of the roof covering. Strips are typically installed at the peaks of sloped roofs.

Zinc roof strips, Source: Home Architect

BASIS OF DESIGN

ROOF/ATTIC CONFIGURATION:

The roof/attic configuration may be vented or unvented. If the project involves re-roofing of an existing building, the project manager and design team should evaluate the opportunity for implementing an unvented attic.

Vented attic

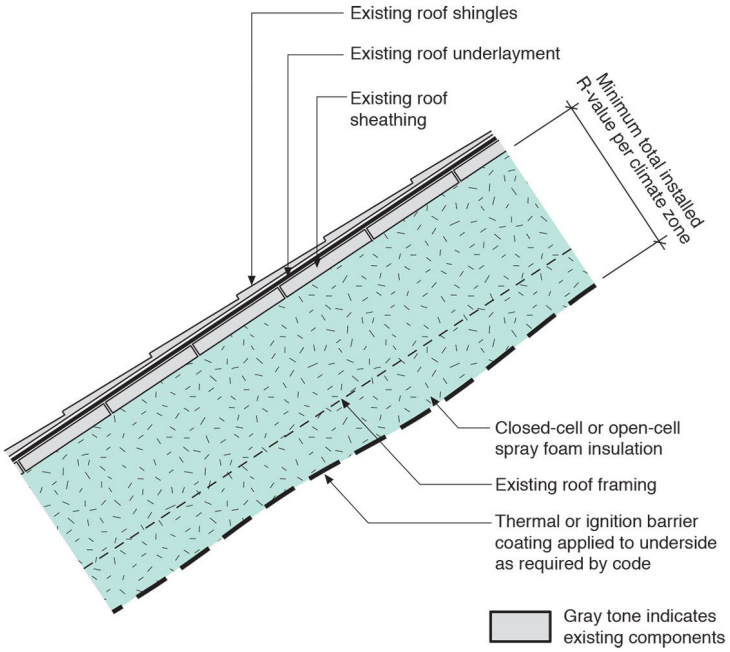
A vented attic is appropriate for situations where the roof is relatively simple in form and where no conditioned space or mechanical distribution is located in the attic space. With a vented attic, access to the attic should be restricted. Consider providing access through an exterior gable entry to allow for continuous insulation at attic floor without penetrations for access hatches.

VENTED ATTIC
ACCESS THROUGH
ROOF GABLE

Unvented attic

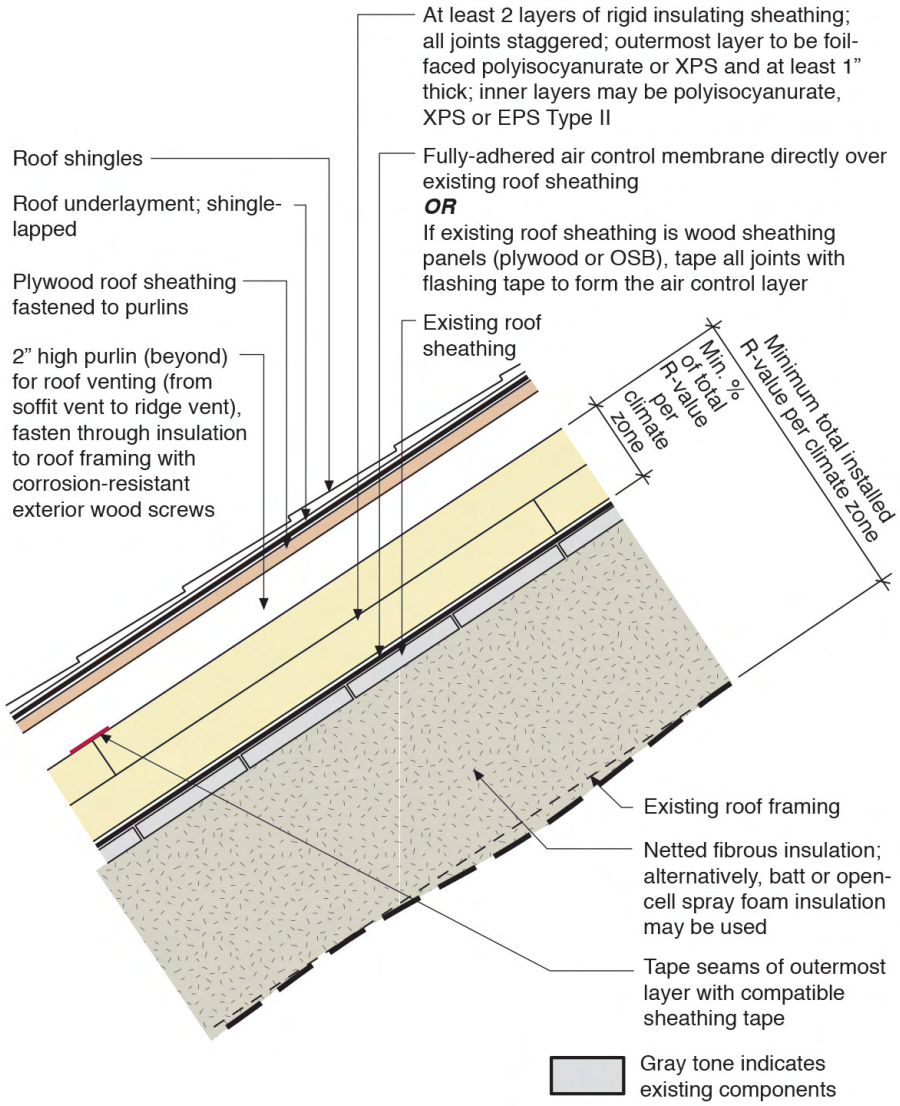
An unvented roof/attic is appropriate for situations where there is living space or mechanical systems/distribution in the space enclosed by the roof rafters. For example, where the ceiling finish is installed directly to the underside of roof framing in a vaulted or cathedral ceiling.

- There are two general approaches for an unvented roof/attic:
    1) closed-cell spray foam applied to the underside of the roof sheathing (see detail below), or



Unvented attic approach 1

    2) rigid insulation and a nail base installed above the sheathing and under the roof covering (shingles, metal roofing, etc.) with additional fibrous insulation below the roof sheathing. This configuration also provides a ventilation space between the rigid insulation and the nailbase. This approach can provide better thermal performance and better resistance to ice dams than a conventional vented attic approach.

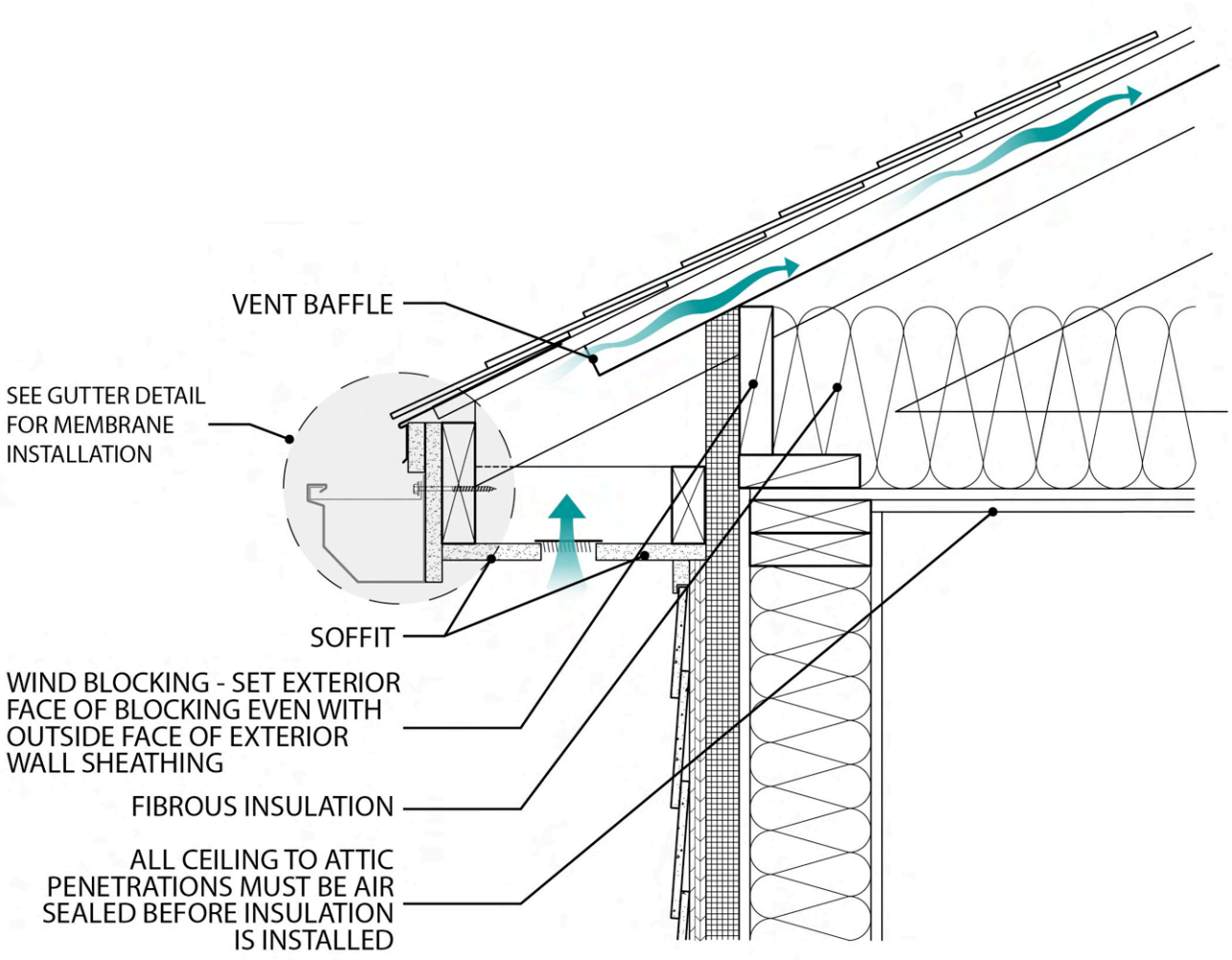


Unvented attic approach 2 showing a vented roof

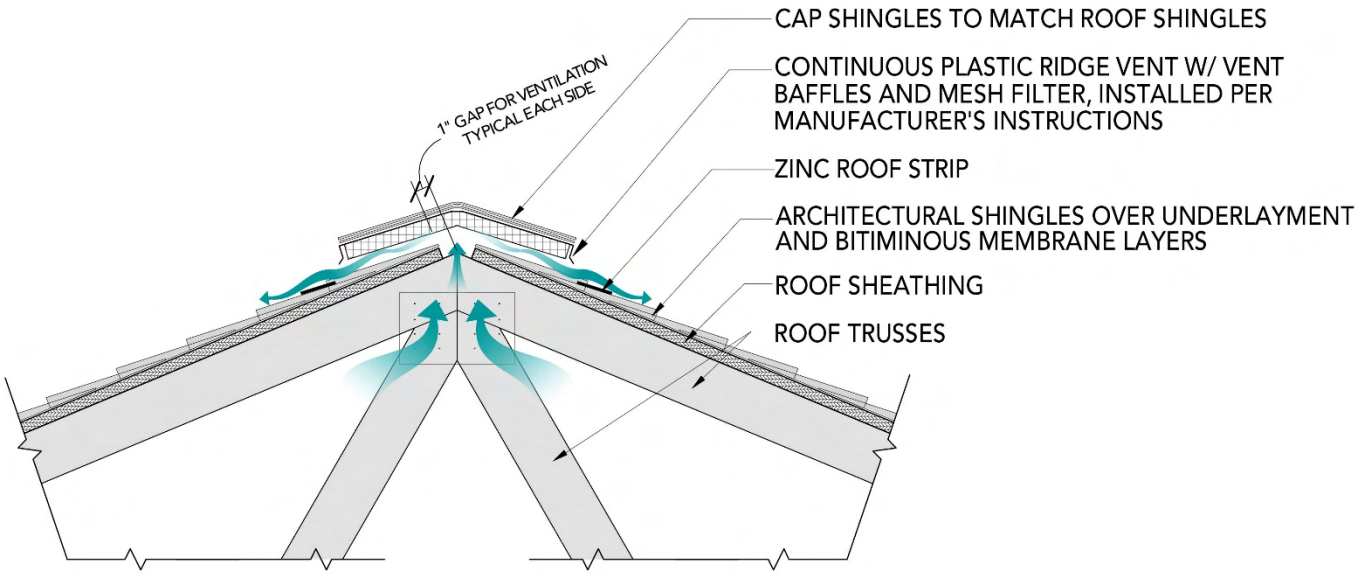
Vented Roof Requirements:

- Ventilation shall be provided at a ratio of 1 square foot of free vent area for each 150 square feet of attic floor—with vents placed proportionately at the eaves (e.g., soffits) and at or near the ridge.
- Vented roofs shall have continuous vent openings at eaves and at the ridge.
- Where permitted by the roof configuration, a ventilation channel at least 2" deep shall be maintained clear from eave to ridge at each roof framing bay (see graphic)
    - Where a skylight, dormer or other obstruction precludes a continuous eave-to-ridge ventilation channel, provision shall be made for venting framing cavities above and below the obstruction.
    - In hipped roof or valley configurations, ventilation openings shall be provided to achieve similar ridge and eave ventilation opening area.

- Wind blocking shall be installed at the perimeter of the attic to prevent roof ventilation from moving through or under the insulation. The wind blocking must be a solid material that is sealed to the wall top plate and to roof rafters. The blocking should extend to within 2” of the roof sheathing and seal to a vent baffle. See details below.



- A vent baffle shall be installed to extend along the roof slope to a point 12” above the top of the attic insulation.



Ridge vent detail

Unvented Roof Requirements:

- The roof shall be designed and constructed with an airtight connection from the roof air barrier to the wall air barrier.
- The unvented roof shall meet the provisions of IRC 806.5 regardless of whether the IRC is applicable to the building.

GUTTER AND RAIN LEADER INSTALLATION:

For Re-Roofing of Existing Buildings

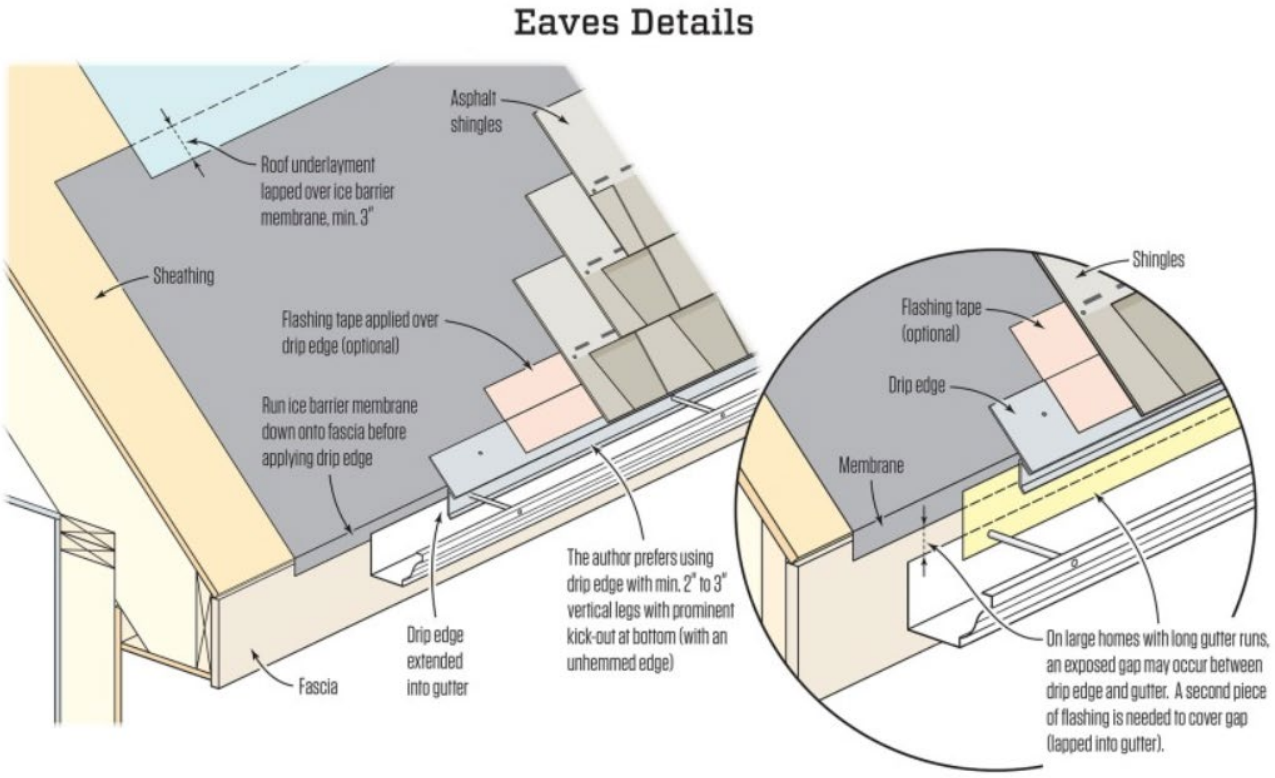
- Remove existing gutters carefully if they are to be reused.
- Remove any/all screw fasteners at the roof edge.

For New Buildings and Re-Roofing of Existing Buildings

- Gutters, existing and new will be installed with the appropriate hangers and spacing to effectively secure them to the building. Hangers should be no greater than 2 feet apart. Include hanger type in specifications.
- Place a self-sealing bituminous membrane or the equivalent between the gutter and the fascia at location of gutter fasteners. See image of roof detail at gutter below.
- If fascia board is visible above the top edge of the gutter, install a flashing tucked under the roof edge membrane or drip edge and lapping into the gutter.
- Downspouts/rain leader will be installed effectively to collect and transport water to grade and away from building. Connect gutter to underground storm water system or to sloped lateral piping that opens on a sloped finish grade a minimum of 5 ft from the foundation or into a rainwater management system.

BASIS OF DESIGN

  - Using of splash-blocks is not permitted for new construction. If existing, ensure the slope of the splash blocks is away from the building as part of the preventative maintenance plan.
  - The downspouts/rain leaders should be 4" Schedule 40 PVC, painted to match the direct adjacent building color. Exterior Acrylic Paint specified for plastics should be used. Provide product information with bid.
- Do not install gutter/leaf guard unless approved by POAH Communities Director of Maintenance. If approved, gutter guard should be installed without damaging existing roof or gutter.
- Ensure gutters are installed with the correct slope to downspouts.
- Install the gutter at an effective distance below the roof edge to allow rain water to enter and not back up into building.

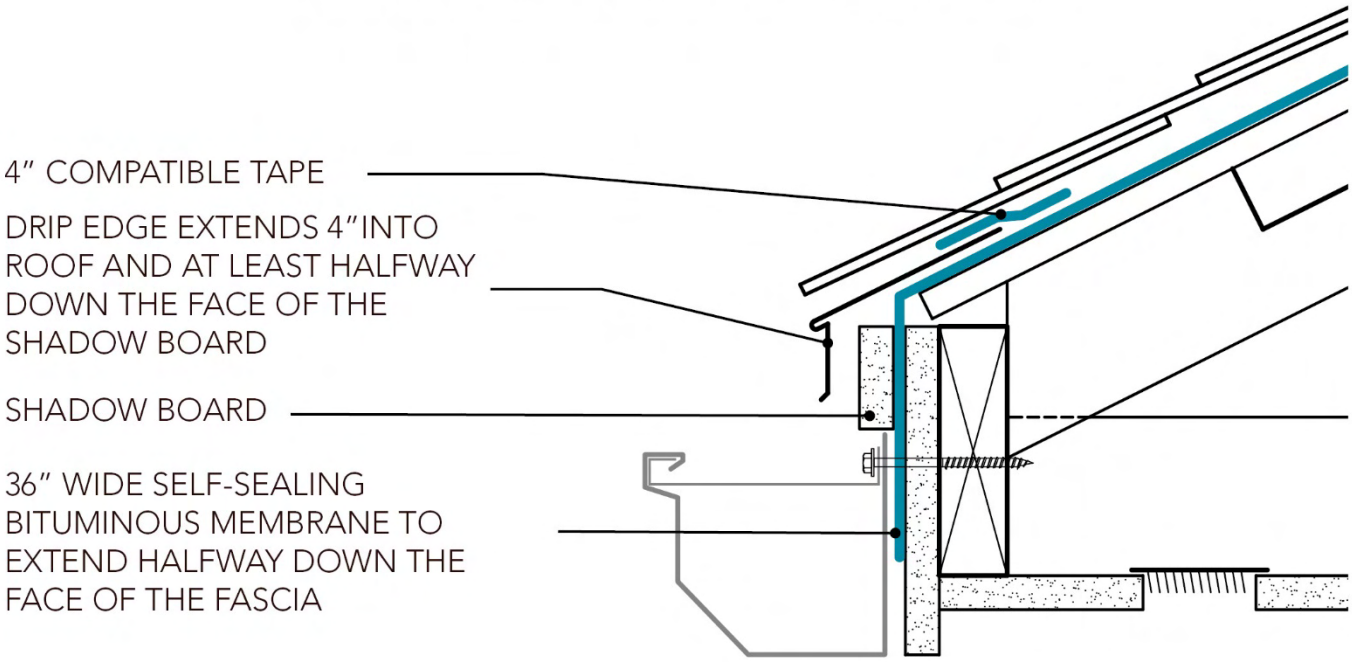


Tim Healey

If ice barrier membrane goes down before fascia, some types can be run wild over the plywood edge and bent down later. Others are too flexible, so the release paper needs to be left on to protect the last few inches of adhesive. It can be carefully sliced and left attached, or pieces of it can be re-adhered to the bottom edge of the membrane.

BASIS OF DESIGN

ROOF DETAIL AT GUTTER



In the example above, the gutter has a back-leg that is tucked under the drip edge. Note the ice and water membrane behind the gutter fastening location.

PRODUCTS:

- **Architectural Shingles** are preferred over 3-tab shingles for durability.

WARRANTY:

- **Labor Warranty:** A separate 10-year labor warranty should be provided by the roofing installer. Most roofs that fail during the roof product warranty do so because they were installed incorrectly and in conflict with the manufacturer's recommended installation.

SPECIFICATIONS:

- **EPA Indoor airPLUS New Construction:** Where code is not updated to include these specifications, refer to this document for more details. https://www.epa.gov/sites/production/files/2020-12/documents/indoor_airplus_nc_specifications_version_2_public_comment_december_2020_508_compliant_1.pdf
- **High Wind Conditions:** Seal the roof deck using one of the following three options, per the IBHS Fortified Hurricane and High Wind Standards:
    1) Install a self-adhered (peel and stick) membrane over the entire roof deck (recommend a #15 felt bond break between membrane and shingles);

2) Install a nominal 4-inch-wide roof deck flashing tape over all roof sheathing panel seams and cover with #30 felt or equivalent synthetic underlayment.

TECHNICAL BRIEF: ICE DAMS

Where ice dams do occur, it is important to understand the causes so that an effective solution can be implemented.

Ice dams are a symptom of poor thermal and air leakage control for roofs in cold winter climates. When diagnosing the causes of ice dams, it is critical to first determine if the roof system is a vented or an unvented roof (see Roof Configuration above). Never allow bath and kitchen exhaust to terminate in an attic. For more information on ice dams and how to avoid them, please view Fine Home Building's article referenced below.

Note: Ice dams should not occur in new buildings since following code provisions would control the mechanisms that cause ice dams. Incidents of ice damming in newer buildings may be reason to seek remedy from the designer, the contractor or both.

HOW TO FIX ICE DAMS

https://static1.squarespace.com/static/57add27ac534a5d1b9a205a7/t/589b67602994ca99ff706c6d/1486579555190/Ice+Dams.pdf

BASIS OF DESIGN

howitworks
THE MECHANICS OF HOME BUILDING

Ice

What do northerners from North Dakota to Maine call the period between Valentine's Day and Easter? Ice-dam season, of course.

During snowy winters, many northern homes are plagued by ice dams, which form when escaping heat warms the roof sheathing and melts the underside of the snow layer on the roof. As the melted water refreezes at the eave, the resulting dam interferes with drainage. Water can then back up, get under the roofing, and lead to interior damage.

Although the impulse of many homeowners is to respond to a water leak by calling a roofer, leaks from ice dams are just a symptom of a larger problem that usually stems from air leaks or insulation defects.

Sealing the roof eaves with flashing membranes adds extra insurance against ice dams. In a few rare cases, increasing the amount of roof ventilation may help. However, air-sealing the connection between the living space and the roof or attic and then improving insulation is usually the best way to solve the problem.

The best course of action is to ignore the contractors who talk about roof repair and ventilation improvements and instead find a home-performance contractor who knows how to identify air leaks using such tools as a blower door, an infrared camera, or a fog machine. But before you call anybody, it helps to have a good understanding of what causes an ice dam to form. Here's how it works.

Martin Holladay is a senior editor.

How ice dams form

1. Warm interior air entering an attic (or roof assembly in a cathedral ceiling) raises the temperature of the roof sheathing, causing the underside of the snow to melt.

2. Water trickles down the roof until it reaches the eave—which is significantly colder than the rest of the roof—where it refreezes.

3. This recurring process causes the ice at the eaves to get thicker and thicker, forming an ice dam.

4. Eventually, water from melting snow backs up behind the ice dam. If the water reservoir is large enough, it can seep up under the roof shingles, leak through the roof sheathing, and cause damage.

Drawings: Christopher Mills

BASIS OF DESIGN

dams

BY MARTIN HOLLADAY

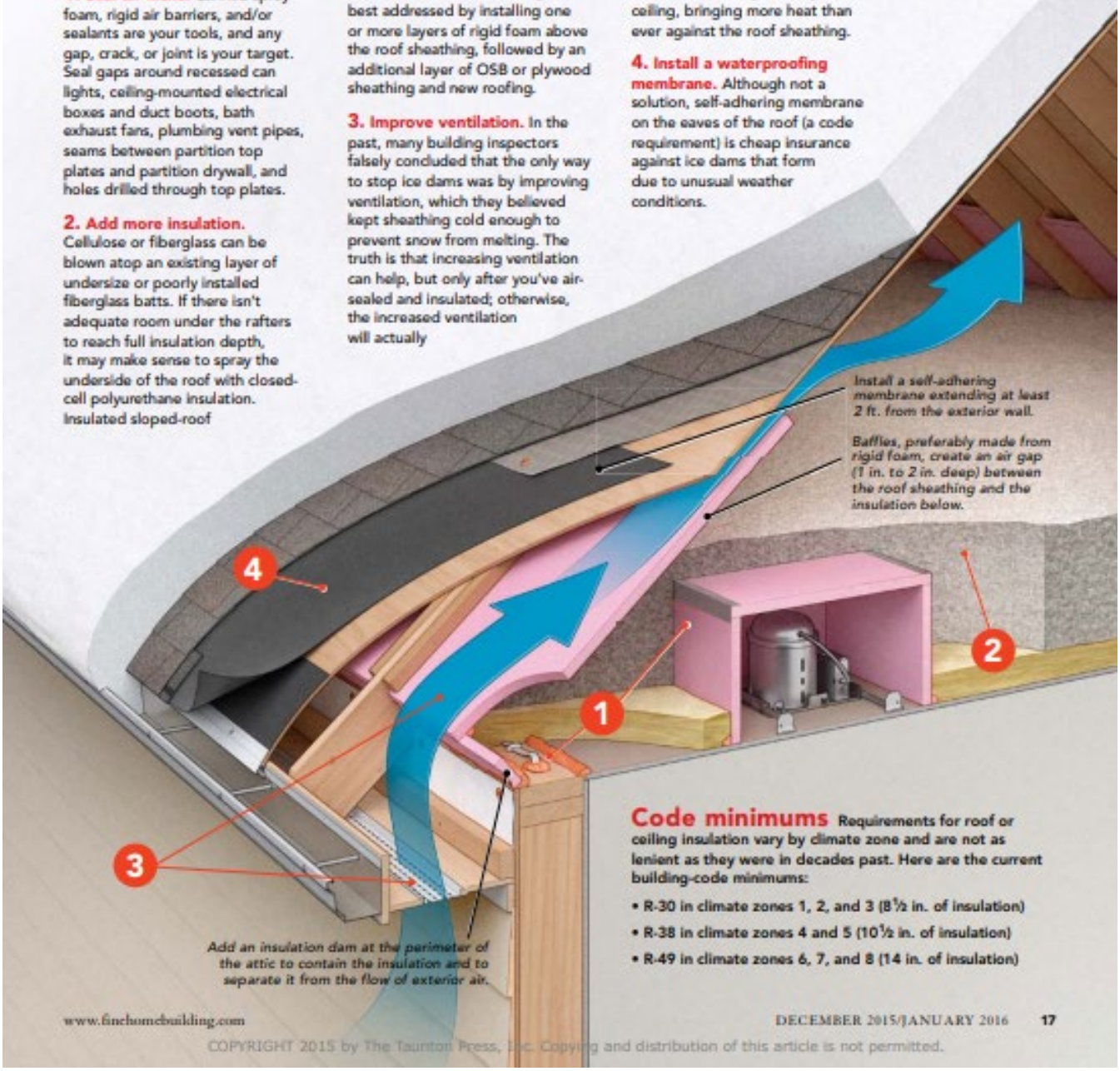
How to fix them Ice dams are not a roofing problem; they're an air-sealing problem. There are four possible ways to prevent ice dams, and they are best taken in order of priority. Step 3 shouldn't be attempted until steps 1 and 2 have been addressed, and in many cases, not every step is necessary.

1. Seal air leaks. Canned spray foam, rigid air barriers, and/or sealants are your tools, and any gap, crack, or joint is your target. Seal gaps around recessed can lights, ceiling-mounted electrical boxes and duct boots, bath exhaust fans, plumbing vent pipes, seams between partition top plates and partition drywall, and holes drilled through top plates.

2. Add more insulation. Cellulose or fiberglass can be blown atop an existing layer of undersize or poorly installed fiberglass batts. If there isn't adequate room under the rafters to reach full insulation depth, it may make sense to spray the underside of the roof with closed-cell polyurethane insulation. Insulated sloped-roof assemblies (cathedral ceilings) are best addressed by installing one or more layers of rigid foam above the roof sheathing, followed by an additional layer of OSB or plywood sheathing and new roofing.

3. Improve ventilation. In the past, many building inspectors falsely concluded that the only way to stop ice dams was by improving ventilation, which they believed kept sheathing cold enough to prevent snow from melting. The truth is that increasing ventilation can help, but only after you've air-sealed and insulated; otherwise, the increased ventilation will actually increase air leakage through the ceiling, bringing more heat than ever against the roof sheathing.

4. Install a waterproofing membrane. Although not a solution, self-adhering membrane on the eaves of the roof (a code requirement) is cheap insurance against ice dams that form due to unusual weather conditions.



Code minimums Requirements for roof or ceiling insulation vary by climate zone and are not as lenient as they were in decades past. Here are the current building-code minimums:

- R-30 in climate zones 1, 2, and 3 (8½ in. of insulation)
- R-38 in climate zones 4 and 5 (10½ in. of insulation)
- R-49 in climate zones 6, 7, and 8 (14 in. of insulation)

BASIS OF DESIGN

SIGNAGE

PROPERTY SIGNAGE

When considering new property signage, POAH's properties will receive either **monument signage**, or **urban signage**. The installation of signage helps identify and brand each property as a POAH Community. The signs also provide information about fair housing, ADA offerings, and leasing websites. All properties need to abide by their local signage zoning ordinances and must receive a permit before any signage is installed.

- Monument Signage: the sign shall be purchased from Creative Sign Design and permitted + installed by a local sign company.
- Urban signs: a local sign installer shall permit, manufacture, and install the new signs.

MONUMENT SIGNAGE

Where: At non-urban properties, monument signs (freestanding signs) are typically installed at the property entrance, or in a significant location to brand the property as a POAH Community.

How: POAH has negotiated pricing with **Creative Sign Design (CSD)** of Florida to manufacture all new property signs. The project manager at each property is responsible for hiring a local sign installer to permit and install the sign. The following steps should be followed when purchasing and installing a new property sign.

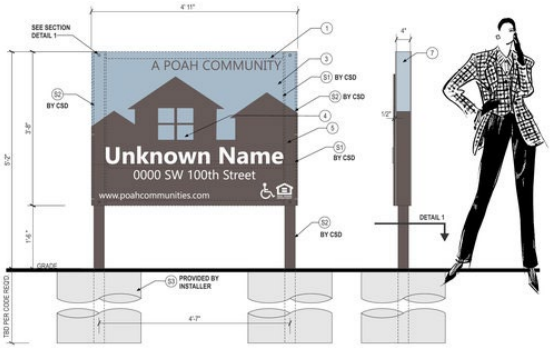
1. Download + review **Monument Signage PDF** (see button below).
2. Select desired sign type and position it on property.
3. Review selection and placement with Design + Building Performance Department.
4. Contact CSD, and contract with them for new sign(s).
    - http://www.creativesigndesigns.com
    - 830 S. Ronald Reagan Blvd.
      Suite 232
      Longwood, FL 3275
    - (800) 804-4809
5. CSD will produce a shop drawing to be used during permitting.
6. Send Request For Proposals to local sign companies for permitting and installation of new sign. Demolition of existing sign may need to be included in scope. Pricing will vary. Contract with selected local sign company.
7. Local sign company to submit CSD's shop drawing for permit at local zoning/planning department.
8. Local sign company to receive permit from municipality.
9. CSD to manufacture and ship new sign to local sign company.
10. Local Sign company to install new sign.

DOWNLOAD THE MONUMENT SIGNAGE PDF HERE

BASIS OF DESIGN

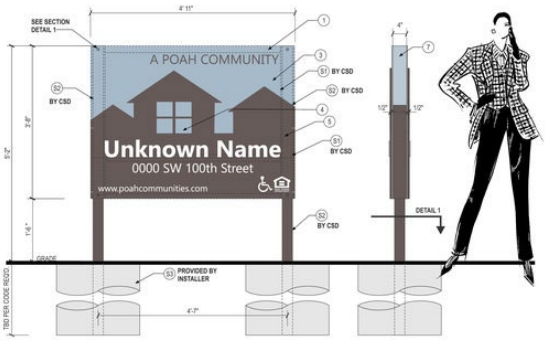
https://www.poahbod.org/s/BOD-Signage-Monument-4wfk.pdf

A1



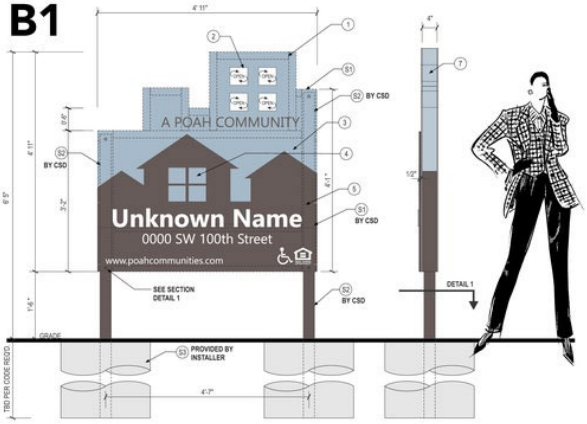
A1: Rectangular - 1 sided
Product only: $2,133.20

A2



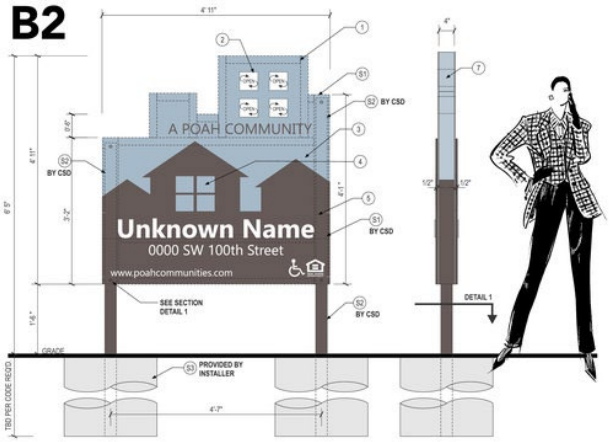
A2: Rectangular - 2 sided
Product only: $2,616.50

B1



B1: Cutout - 1 sided
Product only: $2,533.62

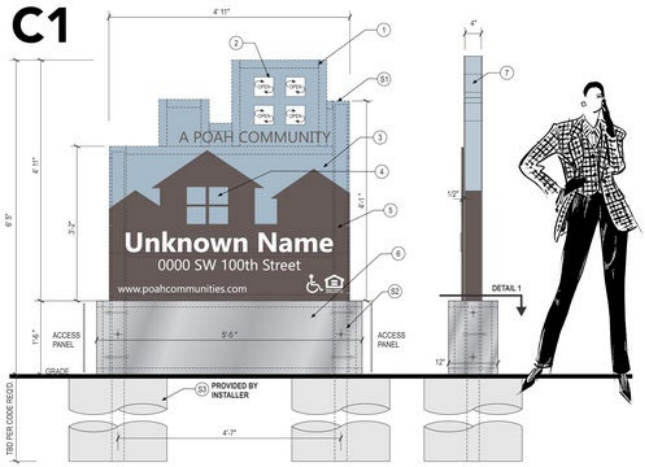
B2



B2: Cutout - 2 sided
Product only: $3,117.02

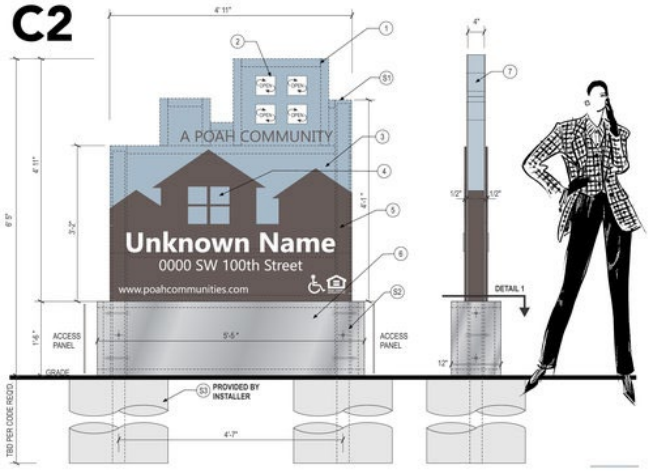
BASIS OF DESIGN

C1



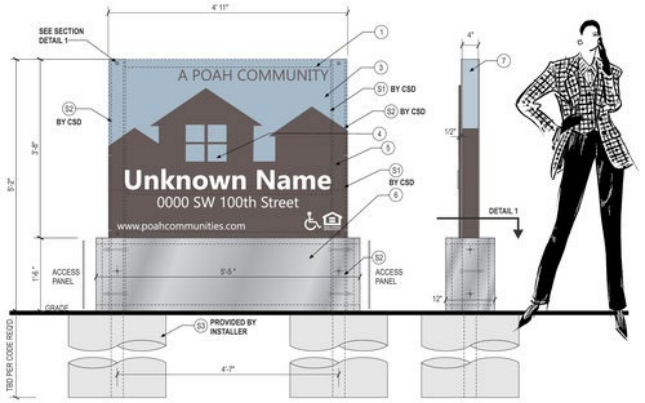
C1: Cutout - 1 sided with base
Product only: $2,933.62

C2



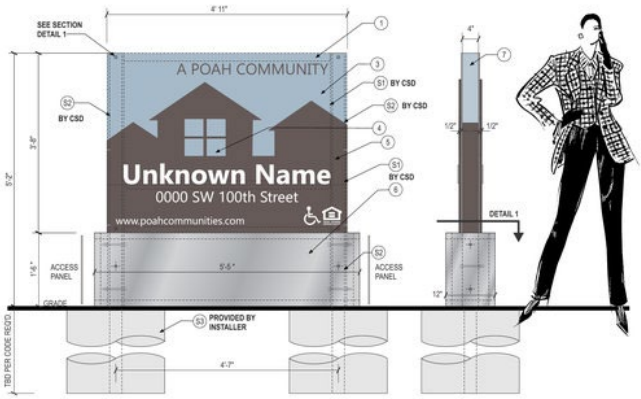
C2: Cutout - 2 sided with base
Product only: $3,533.62

D1



D1: Rectangular - 1 sided with base
Product only: $2,733.20

D2



D2: Rectangular - 2 sided with base
Product only: $3,216.50

BASIS OF DESIGN

URBAN SIGNAGE

Not all properties are able to receive a new monument sign. Urban properties typically do not have space for a free-standing sign, or when they do have space, zoning regulations may not allow one to be installed. For these types of properties, a **local sign company** should provide a wall mounted sign.

1. Review potential urban sign locations and designs with Design + Building Performance Dept.
2. Send a Request For Proposal to local sign companies.
3. Select a local sign company and work with them to finalize a sign design.
    - All designs should incorporate the POAH logo, the property name, property address, ADA logo, www.poahcommunities.com, and the fair housing logo.
4. Local company should then submit design for permit.
5. Once the permit is received, the sign company will manufacture and install the new sign.
6. Local sign companies can also provide exterior wayfinding signage. POAH/POAHC fonts and colors should be used.

BASIS OF DESIGN

INTERIOR WAYFINDING

INCLUDES UNIT, MANAGEMENT, CODE REQUIRED, AND DIRECTIONAL SIGNAGE

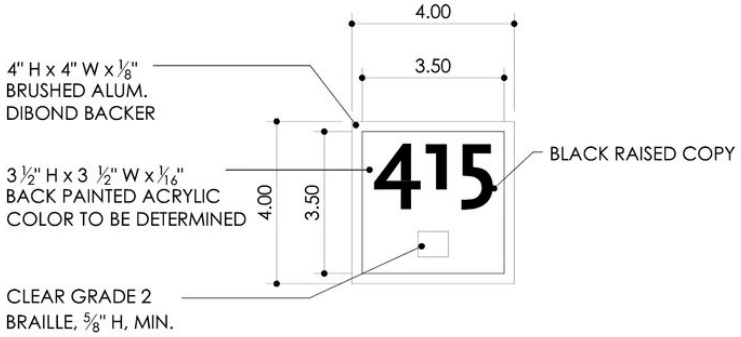
Architect to identify all required signs, including those required by code, and provide a sign schedule. Using the **Interior Wayfinding Template** as a starting point, signage shall be tailored to the specifics of the property. The **project manager** should pick an accent color for the background of interior wayfinding signs.

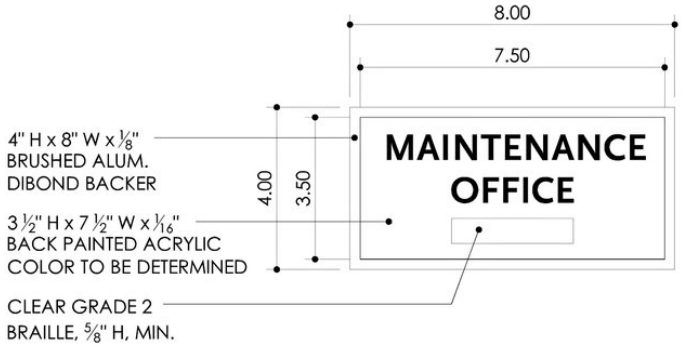
INTERIOR WAYFINDING TEMPLATE

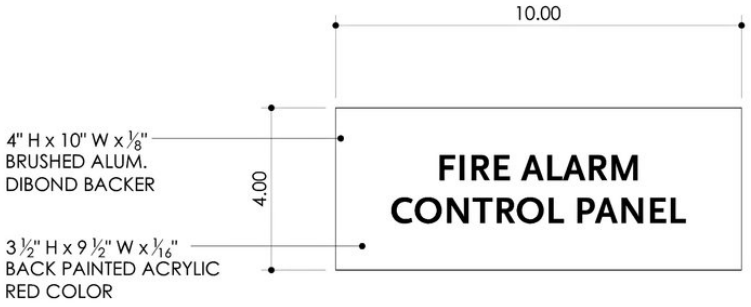
INTERIOR MULTILINGUAL WAYFINDING TEMPLATE

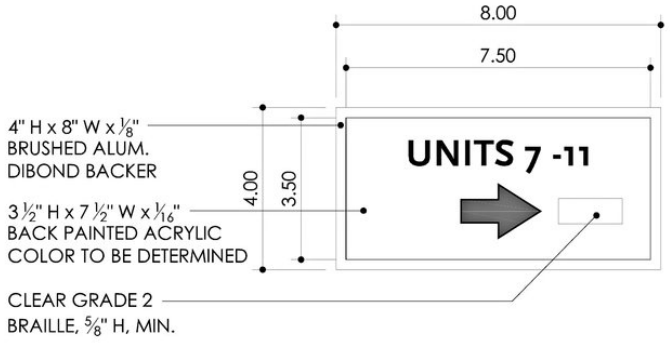
INTERIOR PICTOGRAM WAYFINDING TEMPLATE

INTERIOR MULTILINGUAL/PICTOGRAM WAYFINDING TEMPLATE









BASIS OF DESIGN

TRAUMA-INFORMED HOUSING

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be used in all new construction and rehab projects. This section should be also be referenced and applied during capital planning to guide the scope of resident and staff space upgrades to existing buildings.

What is Trauma-Informed Housing?

Trauma-Informed Housing (TIH) is a model that combines **human-centered design** and **trauma-informed care**.

For POAH, **TIH is about expanding the definition of affordable housing.** In addition to providing housing stability through financial affordability, we are committed to affording our residents the opportunity to feel safe, heard, and empowered through the design and operation of our properties.

What is Human-Centered Design?

Human-Centered Design (HCD) is design that is primarily focused on the physical, mental, and emotional safety, health, and well-being of residents. HCD includes not just trauma-informed principles (see below), but also universal design and health building design/sustainability.

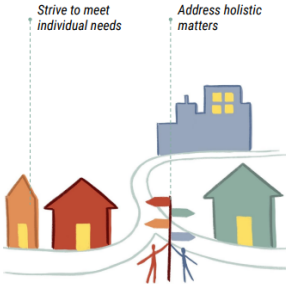
TRAUMA-INFORMED PRINCIPLES IN AFFORDABLE HOUSING

SAFETY & TRUST

Housing communities designed to **create a sense of safety and trust** offer spaces, services, and programs that are welcoming, inclusive, and representative of the local context and culture.

CHOICE & EMPOWERMENT

Housing communities designed to **lift up choice and empowerment** offer residents clear options of spaces and services to use that enable them to make choices of how to best meet their needs.



COMMUNITY & COLLABORATION

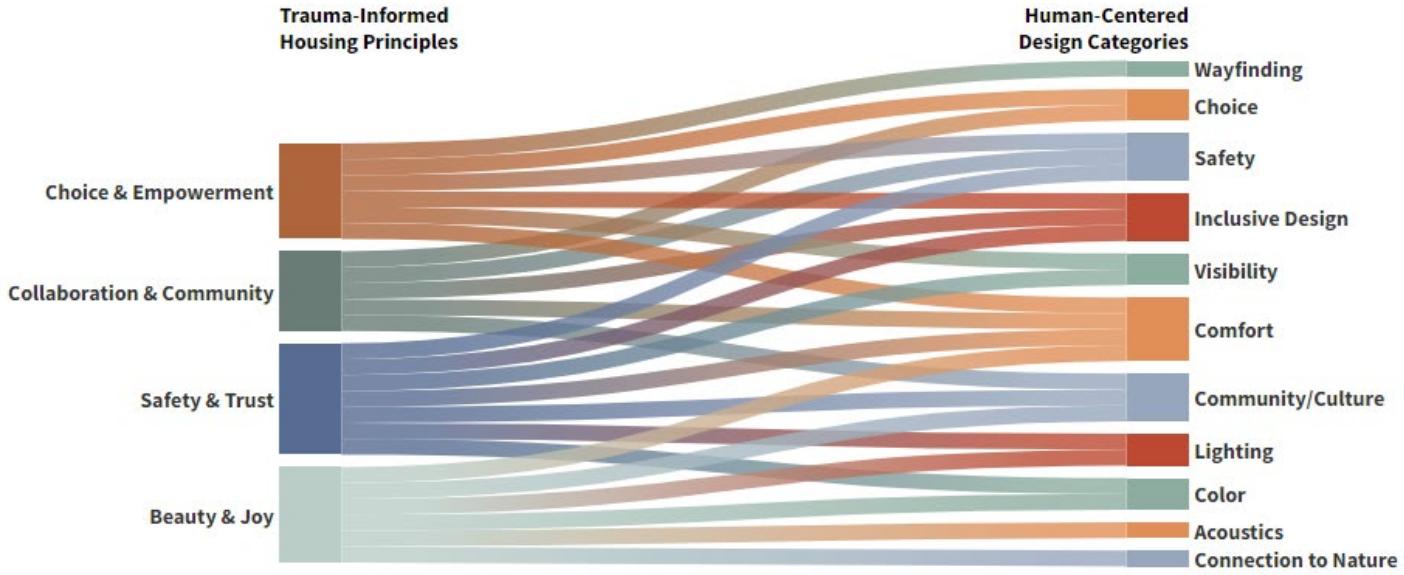
Housing communities designed to **build community and collaboration** cultivate social cohesion with a diversity of space and service offerings.

BEAUTY & JOY

Housing communities **spark beauty and joy** encouraging residents to take care of their environment to cultivate growth, pride, and delight.

BASIS OF DESIGN

HUMAN-CENTERED DESIGN CATEGORIES



EDUCATIONAL MATERIALS

POAH's human-centered design criteria are an extension of the resources and design opportunities (linked below) developed as a part of our Designing Trauma Resilient Communities: Trauma-Informed Housing Toolkit.

1. What is Trauma-Informed Design
2. Design Dos and Don'ts
3. Design Opportunities at a Glance
4. Spatial Program Guide
5. Case Study – Hawthrone Community Building

BASIS OF DESIGN

DESIGN CRITERIA

When to Use These Resources: These resources provide a list of all our human-centered design criteria organized by checklist or visually shown in sample unit floor plans.

SD+DD Design Criteria Organized by…

1. Checklist
2. Sample Unit Floor Plans

Additional resources coming soon!

ADDITIONAL RESOURCES ON TRAUMA-INFORMED HOUSING

POAH's Human-Centered Design Best Practices are an extension of our *Designing Trauma Resilient Communities* project, which utilizes *The Missouri Model Principles of Trauma-Informed Care*. This model focuses on 5 key principles: safety, trustworthiness, choice, collaboration, and empowerment.

To learn more, visit the following links:

1. POAH's Trauma-Informed Housing Toolkit, POAH
2. Center for Trauma Informed Innovation, University Health
3. The Missouri Model of Trauma-Informed Approaches, Missouri Department of Mental Health
4. SAMHSA's Concept of Trauma and Guidance for a Trauma-Informed Approach, Substance Abuse and Mental Health Services Administration

BASIS OF DESIGN

UNIT FINISHES

CONTACTS:

- POAH has negotiated pricing with select manufacturers and wholesalers. When purchasing and installing new flooring please contact the following representatives. See the **Manufacturer Contacts** section of the BOD for more information.

KITCHEN

LIGHT COLOR SCHEME

Light Cabinet Color

Wilsonart
Kalahari Topaz
4588K-07

Wilsonart
Tungsten EV
4814-60

Wilsonart
Desert Zephyr
4841-60

Wilsonart
Vila Roca
4836-38

MEDIUM COLOR SCHEME

Medium Cabinet Color

Wilsonart
Kalahari Topaz
4588K-07

Wilsonart
Silicon EV
4811-60

Wilsonart
Silver Travertine
1858K-55

Wilsonart
Vila Roca
4836-38

DARK COLOR SCHEME

Dark Cabinet Color

Wilsonart
Kalahari Topaz
4588K-07

Wilsonart
Silicon EV
4811-60

Wilsonart
Desert Zephyr
4841-60

Wilsonart
Vila Roca
4836-38

BASIS OF DESIGN

View cabinet spec for door and box requirements:

CABINET SPEC

https://www.poahbod.org/cabinetry

View countertop spec for postform requirements:

COUNTERTOP SPEC

https://www.poahbod.org/cabinetry#cabinetry-countertops

PULLS AND SPLASH PLATE

PULLS:

Amerock
Allison Curved 96MM Pull
Satin Nickel
BP53003G10

SPLASH PLATE:

Broan
Reversible Backsplash
Almond
EP300108
(To be installed on wall behind stove - install with Almond finish facing out.

BATH:

SHOWER/ TUB SURROUND:

Swanstone
Bisque
(018)

VANITY:

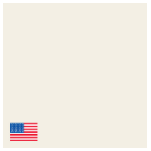
Swanstone
Bisque
(018)

BASIS OF DESIGN

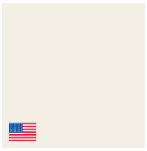
PAINT:

WALLS
Sherwin Williams
6378 – Crisp Linen
Eggshell

CEILINGS
Sherwin Williams
7002 – Downy
Flat



TRIM
Sherwin Williams
7102 – White Flour
Semi-gloss



DOORS
Sherwin Williams
7102 – White Flour
Semi-gloss

For Sheetrock walls use:

- **Prime coat:** Sherwin Williams- ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
- **Top coat:** Sherwin Williams- ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series, at 4.0 mils wet, 1.6 mils dry, per coat.

For all other wall types, see the Paint Spec.

https://www.poahbod.org/paint

BASIS OF DESIGN

UNIT FLOORING

REQUIRED DETAILS FOR ALL FLOORING TYPES:

- **UNIT TURNS:**
  - To achieve **unit compartmentalization**, seal joint from new flooring to existing wall with manufacturer approved joint sealant.
  - All new flooring requires a level subfloor free from cracks, bumps and excessive adhesive residue from former floors.
    - **Subcontractor must evaluate existing subfloor condition and include associated costs for necessary repairs in their bid.**
- **REHABS:**
  - Moisture testing is required in basement or slab on grade units.
  - To achieve **unit compartmentalization**, seal joint from new flooring to existing wall with manufacturer approved joint sealant.
  - All new flooring requires a level subfloor free from cracks, bumps and excessive adhesive residue from former floors.
    - **Subcontractor must evaluate existing subfloor condition and include associated costs for necessary repairs in their bid.**
- **NEW CONSTRUCTION:**
  - Follow **compartmentalization/ air sealing** per architect's details. If not included in details, highlight for architect.

VINYL PLANK OPTIONS:

Location: Kitchen, Living, Bedroom, Entry/Corridor.
Wear Layer: 12 mil

GLUE DOWN OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 8" x 48" planks, 2.0mm thickness.

Mohawk
Leighton
Merino
Glue-down

Mohawk
Leighton
Ashen Tan
Glue-down

Mohawk
Leighton
Sequoia
Glue-down

BASIS OF DESIGN

FLOATING/CLICK OPTIONS:

Subfloor condition: even, smooth, and free of cracks.
Size: 6” x 48” planks, 3.2mm thickness.

Mohawk
Discovery Ridge
Coffee House Tan
Uniclic

Mohawk
Discovery Ridge
Rustic Taupe
Uniclic

CARE & MAINTENANCE

https://www.mohawkflooring.com/luxury-vinyl-tile/guides/luxury-vinyl-care-maintenance

SHEET VINYL OPTIONS:

Location: Bath.
Size: 12'-0” wide rolls, 65 gauge thickness

Mohawk
Gateway
Almond Spice

Mohawk
Gateway
Silver Screen

REQUIRED DETAILS:

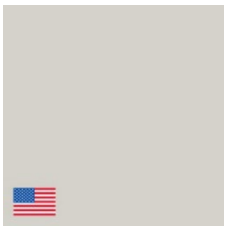
All seams must be **chemically welded.**

CARE & MAINTENANCE

https://www.mohawkflooring.com/luxury-vinyl-tile/guides/luxury-vinyl-care-maintenance

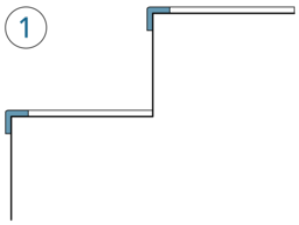
BASIS OF DESIGN

STAIRS:



Tarkett
Vinyl Stair Treads
Service Weight
22 Pearl CB

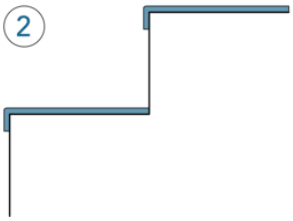
Based on the amount of stair traffic, pick one of the following solutions:



LIGHT TRAFFIC

NOSING

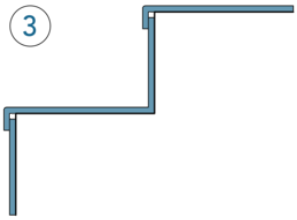
Nosing: Vinyl
Tread: Flooring Material
Riser: Painted



MEDIUM TRAFFIC

TREAD

Nosing/Tread: Vinyl
Riser: Painted



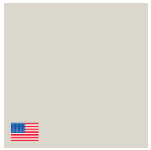
HEAVY TRAFFIC

TREAD + INTEGRATED RISER

All vinyl

RUBBER BASE

- Suggested Manufacturers: Armstrong, Mannington, Johnsonite
- Type TV (vinyl thermoplastic); Group I (solid, homogeneous)
- Length: **Coil stock ONLY**, in manufacturer's standard length
- Size: 4 inches in height, 0.125" min. thickness, and Cove style



Tarkett
Baseworks
Toe 4"
34 Almond

Tarkett
Baseworks
Toe 4"
09 Clay

Tarkett
Baseworks
Toe 4"
280 Shoreline

BASIS OF DESIGN

CORNER INSTALLATION:

Factory Made Outside Corners:
Install factory made outside corners before installing wall base.

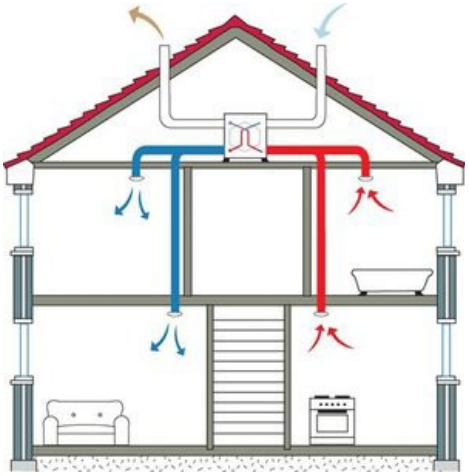
Field-Made Inside Corners:
Use a utility knife to score the back and notch out the base for inside corners.

BASIS OF DESIGN

VENTILATION

WHEN TO USE THIS BASIS OF DESIGN SECTION:

This BOD section should be referenced and applied in all new construction projects as well as any projects involving work on ventilation components or systems in POAH developments. This section should also be referenced during planning activities to guide the scope of pending renovation to existing buildings.



Ventilation has significant impact on resident health, resident satisfaction with the living environment and on building energy use. Historical building ventilation approaches are unlikely to provide appropriate ventilation in modern buildings or for modern expectations. It should not be assumed that new systems designed to meet current code standards will deliver effective and efficient ventilation in multifamily buildings.

WHY VENTILATE - GENERAL INFORMATION:

The purpose of ventilation is threefold:

1. to remove airborne contaminants,
2. to dilute airborne contaminants that cannot be effectively removed, and
3. to provide fresh air.

Removing airborne contaminants is the work of **source control ventilation** (ie range hood and bath exhaust fan). Diluting distributed airborne contaminants and providing fresh air is the work of **general background ventilation.**

Historically, buildings relied upon leaks in the building enclosure and open windows to provide ventilation. **Source control ventilation** is often ineffective in this approach. **General background ventilation** rates are neither controlled nor reliable. The random leaks of this approach bring severe detriment to comfort, energy costs and pest control.

More recently, the need for mechanical ventilation was recognized and exhaust fans were used to move air in and out of buildings. While providing more reliable **source control ventilation** and some control of **general background ventilation** rates, these systems still relied on a leaky building enclosure. The air exhausted from the building was replaced by air "leaking" back into the building. The "exhaust-only" approach affords no control of where the make-up air comes from. Instead of being fresh air, the make-up air for apartment exhaust may be drawn through building cavities and from neighboring apartments.

Today, our goal is to make our building enclosures air-tight and avoid reliance on random leaks. Therefore, ventilation systems need to include supply air. Balancing supply and exhaust air in a building supports good **indoor air quality (IAQ)** which is key to providing healthy homes. By removing carbon dioxide, contaminants produced in cooking activites, VOCs and excess moisture/humidity, the ventilation system improves indoor air quality and increases the long-term durability of the building by limiting the opportunity for mold/mildew growth.

BASIS OF DESIGN

In substantial rehab or new construction, building codes will dictate the amount of fresh air to be supplied to buildings and units **(general background ventilation)**. They also establish the amount of air that needs to be exhausted **(source control ventilation)** from building spaces where airborne contaminants are often generated such as laundry and trash room, as well as kitchens and bathrooms within apartments. While codes dictate the volume rate of ventilation, the codes do not provide for ventilation effectiveness. For example, the code provisions do not ensure that intended fresh air actually reaches apartments nor that source control ventilation actually captures or contains airborne contaminants. The codes also do not require ventilation systems to be optimized for operation expense and energy use.

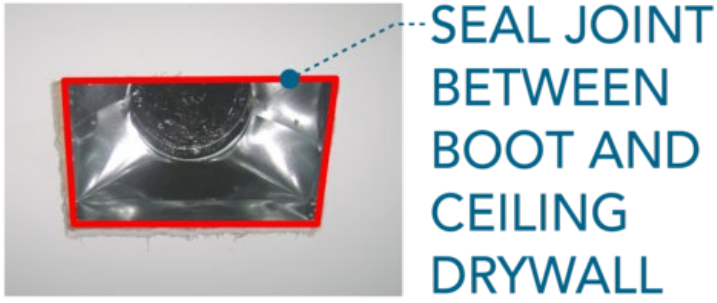
Because of this, POAH needs engineers for substantial rehab or new construction projects to design a ventilation system that is not only code compliant but also effective and energy efficient. The ventilation design will be reviewed by Design & Building Performance and the energy consultant (if applicable). The engineer will also be asked to provide data on ventilation system energy use, flow rates and other system parameters as means to demonstrate the energy efficiency and effectiveness of the design.

For property managers and maintenance staff replacing fans or roof top units, please use the preferred products highlighted below. If new equipment is being installed contact POAH for guidance.

REQUIREMENTS

DESIGN METRICS WILL BE MEASURED DURING AND POST CONSTRUCTION

- **DESIGN PROCESS:** As part of the design work, the mechanical engineer must provide projected energy consumption impact for any modification or new system to be installed. Energy consumption will be verified with energy data post construction.
- **DUCT TIGHTNESS:** When new ductwork is installed the duct leakage shall not exceed the sum of 2.5 CFM50 per register per shaft, and 2.5 CFM50 per floor per shaft during testing. Duct tightness will be measured during construction.
- **FAN EFFICIENCY:** Engineer to provide CFM/watt per specified equipment as well as for the ventilation system in aggregate. Fan efficiency will be measured during building commissioning.
- **AIR CHANGES:** Engineer to provide CFM/bedroom in terms of design ventilation flow to/from apartments as well as for the building ventilation in aggregate. Air flow will be measured during building commissioning.
- **VENTILATION SYSTEM LEAKAGE CONTROL:** For fans installed directly through wall or ceiling finishes (e.g. ceiling bath fan), the fan housing shall be sealed to the interior finish.
- **MOCK UP:** A mock-up must ☐e completed to measure sone level of new fans + existing ductwork.



BASIS OF DESIGN

PREFERRED STRATEGIES

*****ALL VENTILATION SYSTEM DESIGNS SHOULD BE REVIEWED BY THE DESIGN & BUILDING PERFORMANCE DEPT. USE OF STRATEGIES OTHER THAN THE PREFERRED STRATEGIES REQUIRE APPROVAL FROM THE DESIGN & BUILDING PERFORMANCE DEPT.*****

The sections below outline preferred and acceptable ventilation strategies. The strategies are arranged as follows:

APARTMENT OR IN-UNIT VENTILATION STRATEGIES:

- Apartment Source Control Ventilation
- Apartment Background Ventilation

COMMON AREA VENTILATION STRATEGIES:

- Common Area Source Control Ventilation
- Common Area Background Ventilation

EXISTING CONDITION STRATEGIES:

- Existing Conditions Ventilation

APARTMENT SOURCE CONTROL VENTILATION

BATHROOM EXHAUST:

- **Every bathroom must exhaust to exterior by using one of the following systems:**
  - exhaust fan in the ceiling vented to exterior
  - or, exhaust grill connected to a roof top fan that exhausts to exterior
- Fans should be low noise. **Sone (measurement of sound) should be 0.9 maximum.**
  - Please evaluate ductwork. The low sone cannot be achieved if ductwork is loose, or uninsulated. Exhaust ductwork
    should also be as short and straight as possible, minimizing the number of bends and angles. If flexible duct is used, the flexible duct shall be pulled taught and excess duct length shall be eliminate.
  - A mock-up must be completed to measure sone level of new fans + existing ductwork.

- Bathroom exhaust fans should **run continuously at a low CFM (~30) and be capable of boosting to higher CFM** when switched on. The low speed setting is typically set at the fan. By running the fan at a low speed continuously the humidity can be controlled in the space without resident intervention. Excessive humidity leads to mold.
  - The boost capability shall include a "delay-off" operation whereby the fan continues to operate for an additional ~15 minutes after the boost is turned off.

BASIS OF DESIGN

  - In order to provide separate background and boost capabilities, there must be two wires to the fan. If the project is a simple fan replacement with no re-wiring, the separate boost capability may be achieved through a special wall switch or controller at the switch box. Contact POAH Design + Building Performance for other options.
- The cost to run a bath fan continuously cost less than $3 dollars a month at ¢10 cents a kWh.
- There are add-on modules for the Panasonic fan that can be used instead of continuously running. Occupancy sensors and timers can be programmed to help manage humidity and insure long term durability and good IAQ.
- Airtightness measures:
  - Use mastic or tape to seal any gaps between the ductwork and/or fan housing before installing fan or grill.
  - Seal between ductboot and sheetrock.
- After installation the fan should be measured to confirm appropriate draw.

BATHROOM EXHAUST THROUGH SHARED EXHAUST RISER AND ROOF-TOP FAN:

This approach generally employs continuous exhaust flow to achieve source control of excess humidity and odors. Where a shared exhaust riser and roof-top fan are used to provide continuous exhaust from apartment bathrooms, POAH prefers the following measures:

- Seal the shaft to 5cfm at 50 Pascals per floor or less
- Install constant air flow regulators (CARs) for each exhaust intake grille to control exhaust flow rate provided
- Install direct drive exhaust riser fan with barometric control to maintain duct pressure within parameters for CAR operation.

SAMPLE PRODUCTS:

Panasonic
WhisperGreen Select
CFM: 30 - 110
Sone: 0.3 - 0.8
CFM/Watt: 11.5 - 15.1
Manufacturer Number:
FV-05-11VKS1

Panasonic
WhisperSense

Motion/Humidity Sensor
CFM: 80
Sone: 0.3
CFM/Watt: 5.1
Manufacturer Number:
FV-08VQC5

MAINTENANCE:

- Fan should be cleaned every year at minimum:
  - Grill only: Remove register and clean. Clean inside reachable ductwork.
  - Fan: Remove dust and dirt from the fan body using a vacuum, a dirty fan can cause noise issues and loss of efficiency.

BASIS OF DESIGN

KITCHEN EXHAUST:

Building codes allow for kitchen exhaust ventilation to be either 1) intermittent or 2) continuous. Intermittent kitchen exhaust is preferred as it 1) provides for more effective source control (capture efficacy) and 2) results in less aggregate ventilation load.

Codes also allow for kitchen exhaust through either a capture hood over the cooking appliance or through a general area exhaust grille located in the cooking area. The capture hood is preferred as this approach has the potential for reasonably effective capture efficacy of cooking effluent. The general area exhaust is not effective.

- **Every kitchen must exhaust to exterior by using one of the following systems:**
  - Range hood with integral fan exhausted directly to exterior
  - or, range hood connected to a shared exhaust riser served by a rooftop fan exhausted to exterior
- Sone sound should be maximum 7.
- Kitchen exhaust fan ductwork should never terminate into attic space.
- Kitchen exhaust fan should include back draft damper.
- CFM rating should be minimum 100.
- Assist capacity required for buildings 3 stories and above. May be accomplished using an In-line fan or a roof top unit (RTU).
- Range hood should be deep enough that Range Queen, when installed, is not visible. Range Queen Product information is found within the Rangehood BOD section. See link below.

SAMPLE PRODUCTS:

Sample products are located in the **RANGEHOOD** page of the **APPLIANCES** section:

SEE SAMPLE RANGEHOODS HERE

https://www.poahbod.org/appliances#appliances-index-range-hood

MAINTENANCE:

- Range hood should be cleaned every year at minimum:
  - Clean grille.
  - Clean filter.

BASIS OF DESIGN

APARTMENT BACKGROUND VENTILATION

BALANCED VENTILATION WITH RECOVERY:

Balanced energy recovery ventilation (ERV) or heat recovery ventilation (HRV) is preferred in all climates excepting Climate Zone 2a. There are three different general approaches to providing this kind of background ventilation to apartments:

- Individual apartment ERV or HRV
- Floor-by-floor (or other sub-section of the building) ventilation with direct ventilation supply to each apartment
- Central ERV or HRV system with direct supply to apartments

INDIVIDUAL APARTMENT ERV OR HRV

Individual apartment ERV/HRV offers the advantage of apartment-level control, off-the-shelf products and minimized risk of cross-contamination between apartments. It brings the challenges of distributed in-unit equipment that requires periodic maintenance. Ventilation using a separate ERV/HRV for each apartment will require at least one through-wall penetration per apartment for the fresh air intake and stale air vent. However, this approach supports compartmentalization as vertical shafts between floors and penetrations through interior separations are not needed for general apartment ventilation.

SAMPLE PRODUCTS:

DUCTED ERV/HRV WITH CROSS-FLOW OR COUNTER-FLOW ENTHALPY/HEAT EXCHANGE CORE:
These systems will require one or more exterior wall penetrations per apartment. The ducting allows for distribution of ventilation air and can provide a degree of air mixing (to prevent stagnation) within the apartment. (The ventilation may also be integrated with heating and cooling ductwork, provided 1) proper design and controls are implemented to minimize air handler fan energy 2) allow ventilation distribution and 3) prevent short-circuiting of the ventilation supply to the stale air exhaust) If sized properly, these systems can provide bathroom source control ventilation. Typically installation of these systems will occur in soffits or a ceiling plenum in which to run ductwork as well as an area (e.g. upper part of closet) where the equipment could be located. The product shown is RenewAire.

ON THE HORIZON:
As of Spring 2017, two manufacturers are beginning to offer heat pump heat recovery units to the US market. These units offer ventilation and dehumidification with the ability to provide a modest amount of

heating and cooling. Once these products achieve a successful track record, they will offer an interesting solution for complete apartment-side conditioning and ventilation for low load buildings.

FLOOR-BY-FLOOR ERV/HRV

This approach can reduce or eliminate the need for vertical ventilation ducts in a building. Economies of scale can be achieved by sharing ventilation equipment among several apartments. These economies may afford the installation of high quality and highly efficient equipment. Some ventilation equipment may offer economizer capabilities to provide free cooling. This approach may present challenges in balancing the ventilation airflows to each apartment. If sized properly, these systems can provide bathroom source control ventilation. Maintenance requirements of the ventilation system are met without the need for access to apartments. This approach entails a challenge of routing ductwork horizontally through corridors (above the ceiling) and of crossing fire separation assemblies with ductwork. In existing buildings, the deck-to-deck height may not be able to accommodate horizontal ductwork along corridors.

CENTRAL ERV/HRV

This approach may be most suitable for existing buildings with existing exhaust and ventilation supply risers through the building. This approach allows for minimizing the number of penetrations through the exterior enclosure but will require many penetrations through assemblies within the enclosure. Economies of scale can be achieved by sharing ventilation equipment among several apartments. Larger and more sophisticated equipment may offer useful functionality such as enthalpy economizer functionality, variable speed demand control, etc. Typically, commercial-sized ERV/HRV equipment offers only modest recovery efficiency (note the exception of Ventacity with its exceptional performance). Maintenance and controls may require specialized skills. A central ERV/HRV will require vertical shafts through the building. This approach will present challenges in balancing the ventilation airflows to each apartment. In existing buildings, the deck-to-deck height may not be able to accommodate horizontal ductwork along corridors.

- Bathroom exhaust risers should be connected to the ERV/ HRV.
- Rangehood kitchen exhaust risers should NOT be connected to the ERV/ HRV due to grease buildup.

COMMON AREA SOURCE CONTROL VENTILATION

The following preferred strategies apply to trash rooms, janitor closets, elevator machine rooms and other areas outside of apartments where airborne contaminants are generated.

- Seal the shaft to 5cfm per floor or less (measured at 50 Pascals)
- Install constant air flow regulators (CARs) for each exhaust intake grille to control exhaust flow rate provided
- Install direct drive exhaust riser fan with barometric control to maintain duct pressure within parameters for CAR operation.

BASIS OF DESIGN

COMMON AREA/CORRIDOR BACKGROUND VENTILATION

Preferred strategies will ventilate corridors as per the requirements of that space plus additional supply airflow commensurate with common area exhaust of spaces such as trash rooms, janitor closets, elevator machine rooms that are directly attached to the corridor. The ventilation design for new and renovation projects shall not employ the corridor as a make-up air plenum for apartment exhaust (unless the project is over 54 ft in height and is in Chicago where physics of air are different – hence "Windy City").

HALLWAY VENTILATION BY ERV/HRV:

Providing hallway ventilation by ERV or HRV will significantly reduce the thermal load of the hallway ventilation air. It will bring a slight increase in fan energy however this may be mitigated by high efficiency equipment.

- **NEW CONSTRUCTION:** do not install combustion equipment with an efficiency rating below 83%
- **REHAB:** do not install a new piece of equipment with an efficiency rating equal to or less than the efficiency rating of the unit it is replacing.

MAINTENANCE:

- The manufactures' guide should be followed for ongoing maintenance. Perform the following at least once a year:
    - Clean/replace filters regularly - typically 3 to 6 times a year depending on equipment.
    - Check belt drives for wear, tension, alignment, debris
    - Tension belt drives per manufacturer's directions
    - Clean motor and lubricate if necessary
    - Clean heating / cooling coils
    - Clear burner orifices

HALLWAY SUPPLY:

- Applies to buildings with corridors
- Across the portfolio the fresh air systems simply supply air into corridors with the expectation that the air will move through the gap below the door. This is against the code in most locations for fire and smoke reasons. It is also ineffective in making up air lost in kitchen and bathroom exhaust systems.
    - If replacing a make-up air unit, size only for the corridor ventilation and make-up of exhaust in directly attached building services such as laundry, trash rooms, elevator machine rooms, etc. This right sizing typically results in a significant reduction in capacity. Do not simply replace the MAU with an in-kind product.
    - Weather-strip all apartment doors.
- The air provided to common spaces is should be tempered or pre-conditioned.
    - The hallway supply may be tempered or "pre-conditioned" by energy recovery from other common area or apartment exhaust

BASIS OF DESIGN

- Cooling and dehumidification capacity should be provided for hallway supply ventilation systems in climate zones 5 or lower.

- Ideally ventilation system replacement work would not be completed on a component by component basis. In most of our properties it is preferred that the following occurs to update and drastically improve the performance, both from an indoor air quality and energy efficiency perspective, at one time
  - Air seal the existing ductwork
  - Right size the roof top exhaust fans with direct drive, ECM fans
  - Install CAR dampers at register locations or branch take-offs (only after ductwork is sealed. Applies to buildings 3 stories and above).
  - Right size the corridor MAU to the required hallway ventilation
  - Individual apartments shall be air sealed and compartmentalized (See Building Enclosure section).

MAINTENANCE:

- The manufactures' guide should be followed for ongoing maintenance. Perform the following at least once a year:
  - Clean/replace filters regularly – typically 3 to 6 times a year depending on equipment
  - Check belt drives for wear, tension, alignment, debris
  - Tension belt drives per manufacturer's directions
  - Clean motor and lubricate if necessary
  - Clean heating / cooling coils
  - Clear burner orifices

WEATHER-STRIP ALL UNIT ENTRANCE DOORS:

Independent of which common are ventilation strategy is used, all unit entrance doors need to be weatherstripped to maintain unit compartmentalization.

SAMPLE PRODUCT:

Q-Lon
Door Weatherstripping
at **Head and Jamb**
Polyethylene-clad urethane foam secured to a PVC carrier.

Pemko
Door Weatherstripping
at **Sill**
36" Fire-Rated Door Sweep Aluminum
Manufacturer Number: 307AV36

BASIS OF DESIGN

EXISTING CONDITIONS

LAST AND LEAST FAVORABLE OPTION

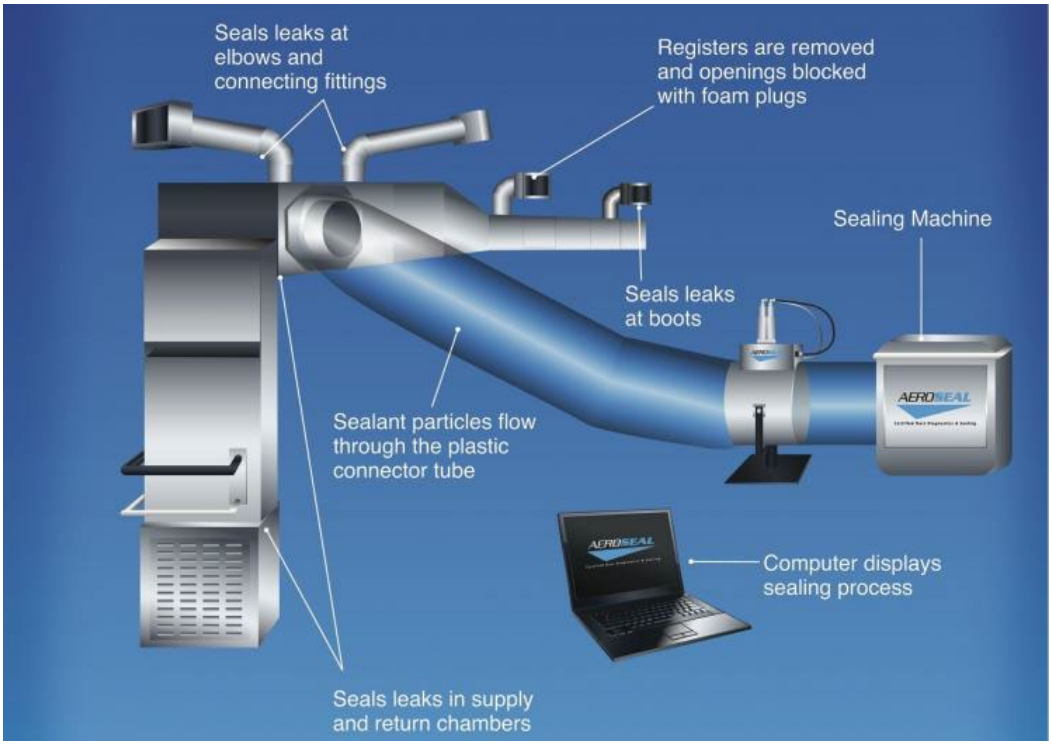
If there is no feasible way to vent directly into units (ie because hallway ceiling height is too low), the following configuration may be allowed. If air is supplied to the corridor in equal (or more) volume to the volume of air exhausted from the apartment units, this is NOT a balanced system. Instead, it creates an unbalanced supply ventilation system for the corridors and an unbalanced exhaust ventilation system for the apartments. Supplying pre-conditioned, filtered outdoor air to the corridors only marginally improves the situation for the adjacent apartments with the unbalanced exhaust ventilation systems. In very few locations it is permissible to assume air supplied to corridors will enter units though an undercut door. Most fire codes don't allow this. This also eliminates any compartmentalization from unit to hallway.

The steps below are suggested for situations where direct ducted supply air to units or individual/HRV/ERV are not possible.

EXHAUST SYSTEM IMPROVEMENTS:

- Aero seal (or equivalent) all ducts. A big portion of what exhaust fans are pulling from the building is duct leakage. If you can substantially eliminate that, then you could meet the ventilation requirement with smaller equipment and have less air to “balance” on the other side.
- Bathroom exhaust: this can be continuous. This can be the background ventilation for the apartment as well as the source control for the moisture and odor generation in the bathroom. Typically, for anything larger than a studio, the background ventilation rate for the apartment will be larger than the required continuous duty source control needed for a bathroom. Use a constant airflow regulator, sized to the apartment, behind the bath exhaust grille.

BASIS OF DESIGN



- Kitchen exhaust changes from continuous to intermittent through a range hood. This requires fan powered range hoods. 150-200 cfm of exhaust at a range hood with good capture efficacy can remove odors and contaminants (moisture, heat, fine particles, NOx, SOx, etc) reasonably well. Kitchen exhaust through a grille on the wall of a kitchen is really not much better than cracking a window in the living room. The intermittent exhaust will yield a MUCH lower 24/7 average exhaust rate, (more effective contaminant capture and much less energy use). If an engineer insists on making up this intermittent range hood exhaust flow (150-200 cfm per range hood) make sure a realistic diversity factor is used and that the supply is either averaged over 24hr period or the supply ventilation can ramp up during periods of peak range hood use and then back down. The riser fan should be variable speed and controlled by a barometric sensor in the exhaust riser. Maintain a slight negative in the exhaust riser so that exhaust goes up the riser and not back-flow into another apartment. Not too negative because we don't want range hoods to continually suck at each kitchen. This approach will not work unless ducts are sealed between units and between unit and corridors.
- Compartmentalize between units and between unit and corridors. This will reduce the incidence of airborne stuff being exchanged between units and will make the air in the units and the source of make-up air more likely to be controlled.

With all of these improvements, there is now much less air being sucked out of the building. There would be less fan energy, better contaminant control, less thermal energy to heat the air drawn in by the exhaust, and smaller equipment on the roof.

BASIS OF DESIGN

SUPPLY SYSTEM IMPROVEMENTS:

Supply fresh air to the corridors based on square feet and CFM exhausted from corridor ventilation (something like 6 cfm per 100 sf), trash rooms, janitor closets and elevator machine rooms (if the ventilation supply rate to the corridor is more than the exhaust from connected trash rooms and such, then you shouldn't need to bump up the supply). The design supply ventilation rate drops to about 1/5 or less of what it previously was.

More likely, you're to have a situation (especially in Chicago if the building is over 53ft high) where engineers insist on supplying to the corridors an equal volume to the exhaust from the apartments. This is far from optimal and in no way represents a balanced system.

1. Aero seal (or equivalent) all supply ventilation shafts. A big portion of what supply fans are pushing into the building is not making it to the supply diffusers/grilles. If you can substantially eliminate the leakage, then you could meet ventilation requirement with smaller equipment and have less air to precondition at the building owner's expense.
2. Gather the apartment bathroom exhausts to an ERV that will pre-condition the supply ventilation air. Use a high efficiency ERV (ex: Ventacity) so that the ventilation air is delivered at close to neutral temperature.
3. Carefully balance the supply rates at each grille and periodically re-balance or use CAR devices.
4. Separate heating and cooling from the ventilation air. There is no need for a furnace/DX RTU. Use an ERV that can be carried through a roof hatch or the roof access door.
    - Use fan coils or other heating or cooling in corridors. Source in each corridor making each corridor its own zone (or pair of zones).
    - Dehumidification should be provided. It could be provided either through the central ventilation unit or with the corridor heating and cooling units.

Again, the unit entry doors should be gasketed and weather stripped. And so should doors to stairs, doors to trash rooms, doors to elevator lobbies…

BASIS OF DESIGN

WINDOWS

GENERAL INFORMATION:

- Selecting the right windows can save energy and affect resident comfort.
- Window installation will have an impact on building durability (water control) as well as energy use and resident comfort.
- There are three main components of windows that affect performance: the glazing, the frame, and the spacer (material or system that separates the glass panes).
    - **Window frames** are available in a wide range of materials. Common materials for windows include wood, vinyl, aluminum, and fiberglass.
    - **Glazing** choices affect how much light the window will transmit and how much of the sun's heat they allow into interior spaces, and how well they prevent the flow of heat.
    - The **spacer** is the component that separates two panes of glass from one another and holds them at a fixed separation. Older double-pane glazing units typically have metal spacer that are highly conductive. This can increase the risk of condensation on the glass near the window frame. Newer high performance windows have thermal spaces that help maintain resistance to heat flow at the perimeter of the glazing unit.
- Window rating are based on three primary classifications:
    - **U-factor**, the amount of heat that a material conducts (lower is better).
    - **Solar Heat Gain Coefficient (SHGC)**, a measure of how much of the sun's heat energy is transmitted through the glass.
    - **Visual Transmittance (VT)**, is the percentage of visible light transmitted through the glass.
- Two other voluntary criteria (not required to be included on NFRC labels) are also important to window performance:
    - Air leakage
    - Condensation resistance

Considerations for historic buildings:

- Historic buildings may have restrictions on the type (operation) of window, the frame material, and certain panning details.
- For projects using historic tax credits, all window details will have to be reviewed by local governing authorities.

BASIS OF DESIGN

REQUIREMENTS

SAFETY REQUIREMENTS:

- POAH and POAH Communities Window Limiter Policy: Windows should be limited to opening 4" maximum.

  CLICK HERE FOR THE WINDOW LIMITER POLICY

  https://static1.squarespace.com/static/57add27ac534a5d1b9a205a7/t/58dd5adfa5790a2b20301b21/1490901728393/Window+Limiting+Device+Policy+and+Implementation+11-12-2014.pdf

REQUIRED DETAILS:

- For each unique window type or wall assembly provide details for the head, sill and jamb conditions.
- The details must clearly demonstrate the water control for the window opening (flashing and drainage).
- The details must also clearly demonstrate how the air barrier of surrounding assemblies will be transferred to the window.

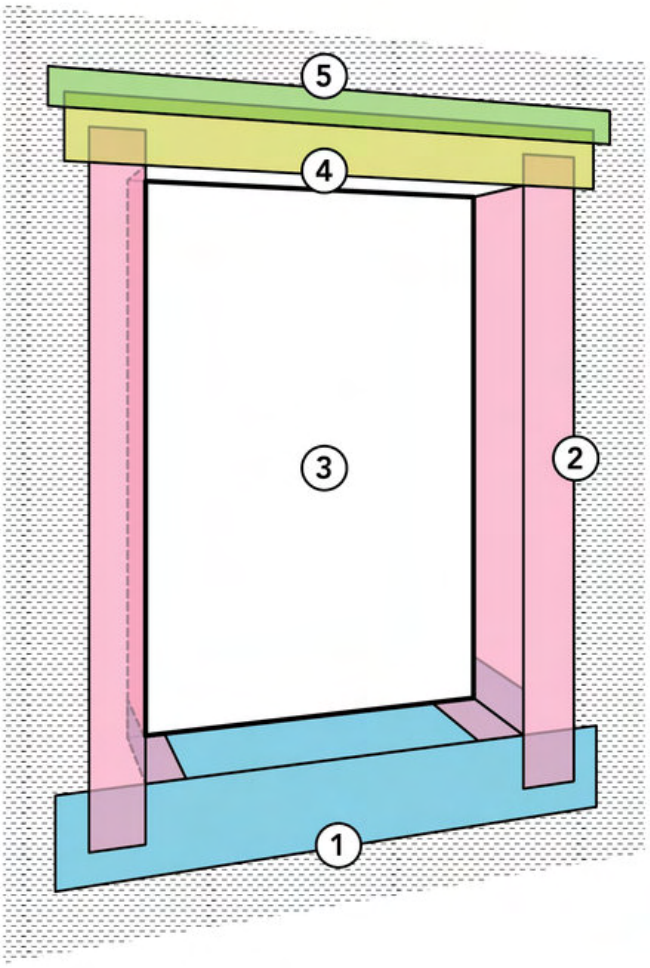
INSTALLATION REQUIREMENTS:

- Window openings shall be fully flashed with flashing at the sill and jambs of the window opening.
- The window opening shall have provision to drain any incidental water on the flashing in the window opening. The sill flashing shall drain over the drainage plane of the wall or over the wall cladding.
- The window shall be fully air sealed to the window opening at the entire **interior** perimeter of the window frame.
- For mulled window units, the junction of windows shall include:
  - Provision for drainage from the joint
  - Continuous air barrier across the interior side of the joint

BASIS OF DESIGN

WINDOW FLASHING DIAGRAM

INSTALL FLASHING FROM BOTTOM UP



STEP 5
FLASHING TERMINATION
Terminate the top edge of flashing with sheathing tape (typical for all bituminous or butyl self-adhered flashing membranes)

STEP 4
HEAD FLASHING
Head flashing laps over jamb flashing and over window head flange

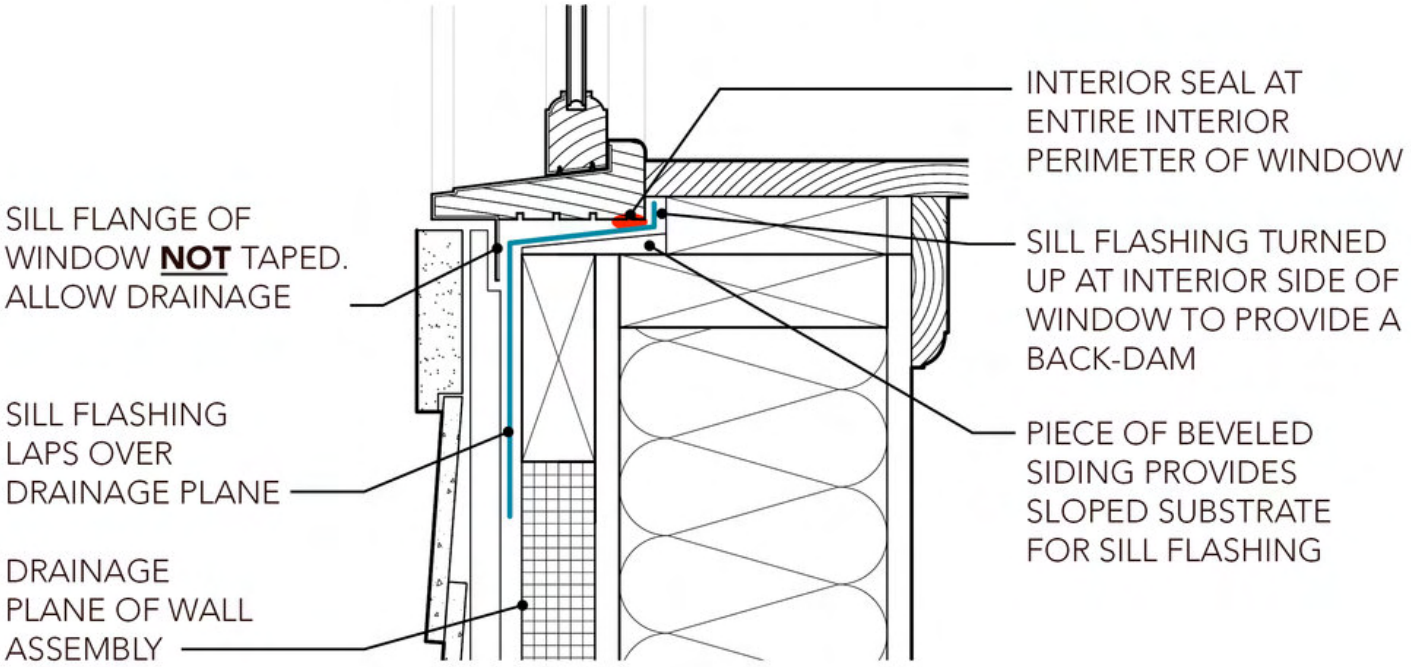
STEP 3
WINDOW UNIT
Install window unit in opening

STEP 2
JAMB FLASHING
Jamb flashing laps over sill flashing

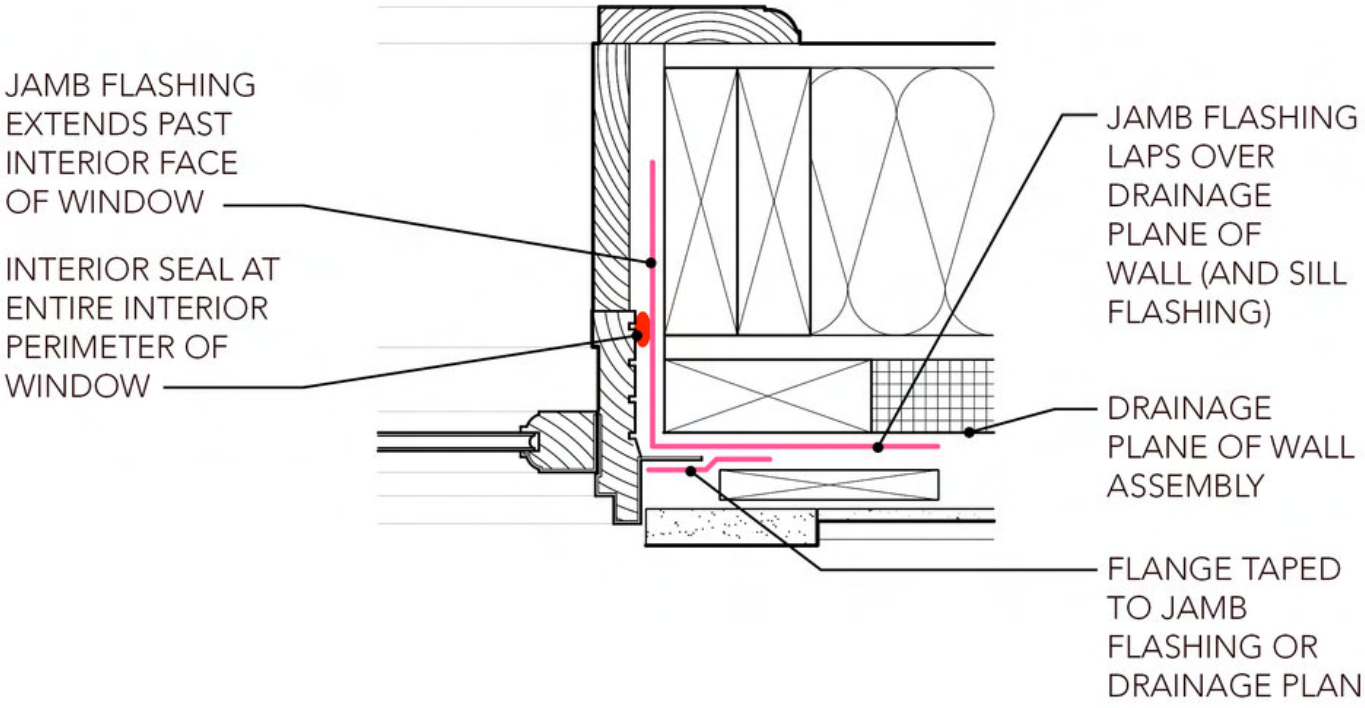
STEP 1
SILL FLASHING
Sill flashing turns up at jambs

BASIS OF DESIGN

WINDOW FLASHING AT SILL



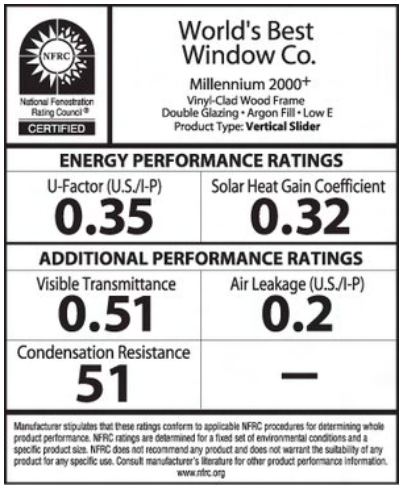
WINDOW FLASHING AT JAMB



BASIS OF DESIGN

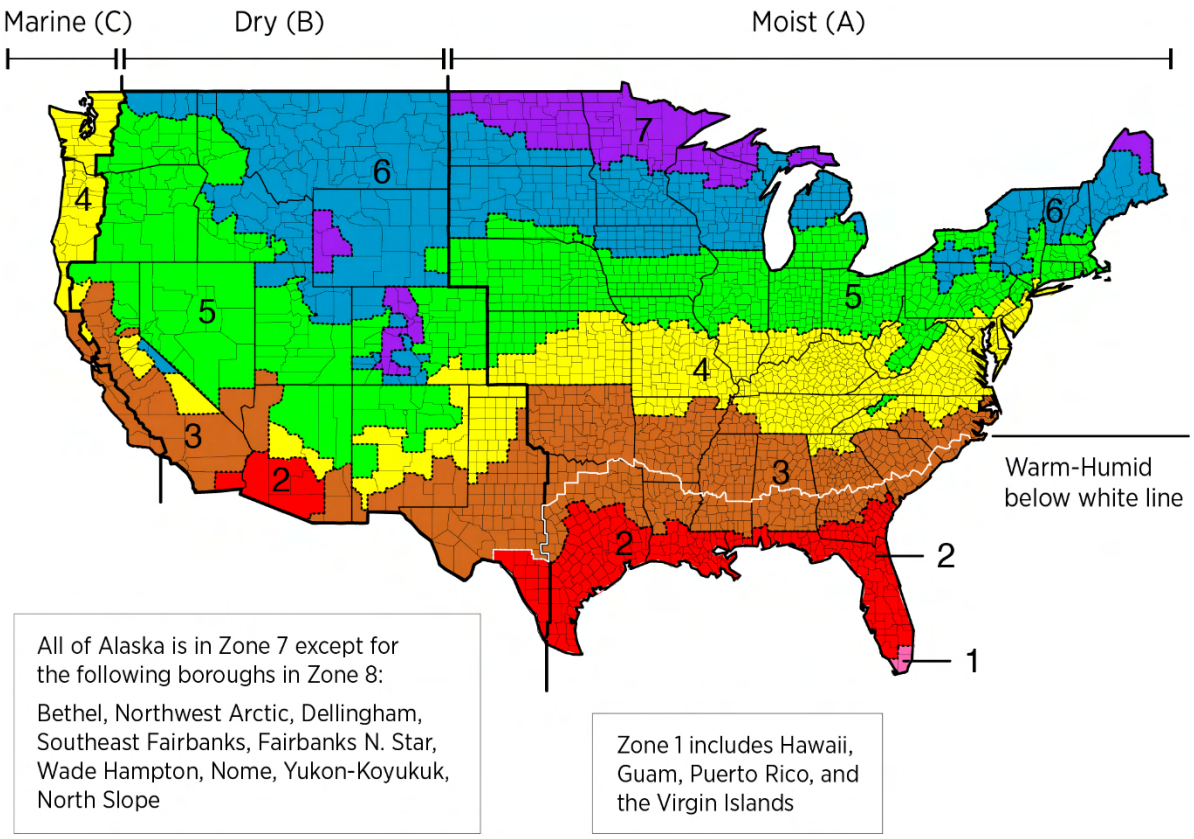
PERFORMANCE REQUIREMENTS:

- Windows must comply with **local energy code**.
  - To verify if specific window energy properties comply with the local code requirements, look for the **NFRC label**.
  - The National Fenestration Rating Council (NFRC) label is needed for verification of energy code compliance. The NFRC label displays whole-window energy properties and appears on all fenestration products which are part of the ENERGY STAR program (www.nfrc.org).
- Windows must be **ENERGY STAR** certified. Often energy star certified windows meet or exceed energy code requirements.
- Proper window installation is necessary for optimal performance, to avoid air and water leakage. Always follow manufacturers' installation guidelines and use trained professionals for window and skylight installation.



BASIS OF DESIGN

- Window performance is based on location and climate. See below for climate zone requirements. To find your climate zone, use the following link: https://basc.pnnl.gov/images/iecc-climate-zone-map

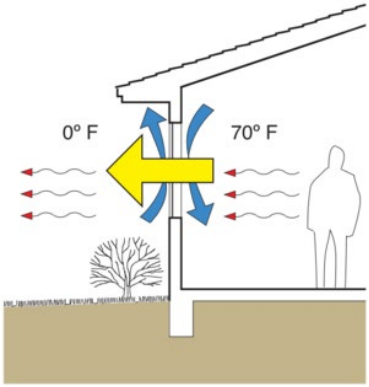


- Windows must meet the following U-Factor and Solar Heat Gain Coefficient (SHGC) requirements.

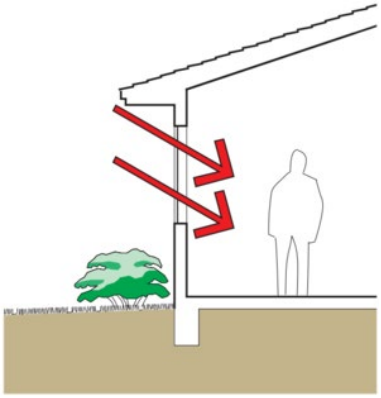
Climate Zone	Fenestration U-Factor	Maximum SHGC
1	0.50	0.25
2	0.40	0.25
3	0.30	0.25
4	0.29	0.40
5	0.23	0.40
6	0.21	0.40
7	0.17	Any

BASIS OF DESIGN

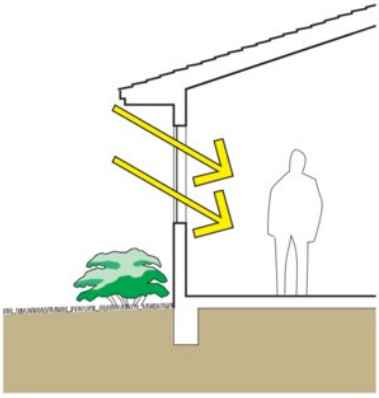
TERMS & VOCABULARY:



U-Factor
The rate of heat loss is indicated in terms of the U-factor (U-value). This rate of non-solar heat loss or gain through a whole window assembly is measured in Btu/hr-sf-°F. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating value.

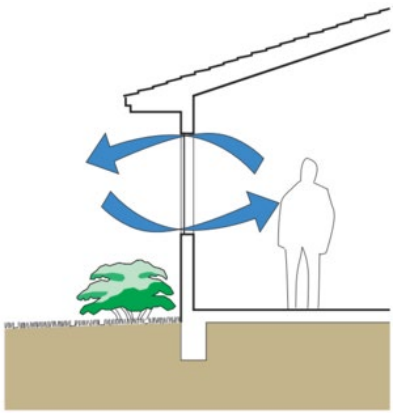


Solar Heat Gain Coefficient (SHGC)
The SHGC is the fraction of incident solar radiation admitted through a window. SHGC is expressed as a number between 0 and 1. The lower a window's solar heat gain coefficient, the less solar heat it transmits. Whether a higher or lower SHGC is desirable depends on the climate, orientation, shading conditions, and other factors.



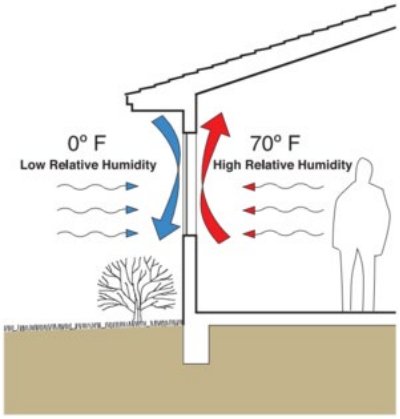
Visible Transmittance (VT)
The VT is an optical property that indicates the amount of visible light transmitted. VT is a whole window rating and includes the impact of the frame which does not transmit any visible light. While VT theoretically varies between 0 and 1, most values are between 0.3 and 0.7. The higher the VT, the more light is transmitted.

BASIS OF DESIGN



Air Leakage (AL)

AL is expressed in cubic feet of air passing through a square foot of window area (cfm/sf). The lower the AL, the less air will pass through cracks in the assembly. AL is very important, but not as important as U-factor and SHGC.



Condensation Resistance (CR)

CR measures how well a window resists the formation of condensation on the inside surface. CR is expressed as a number between 1 and 100. The higher the number, the better a product is able to resist condensation. CR is meant to compare products and their potential for condensation formation. CR is an optional rating on the NFRC label.

Further Resources:

- Efficient Windows Collaborative
  - http://www.efficientwindows.org/
- The National Fenestration Research Council
  - http://www.nfrc.org/