



Inspection Insights



Inspection Insights

Increase Knowledge

Establish Credibility

Learn Hands On

Increase Home Sales

Introduction



Bruce Kelly

President of a Local
Inspection Company

ASHI Inspector

NEHA Certified

EDI Certified

- **Real Estate License**
- **Started Inspections in 1990**
- **Licenses held for inspection company**
- **Pilots License**
- **Hometown**
- **Attended CMSU and attained my Bachelor's degree from William Jewell College**
- **Second Generation Builder**
- **Owned and Operated a Residential and Commercial Construction Company for 23 Years**

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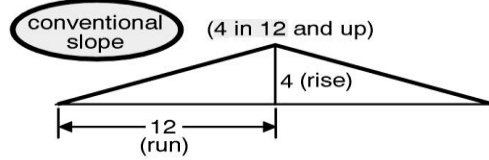
Roof



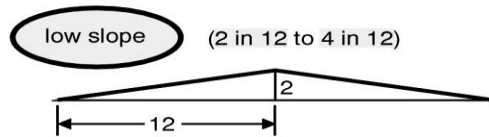
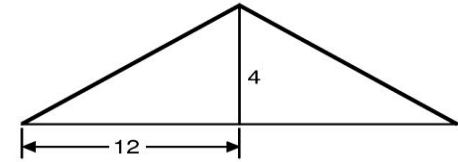
Roof

Roof slopes

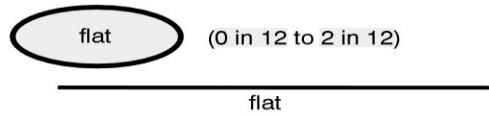
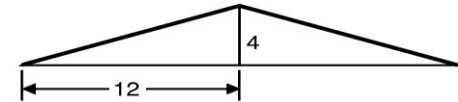
slope=rise/run



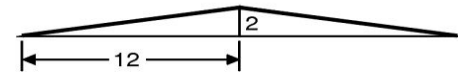
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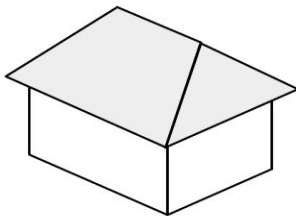
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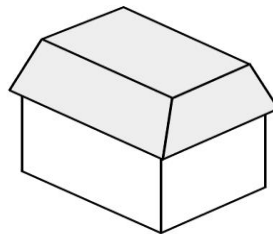
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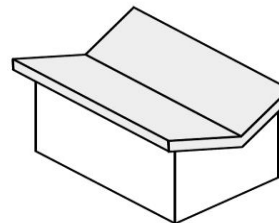
Steep roof types



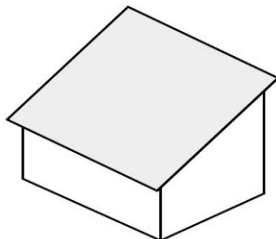
hip



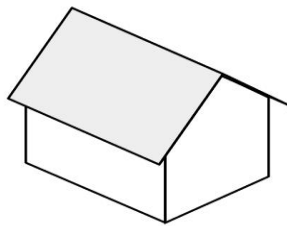
mansard



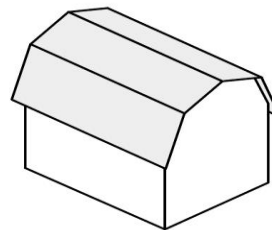
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shed



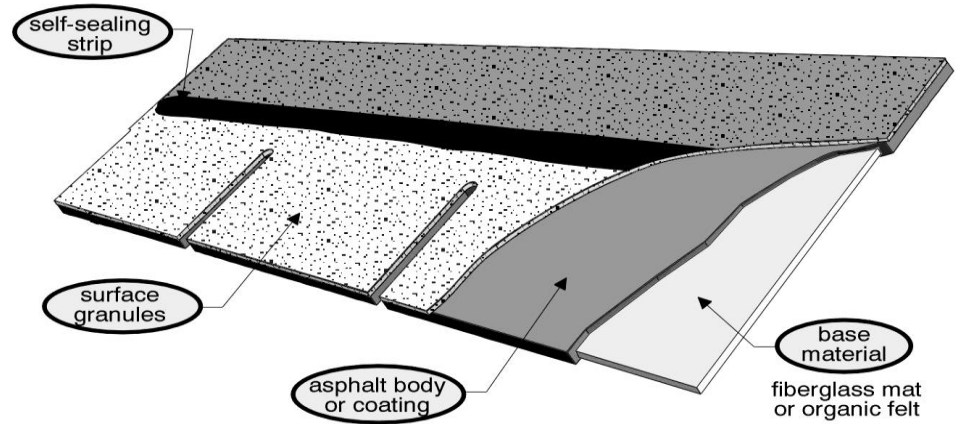
gable



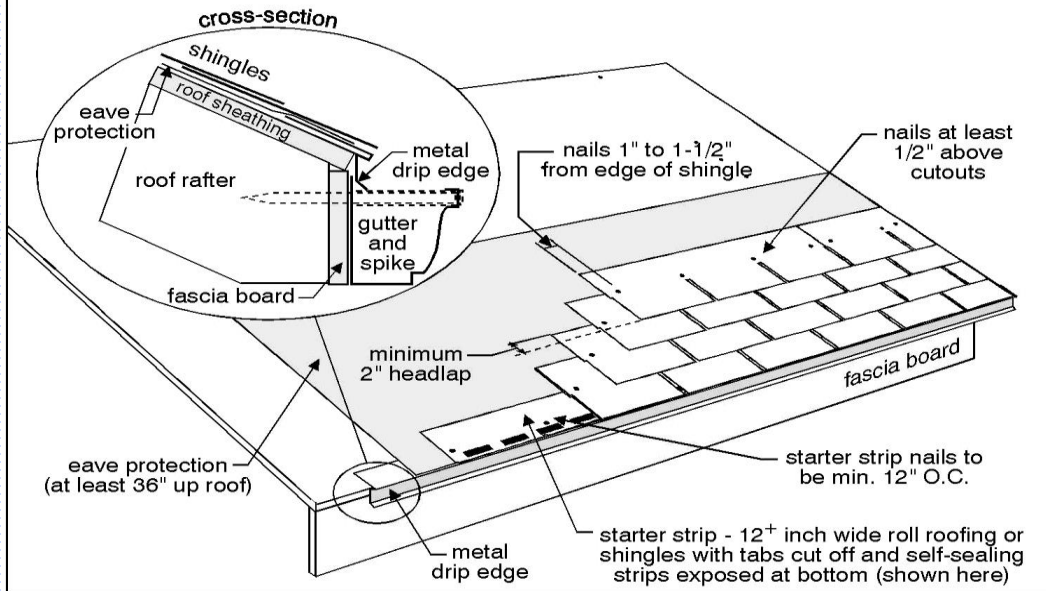
gambrel

Roof

Asphalt shingle composition



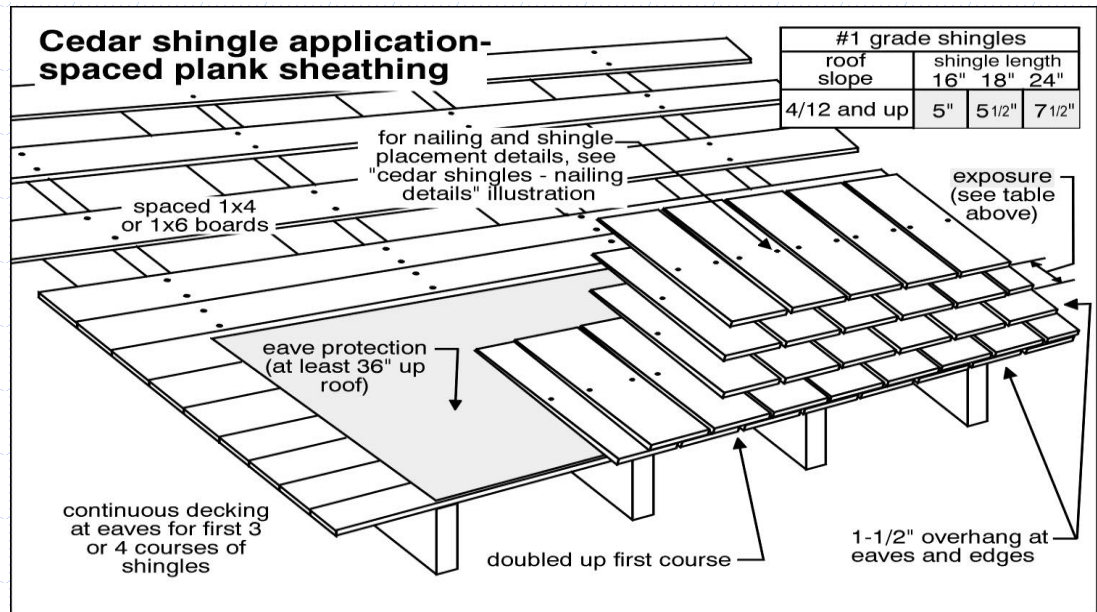
Typical asphalt shingle application - showing metal drip edge



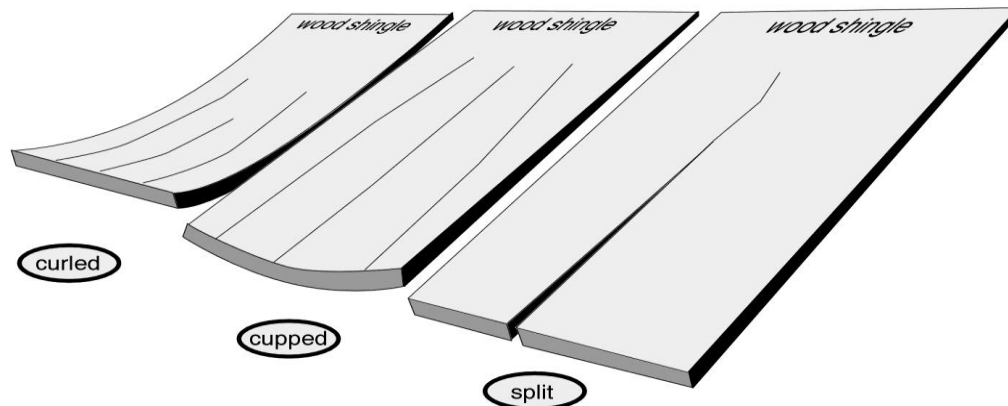
Roof



Roof



Curling, cupping and splitting wood shingles

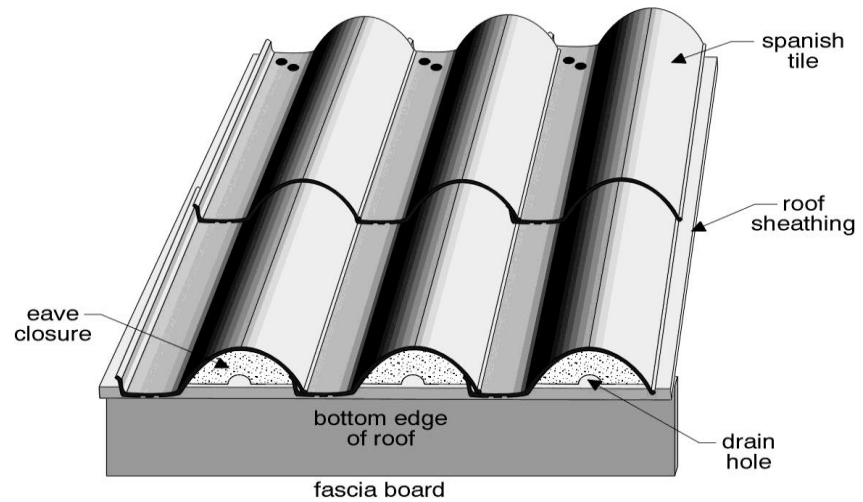


Roof

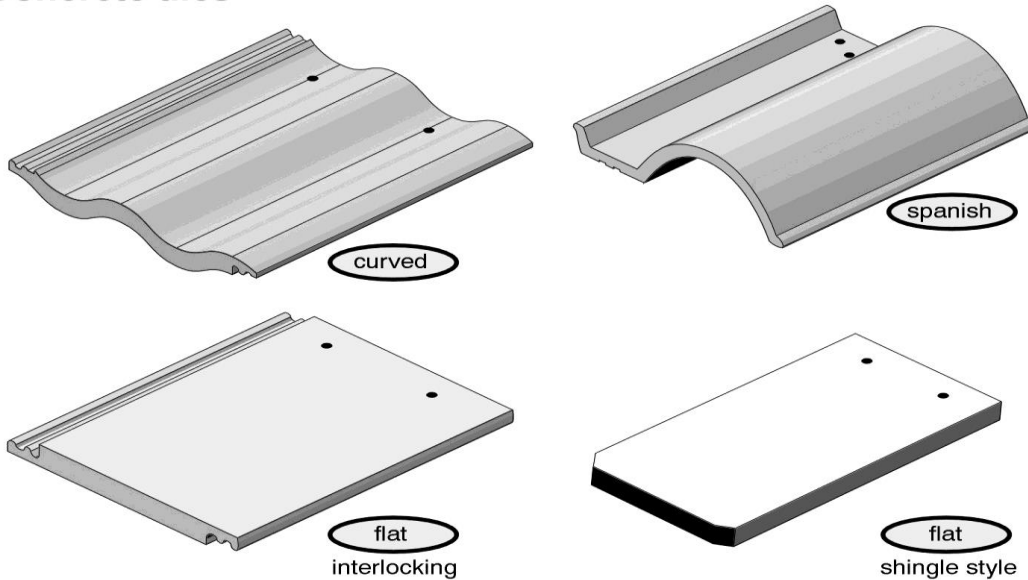


Roof

Eave closures for spanish or mission tiles



Concrete tiles

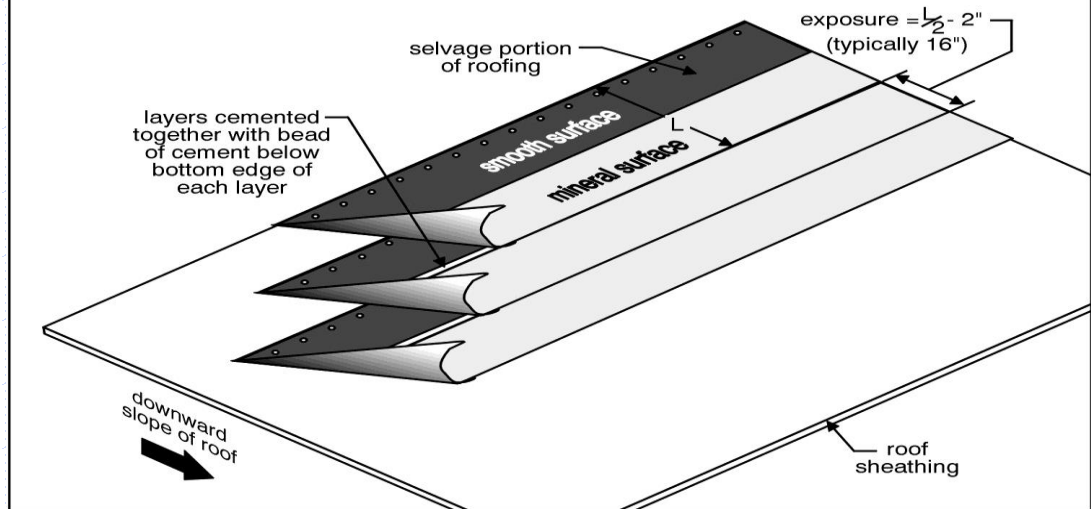


Roof



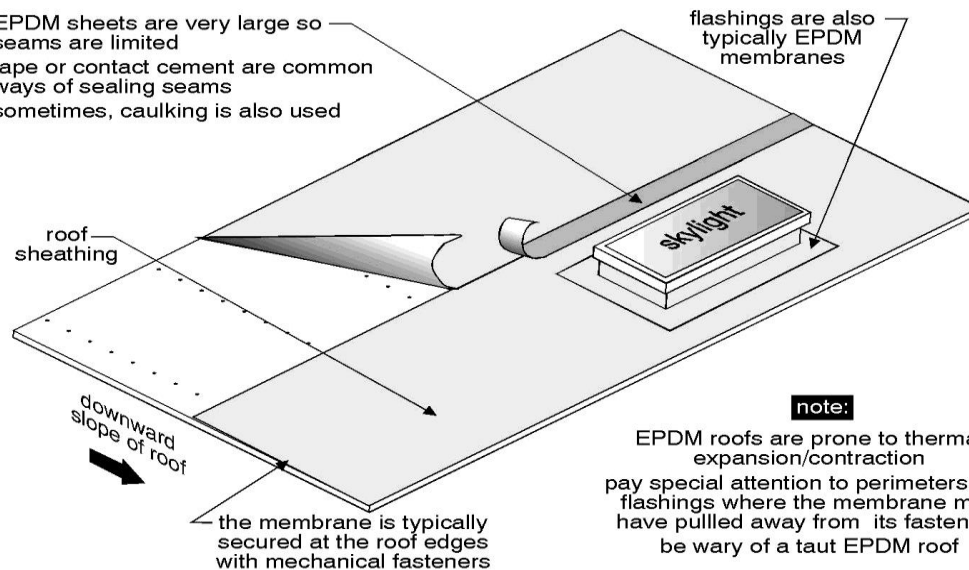
Roof

Roll roofing



EPDM roof membrane

EPDM sheets are very large so seams are limited
tape or contact cement are common ways of sealing seams
sometimes, caulking is also used



note:

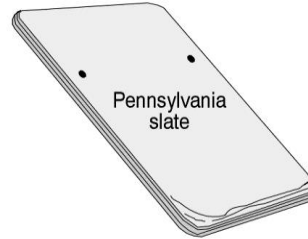
EPDM roofs are prone to thermal expansion/contraction
pay special attention to perimeters and flashings where the membrane may have pulled away from its fasteners
be wary of a taut EPDM roof

Roof



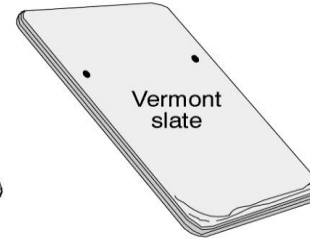
Roof

Slate types



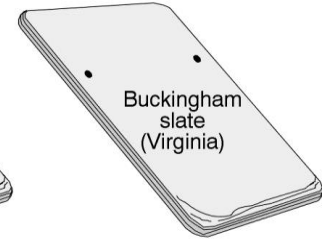
typical life: 35 to 75 years

typical color: blue-grey, blue-black and black



typical life: 100 years

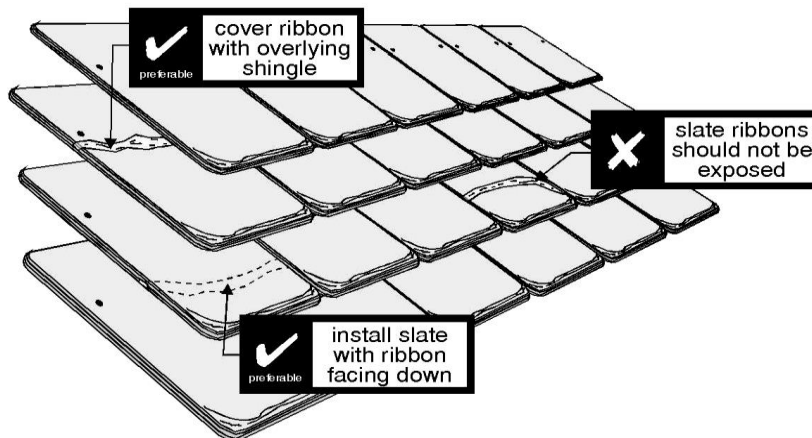
typical color: light-grey, grey-black, green, mottled purple and green, red (rare) and purple (rare)



typical life: 175 years

typical color: blue-grey to dark grey with an unusual luster

Slate ribbons



Roof



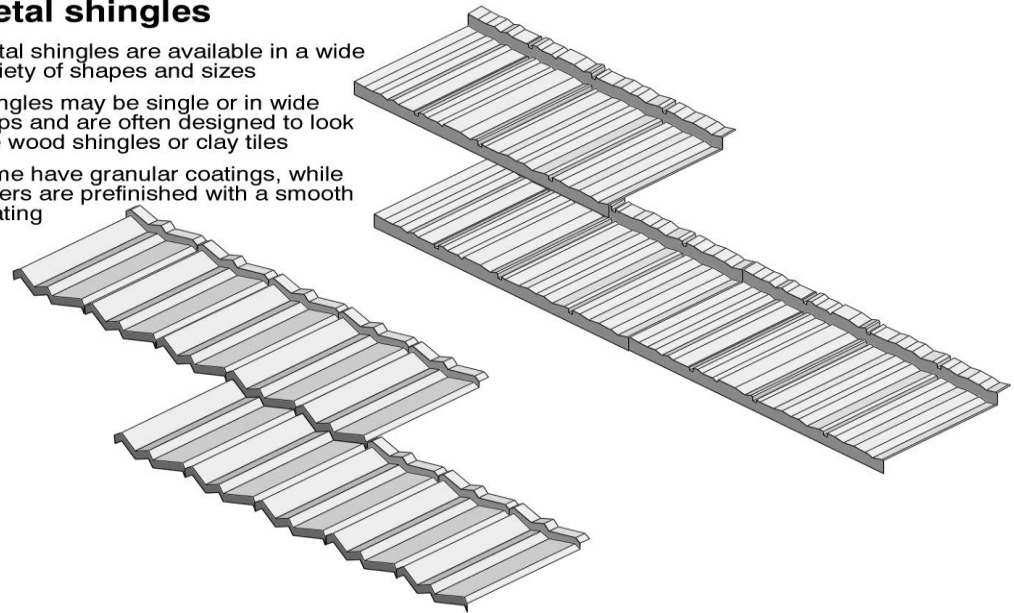
Roof

Metal shingles

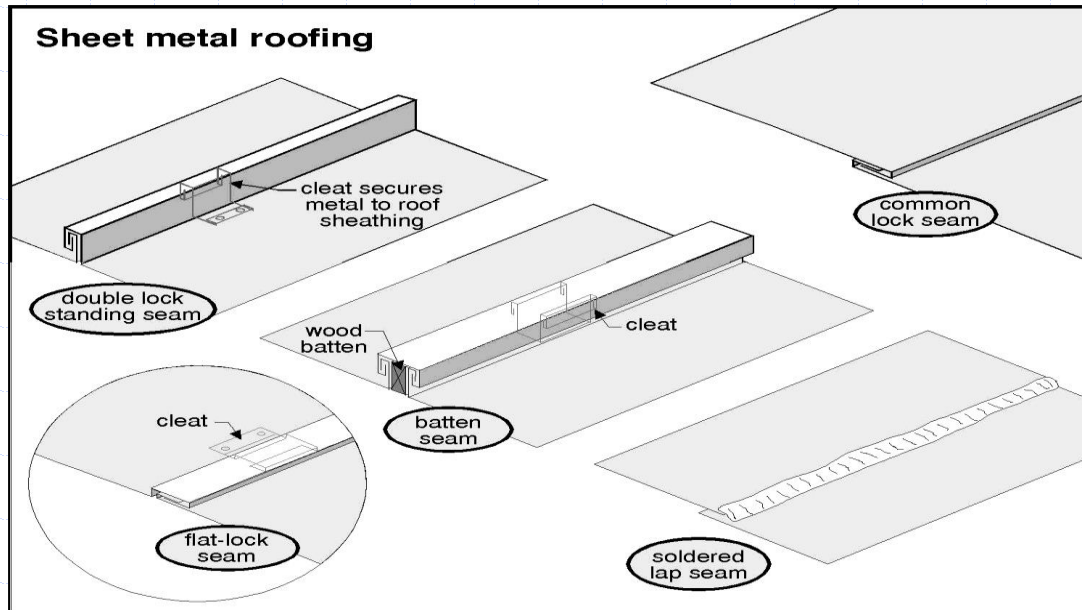
metal shingles are available in a wide variety of shapes and sizes

shingles may be single or in wide strips and are often designed to look like wood shingles or clay tiles

some have granular coatings, while others are prefinished with a smooth coating

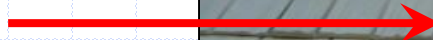


Sheet metal roofing



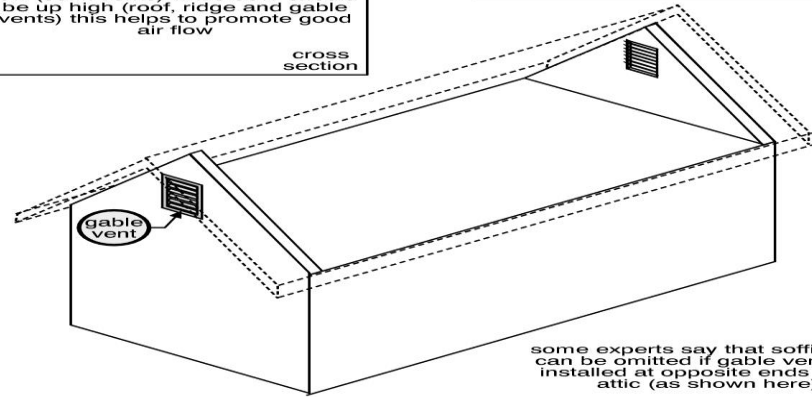
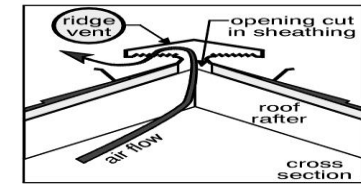
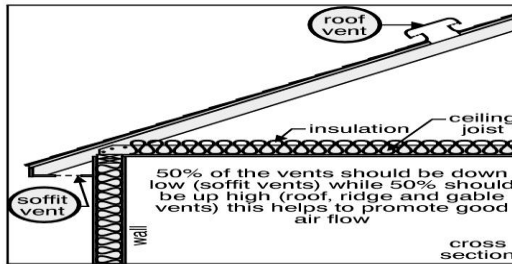
Roof

Plastic



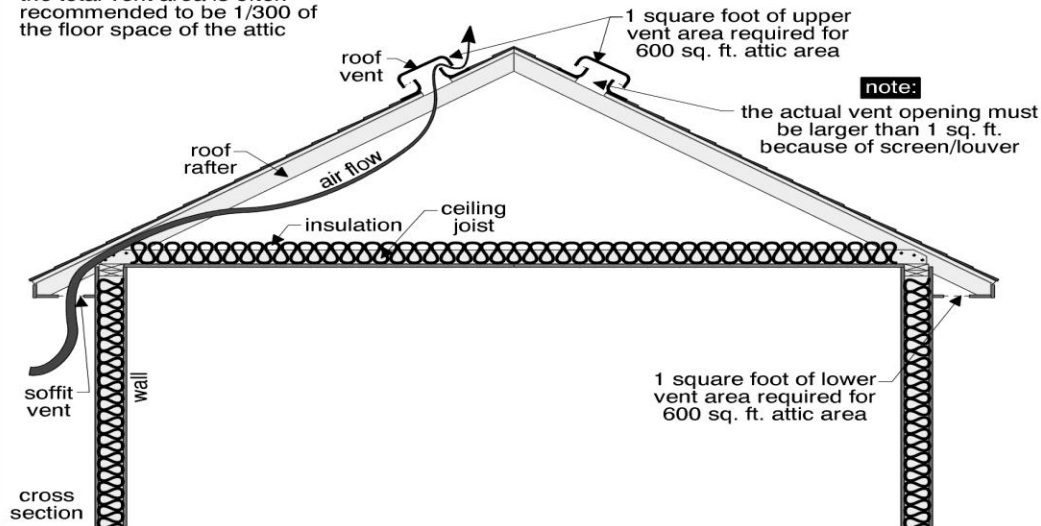
Roof

Types and locations of vents



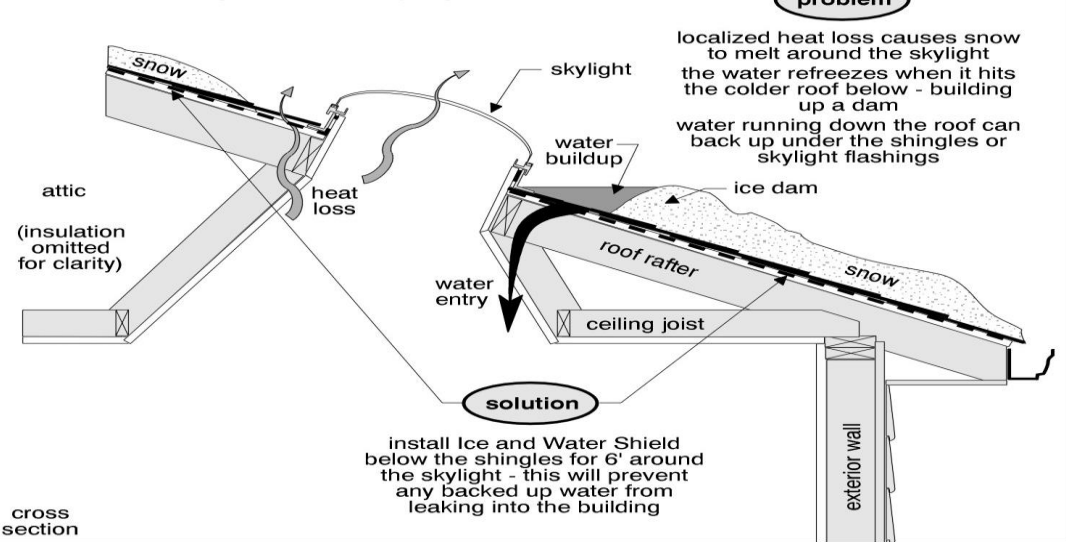
Recommended amount of attic ventilation

the total vent area is often recommended to be 1/300 of the floor space of the attic

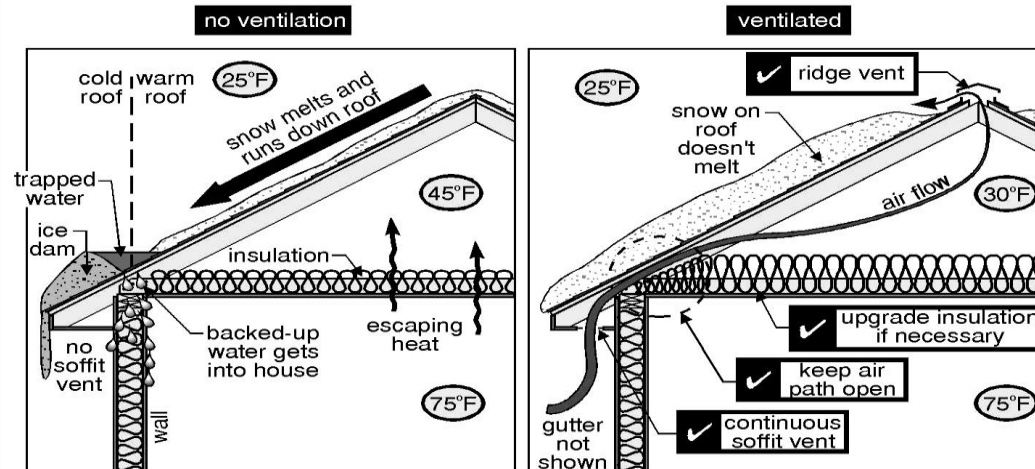


Roof

Ice damming below skylight



Preventing ice dams with ventilation

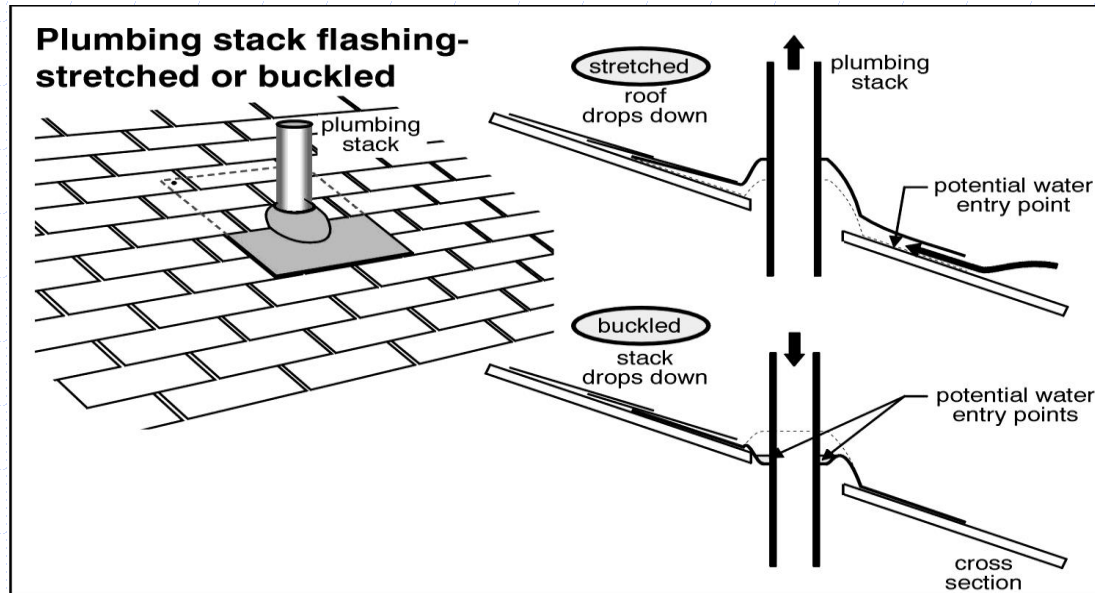


note:

ridge venting is more effective than individual upper level vents

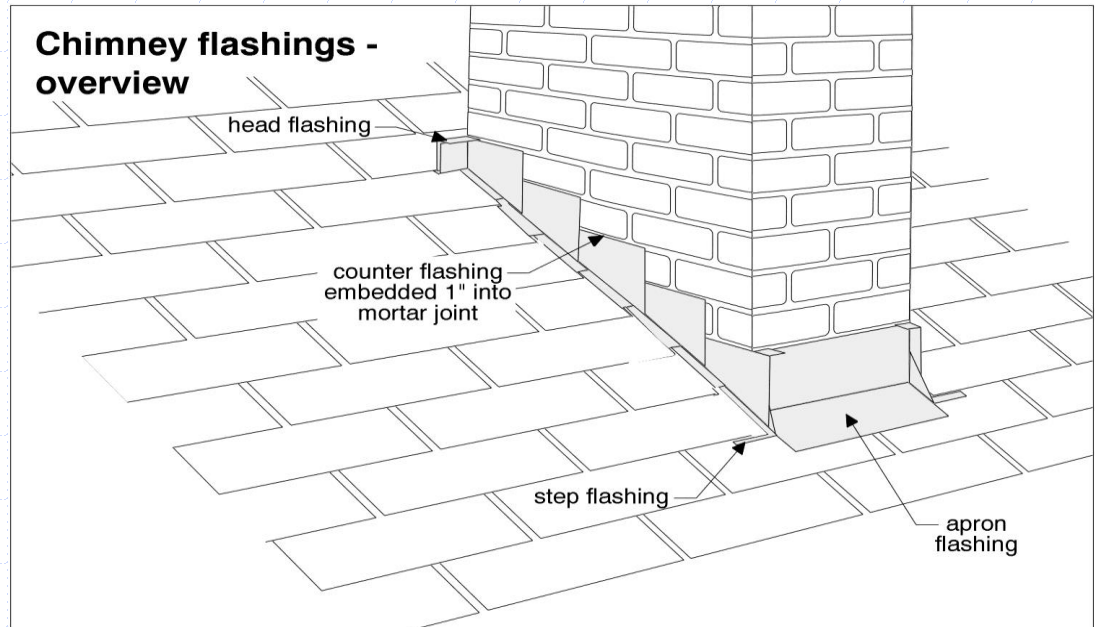
Roof

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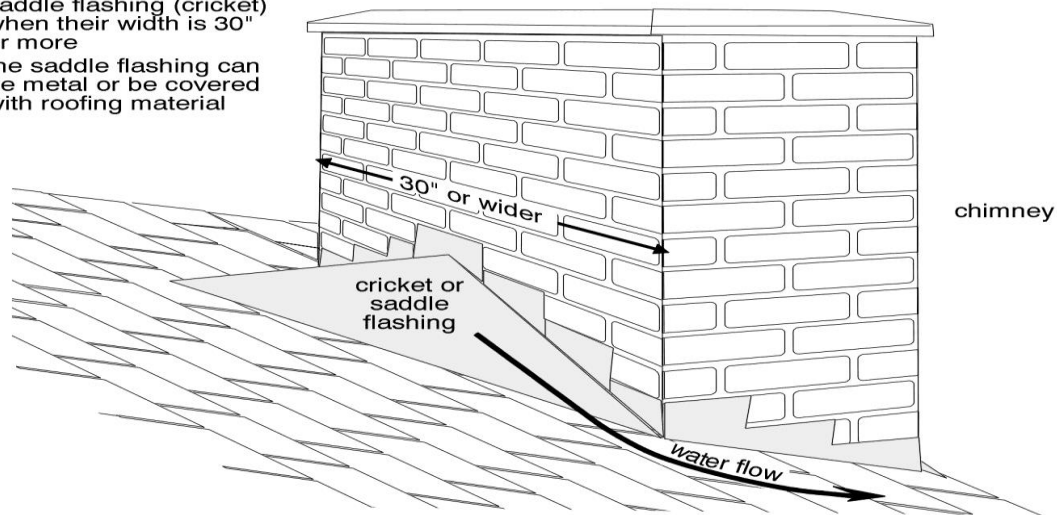
Roof

Chimney flashings - overview



Chimney saddle flashings

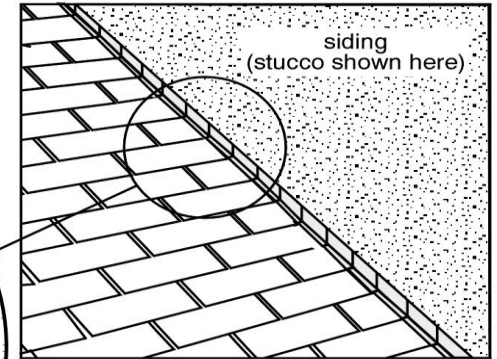
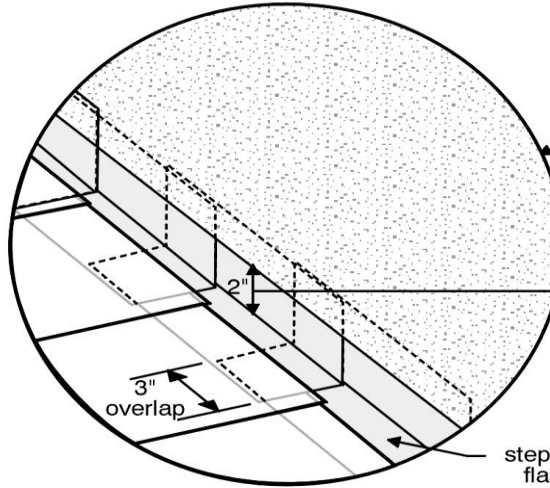
chimneys require a saddle flashing (cricket) when their width is 30" or more the saddle flashing can be metal or be covered with roofing material



Roof

Roof/sidewall flashings

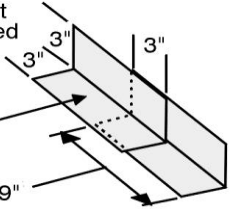
sidings such as wood, metal, vinyl or stucco can serve as counter flashing



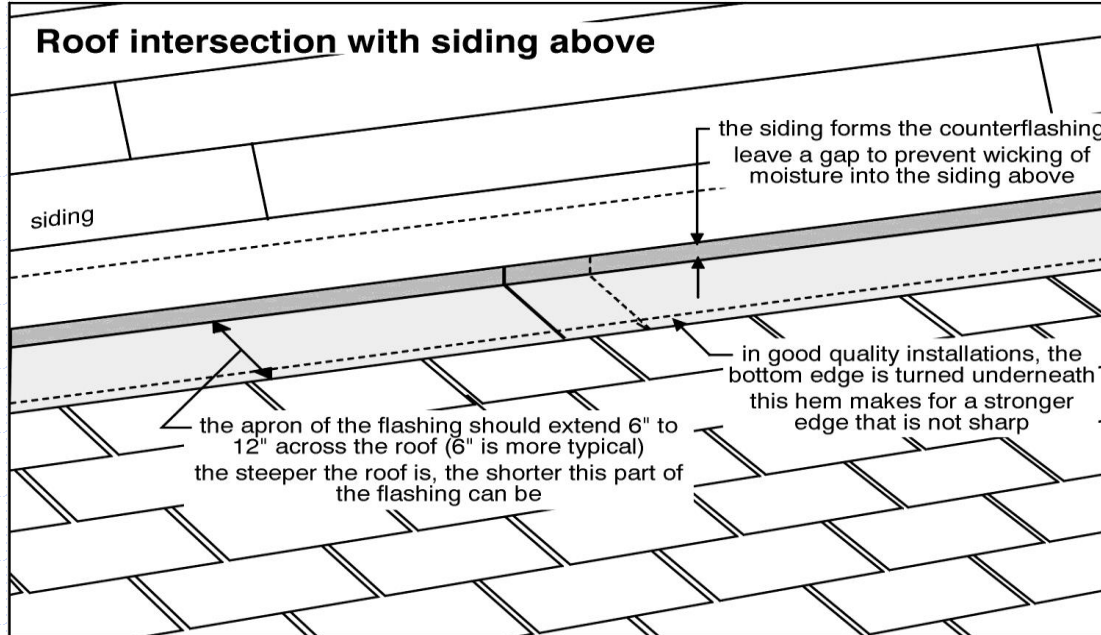
a two inch clearance is desirable to prevent water from being wicked up into the siding

step or base flashings

typically 9"



Roof intersection with siding above



siding

the siding forms the counterflashing
leave a gap to prevent wicking of
moisture into the siding above

the apron of the flashing should extend 6" to
12" across the roof (6" is more typical)
the steeper the roof is, the shorter this part of
the flashing can be

in good quality installations, the
bottom edge is turned underneath
this hem makes for a stronger
edge that is not sharp

Roof

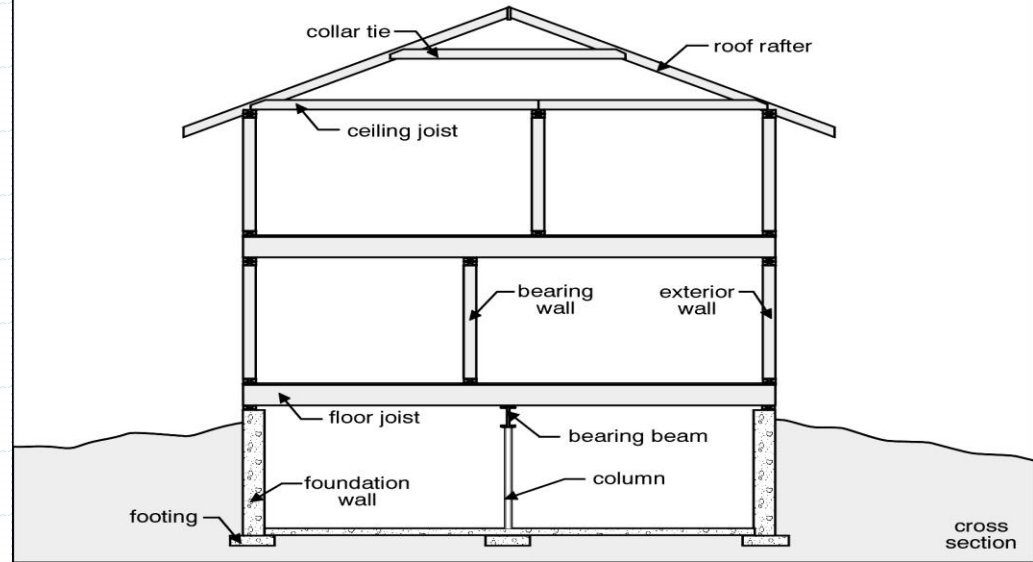


Structure

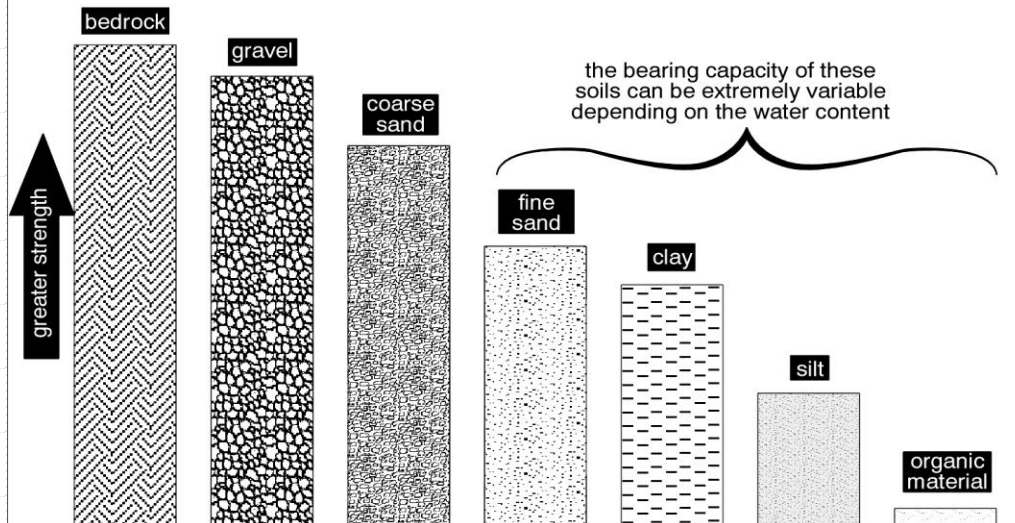


Structure

Overview of house structure

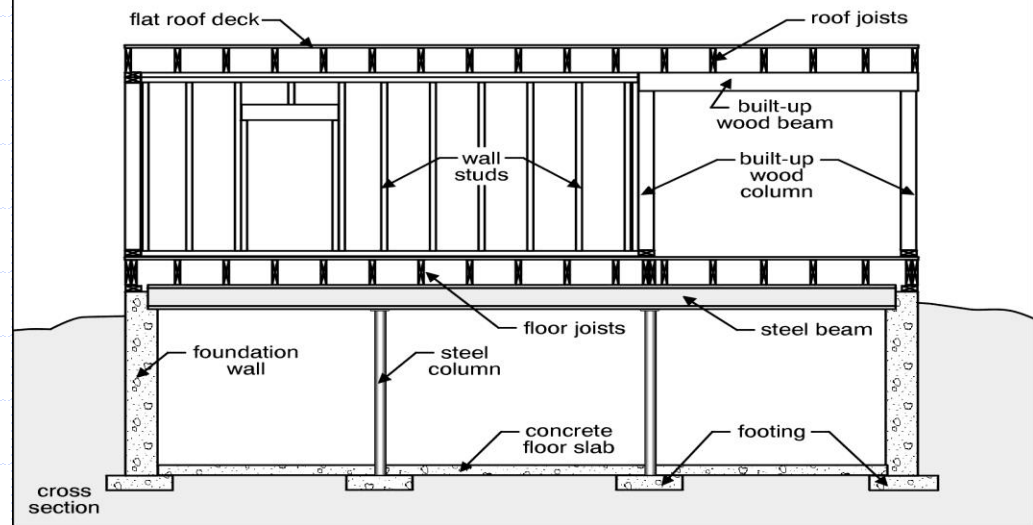


Bearing strength of soils

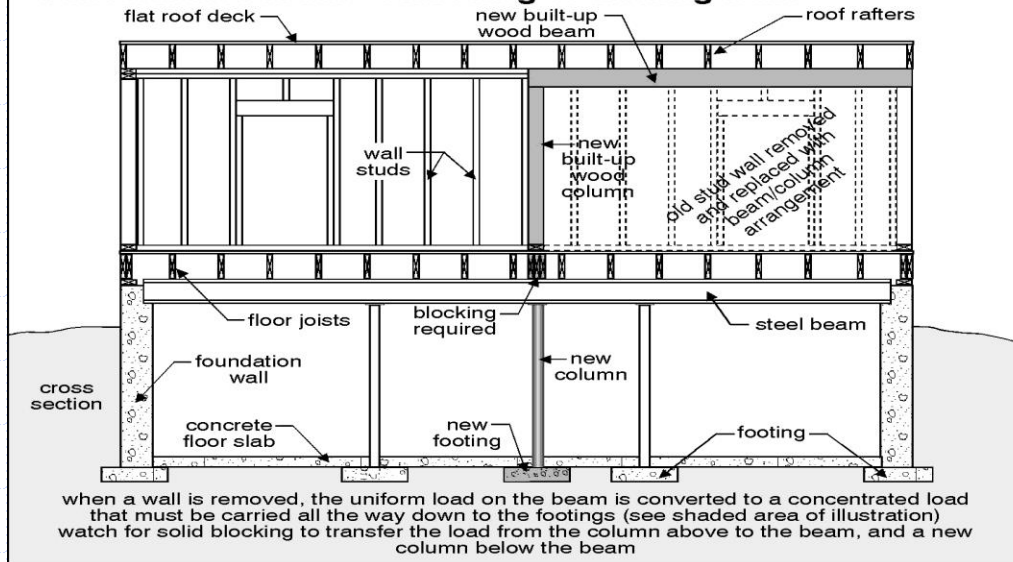


Structure

Beams - shown in relation to house structure

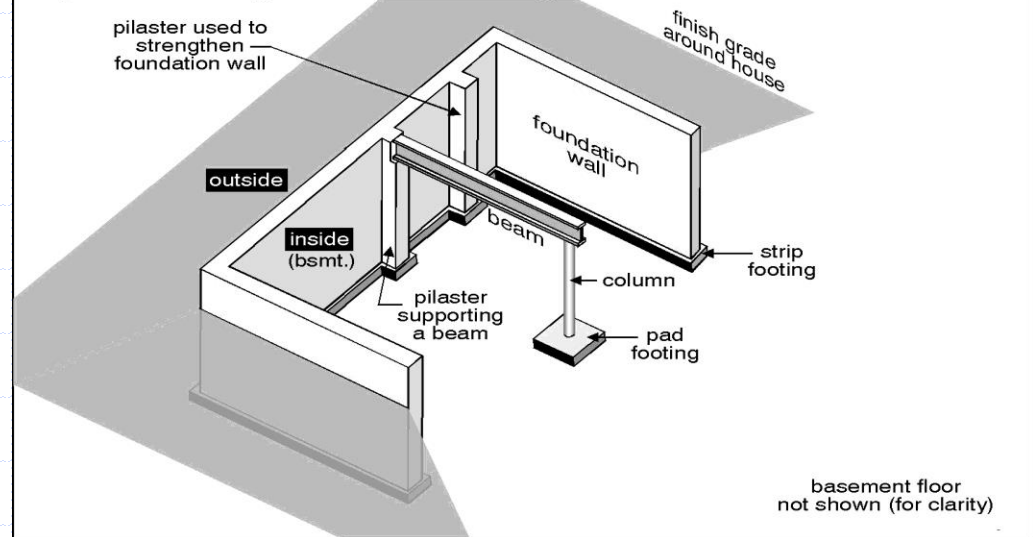


Concentrated loads - removing or altering walls

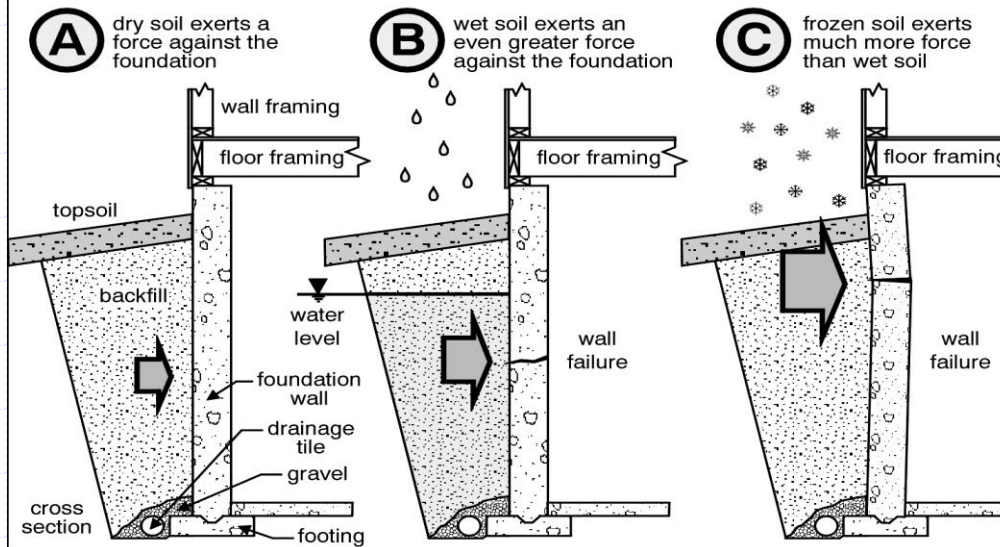


Structure

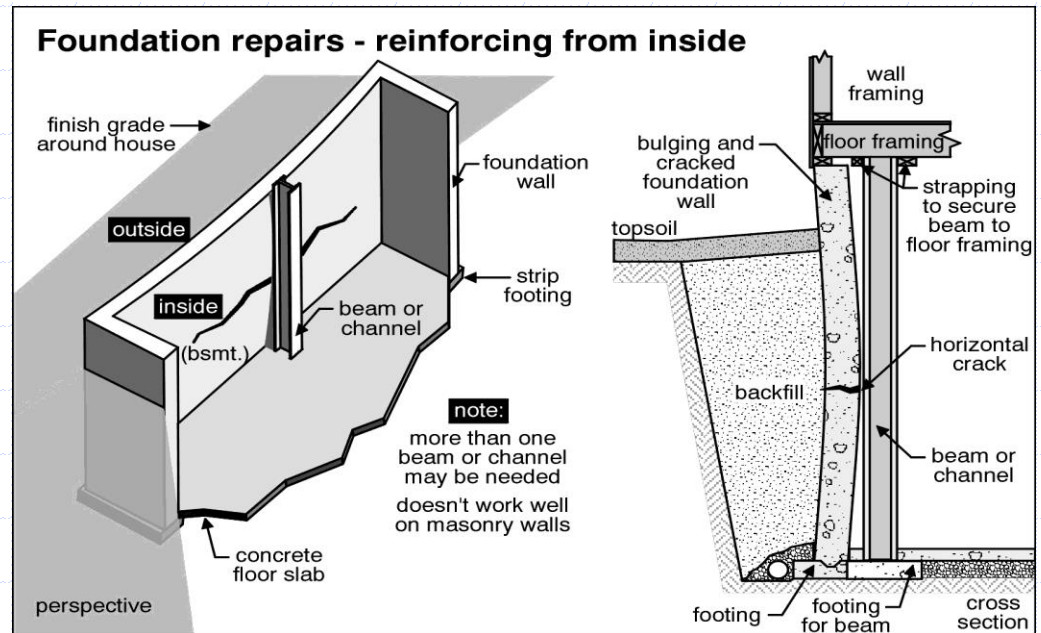
Spread footings and pad footings



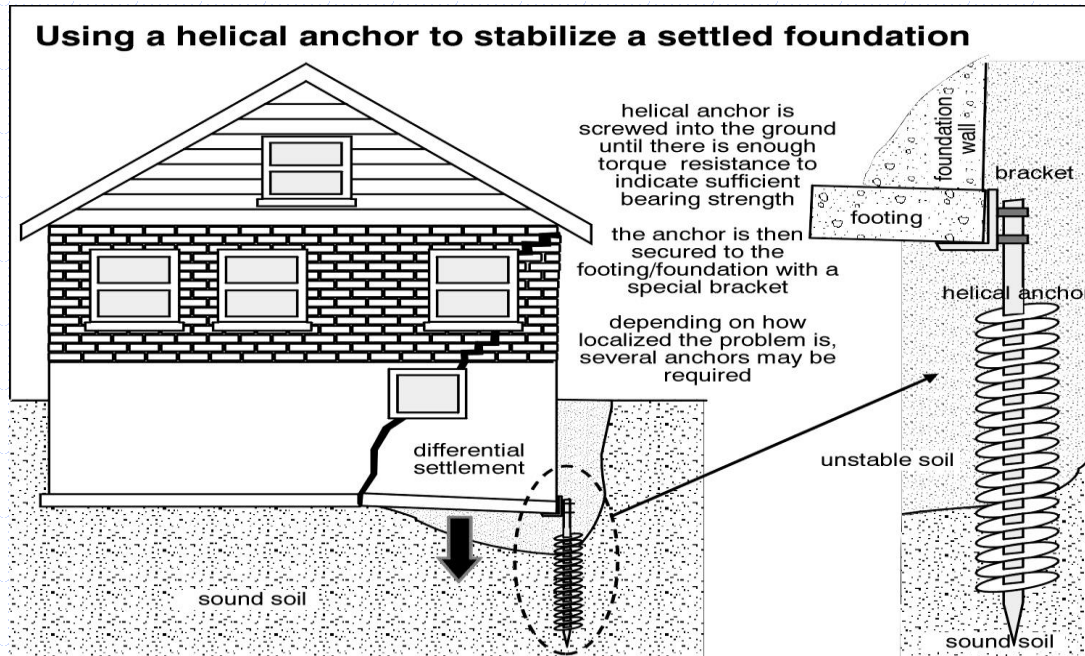
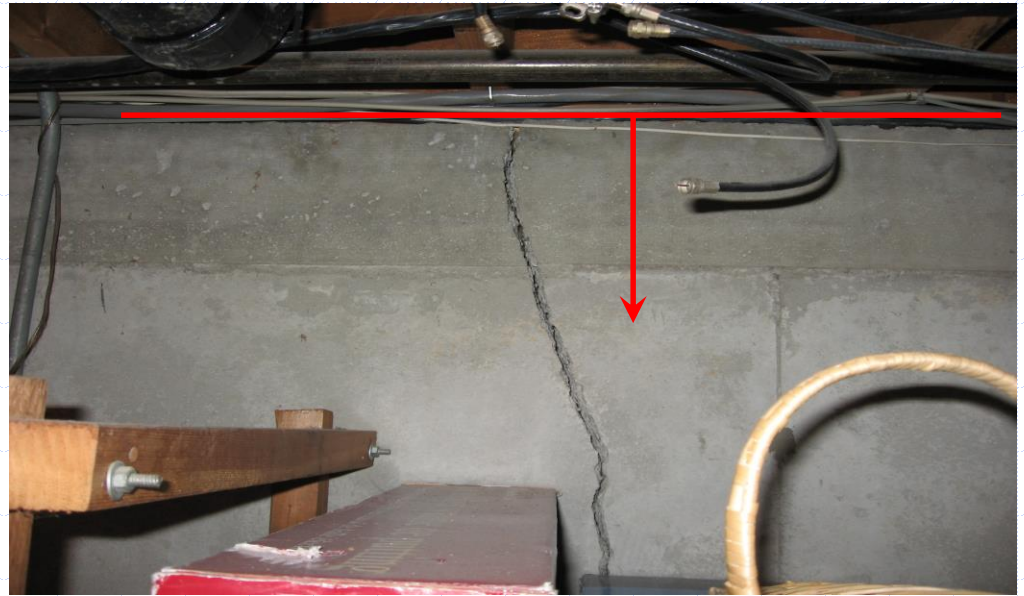
Soil pressure on foundation walls



Structure



Structure

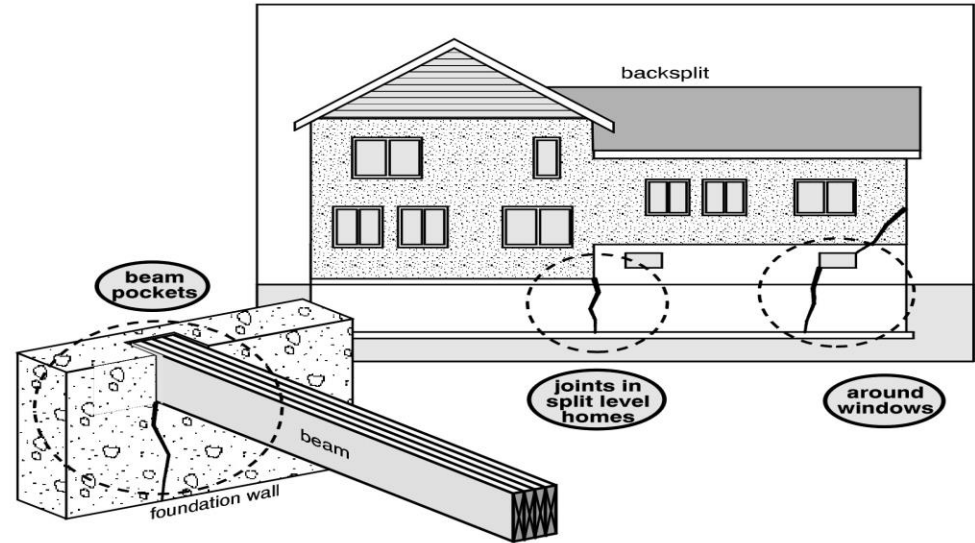


Structure

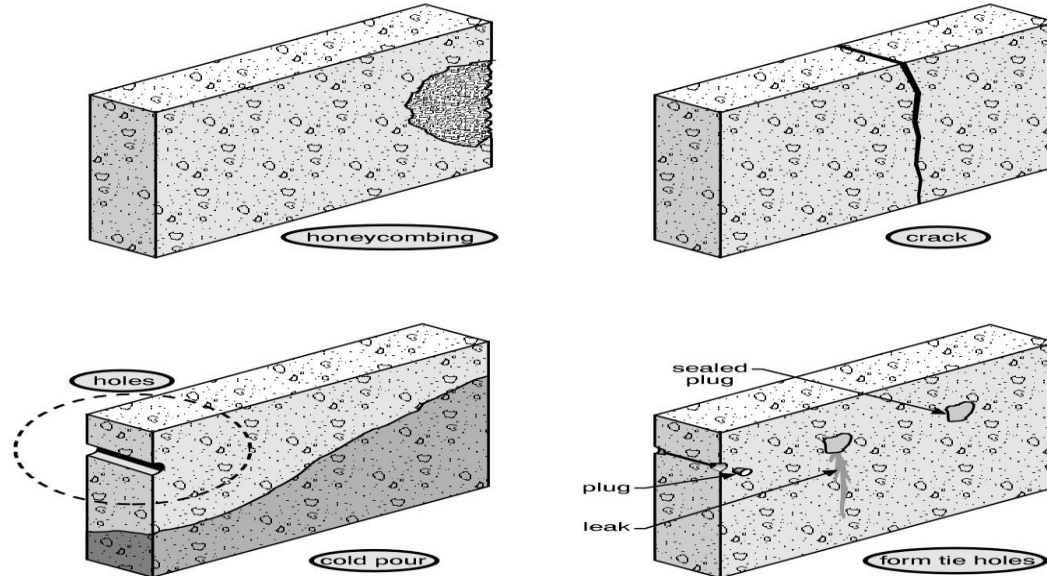


Structure

Where cracks appear



Concrete flaws

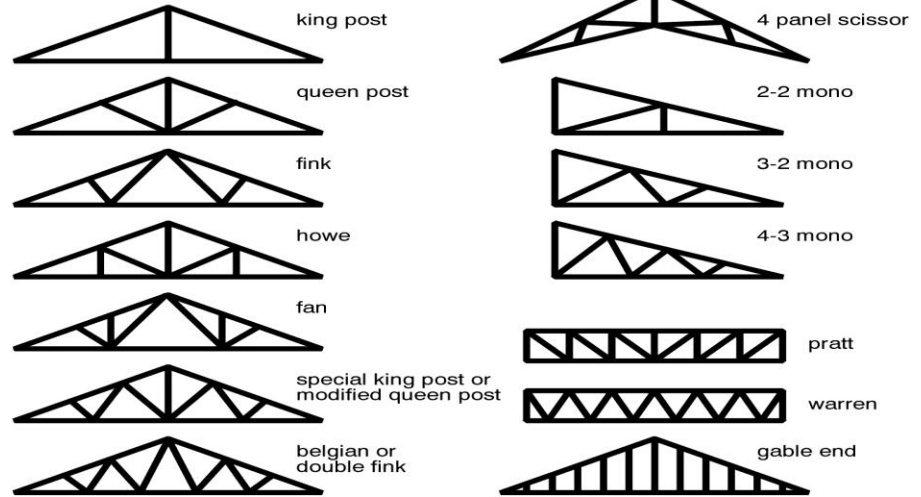


Structure



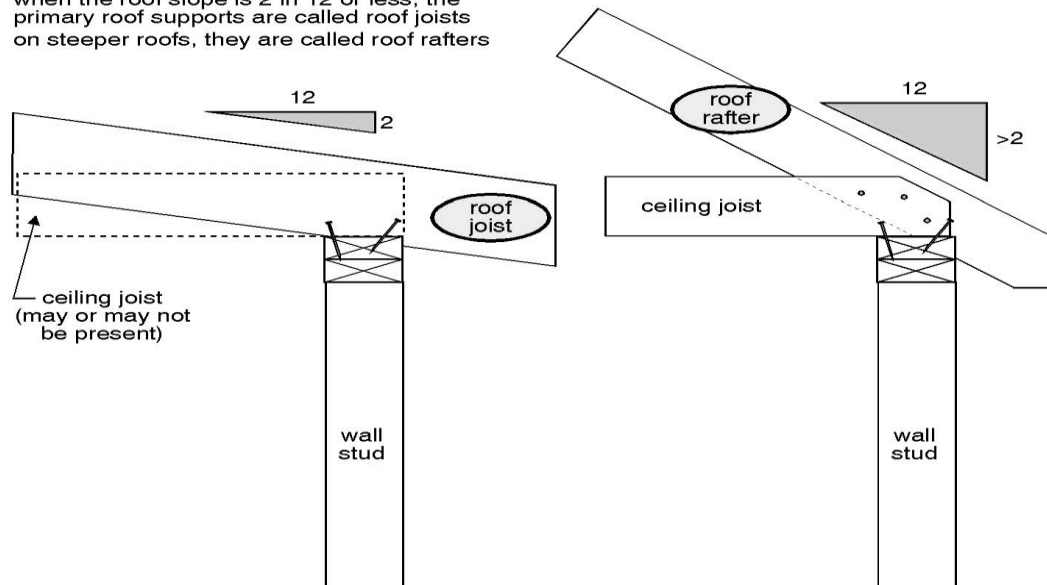
Structure

Truss types



Roof joists versus roof rafters

when the roof slope is 2 in 12 or less, the primary roof supports are called roof joists on steeper roofs, they are called roof rafters

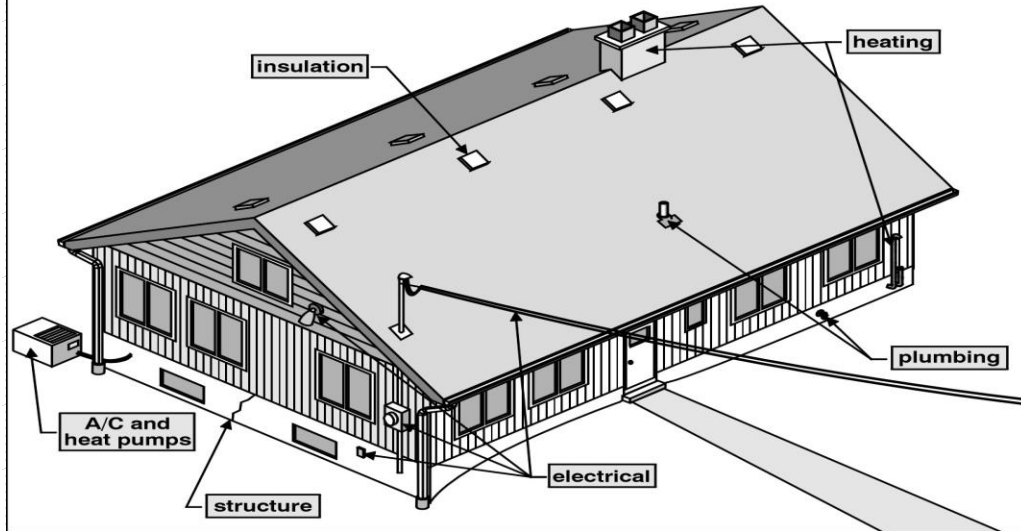


Exterior

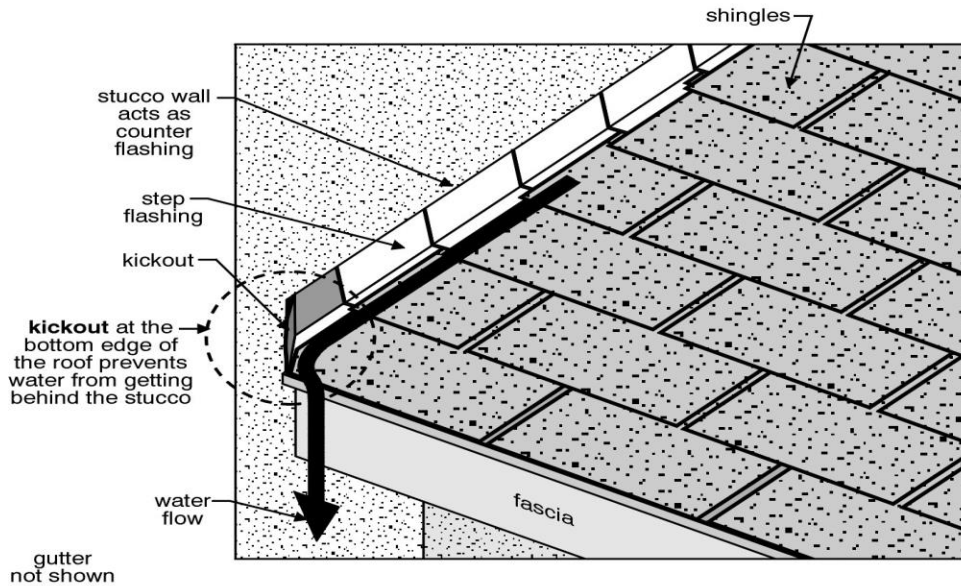


Exterior

Exterior inspection includes other systems



Kickout prevents siding/wall damage

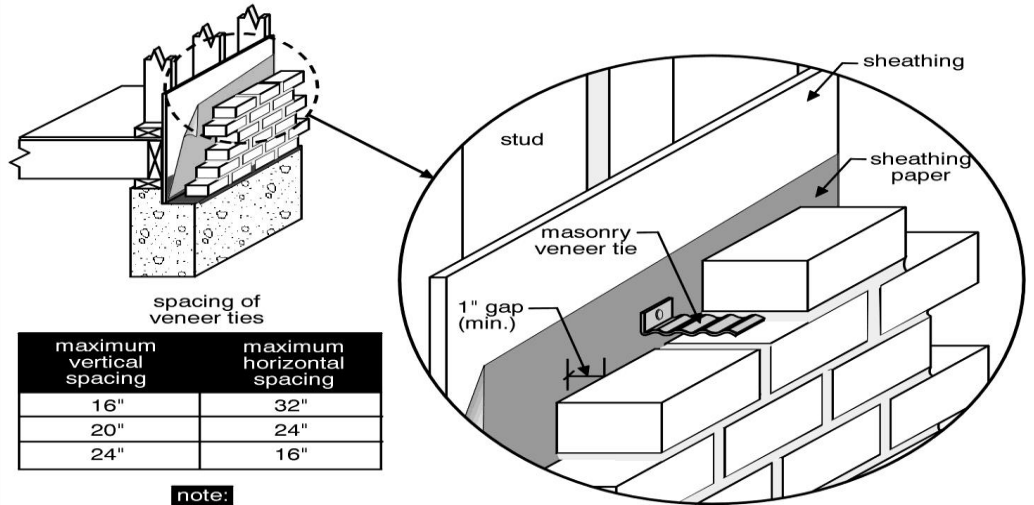


Exterior



Exterior

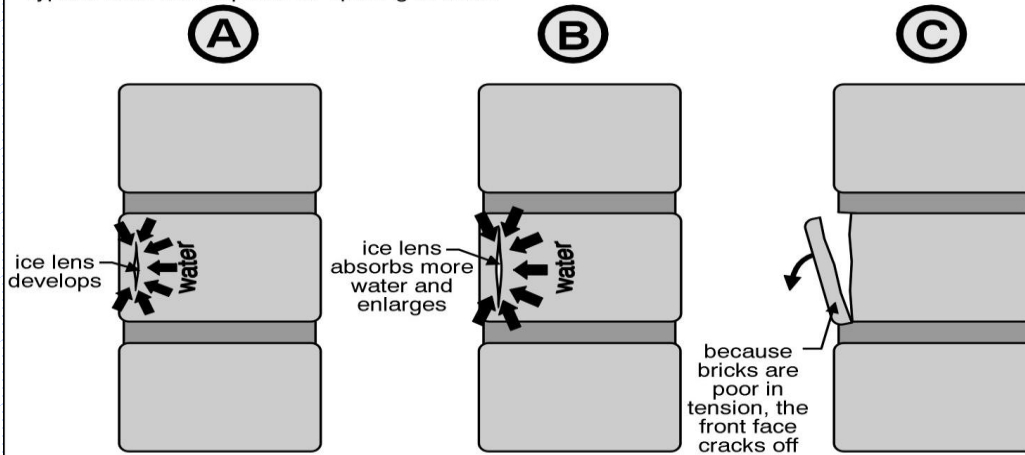
Brick veneer wall - masonry tie detail



note:
veneer ties are nailed through sheathing into studs

Freezing water spalls bricks

freezing temperatures, saturated brick and a susceptible type of brick are required for spalling to occur



note:

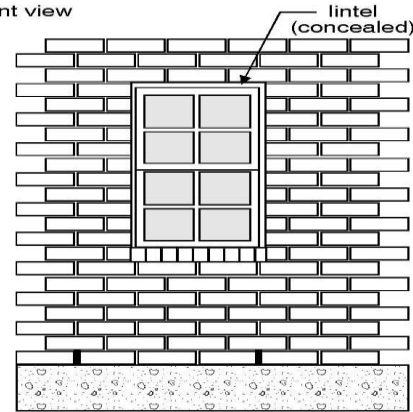
cross section

brick spalling is often a problem with bricks that have a tough glazed finish and a soft permeable core

Exterior

Veneer versus solid masonry

front view

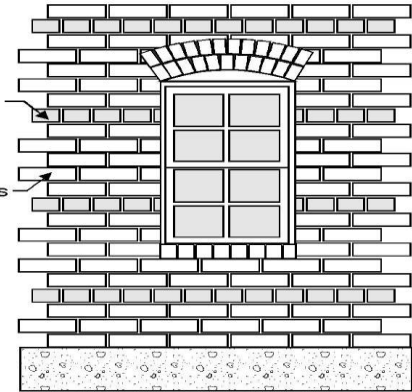


veneer walls

- usually have weep holes
- typically don't have masonry arches
- no header bricks

headers

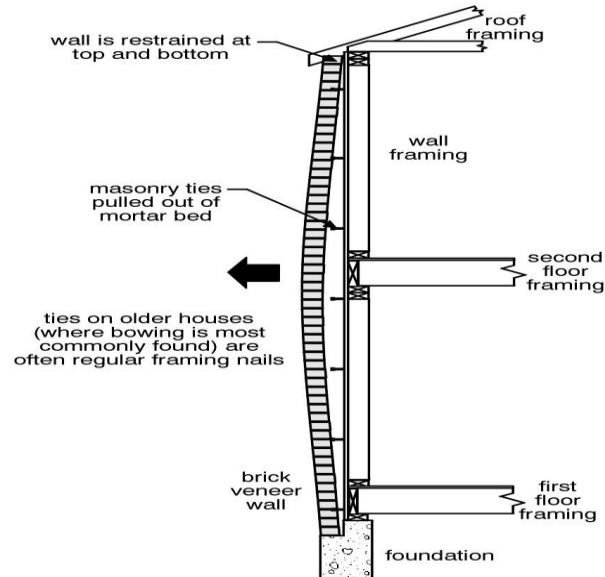
stretchers



solid masonry walls

- no weep holes
- typically have masonry arches (instead of lintels)
- header bricks are typical

Bowed brick veneer wall - older home



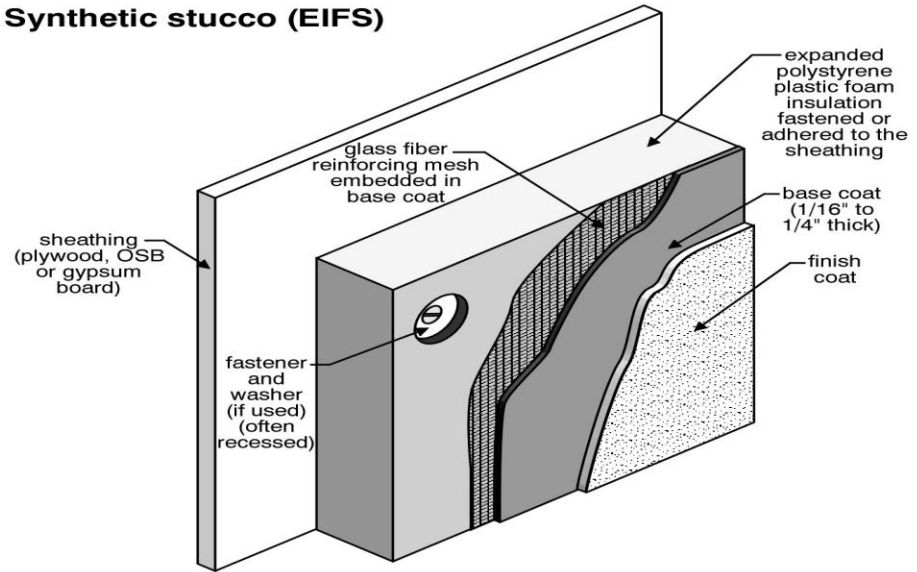
cross section

Exterior



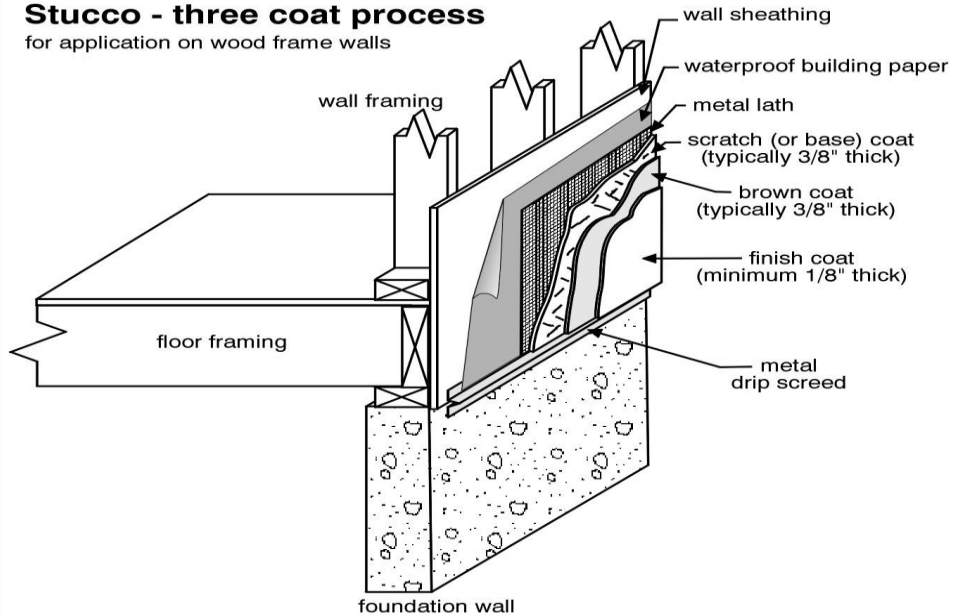
Exterior

Synthetic stucco (EIFS)



Stucco - three coat process

for application on wood frame walls



Exterior

Problems with Synthetic Stucco.

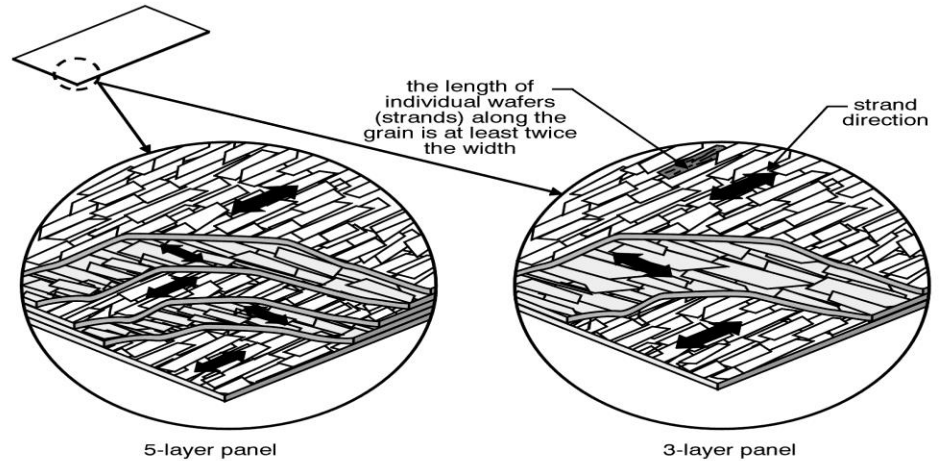
- **Improper Installation.**
- **Bottom edge of stucco embedded in soil allow termites to burrow through to wall cavity.**
- **Lack of flashing around windows and doors allows moisture to enter wall cavity.**
- **Lack of sealant around penetrations, light fixtures, receptacles, etc. .**
- **Gutters allowing water to drain onto the stucco.**

Exterior

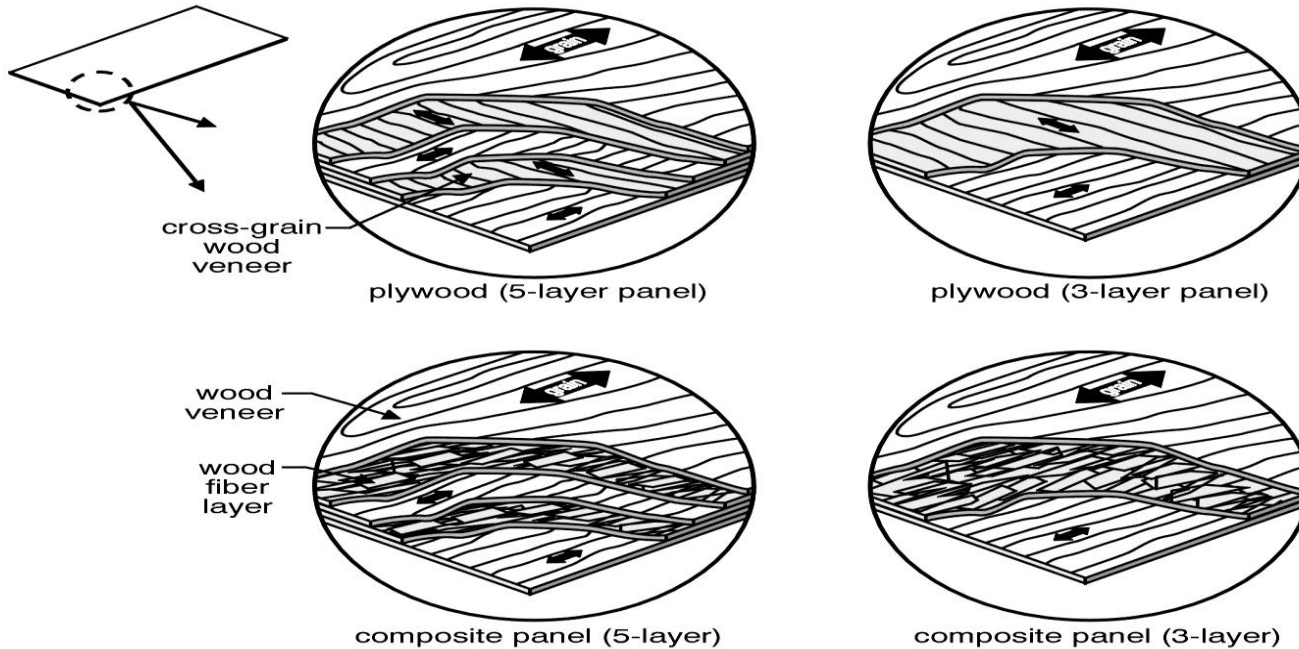


Exterior

Oriented strandboard (OSB) siding



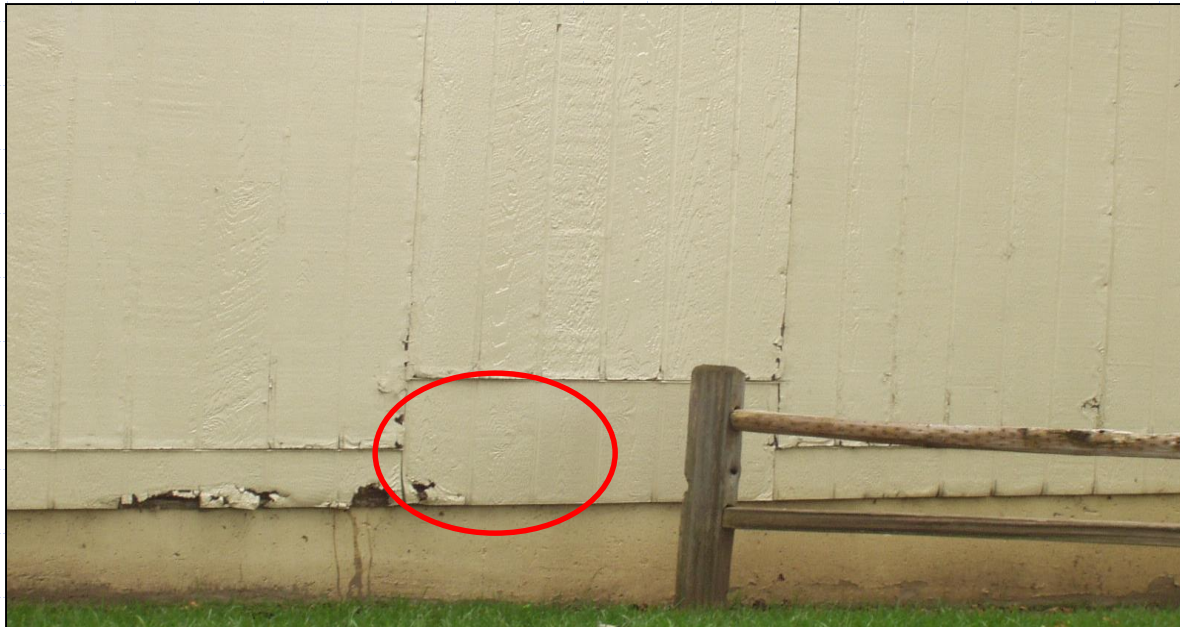
Plywood and composite siding



Exterior



Exterior



Exterior

Don't Let LP or Masonite Siding Ruin Your Deal!

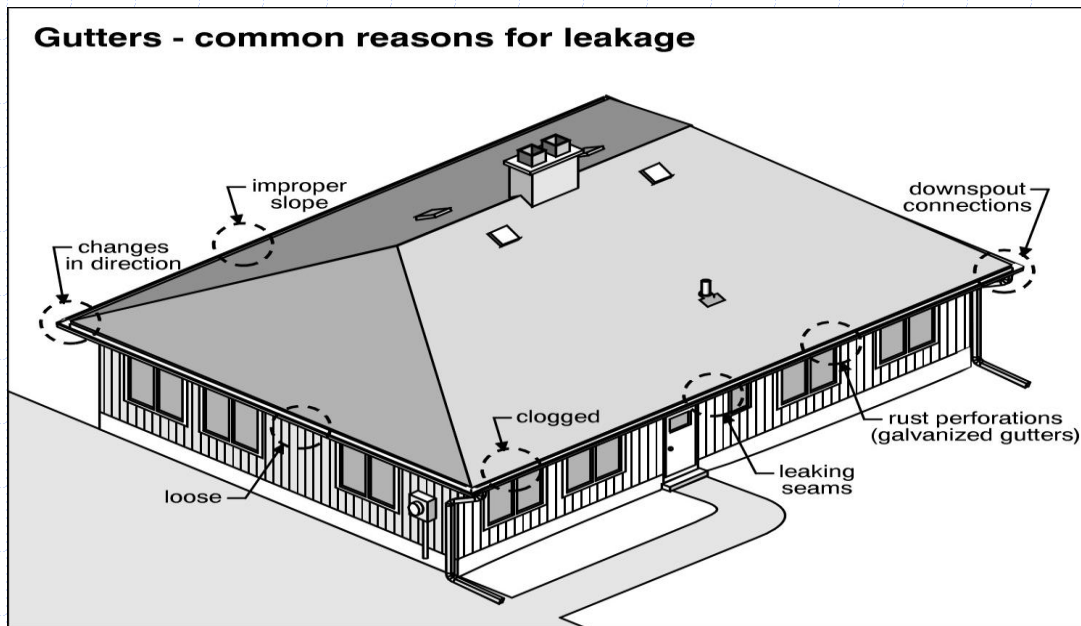
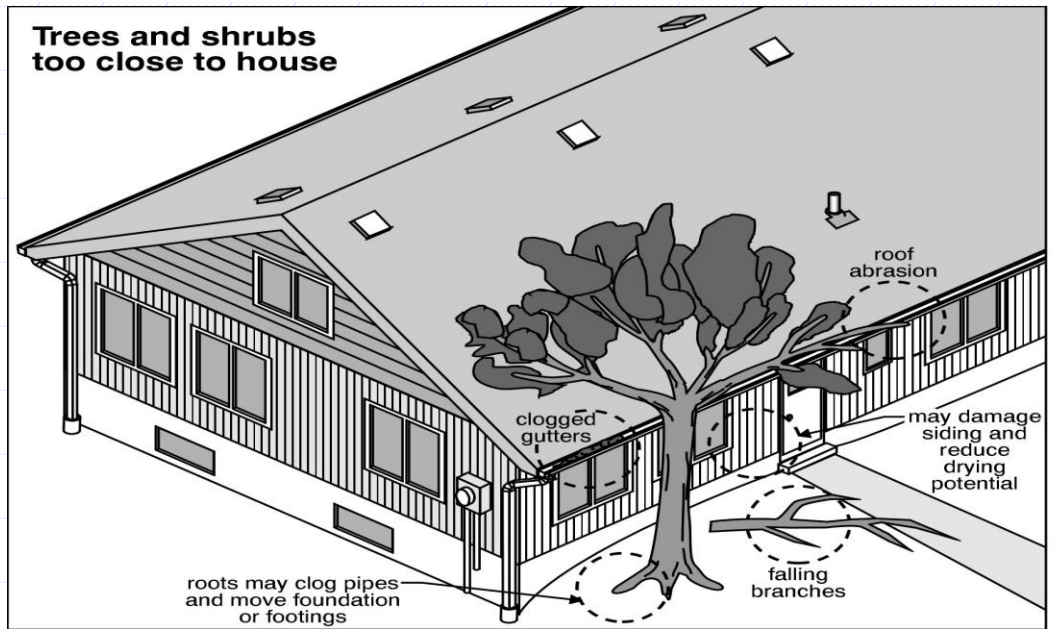
- Find out if a claim has been filed
- Have siding inspected for condition
- Inform client of normal maintenance procedures

Exterior

Class Action Lawsuits

- ◆ Several class action lawsuits are taking place throughout the country involving different composition board manufactures.
- ◆ Louisiana-Pacific www.lpsiding.com or 800-648-6893
- ◆ Georgia-Pacific Corporation 888-882-5246
- ◆ Masonite Corporation
www.kinsella.com/masonite or 800-330-2722

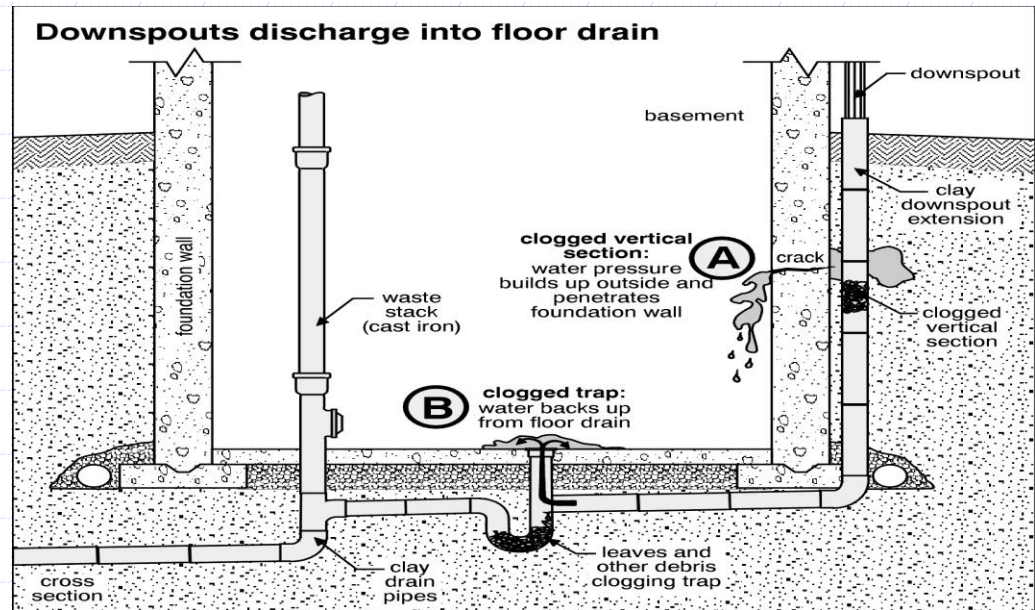
Exterior



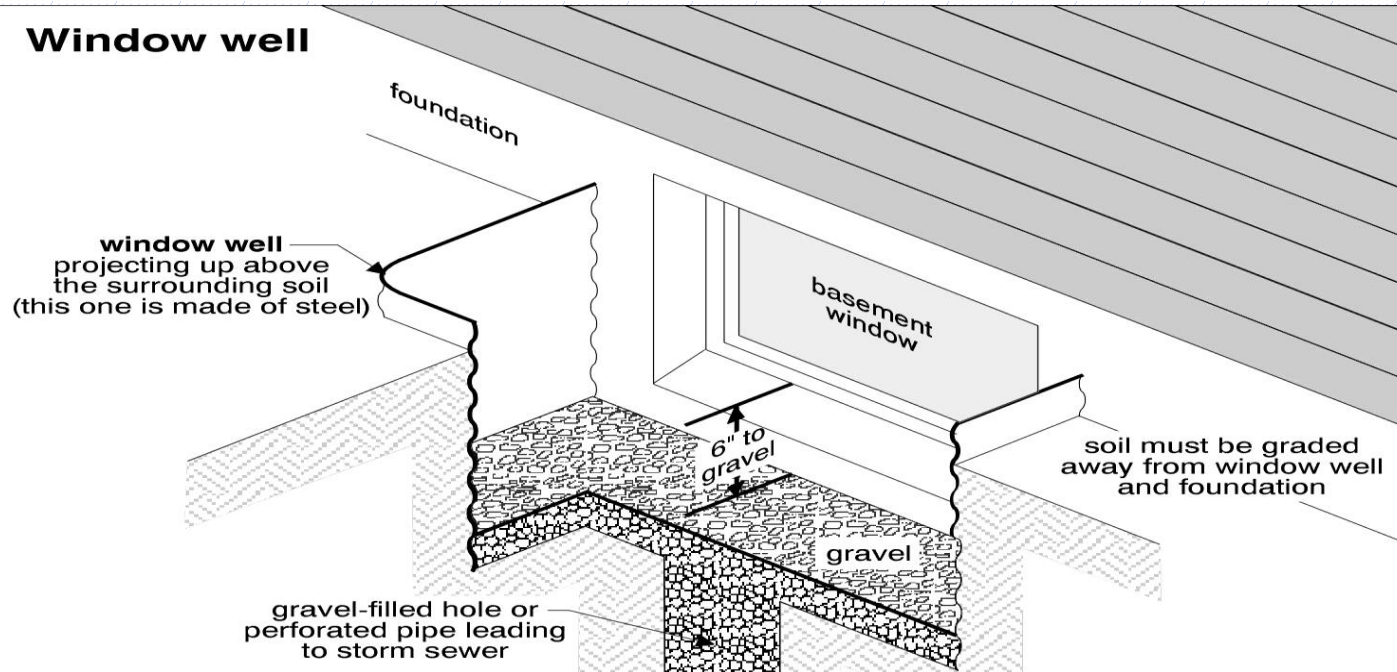
Exterior



Exterior

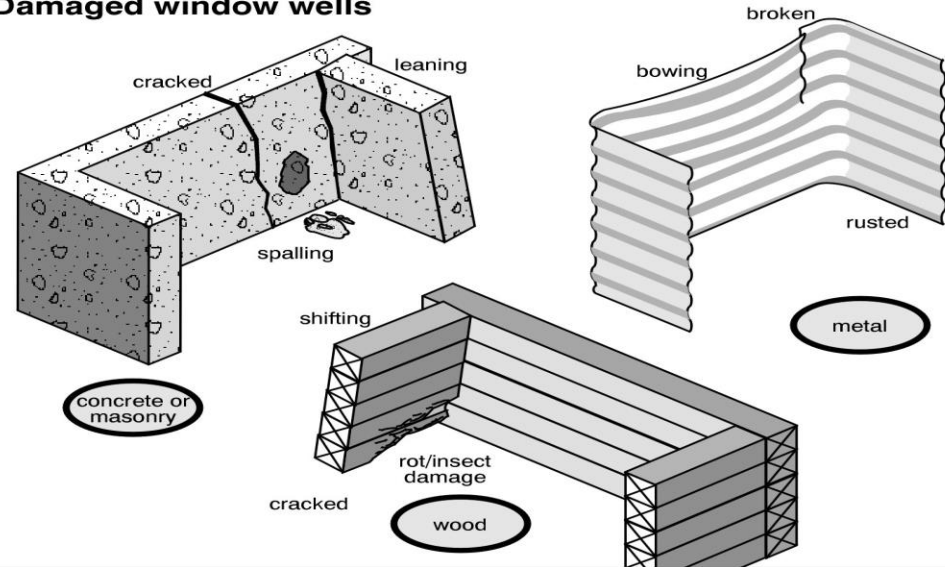


Window well

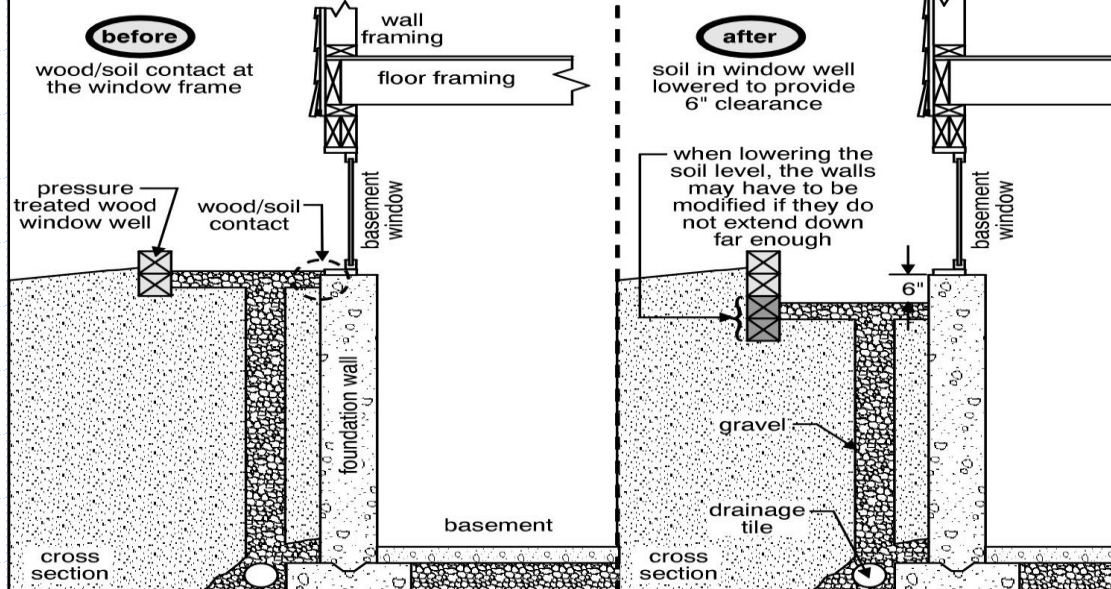


Exterior

Damaged window wells



Wood soil contact

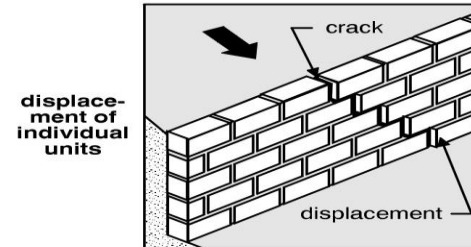
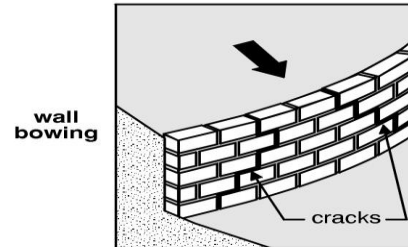
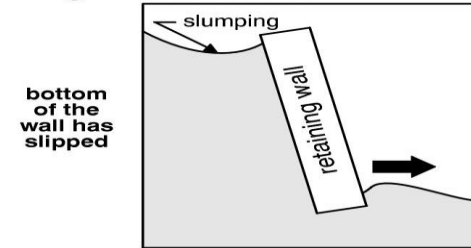
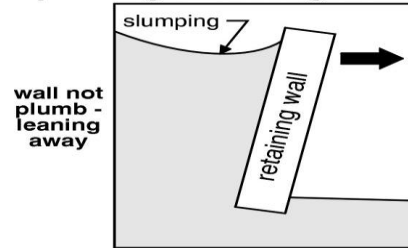


Exterior

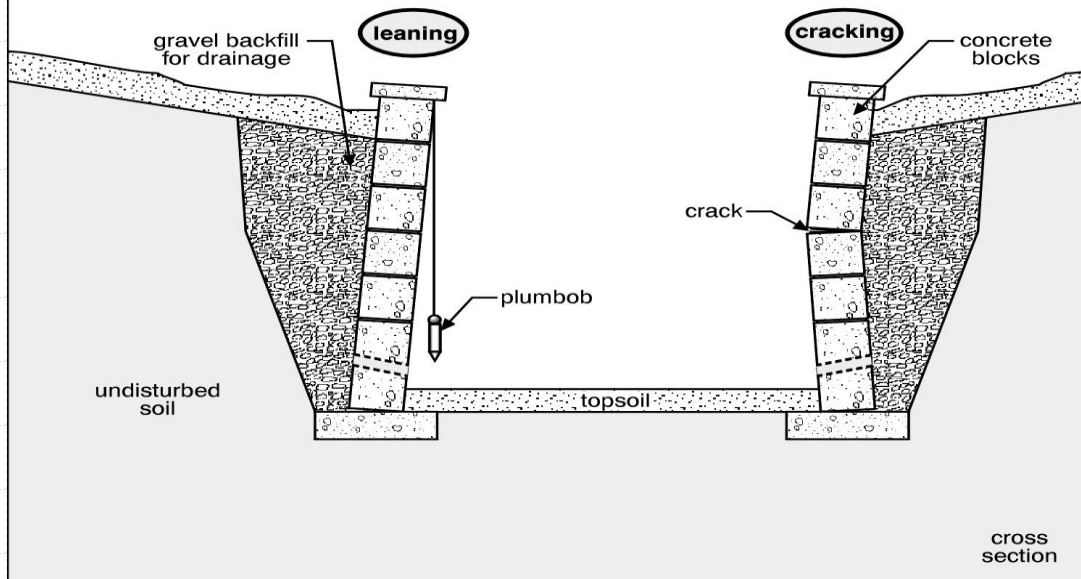


Exterior

Inspecting retaining walls - things to watch for



Movement or cracking





Break

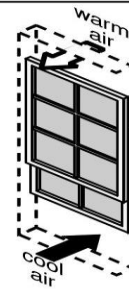
Interior



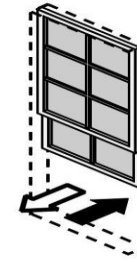
Interior

Window types

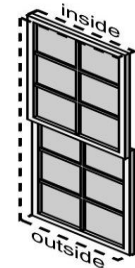
single
and
double-
hung



double-hung

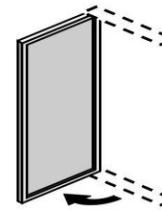


single-hung

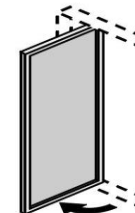


closed

casement



opens
out



opens out
(pivot offset)

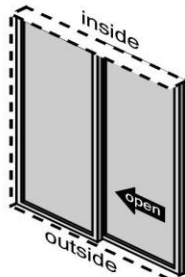


opens
in

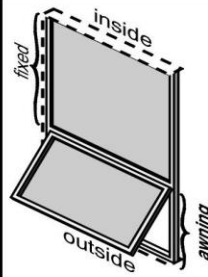


closed

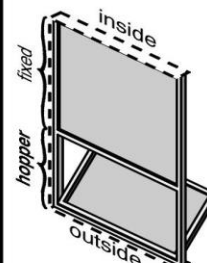
horizontal
slider



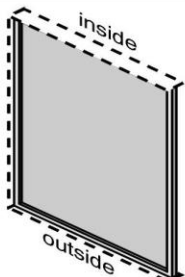
awning



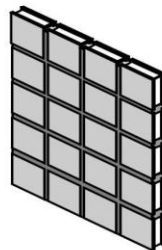
hopper



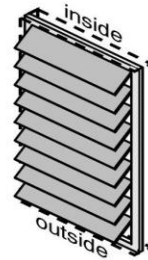
fixed



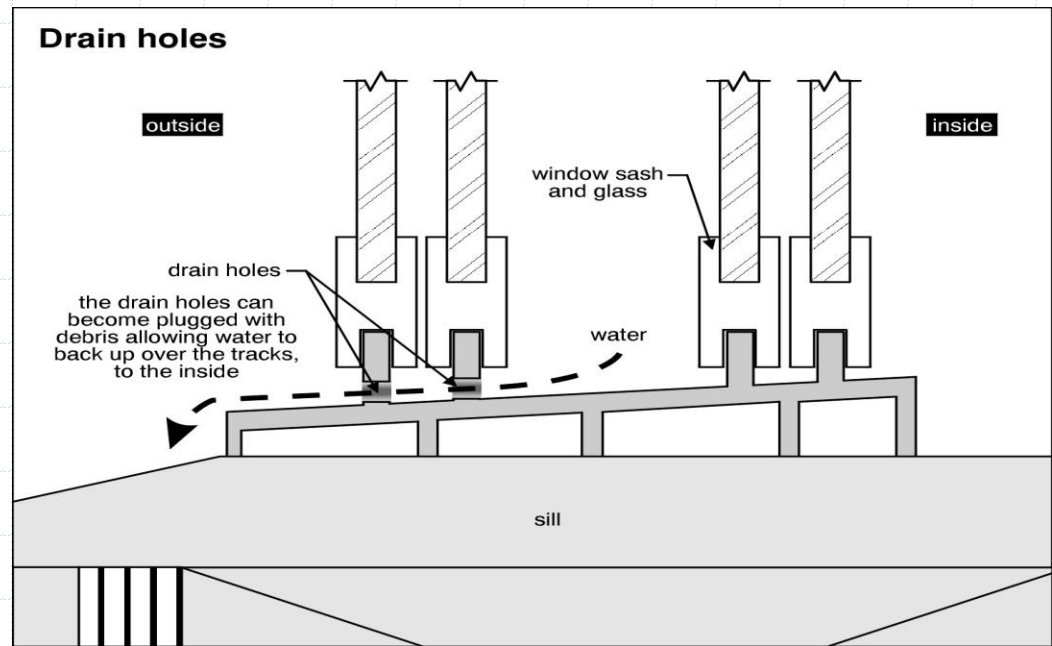
fixed
(glass
block)



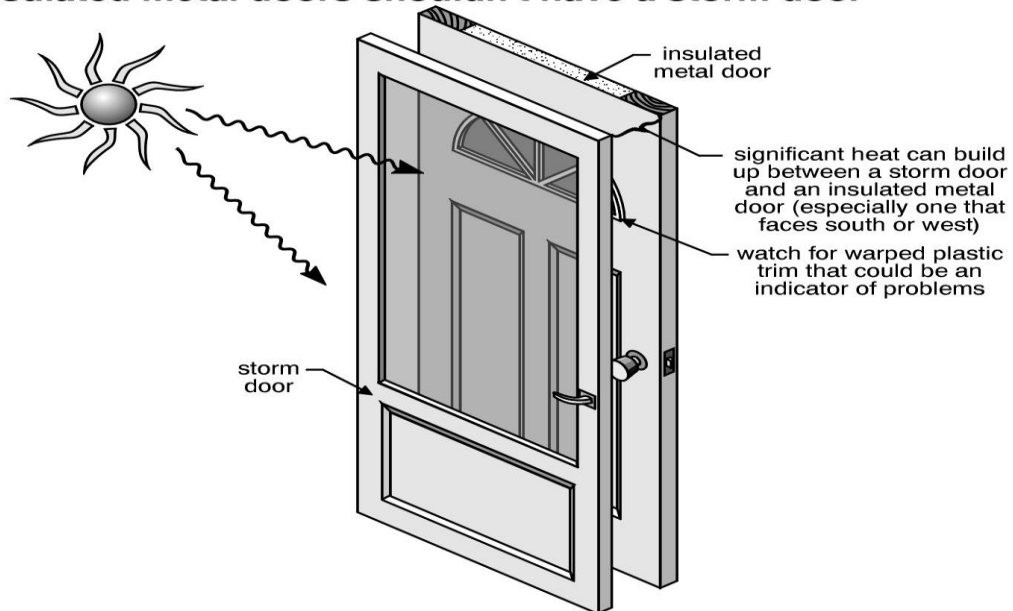
jalousie



Interior

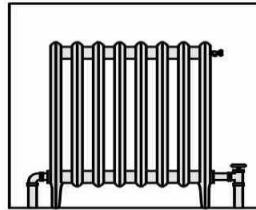


Insulated metal doors shouldn't have a storm door

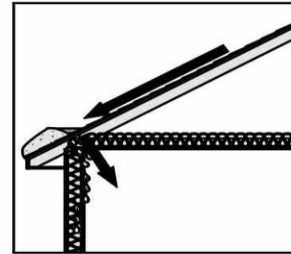


Interior

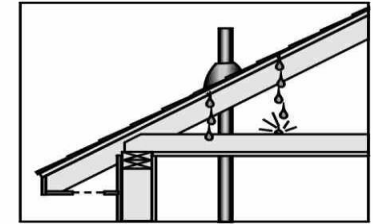
Sources of interior water damage



heating leaks



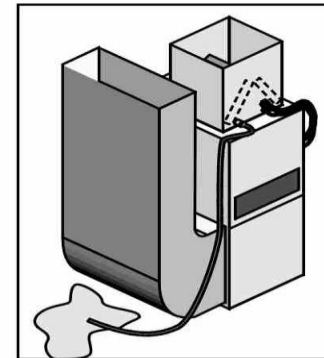
ice damming
and condensation



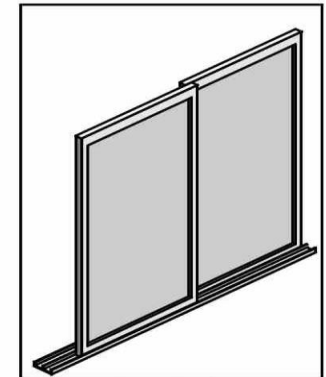
roof or
flashing leaks



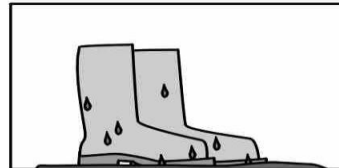
plumbing leaks



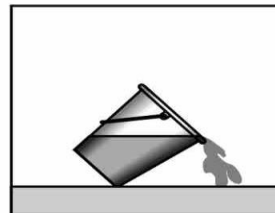
air conditioning leaks



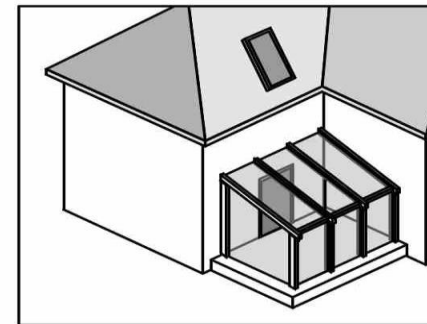
door leaks



melting snow



accidental spills



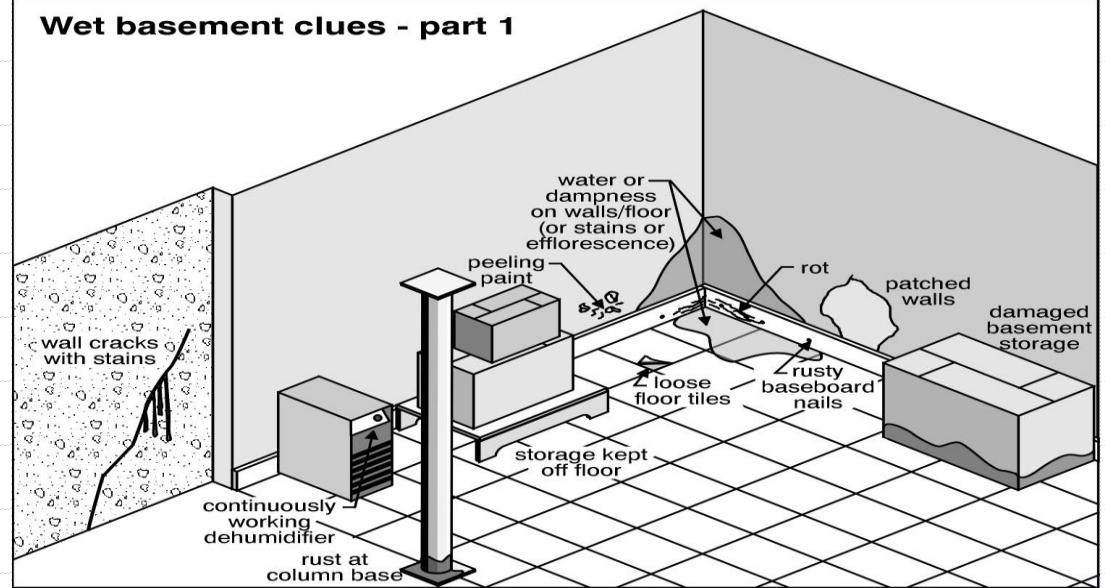
wall, window, solarium and skylight leaks

Interior



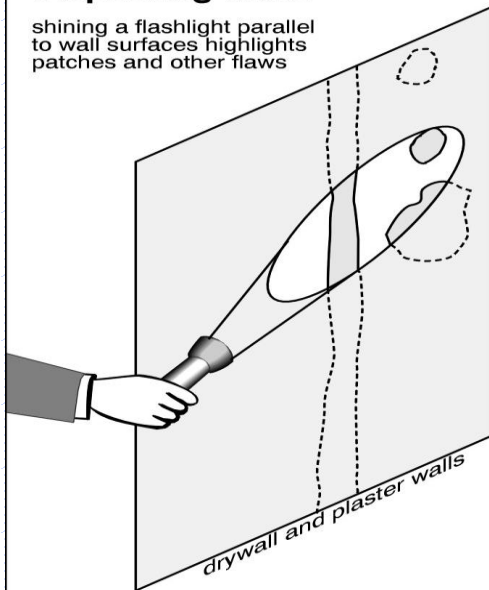
Interior

Wet basement clues - part 1

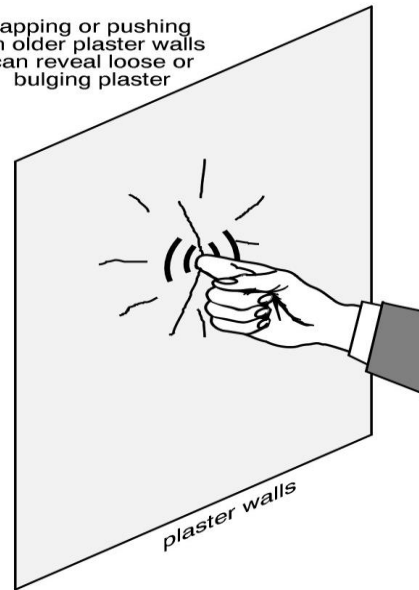


Inspecting walls

shining a flashlight parallel to wall surfaces highlights patches and other flaws



tapping or pushing on older plaster walls can reveal loose or bulging plaster

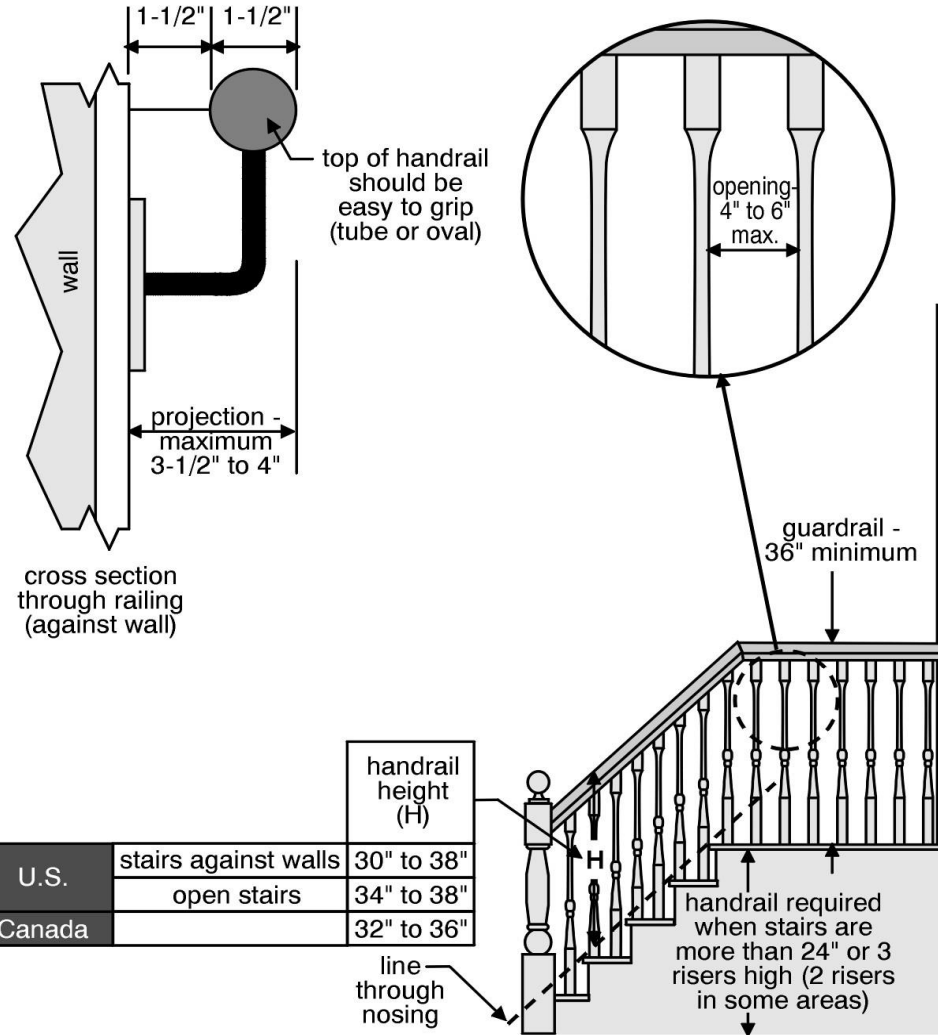


Interior



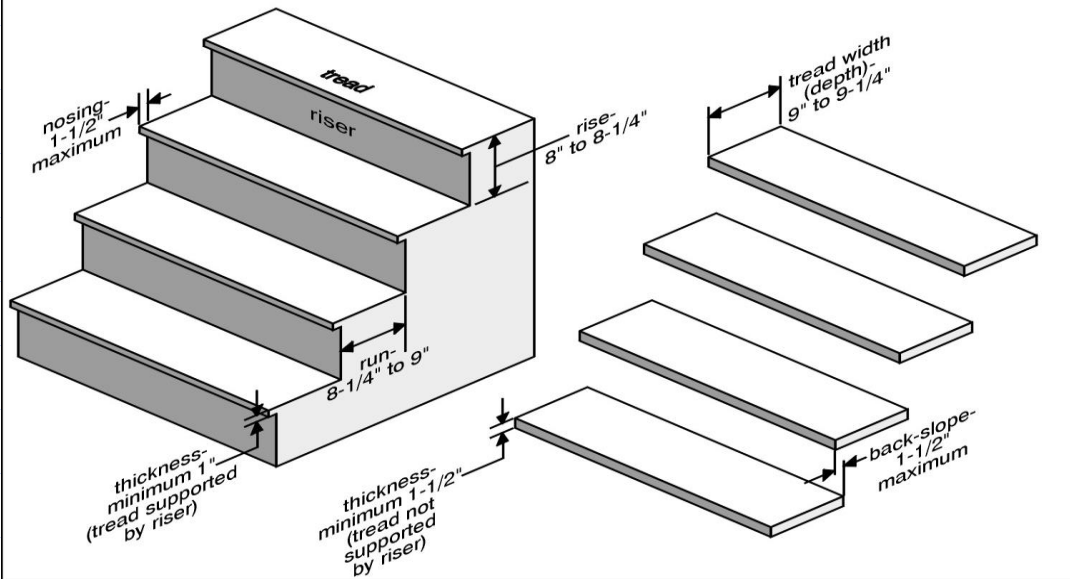
Interior

Handrails and guards

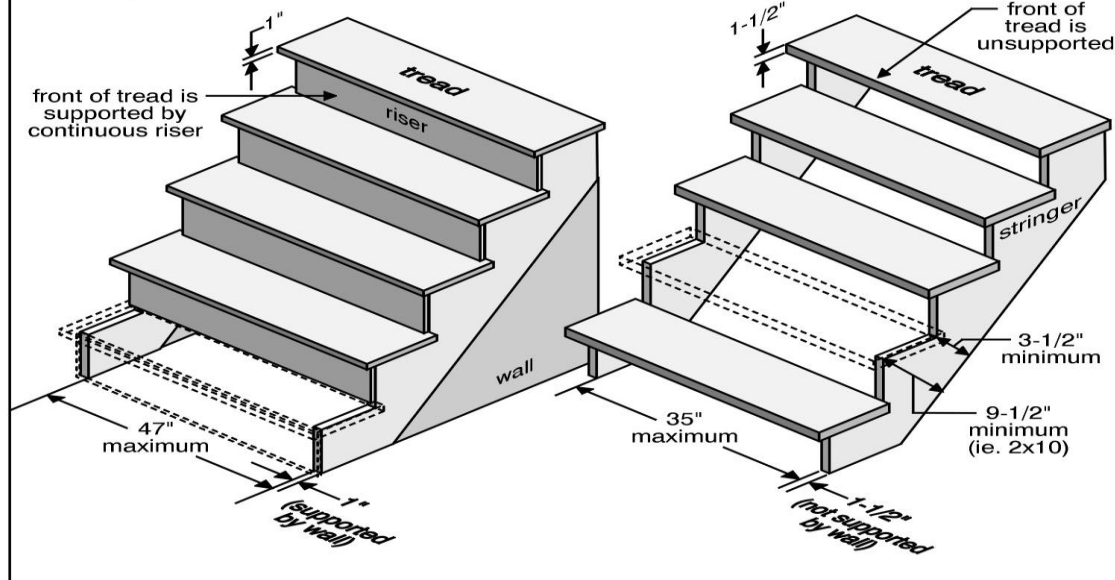


Interior

Stair dimensions (straight stairs)



Stringers

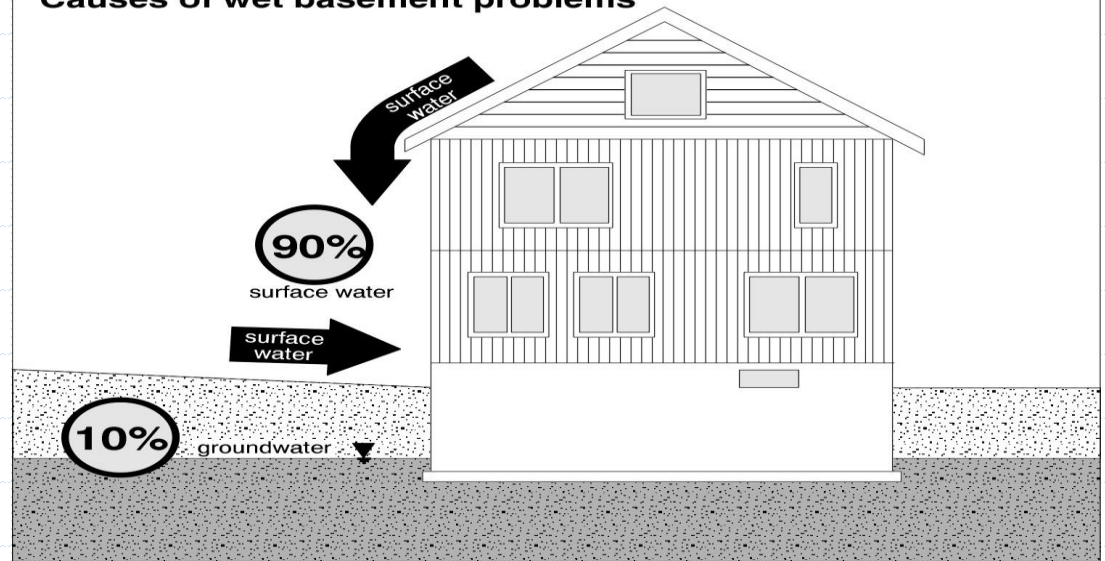


Interior



Interior

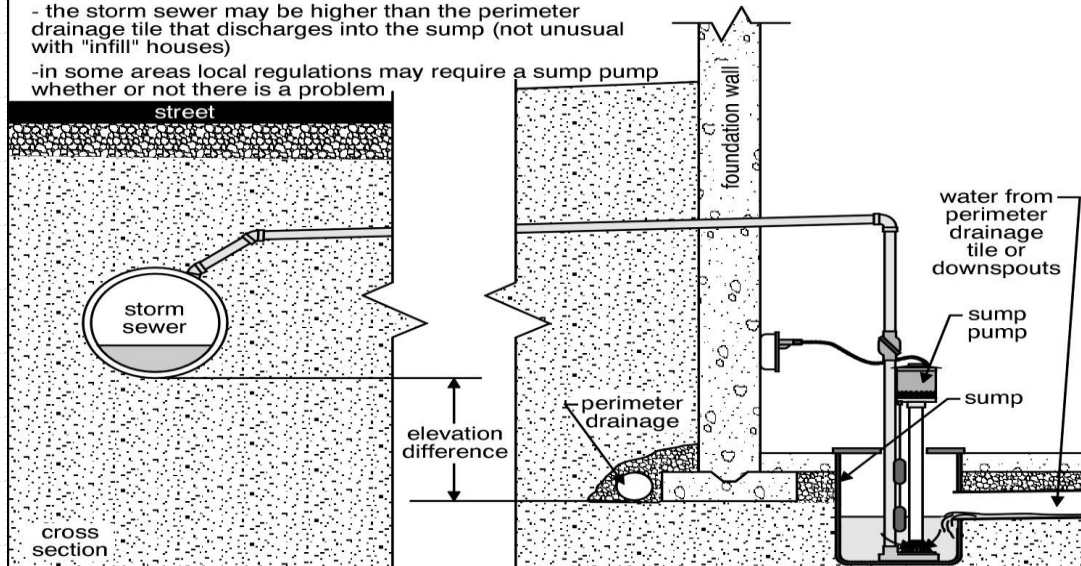
Causes of wet basement problems



Why is there a sump pump in the basement?

there are reasons other than wet basement problems for having a sump pump in the basement

- the storm sewer may be higher than the perimeter drainage tile that discharges into the sump (not unusual with "infill" houses)
- in some areas local regulations may require a sump pump whether or not there is a problem



Interior

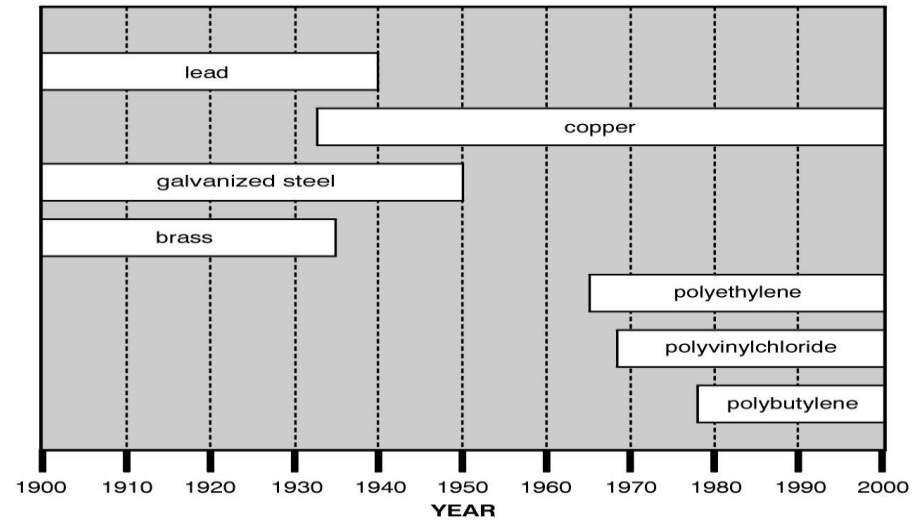


Plumbing

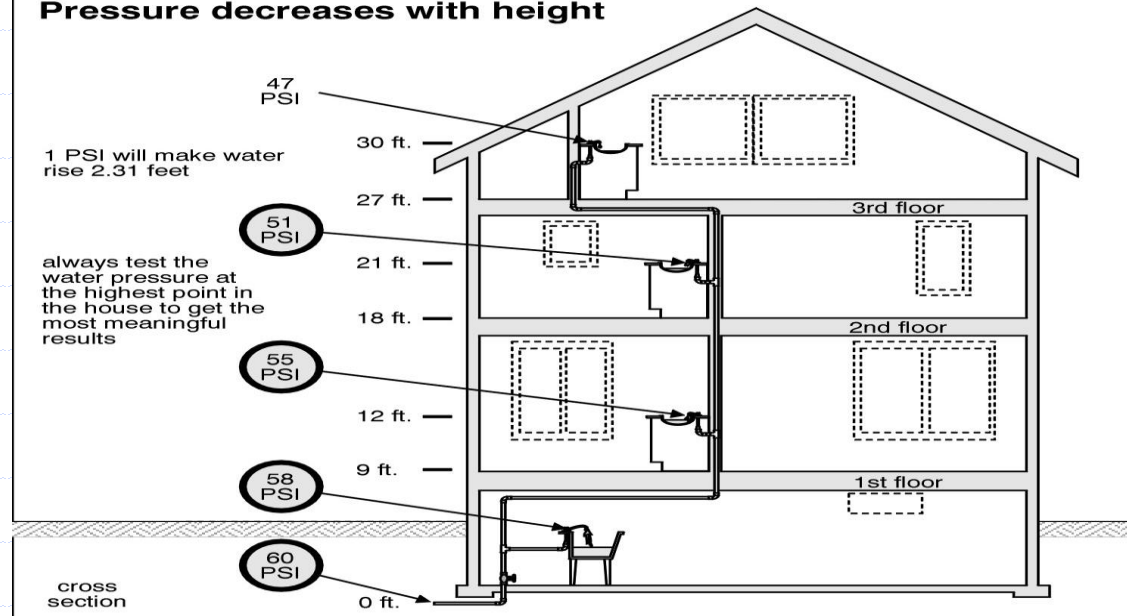


Plumbing

Service piping - when different types were used



Pressure decreases with height

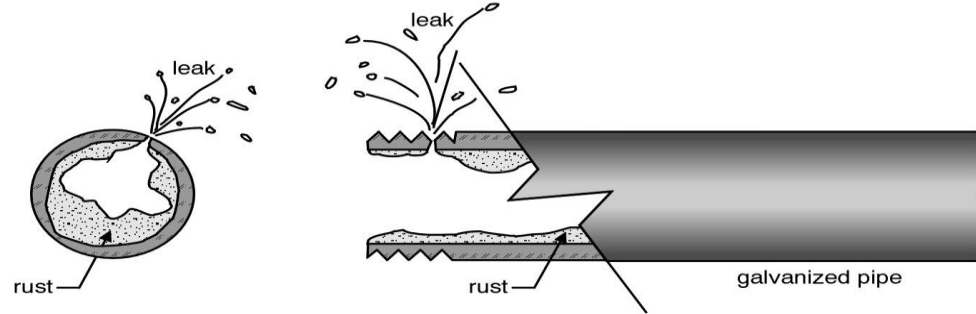


Plumbing

Galvanized steel pipe

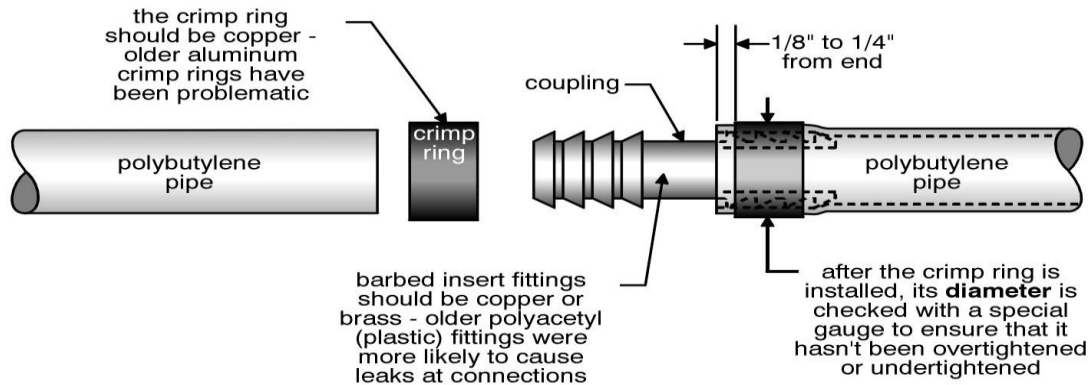
rusting of galvanized pipe can greatly reduce water pressure and will eventually cause leaks as rust creates holes in the pipe walls

problems are likely to occur soonest on pipes carrying hot water, horizontal pipes and at threaded (thinner) sections



cross section

Polybutylene pipe - crimp fitting



Plumbing

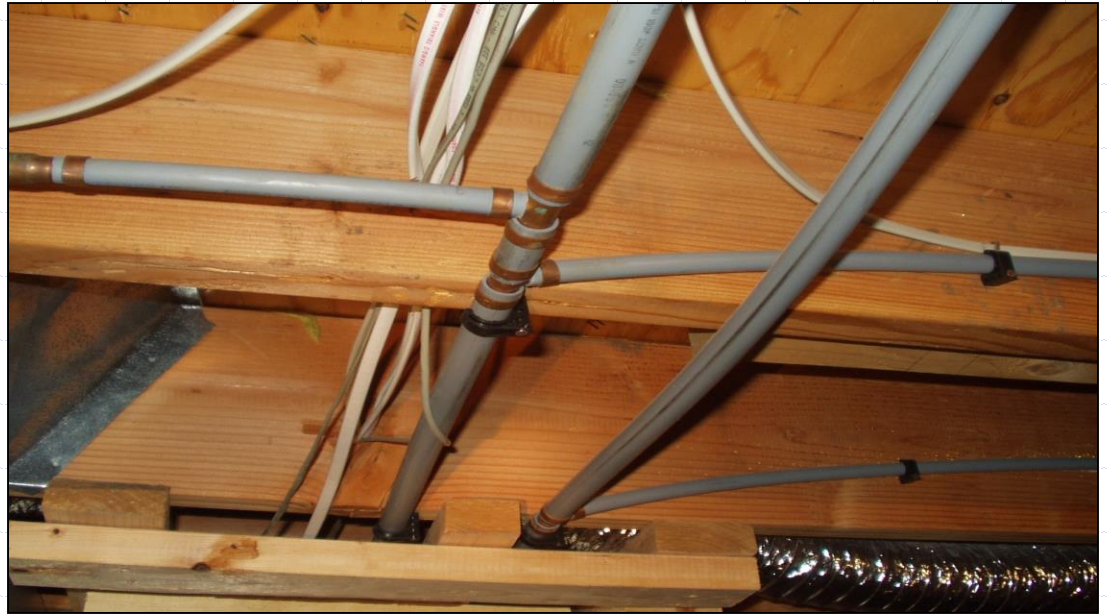


Plumbing

Problems With Polybutylene

- Oxidants in the public water supply, especially chlorine react with the piping and fittings causing the pipe to become brittle
- Brittleness causes the pipe to become weak and susceptible to sudden failure
- Improper installation also leads to problems
- Plastic and metal fittings both fail due to improperly calibrated crimping machines, but plastic fails at a greater rate
- Failure takes 10-15 years in most cases
- The piping will deteriorate from the inside, so a visual inspection cannot determine if the piping is in good condition

Plumbing



Plumbing

CLASS ACTION SUIT - COX VS. SHELL OIL

- ◆ In 1995 manufacturers agreed to pay at least \$950 MM.
- ◆ You must own or have previously owned a dwelling plumbed with polybutylene or have had PB yard service.
- ◆ The polybutylene must have been installed between January 1, 1978 and July 31, 1995.
- ◆ Interior polybutylene must have been installed with PB pipe and the insert fittings.
- ◆ To obtain a claim eligibility form, call ***1-800-392-7591 or visit www.pbpipe.com***

Plumbing

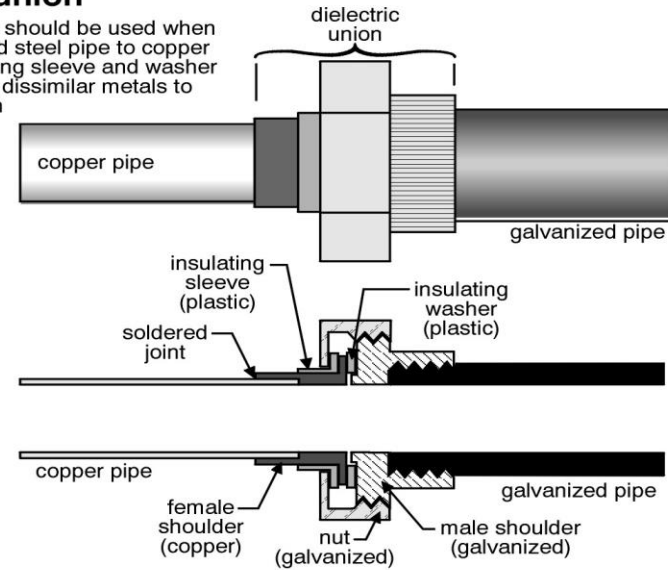
Leaks occurring after August 21, 1995 in PB piping

Dwelling Type	Leak Must Occur Within	Must be Filed Within
Mobiles homes	10 years of PB yard service line installation	11 years of PB yard service line installation
Yard Service	10 years of PB yard service line installation	11 years of PB yard service line installation
Single Family w/ Plastic Fittings	13 years of PB plumbing installation	14 years of PB plumbing installation
Single Family w/ Metal Fittings	16 years of PB plumbing installation or January 31, 2009 (whichever comes first)	17 years of PB plumbing installation or May 1, 2009 (whichever comes first)

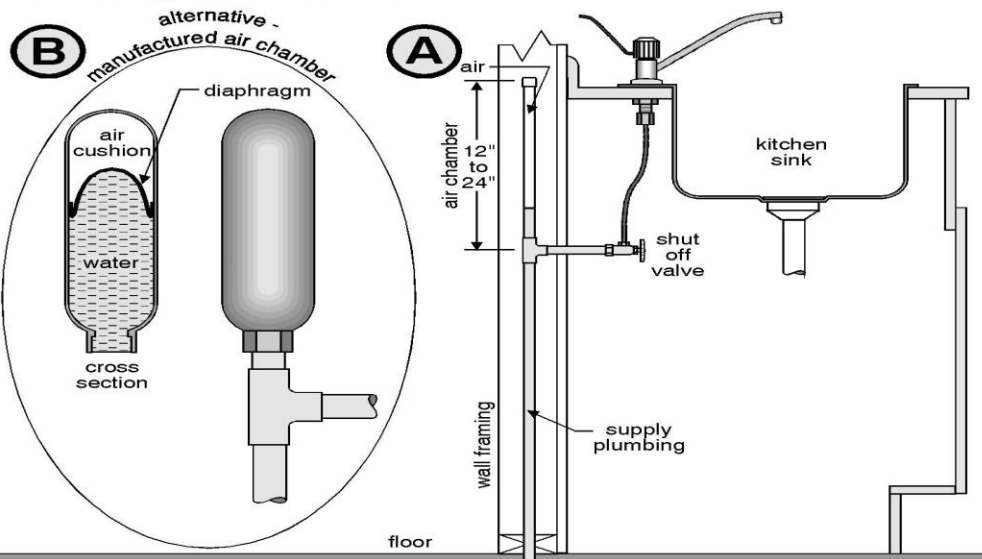
Plumbing

Dielectric union

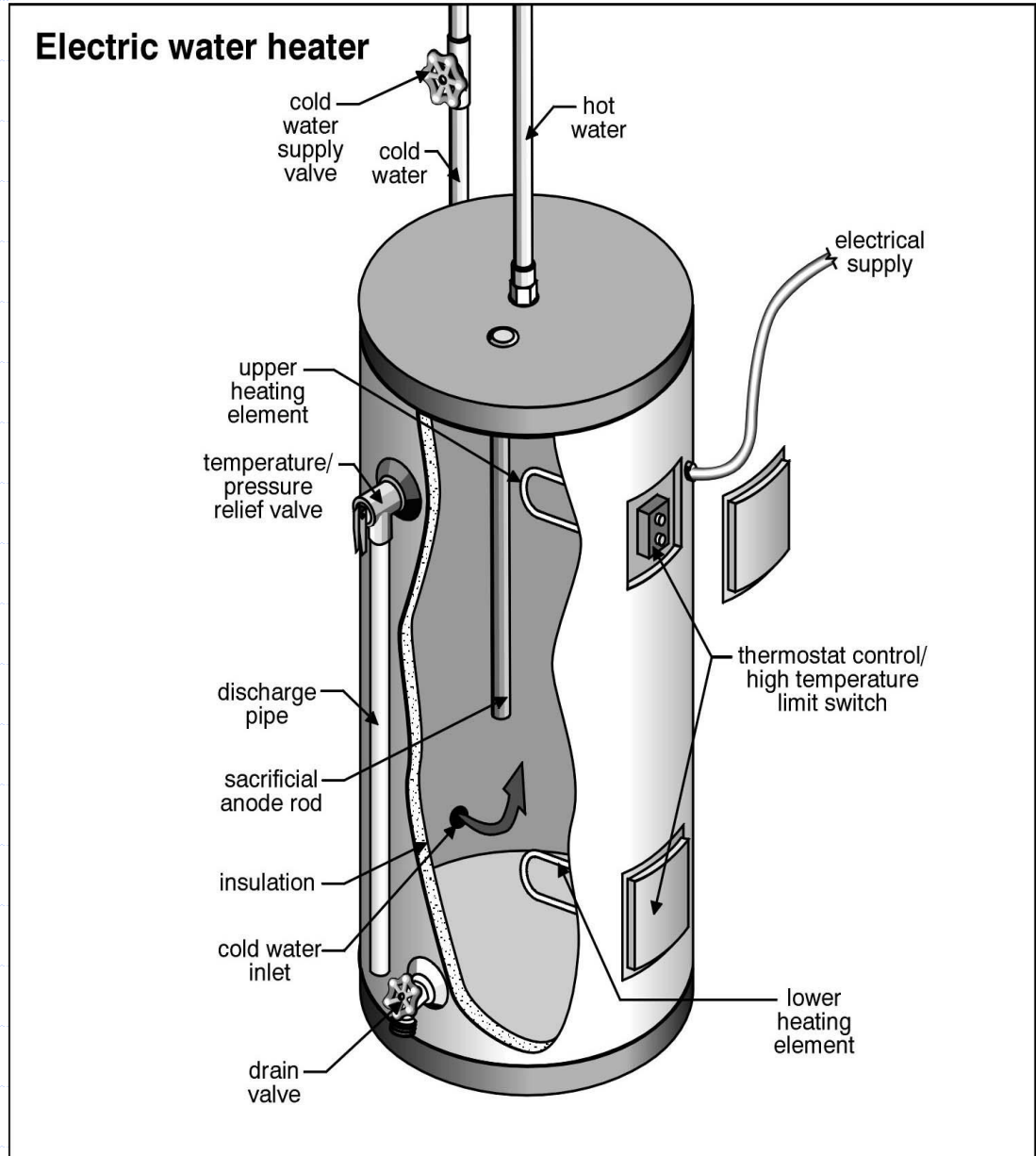
a dielectric union should be used when joining galvanized steel pipe to copper pipe - the insulating sleeve and washer separate the two dissimilar metals to prevent corrosion



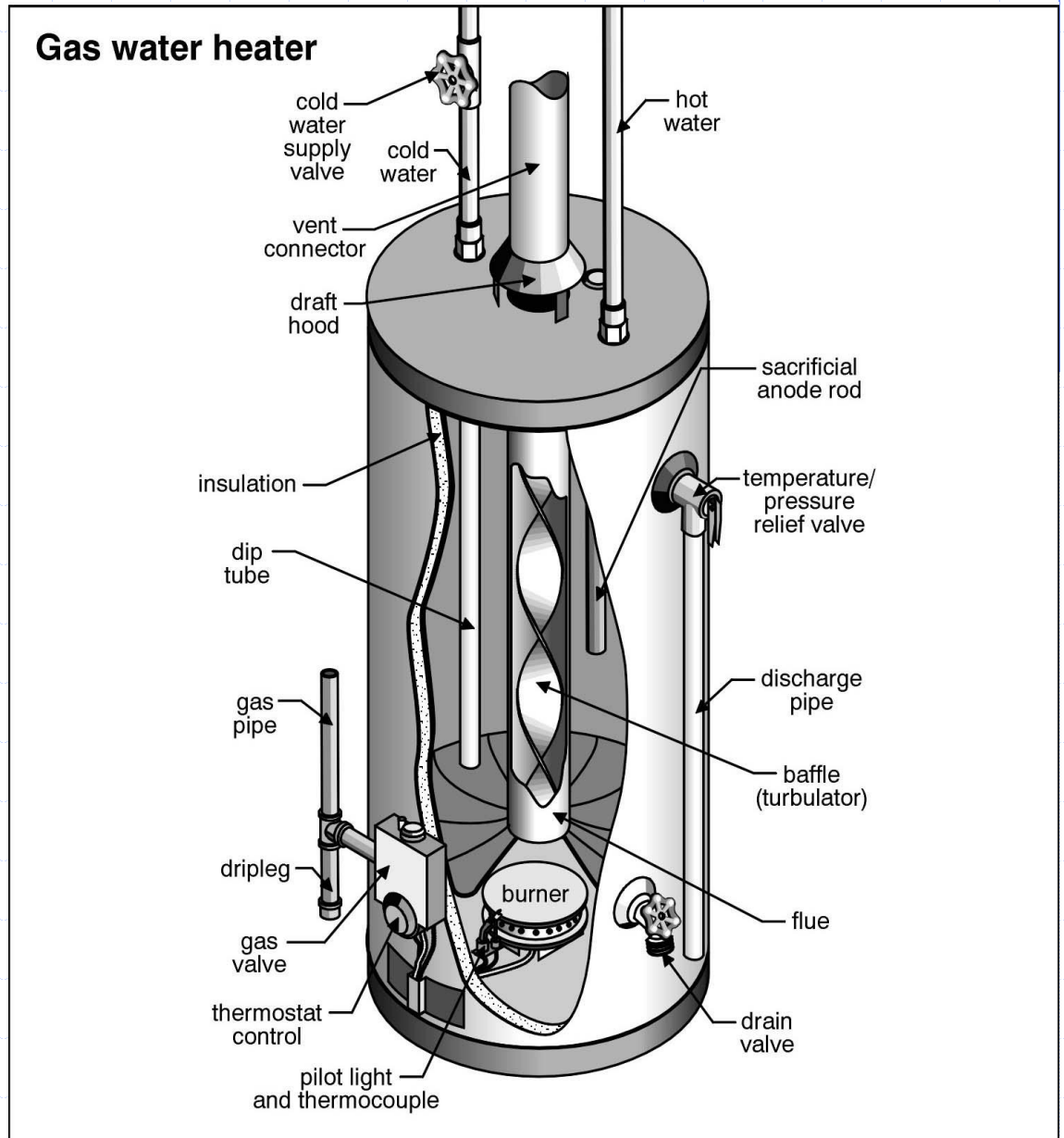
Correcting water hammer



Plumbing



Plumbing



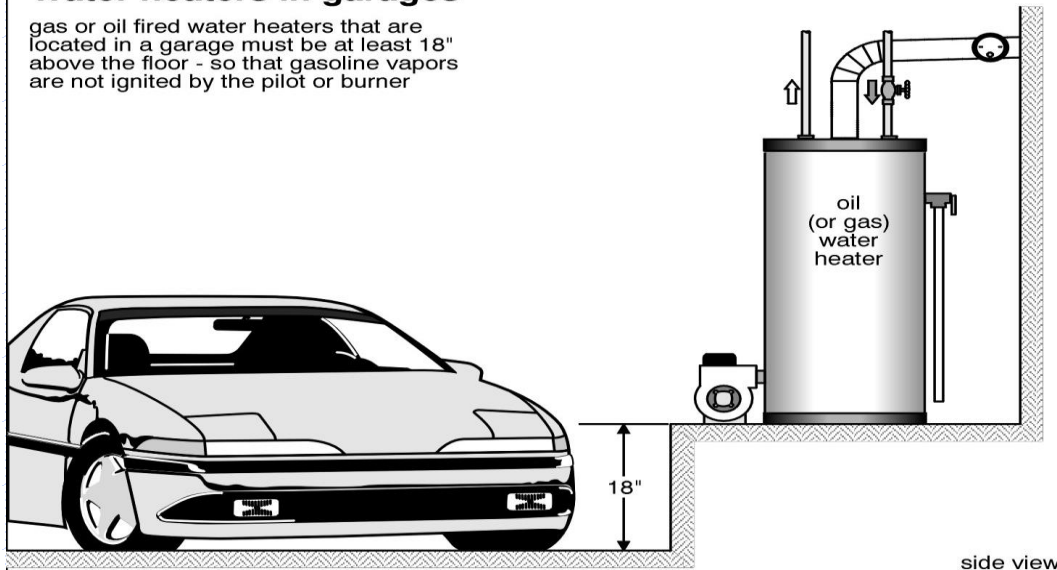
Plumbing



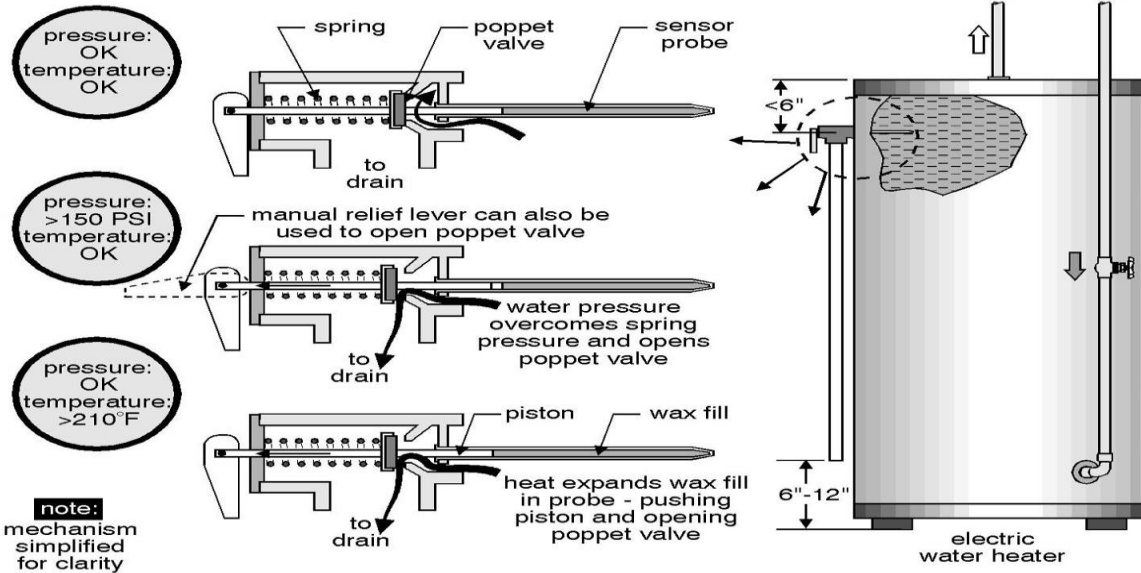
Plumbing

Water heaters in garages

gas or oil fired water heaters that are located in a garage must be at least 18" above the floor - so that gasoline vapors are not ignited by the pilot or burner



Temperature/pressure relief valve

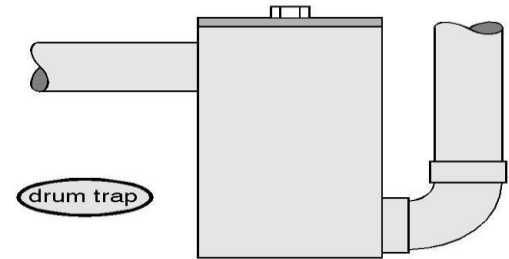
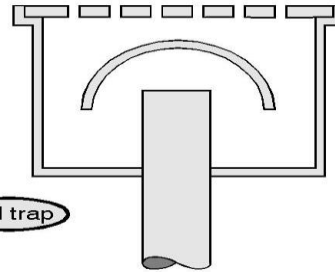
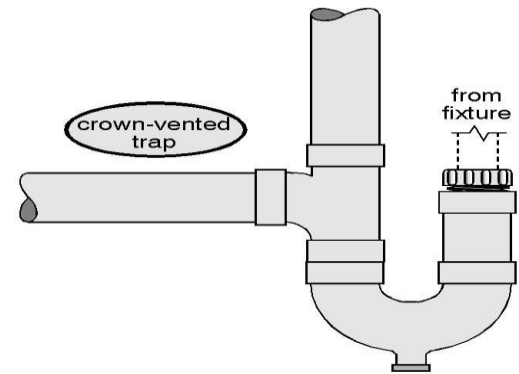
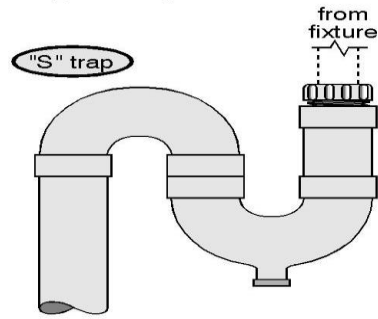


Plumbing

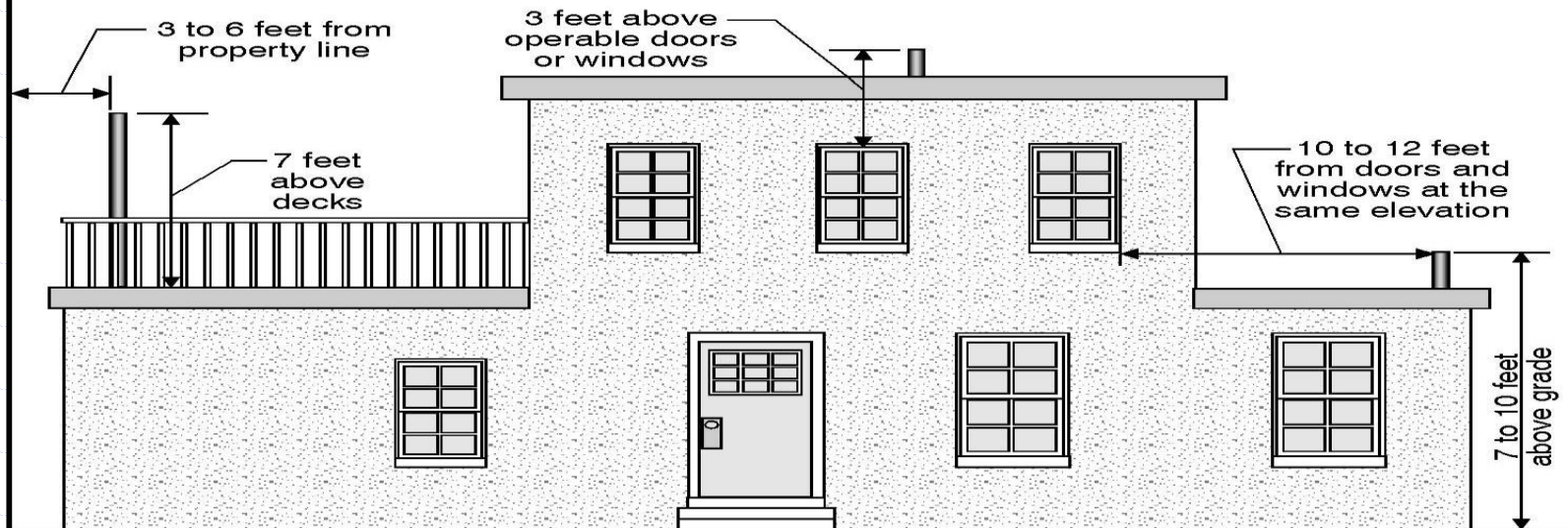


Plumbing

Illegal traps

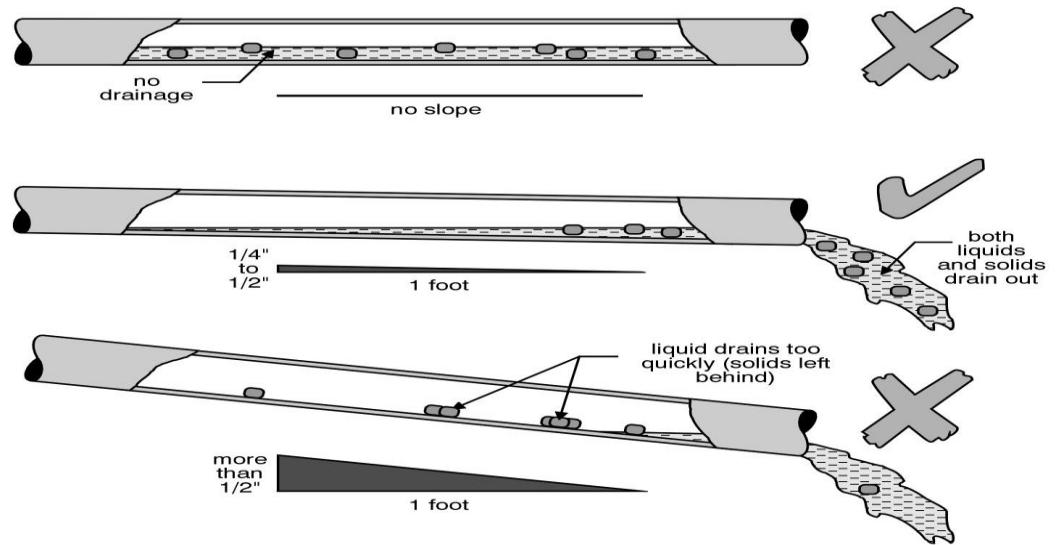


Plumbing vent clearances

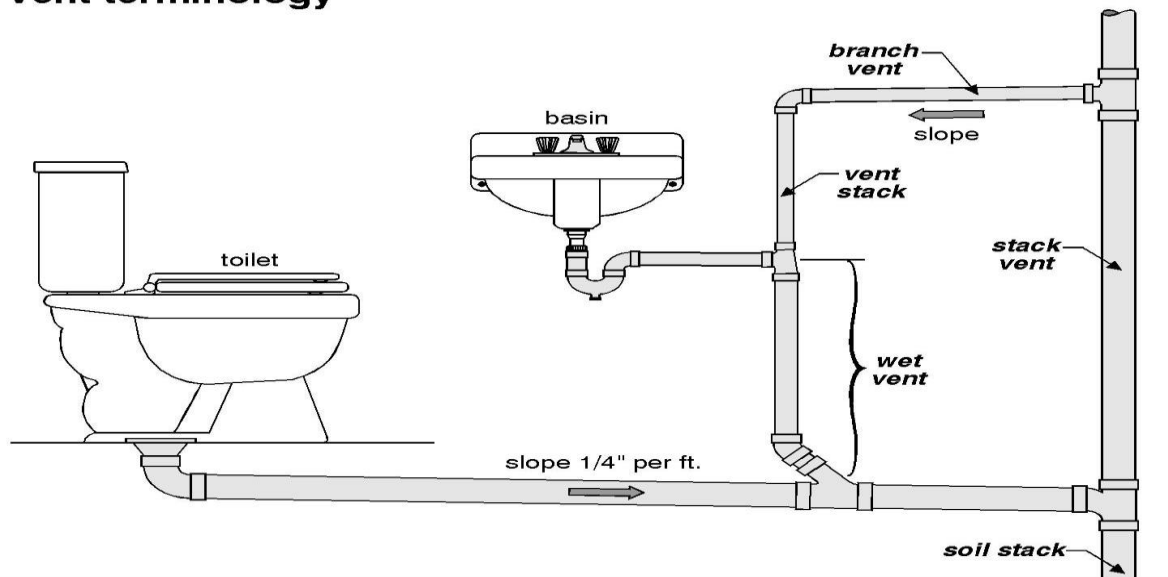


Plumbing

Too little or too much slope isn't good

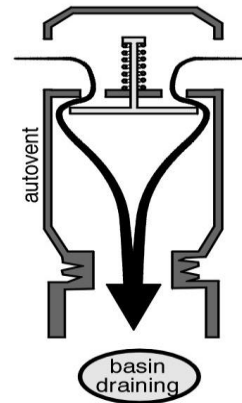


Vent terminology

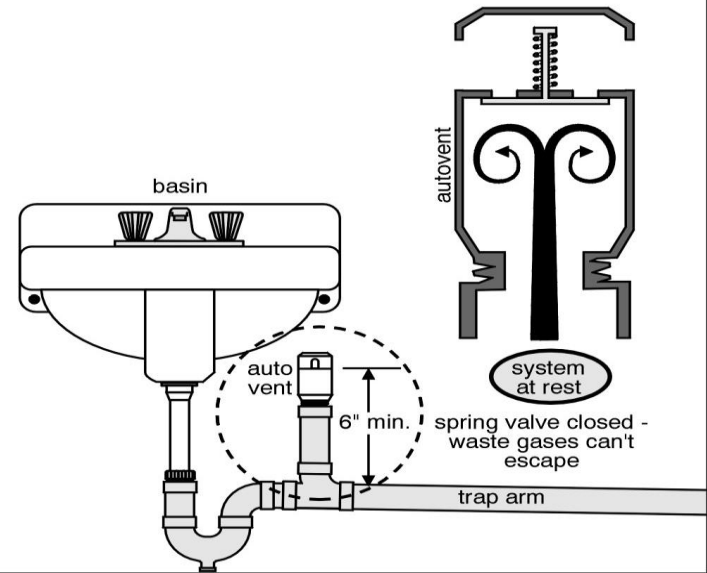


Plumbing

Automatic air vent or air admittance valve

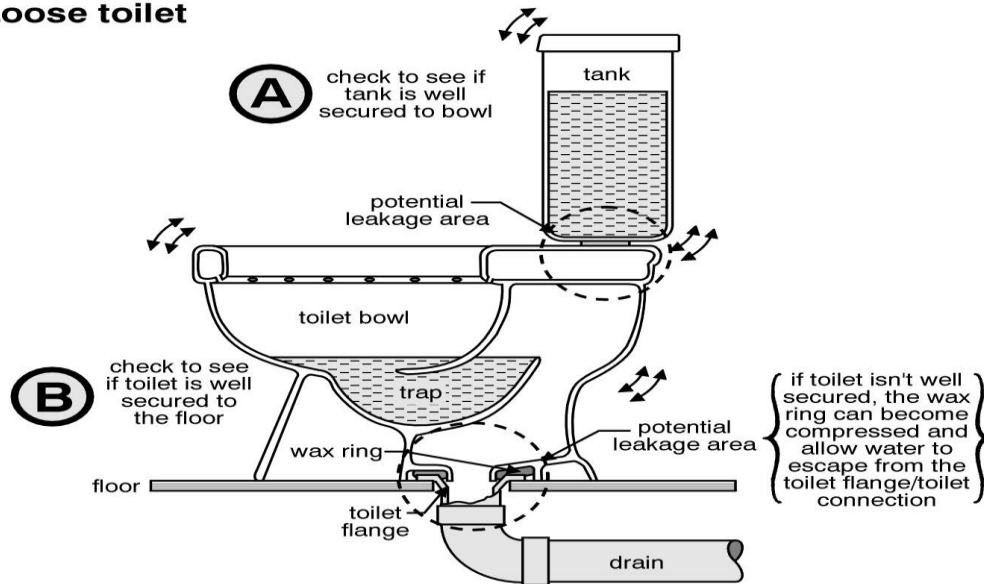


waste piping under negative pressure - spring valve opens to let air into the system

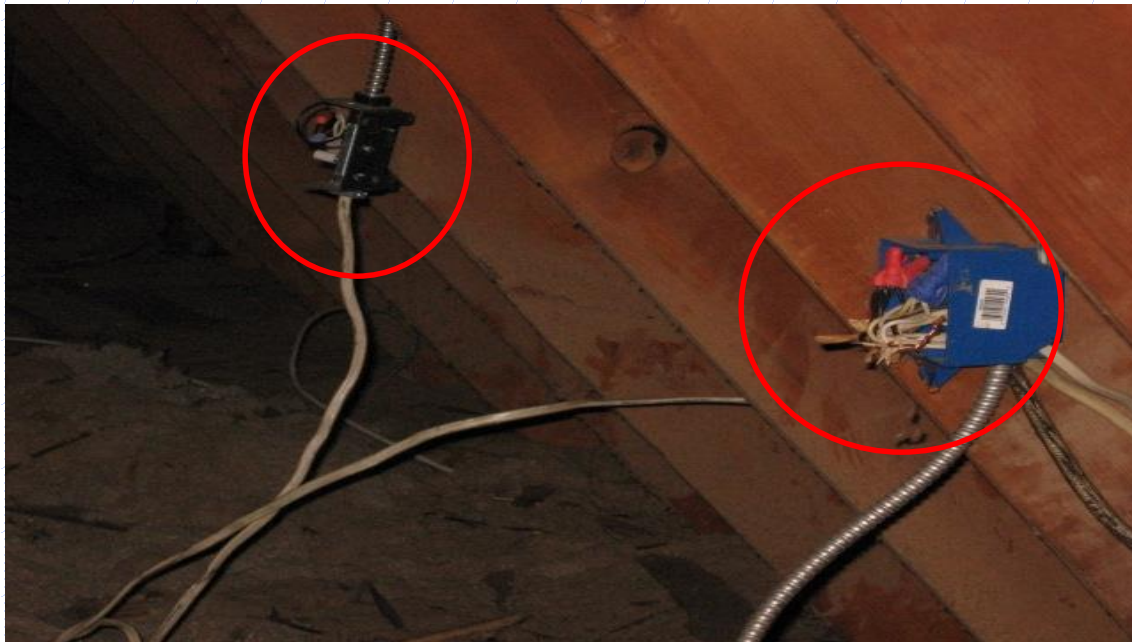


spring valve closed - waste gases can't escape

Loose toilet

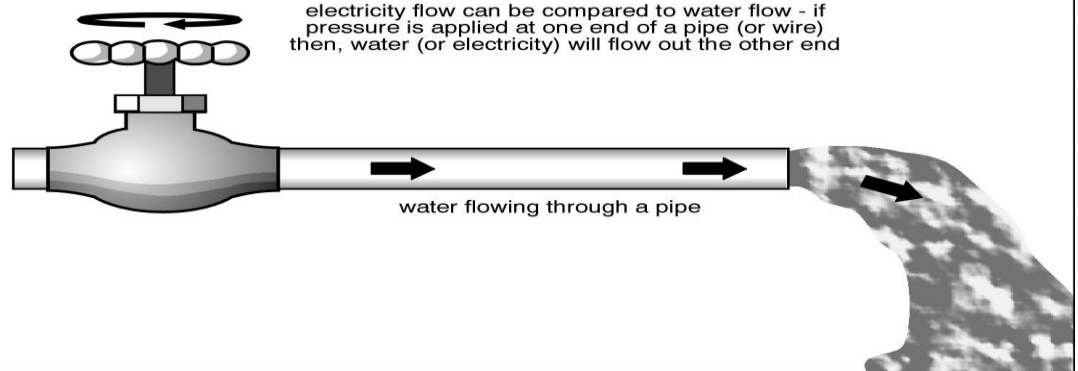
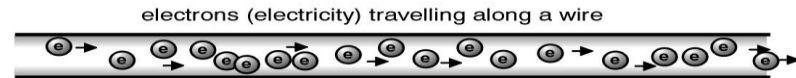


Electrical

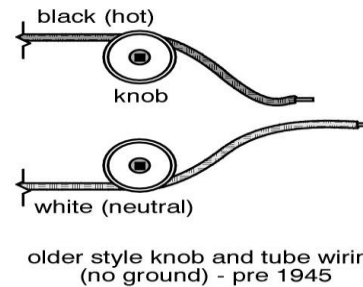
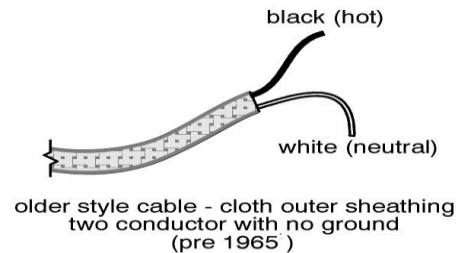
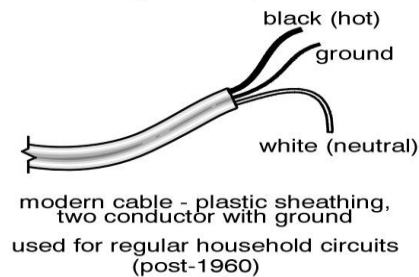
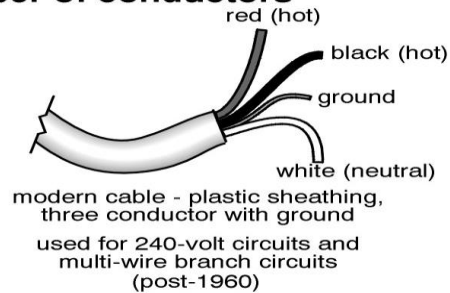


Electrical

Electricity - basic concepts

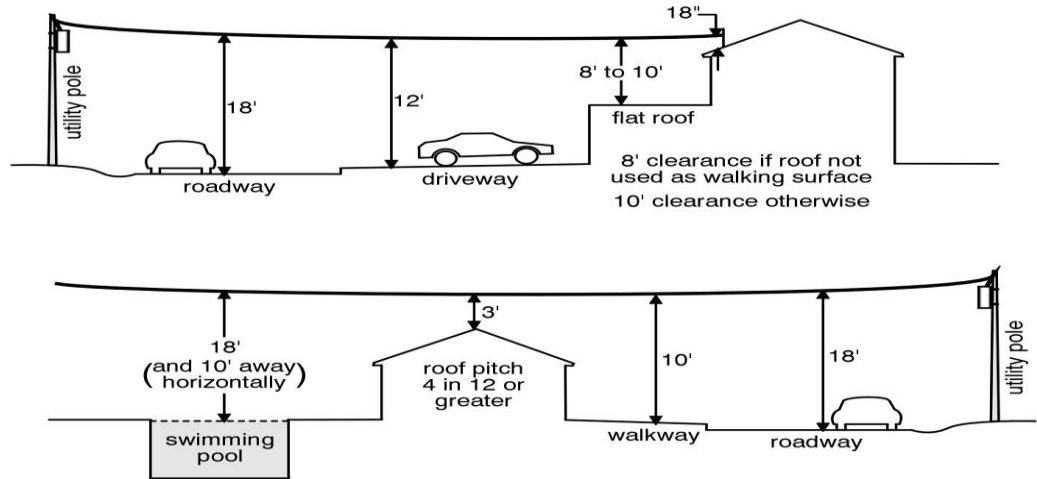


Number of conductors



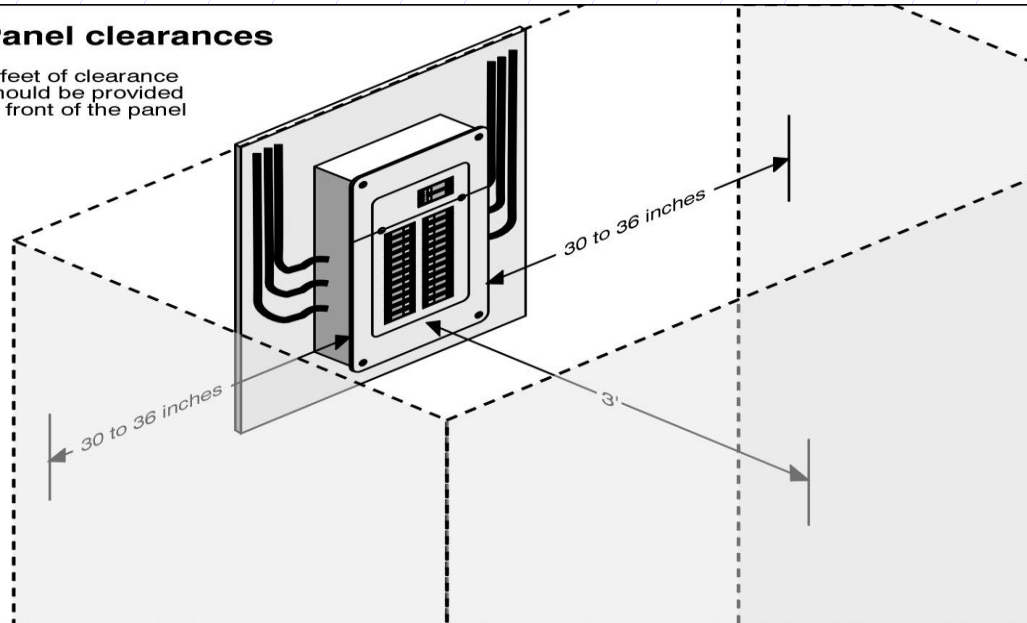
Electrical

Service drop clearances (United States)



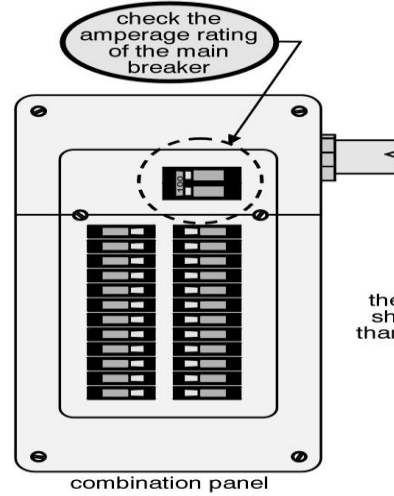
Panel clearances

3 feet of clearance should be provided in front of the panel

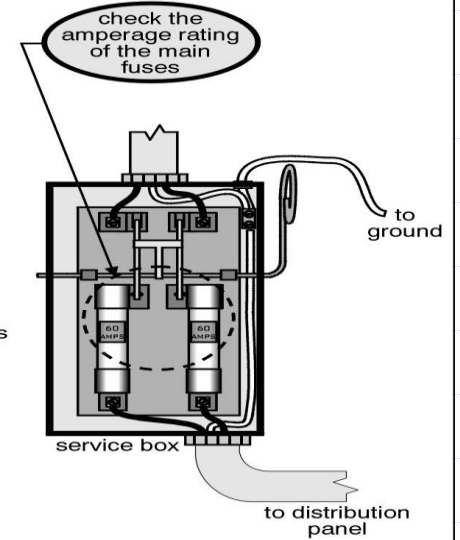


Electrical

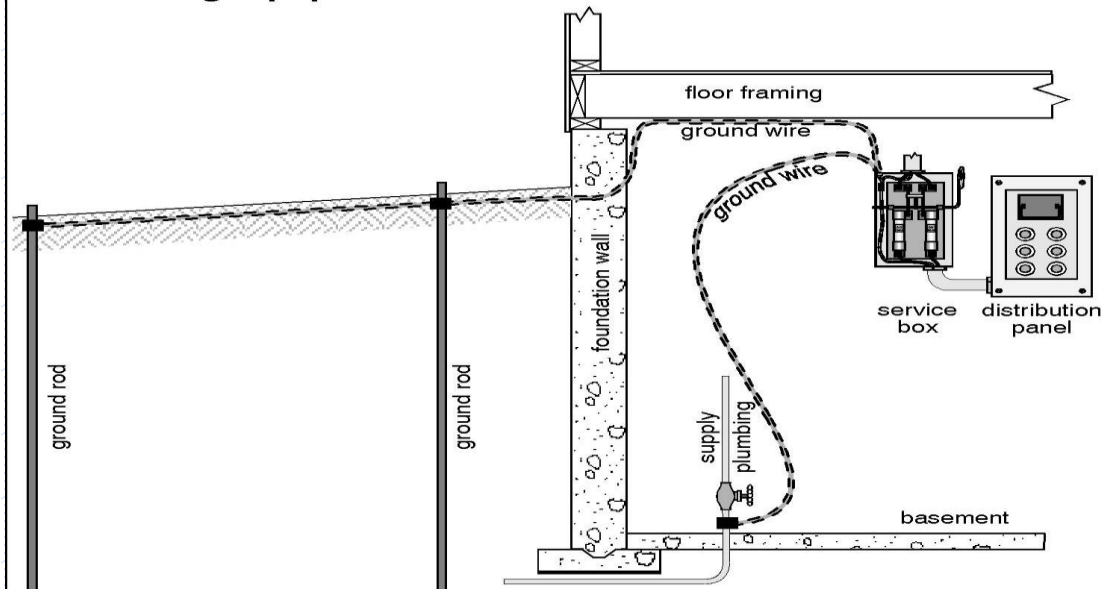
Determining service size by the main disconnect



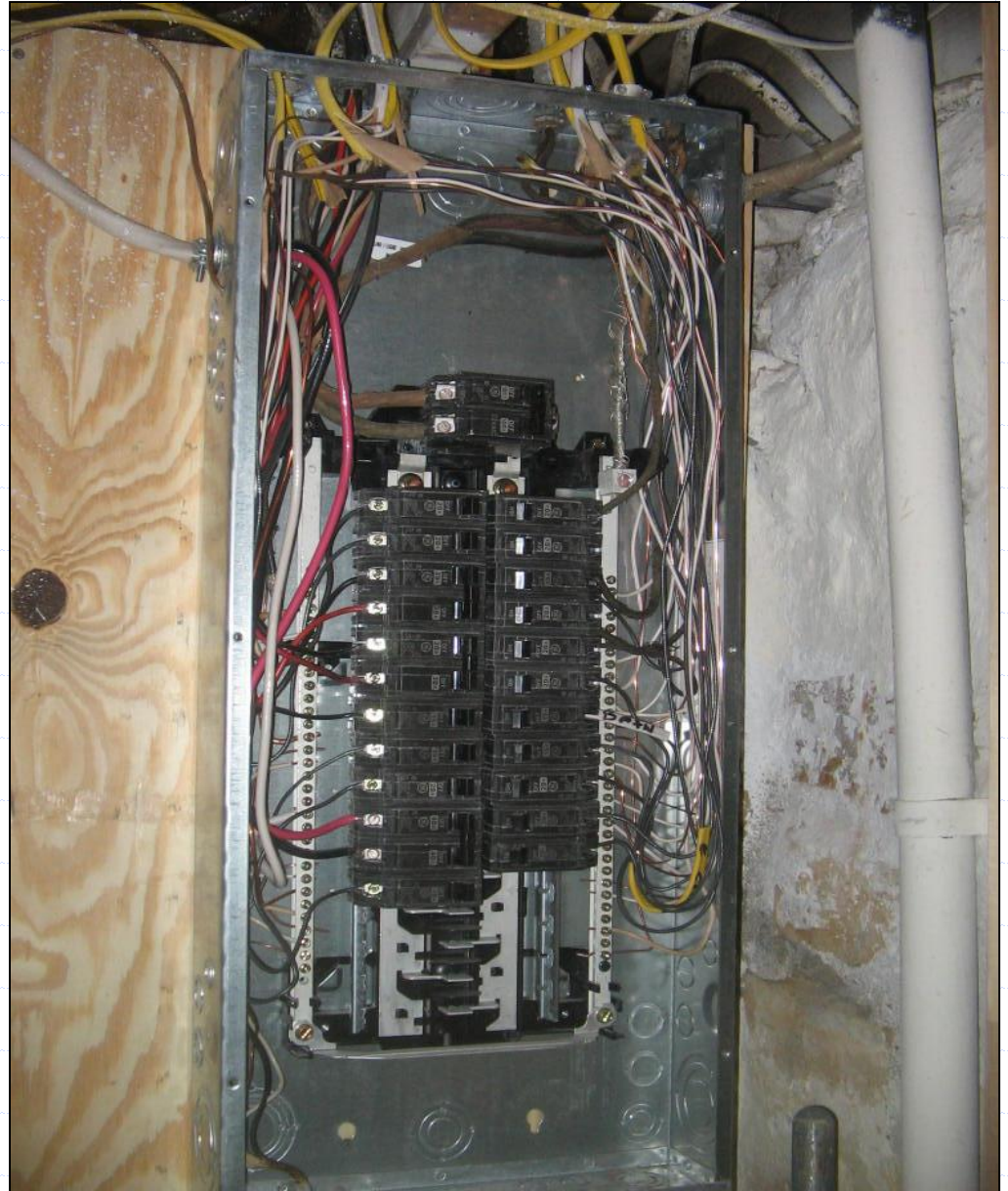
note:
the panel (box) rating should be no smaller than the fuses/breakers



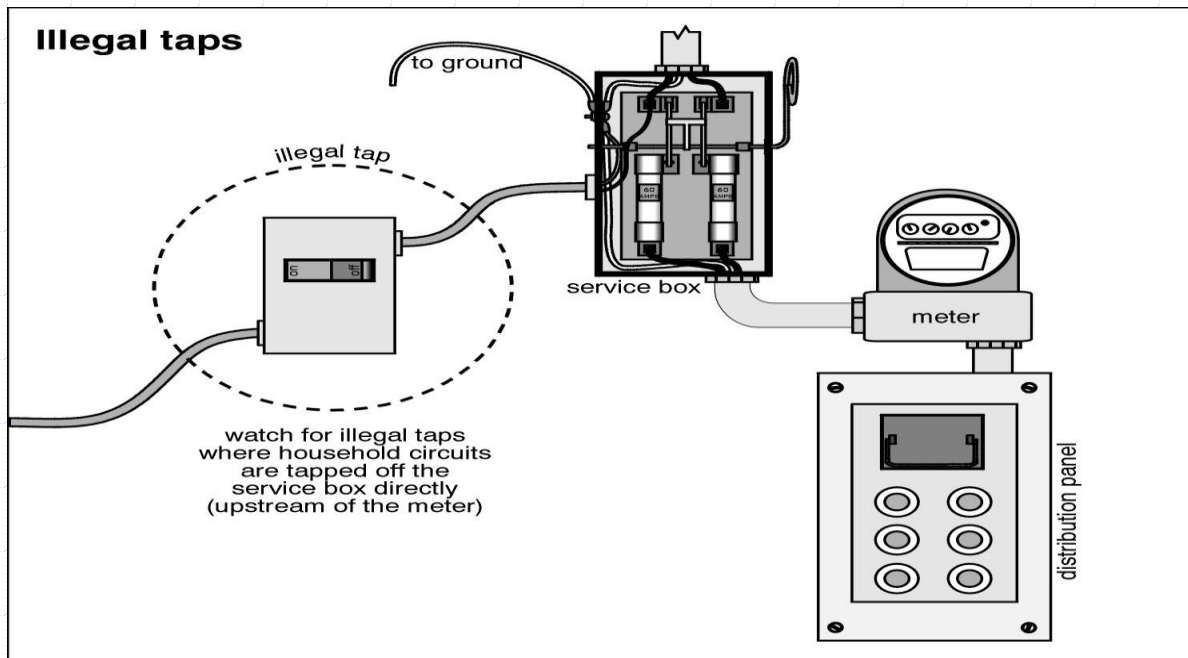
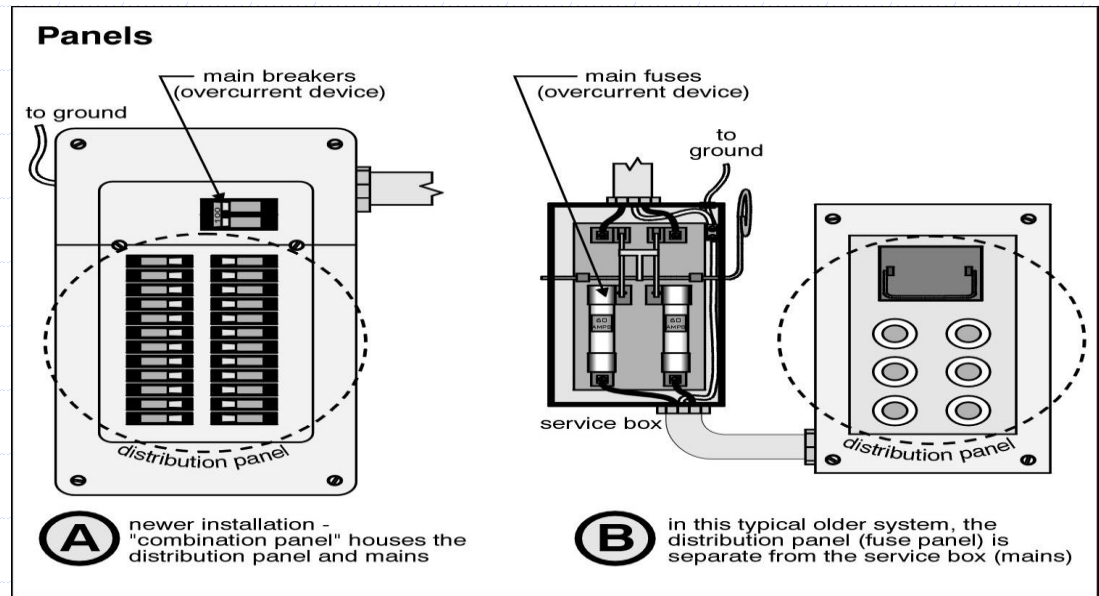
Grounding equipment



Electrical

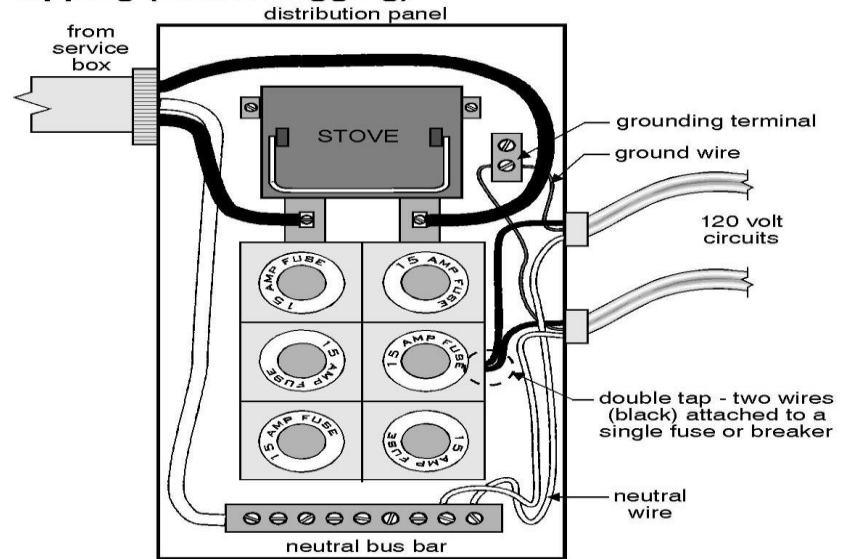


Electrical

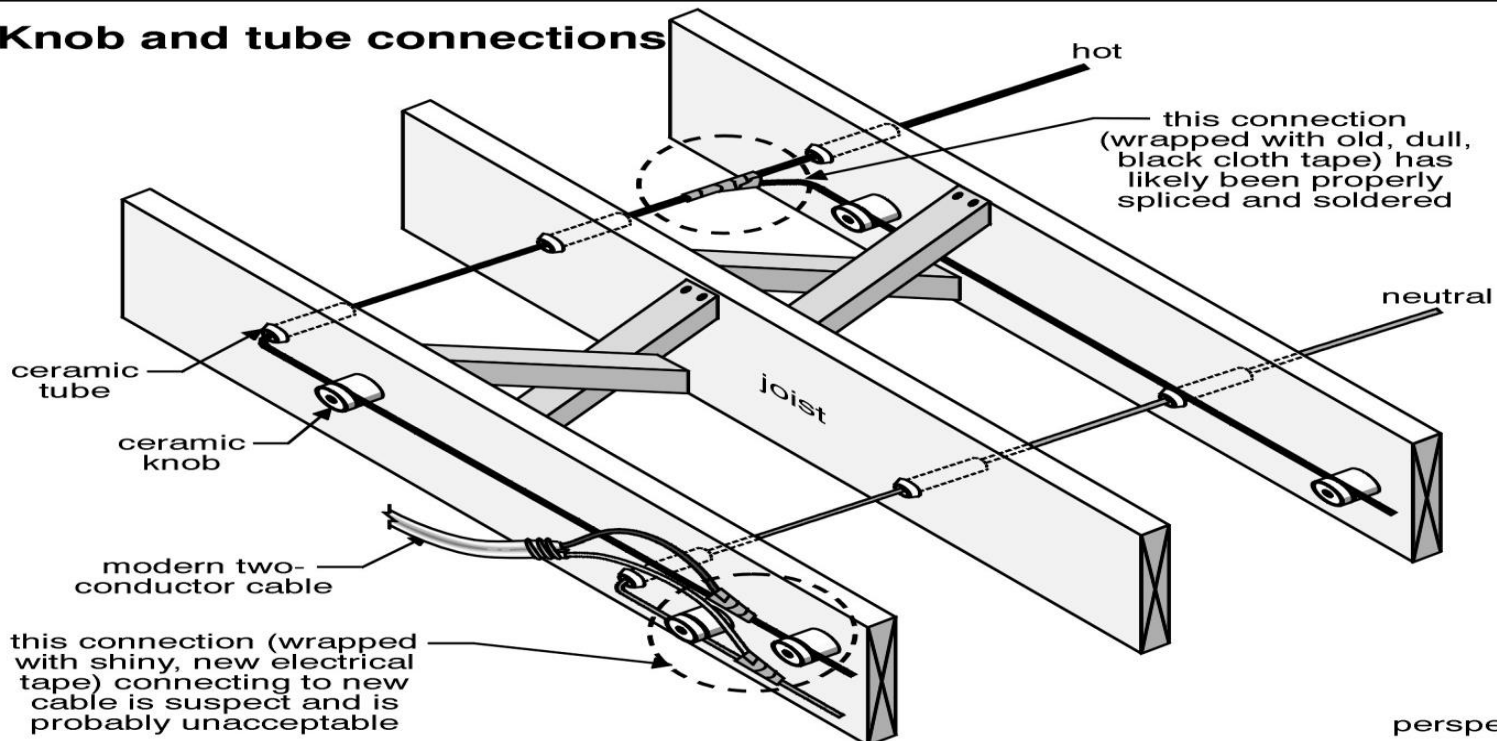


Electrical

Double tapping (double lugging)

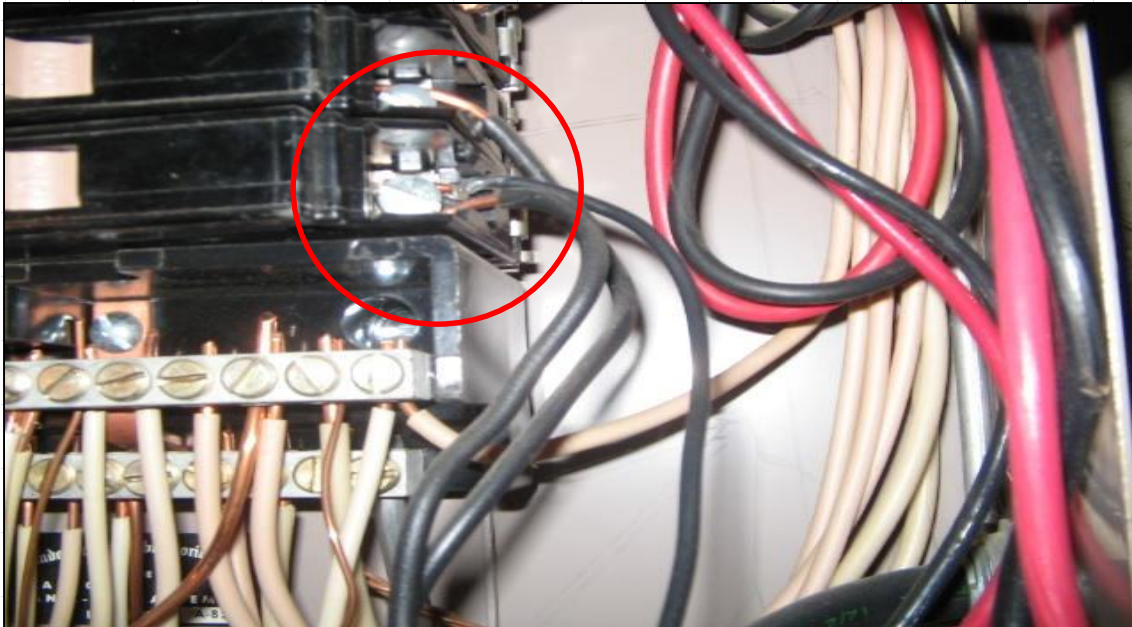
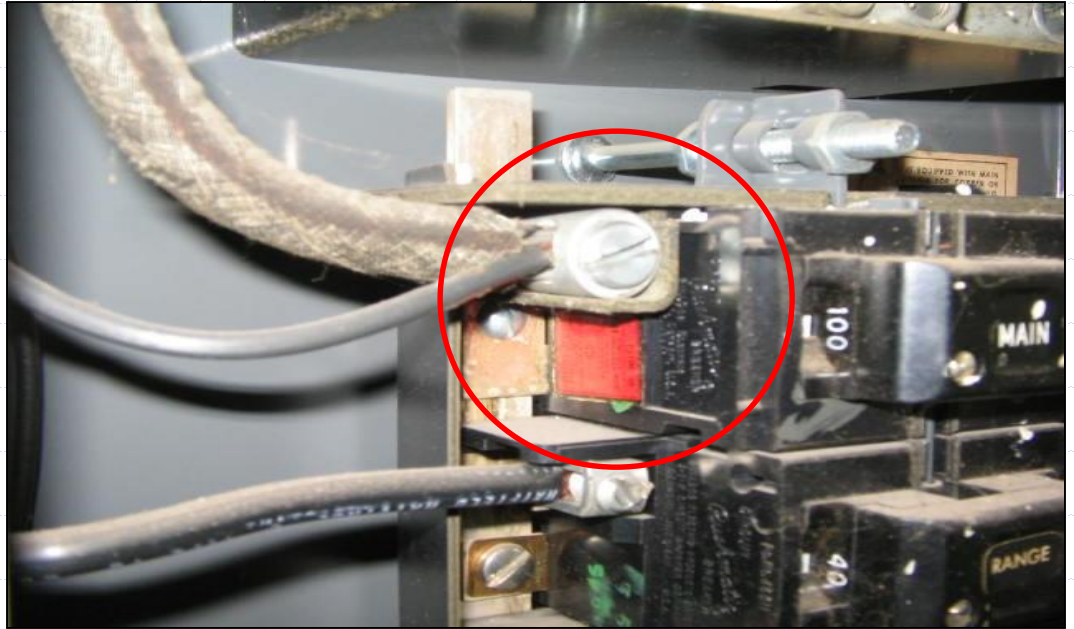


Knob and tube connections



perspective

Electrical



Electrical

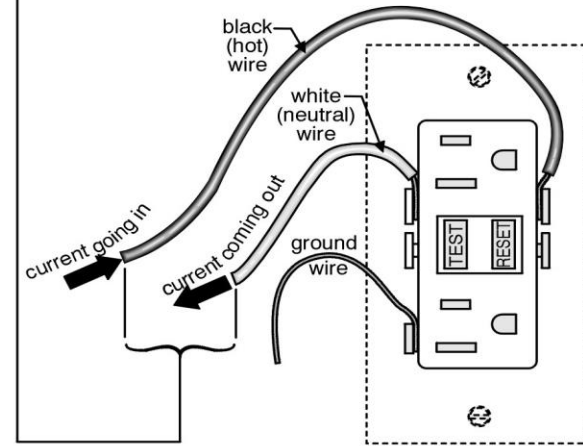
Ground fault interrupter

the GFI circuitry within the outlet checks constantly for a difference between the current in the black and white wires

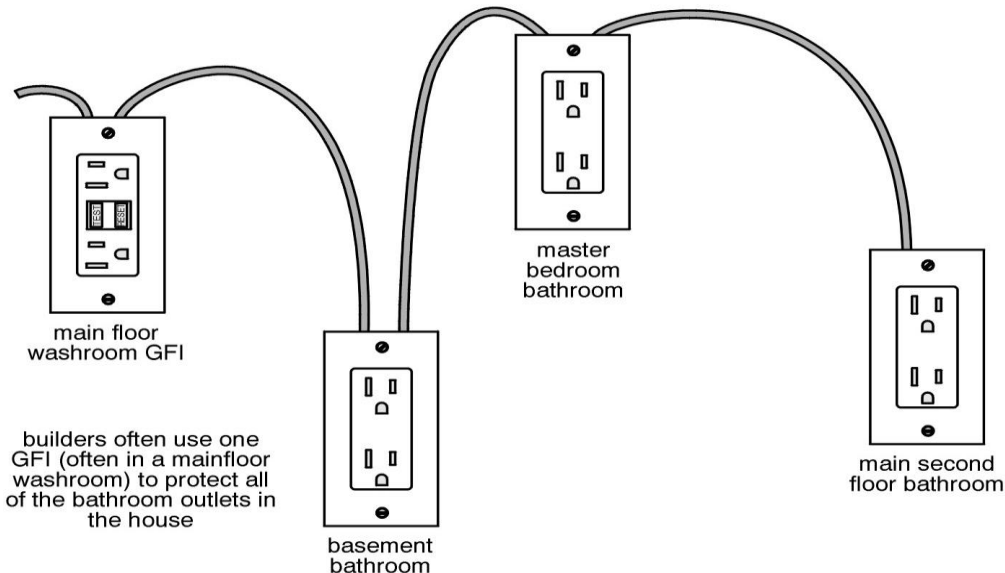
if there is a difference (even as little as 5 milliamps), there is a current leak (possibly through your body) and the GFI shuts down the receptacle and other receptacles downstream

note:

if the GFI is in the panel, the entire circuit will be shut down



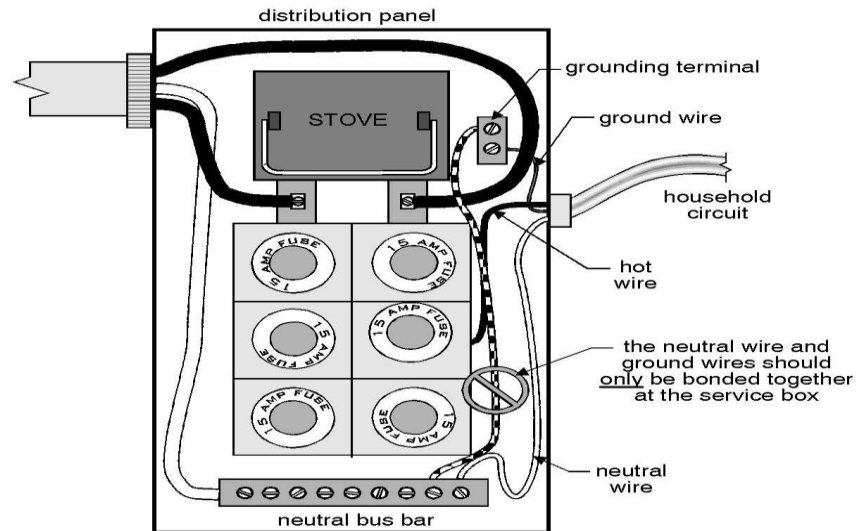
GFI's can protect ordinary outlets downstream



Electrical

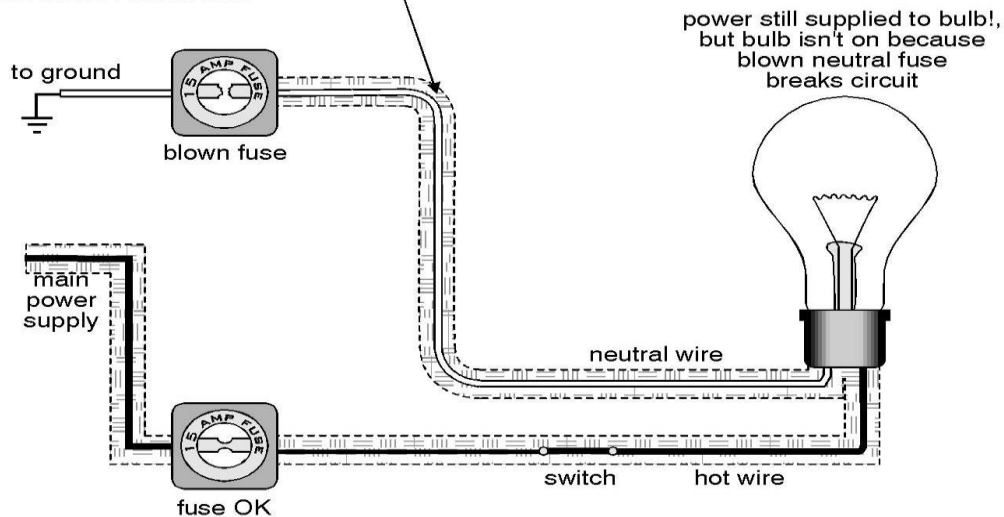
Typically found with older homes fuse panel in stairways or hallway

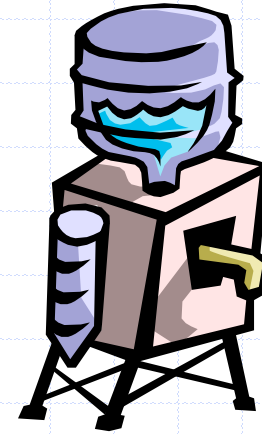
Don't bond neutral and ground wires downstream of service box



Fused neutrals in old wiring systems

shock hazard exists all along circuit back to blown neutral fuse





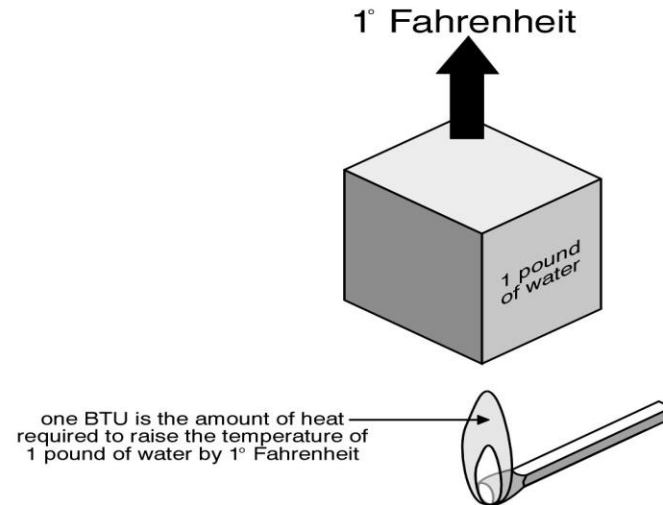
Break

Heating

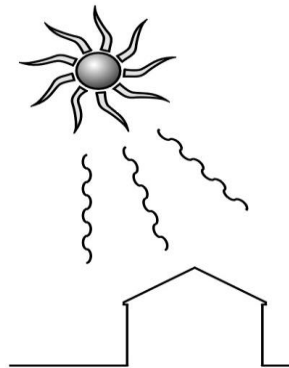


Heating

British Thermal Unit (BTU's)

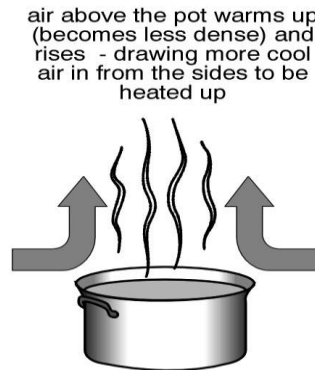


Methods of heat transfer



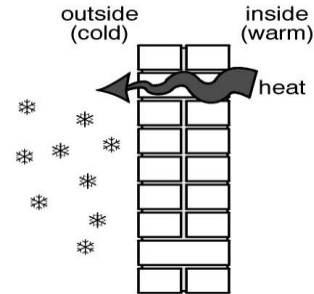
radiation

heat transferred through electromagnetic waves
e.g. thermal infrared energy (sunlight)



convection

heat transfer within a gas or liquid

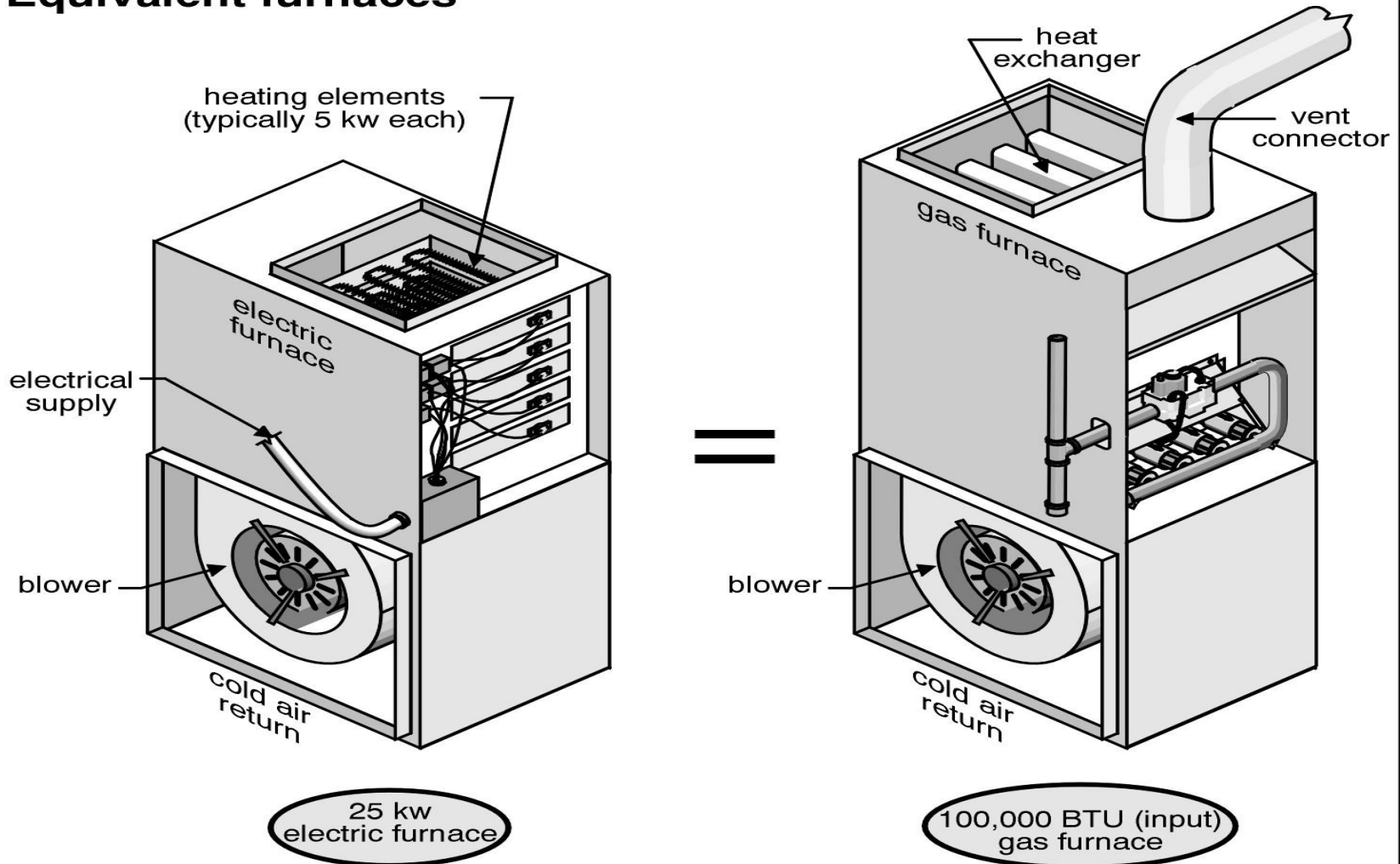


conduction

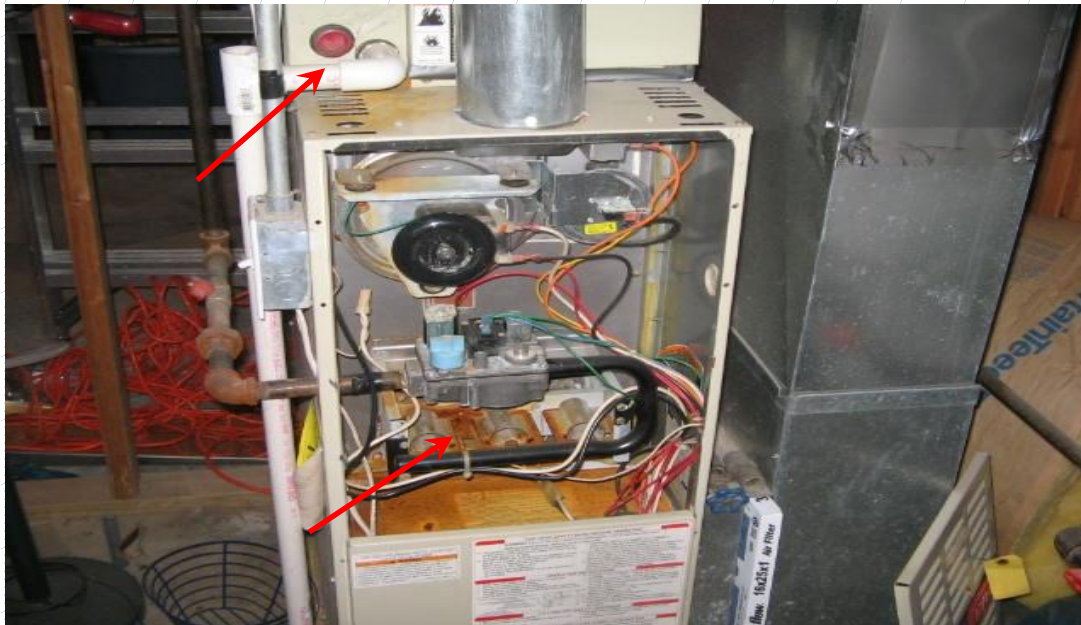
heat transfer through a solid material

Heating

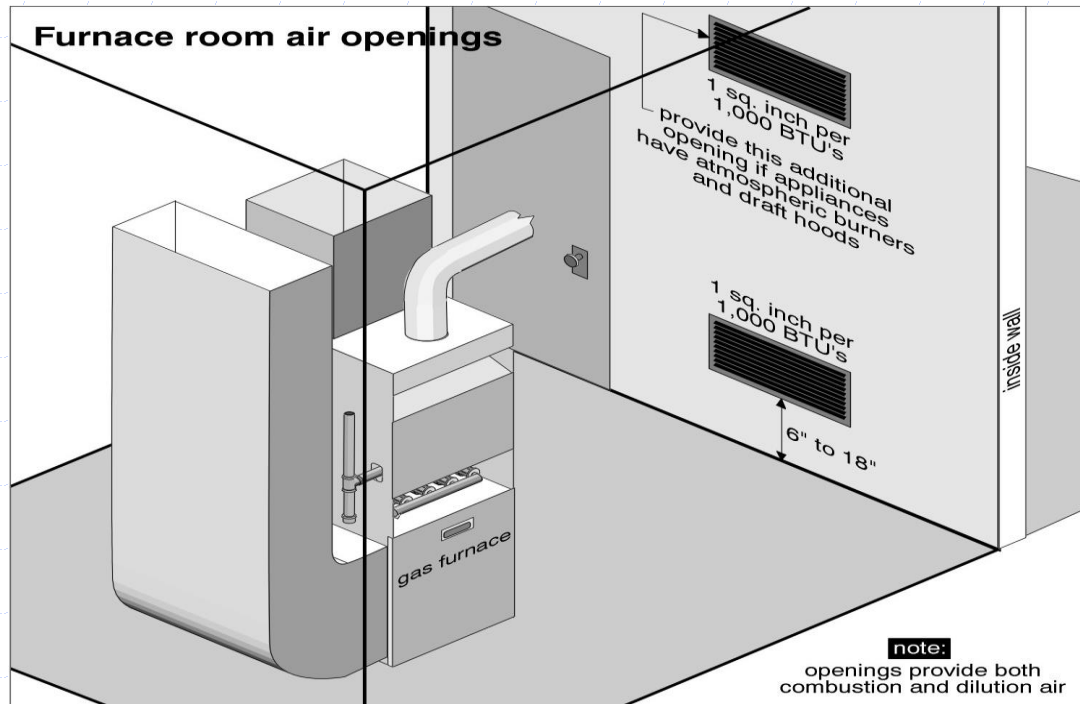
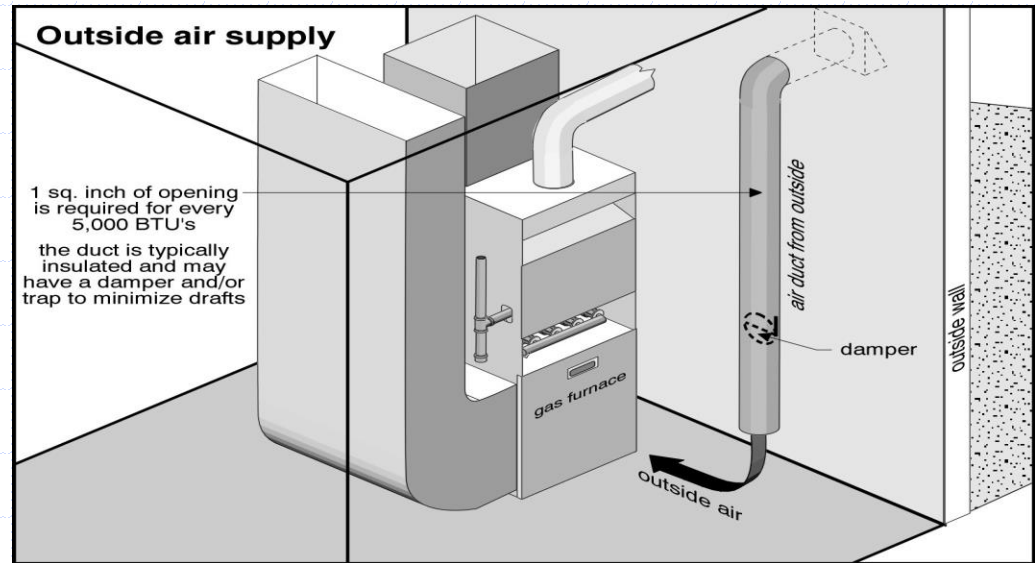
Equivalent furnaces



Heating

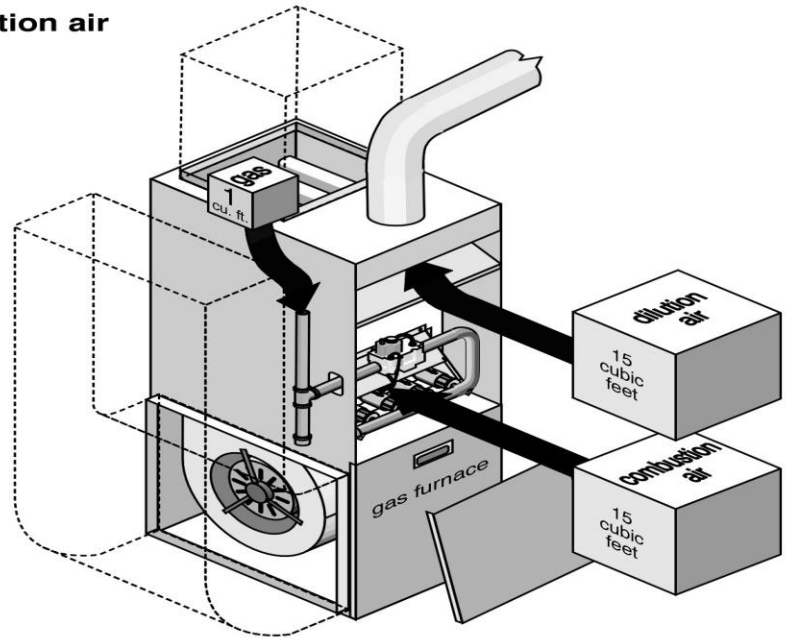


Heating



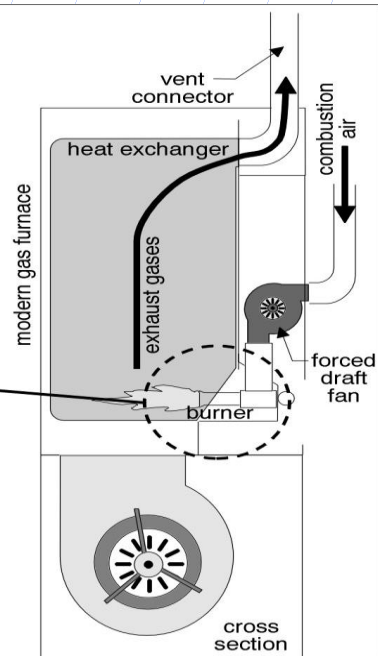
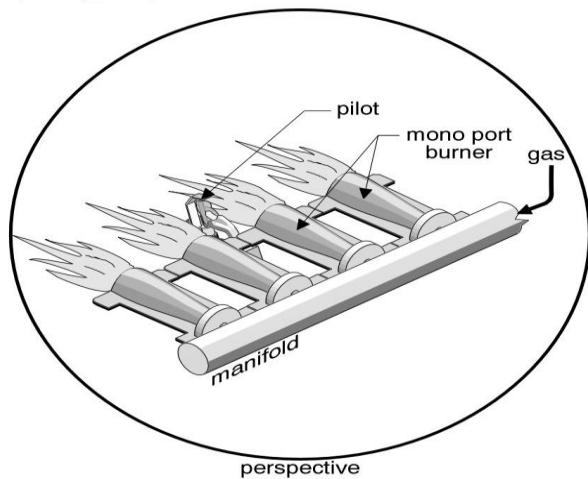
Heating

Combustion air

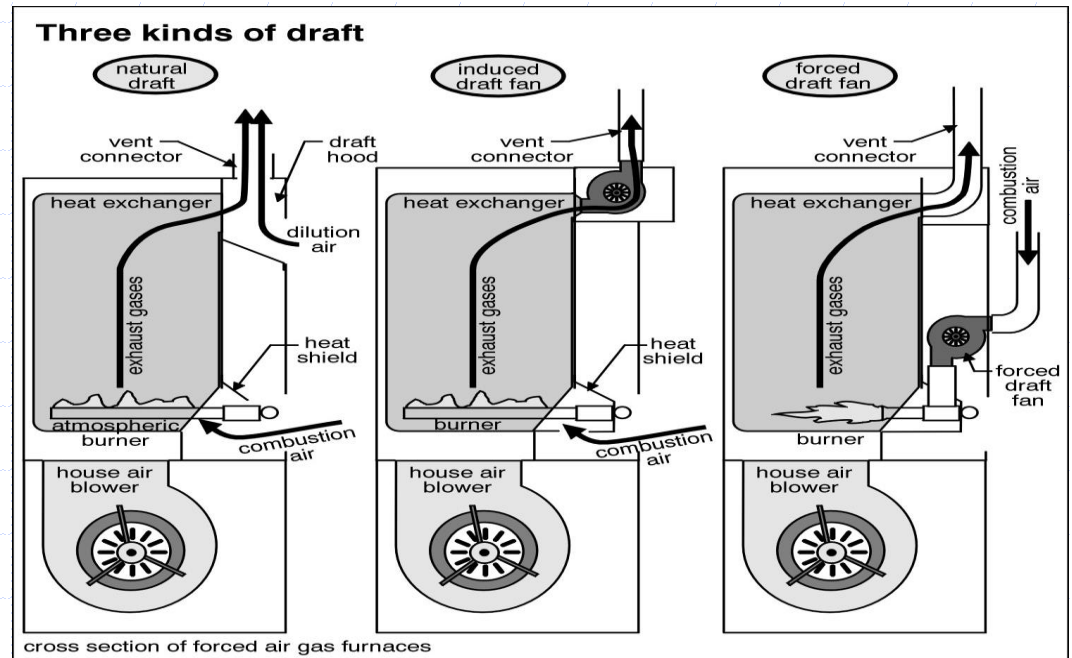


Monoport burners

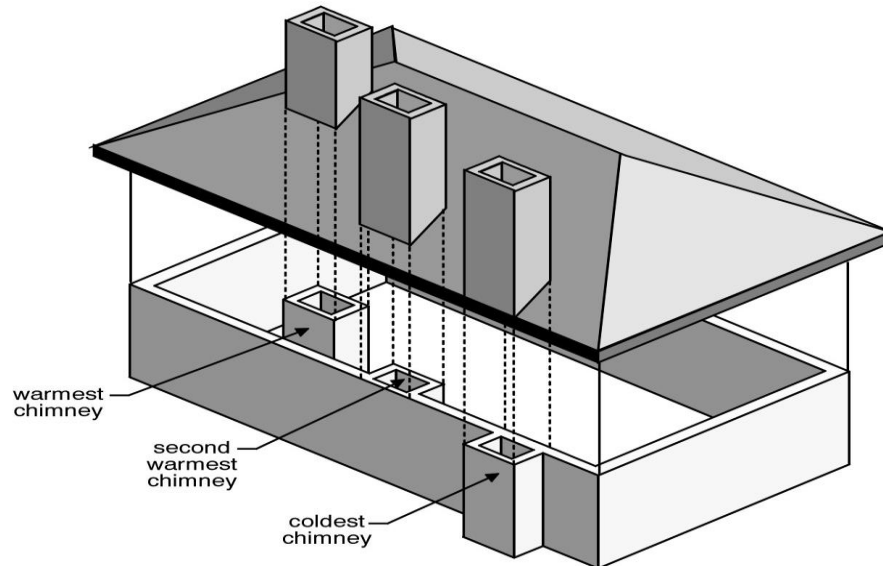
monoport burners are often found on newer gas furnaces and conversion gas burners
they are typically fan assisted



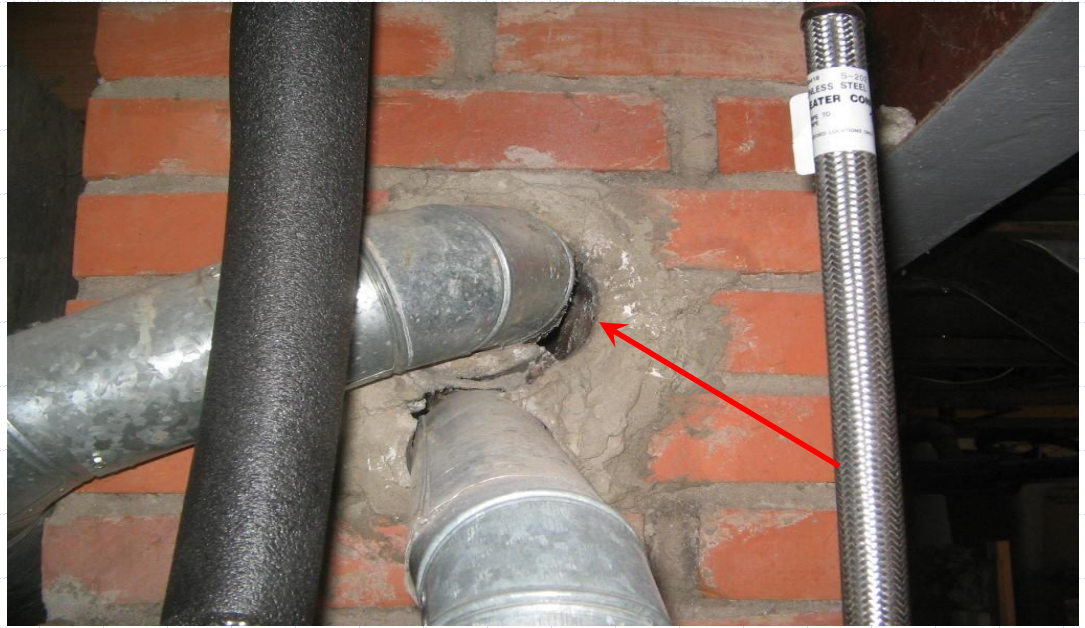
Heating



Warm chimneys are best

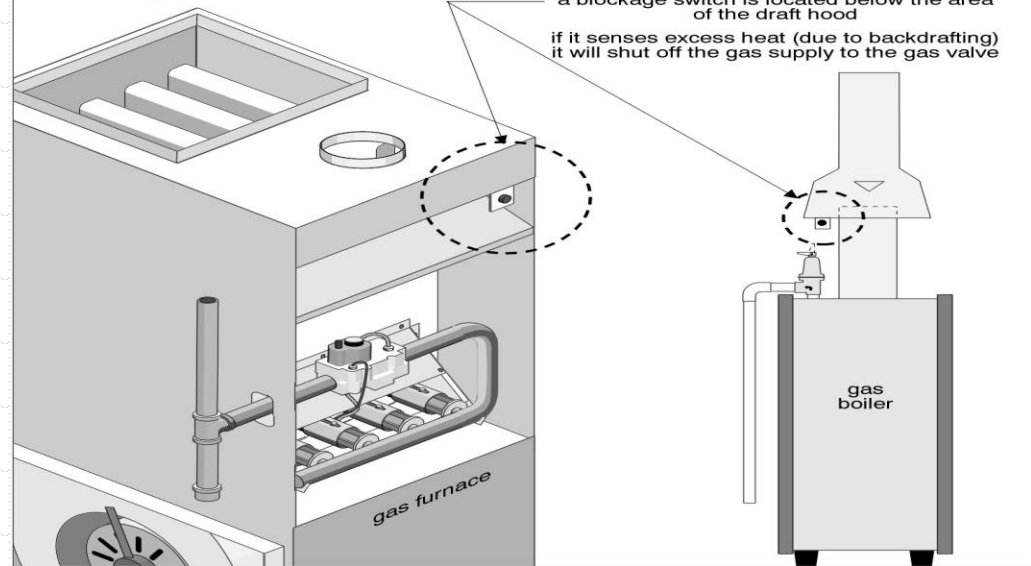


Heating



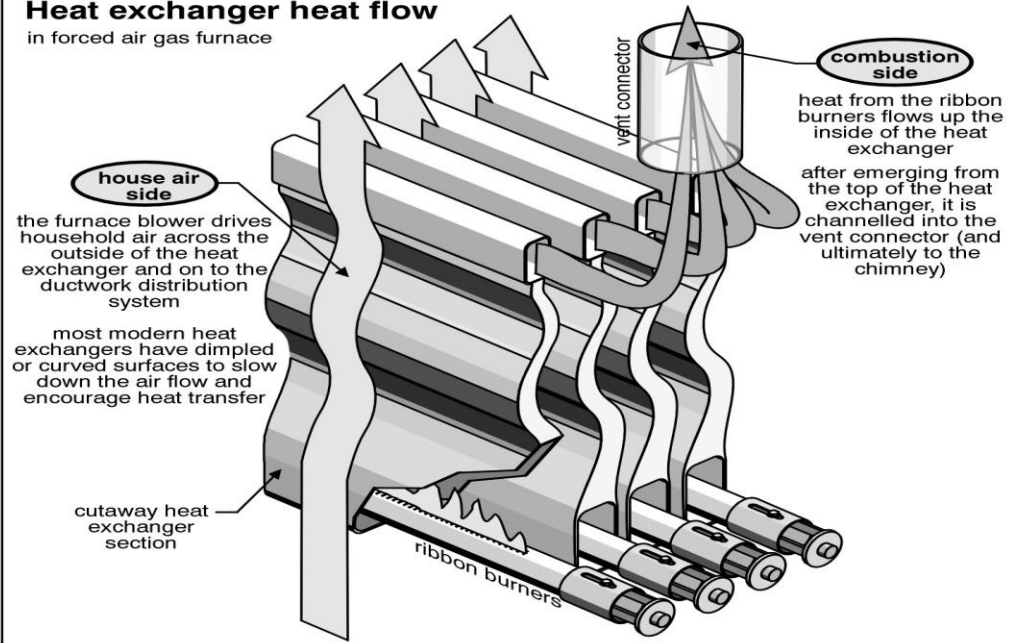
Heating

Blockage switches



Heat exchanger heat flow

in forced air gas furnace



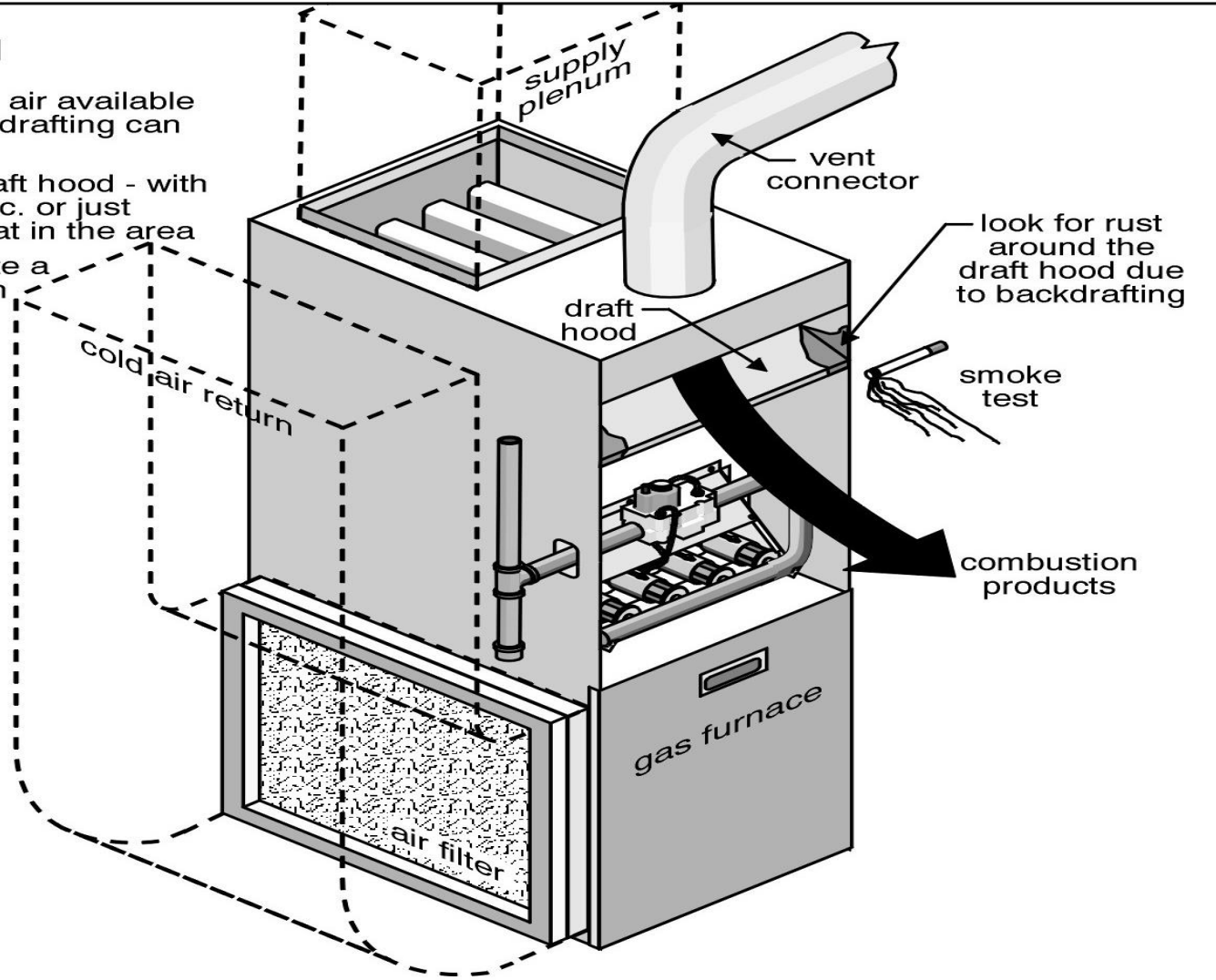
Heating

Backdrafting

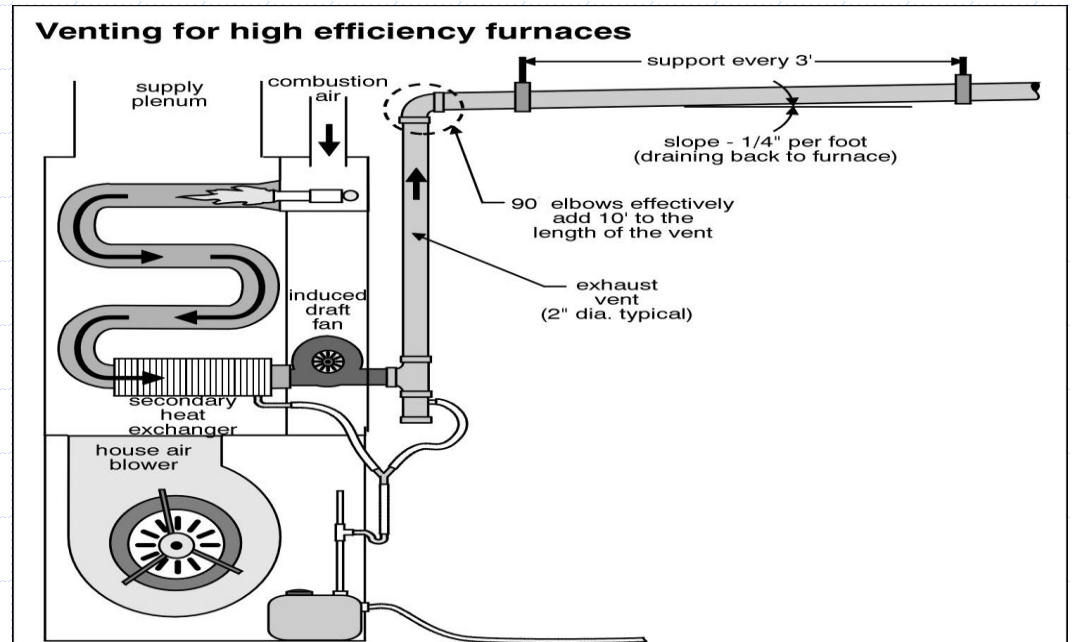
if there is insufficient air available to the furnace, back drafting can occur

check for it at the draft hood - with a match, cigarette etc. or just check for excess heat in the area

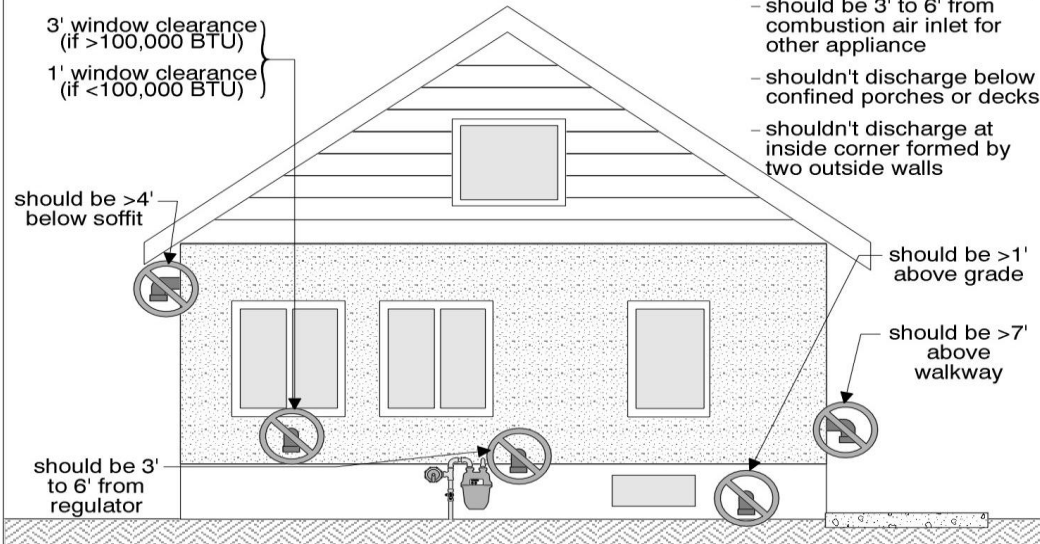
rust may also indicate a backdrafting problem



Heating



Improper sidewall vent locations - high efficiency furnaces

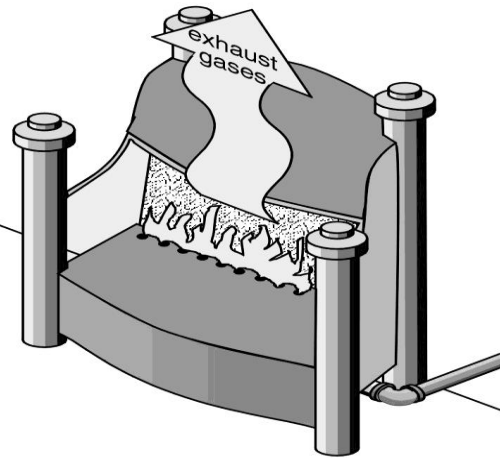


Heating



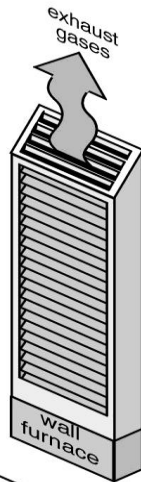
Heating

Unvented space heater



unvented space heaters are not permitted in some areas
these are typically older units
the exhaust gases discharge directly into the living space - causing problems such as spillage, backdrafting, carbon monoxide poisoning and excess humidity

Unvented wall furnace

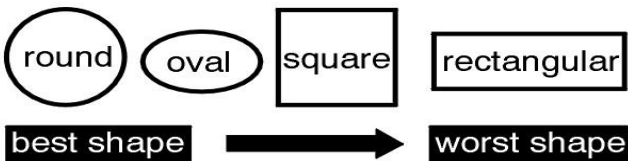


unvented wall furnaces are not permitted in some areas
the exhaust gases discharge directly into the living space - causing problems such as spillage, backdrafting, carbon monoxide poisoning and excess humidity

Heating



Factors affecting air supply

① **duct size** - bigger is better

② **duct shape** -  round oval square rectangular
best shape → worst shape

③ **duct length** - shorter is better

④ **number of corners** - fewer is better

⑤ **duct type** - flex duct  can have pressure losses 3 times that of  smooth duct

⑥ **blower size** - should be appropriate

⑦ **blower speed** - should be appropriate

⑧ **blower blade profile**

⑨ **furnace location** - central location is particularly important in larger homes

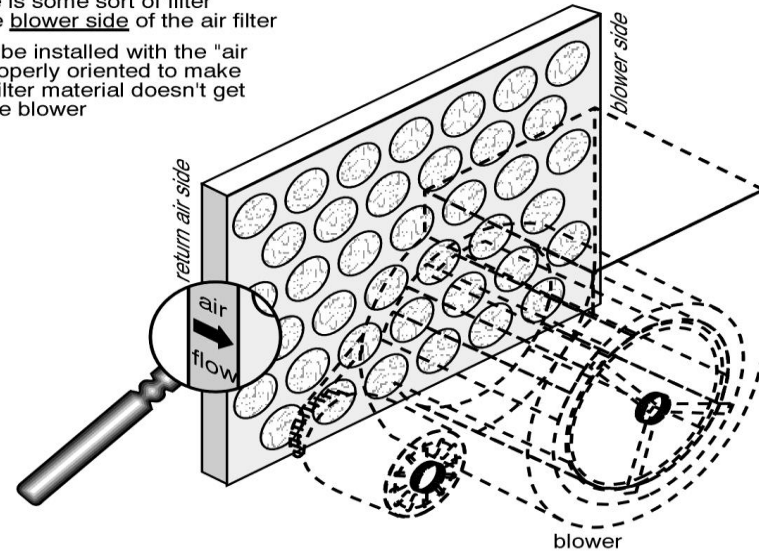
⑩ **system extras** - air filters and air conditioning coils can create significant pressure loss

Heating

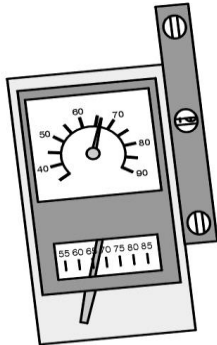
Air filter orientation

typically, there is some sort of filter support on the blower side of the air filter

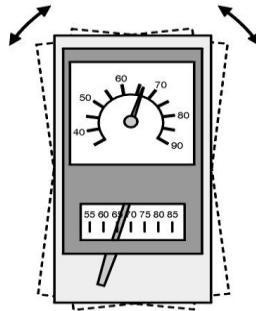
the filter must be installed with the "air flow" arrow properly oriented to make sure that the filter material doesn't get sucked into the blower



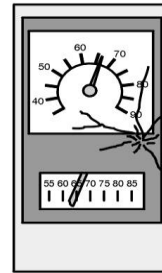
Thermostat conditions to watch for



• not level



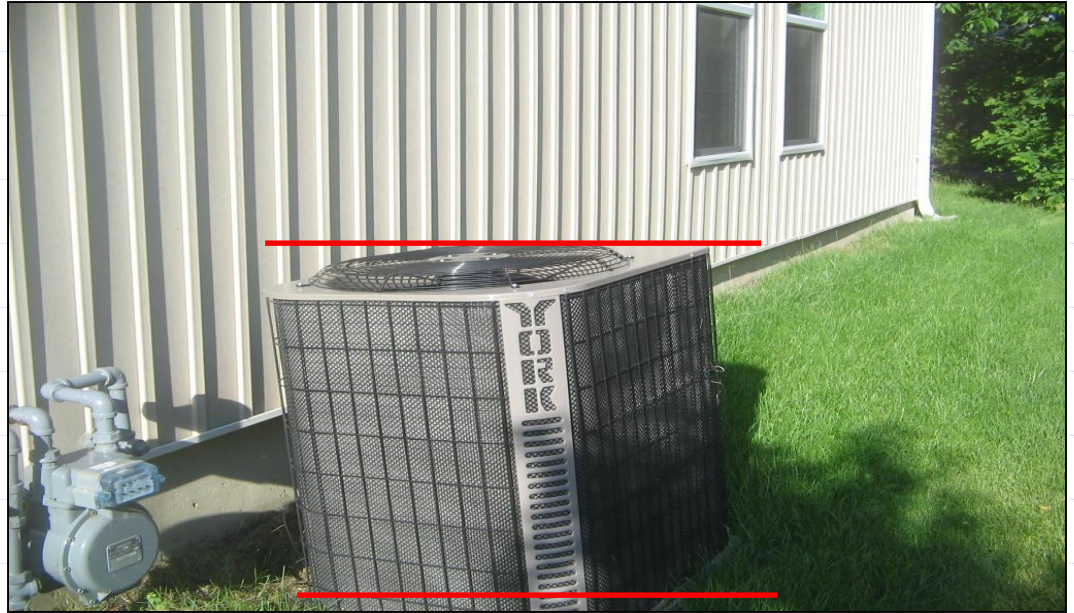
• loose



• damaged

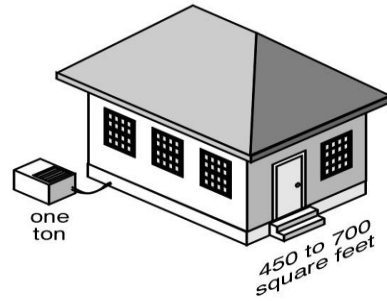
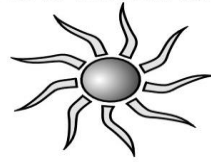
- poor location
- poor adjustment/calibration
- dirty
- anticipator problems

Booting

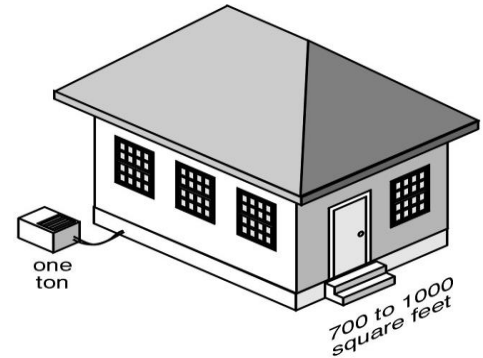
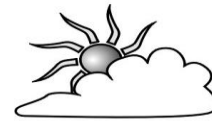


Cooling

How much area can one ton cool?

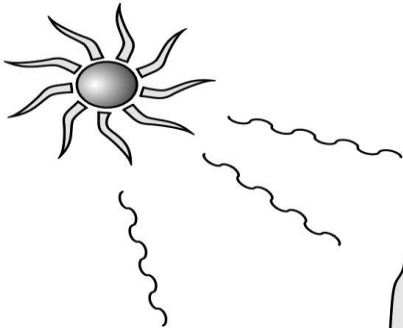


(A) southern U.S.

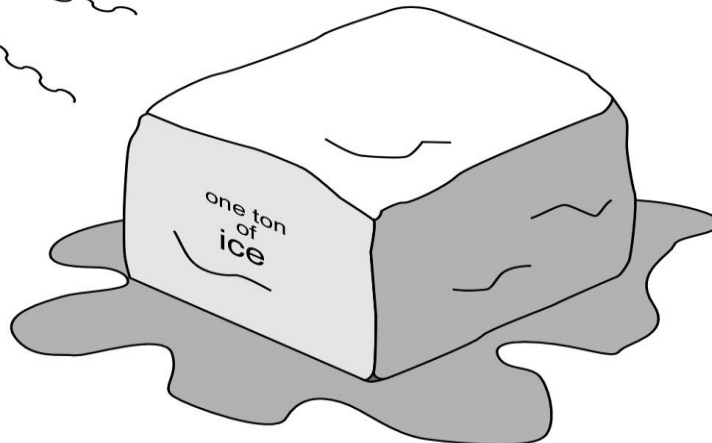


(B) northern U.S. and Canada

One ton of cooling

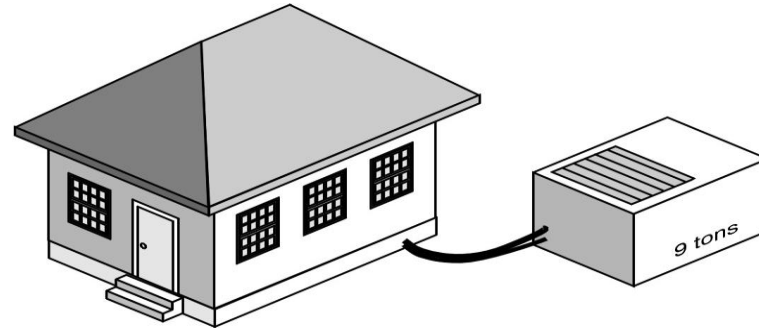


cooling is typically measured in tons
one ton of cooling is equivalent to
12,000 BTU/hour
(12,000 BTU's is the amount of heat
required to melt **one ton of ice**)



Goofing

Bigger is not better

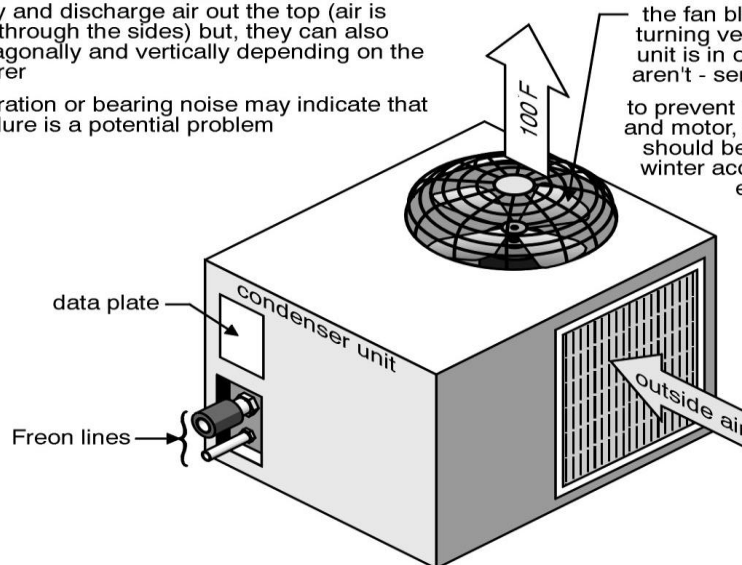


an air conditioner that is **too large** will:
cycle on and off more frequently - potentially causing
premature compressor failure
cool the house too quickly - (satisfying the thermostat and
shutting down) before the house can be sufficiently
dehumidified

Condenser fan

the fans in most modern condenser units rotate horizontally and discharge air out the top (air is brought in through the sides) but, they can also operate diagonally and vertically depending on the manufacturer

excess vibration or bearing noise may indicate that bearing failure is a potential problem

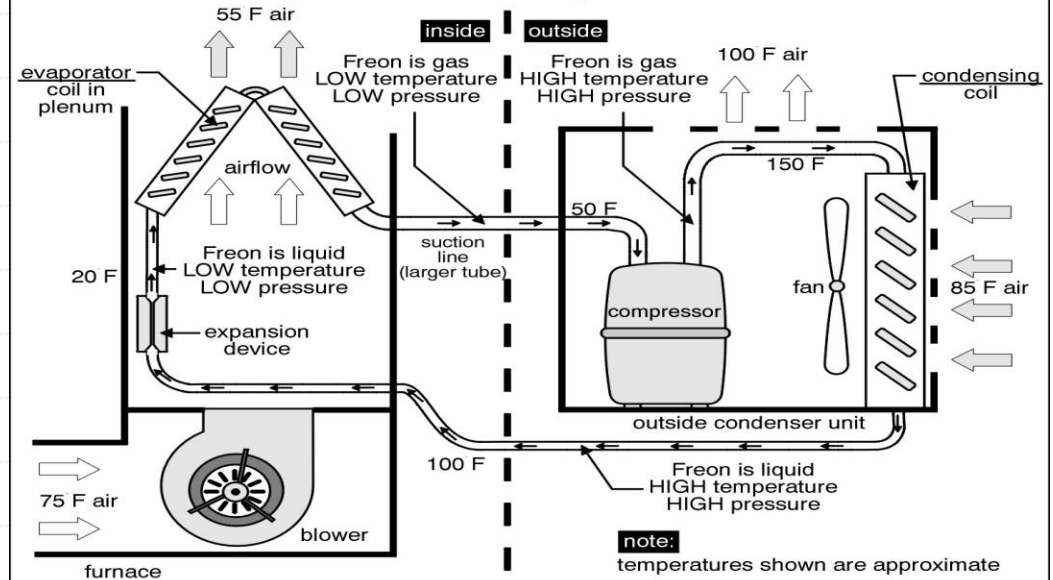


the fan blades should be turning very fast when the unit is in operation (if they aren't - service is required)

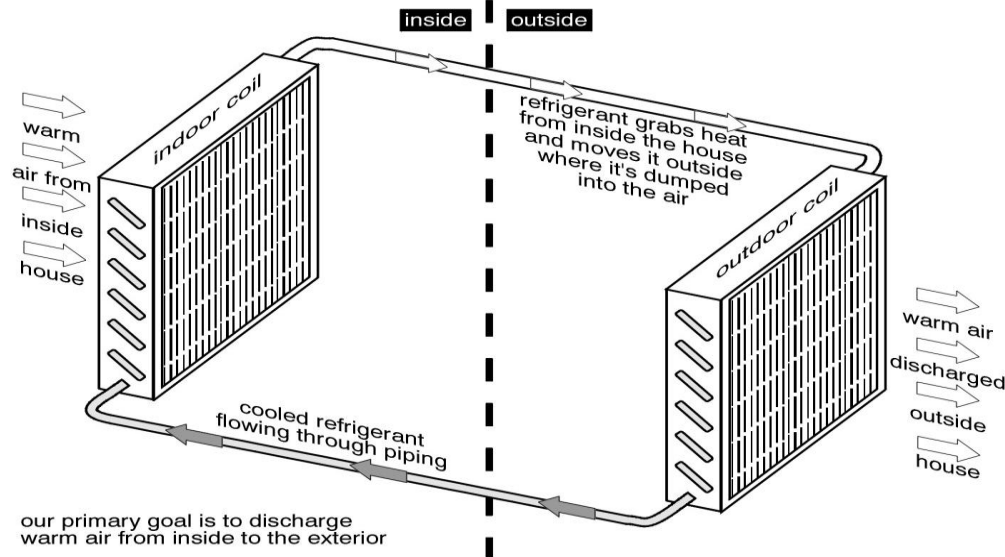
to prevent rusting of the fan and motor, condensing units should be covered in the winter according to some experts

Cooling

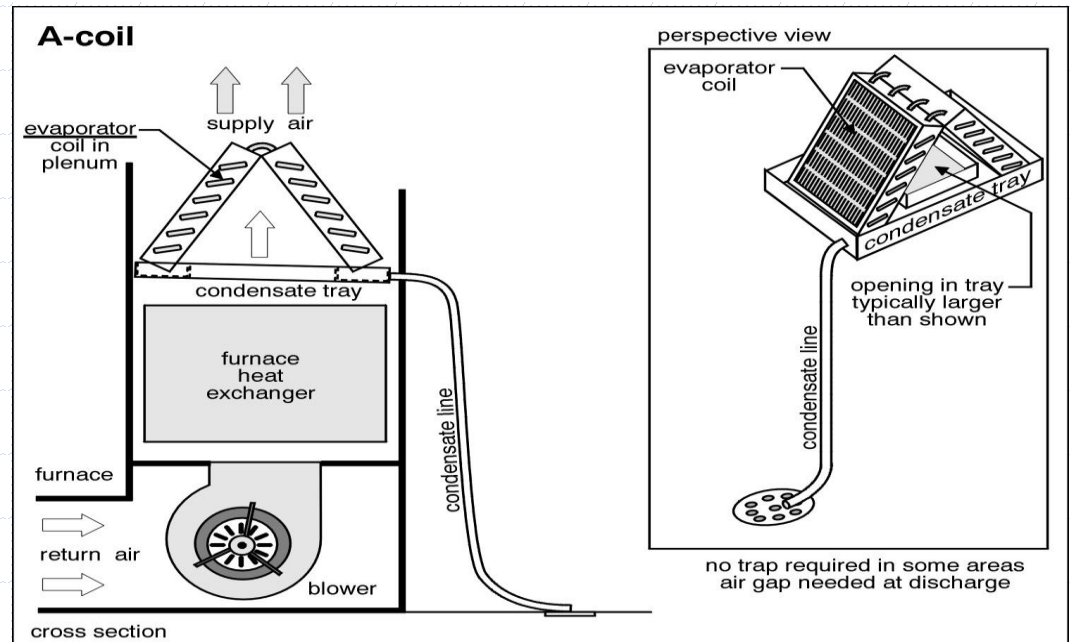
Air conditioning - schematic of system



Moving heat from the inside to the outside



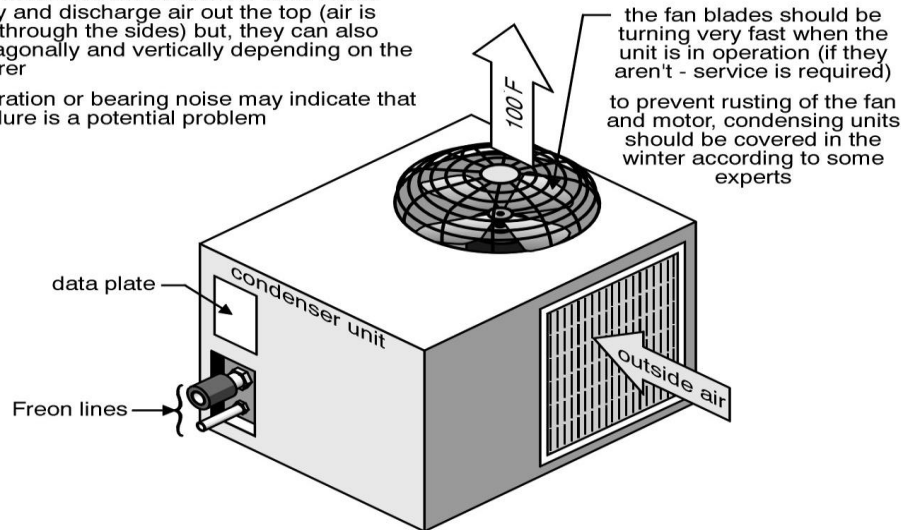
Cooning



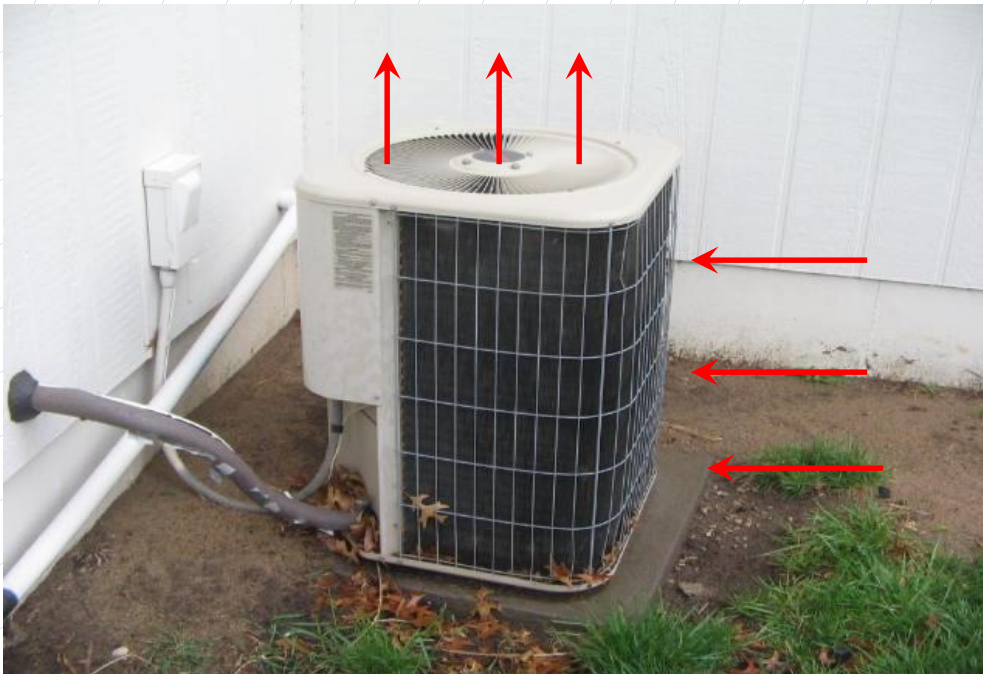
Condenser fan

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Goofing

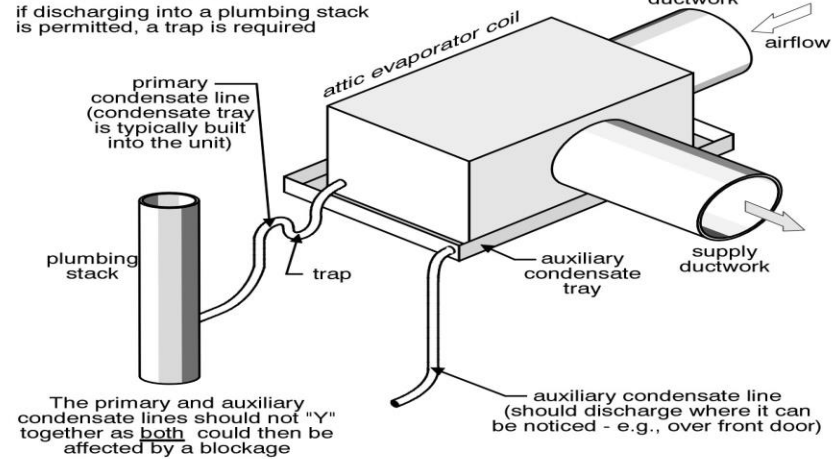


Air Movement

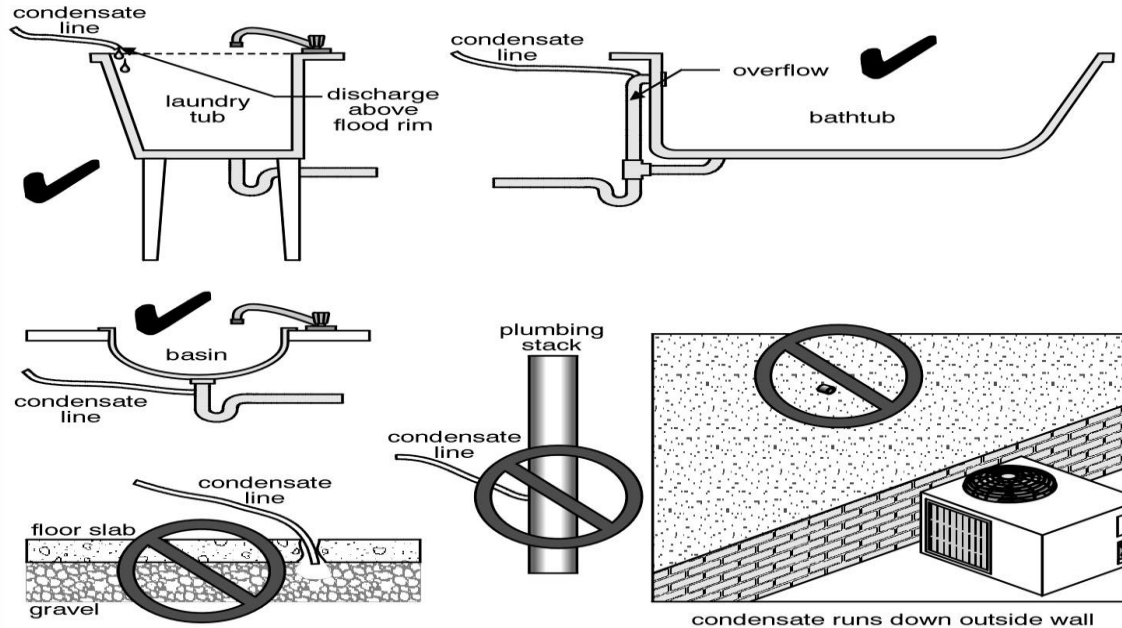
Cooling

Auxiliary condensate line from attic evaporator coil

ideally the condensate is discharged directly to the exterior
if discharging into a plumbing stack is permitted, a trap is required



Condensate discharge locations

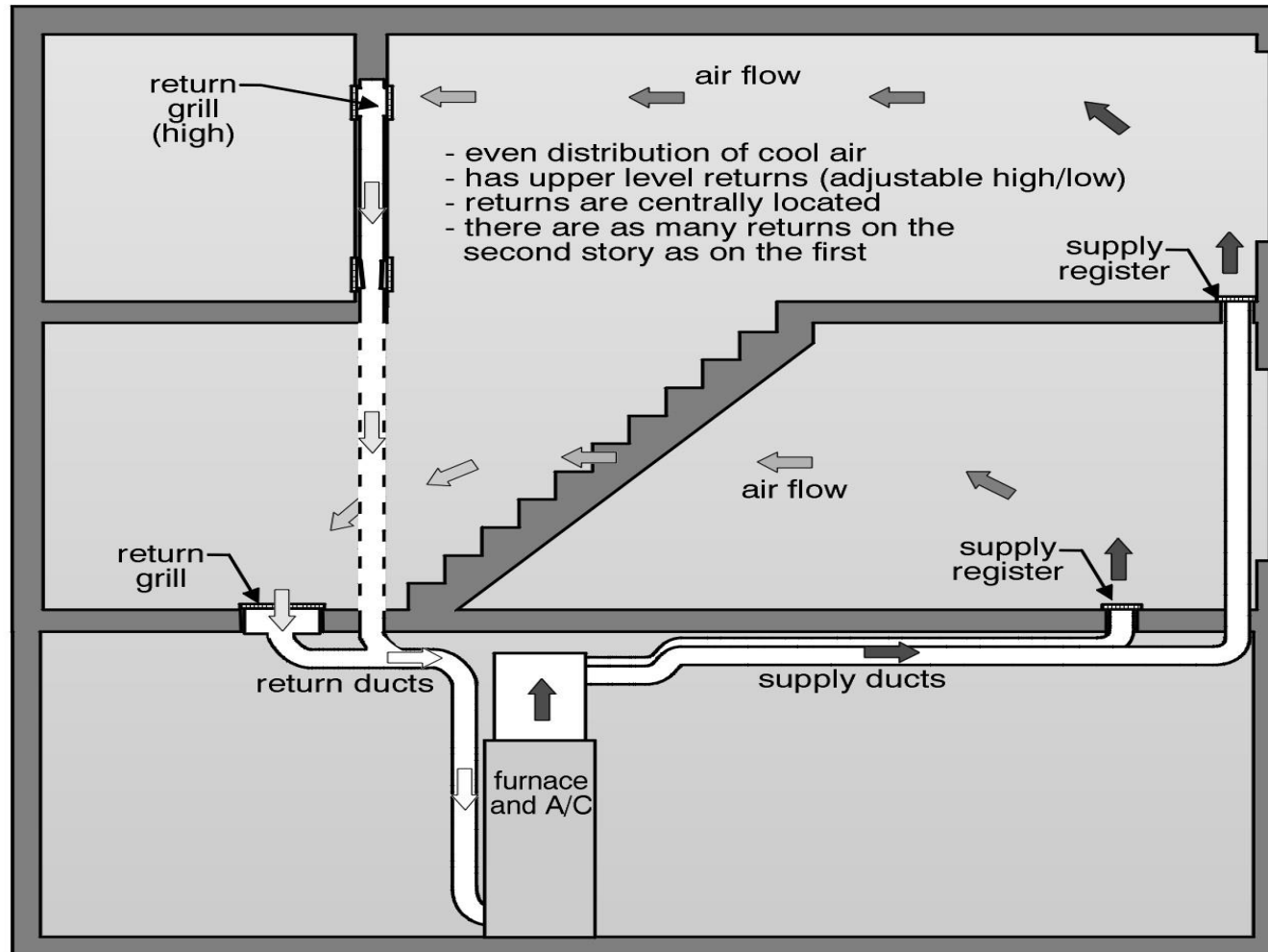


Goofing



Cooling

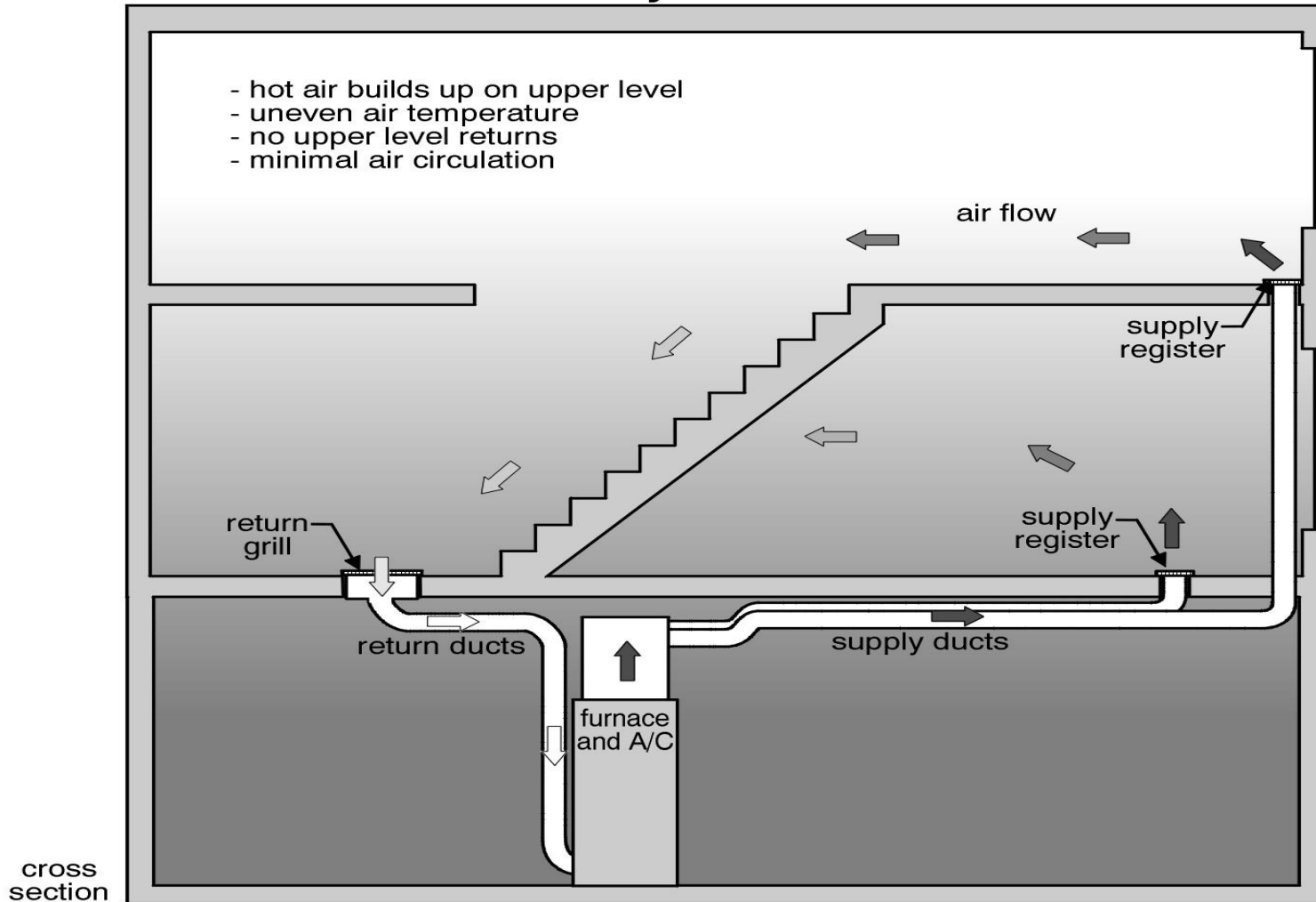
Flow of cooled air - modern ductwork



Cooling

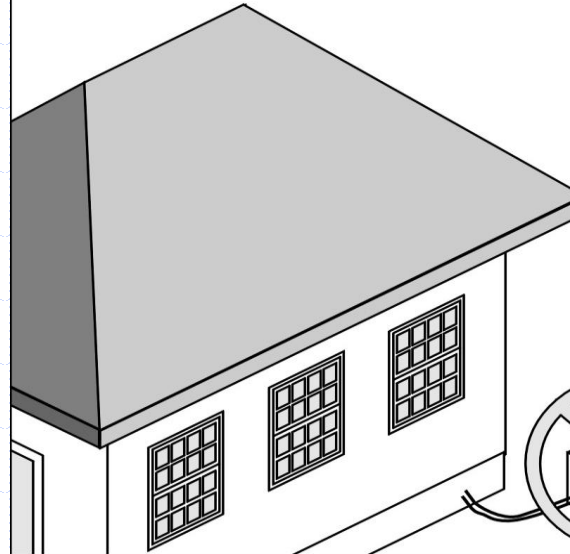
Flow of cooled air - older-style ductwork

- hot air builds up on upper level
- uneven air temperature
- no upper level returns
- minimal air circulation

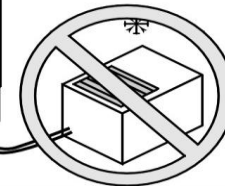


Goofing

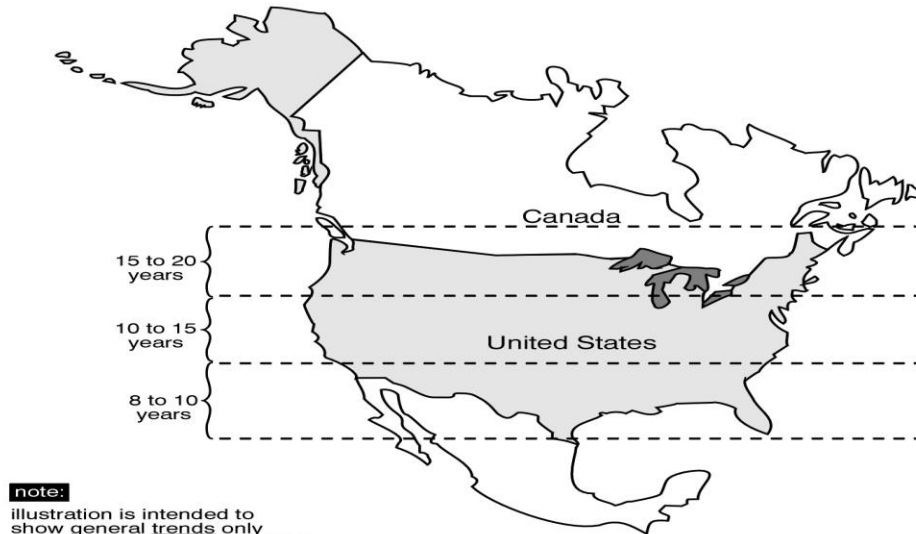
Don't test when it's cold



air conditioning shouldn't be tested when the temperature is below 65 F or when the power hasn't been on to the unit for at least 12 to 24 hours as the compressor could seize



Typical compressor life



note:
illustration is intended to show general trends only and is not to be taken literally

Insulation

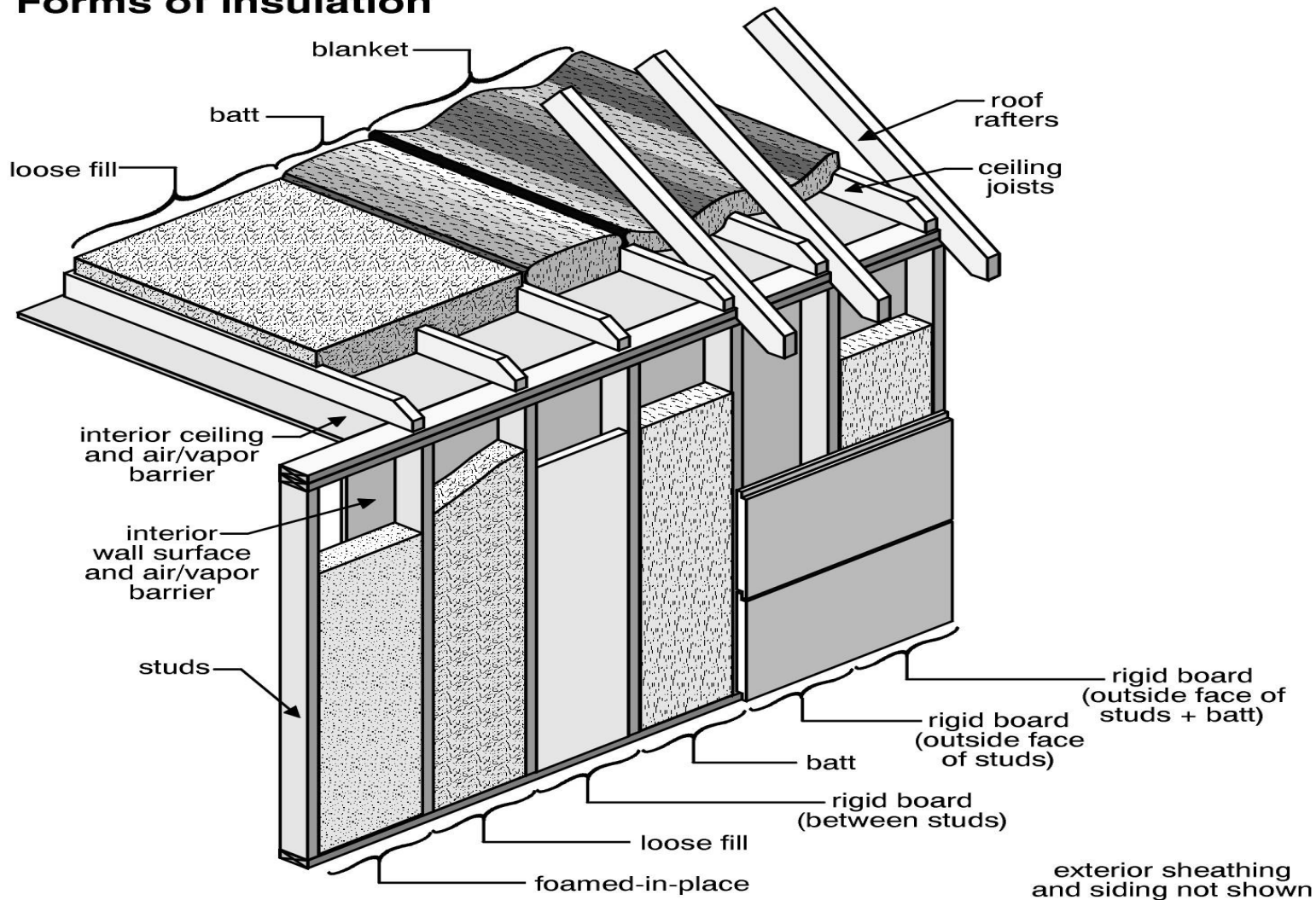


Where is the insulation?



Insulation

Forms of insulation

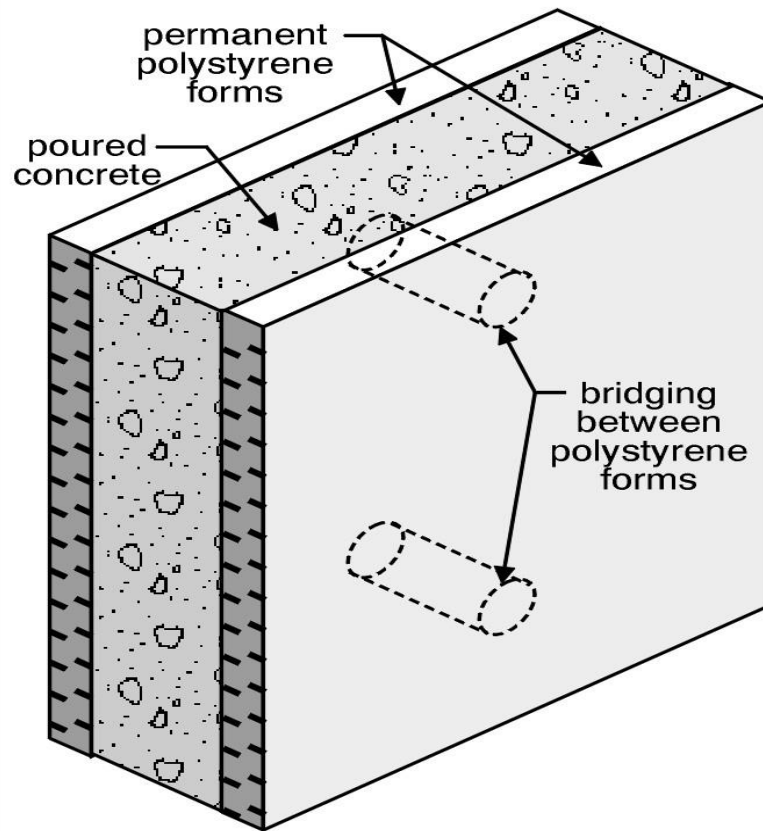


Insulation

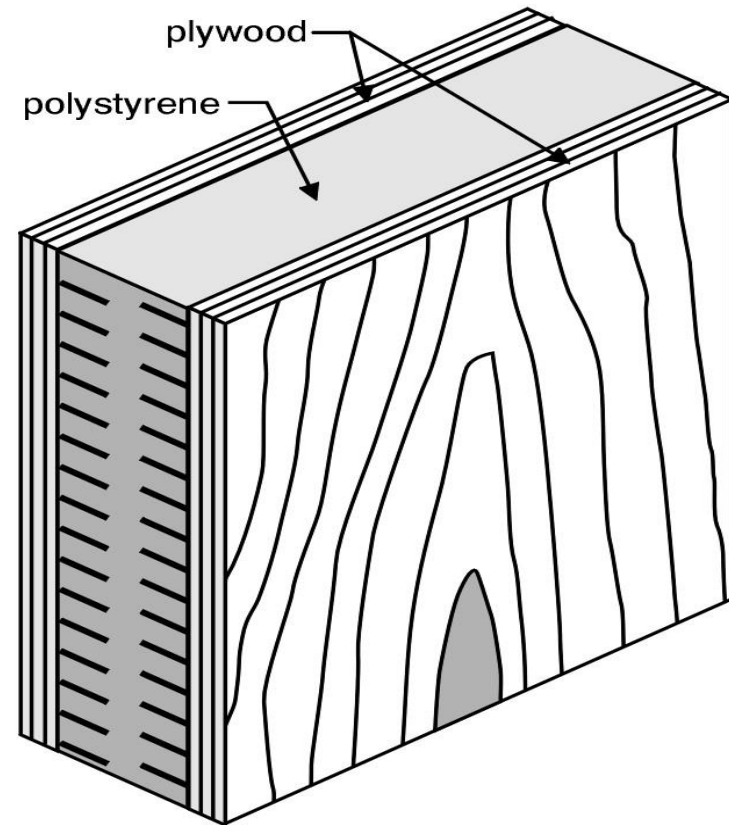


Insulation

Other types of polystyrene insulation



**for concrete walls
(above and below grade)**



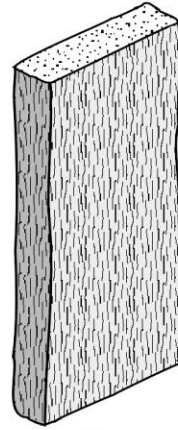
**prefabricated
wall panels**

Insulation



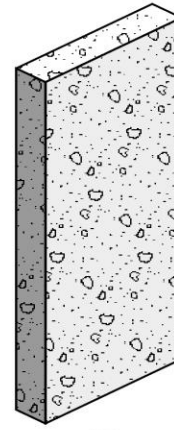
Insulation

R-value per inch



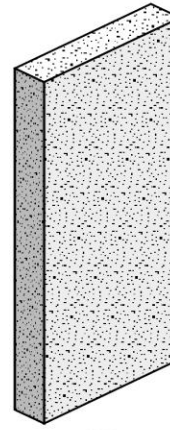
3.0

fiberglass
insulation



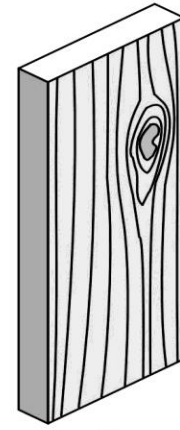
0.08

concrete



0.2

stucco

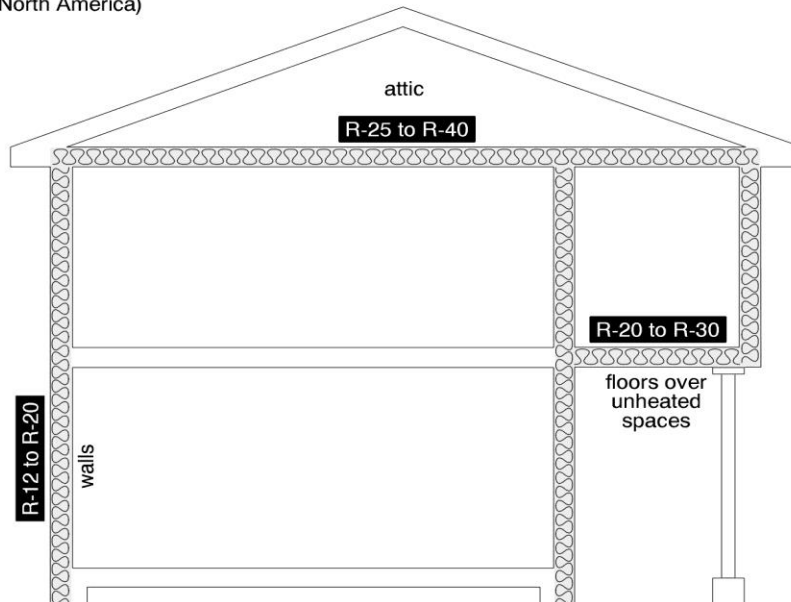


1.25

pine board

Recommended insulation levels

(northern North America)



Insulation



Insulation

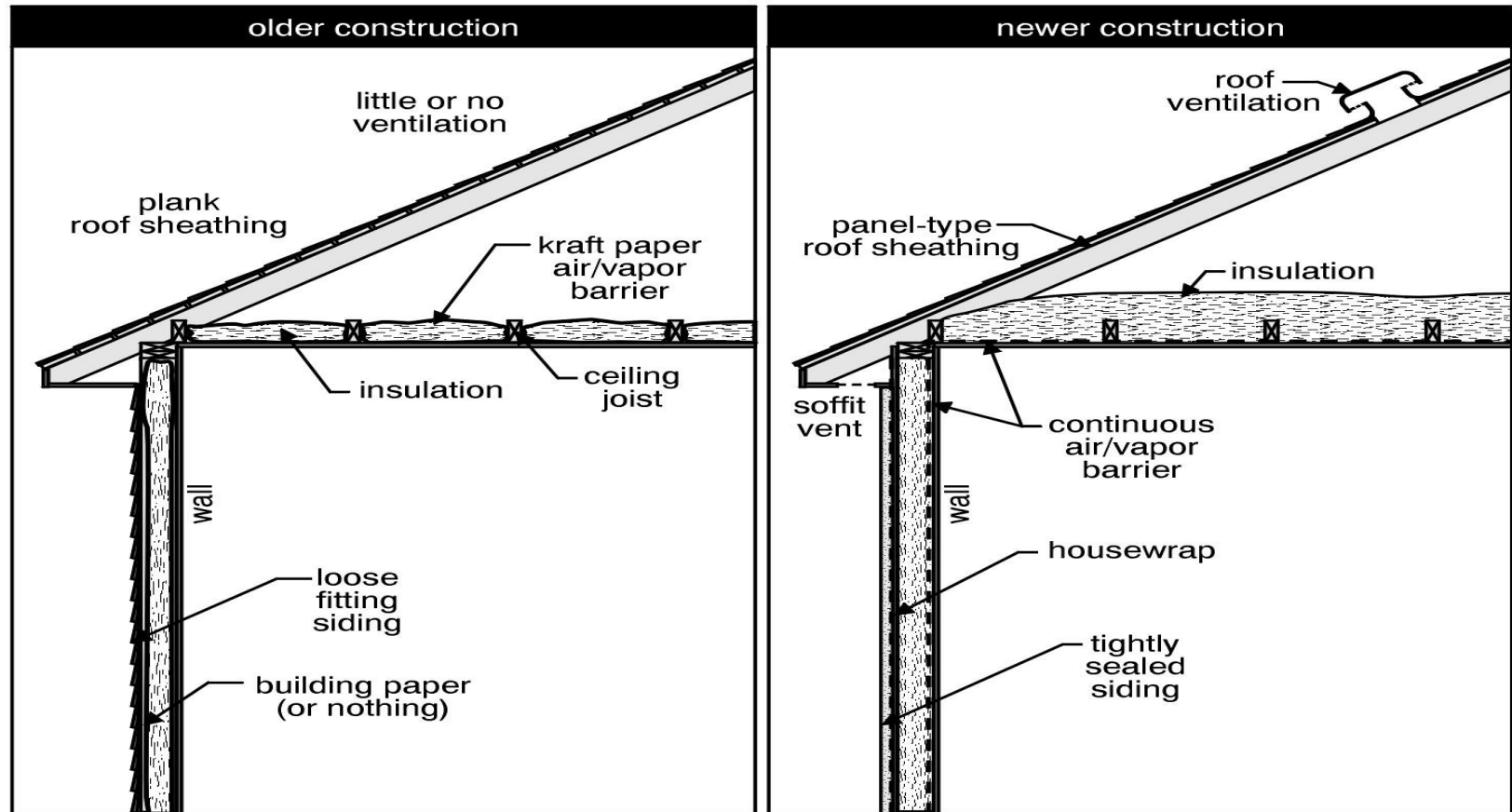


Insulation



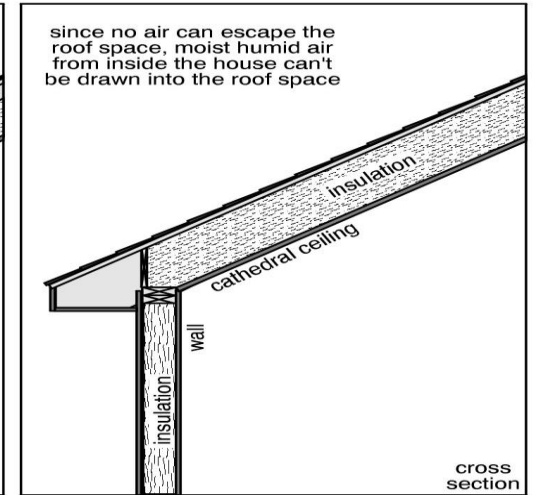
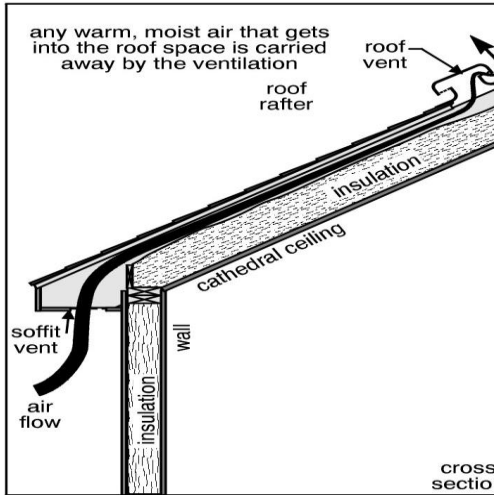
Insulation

Differences between old and new construction

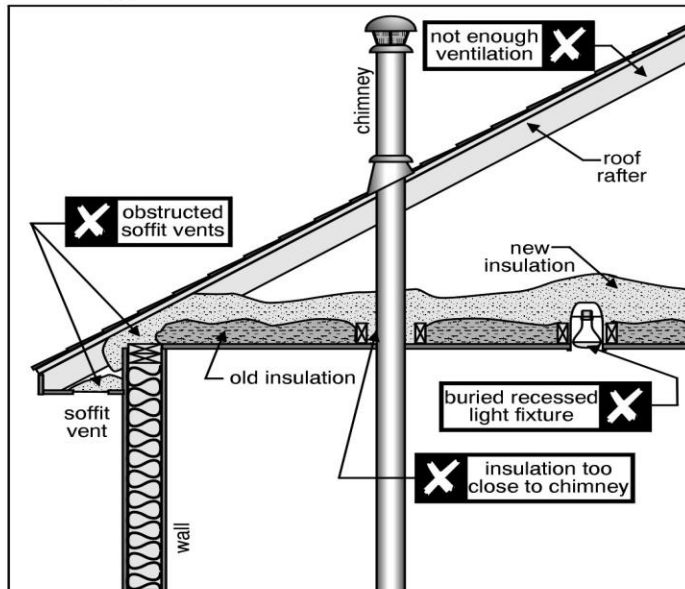


Insulation

Two different strategies for insulating cathedral/flat roofs

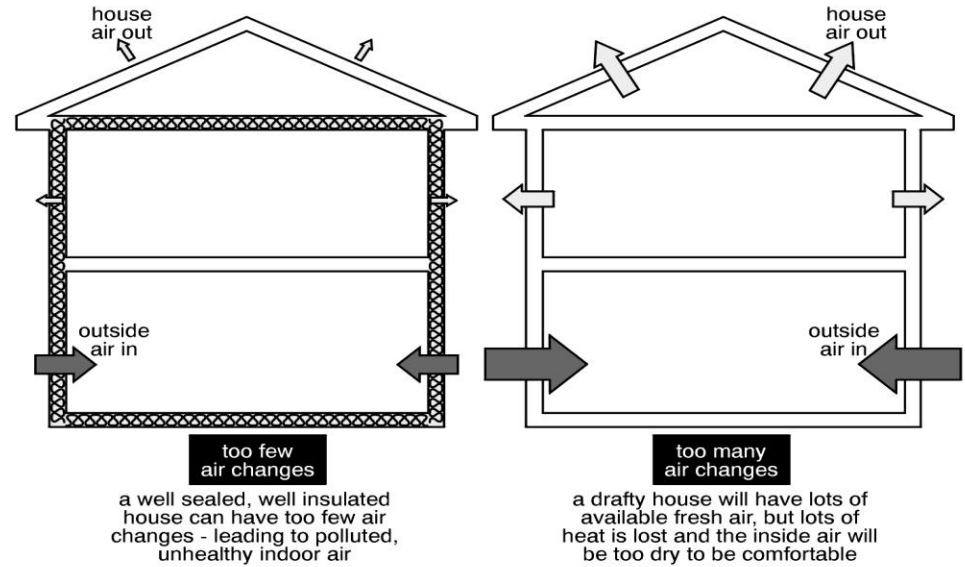


Risks of adding more insulation

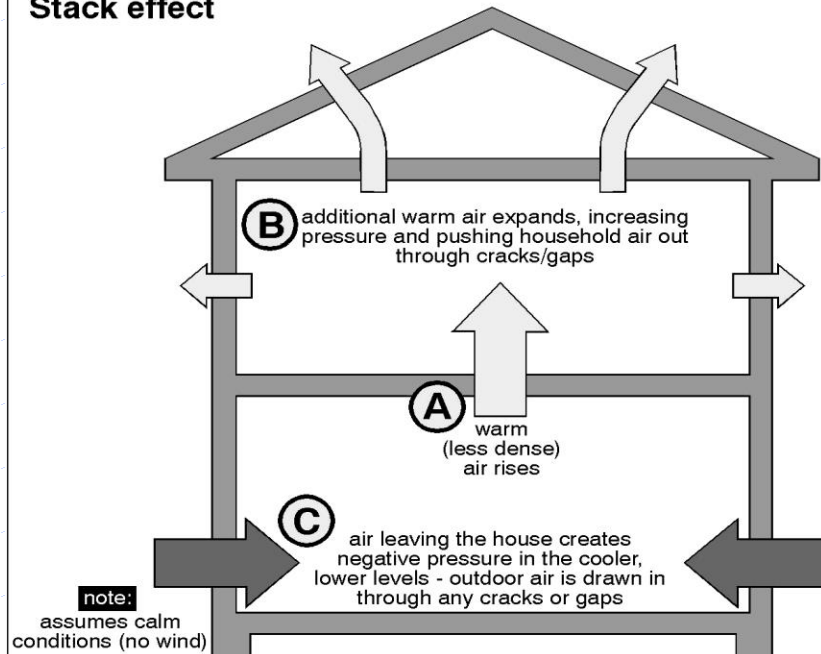


Insulation

Balanced air changes

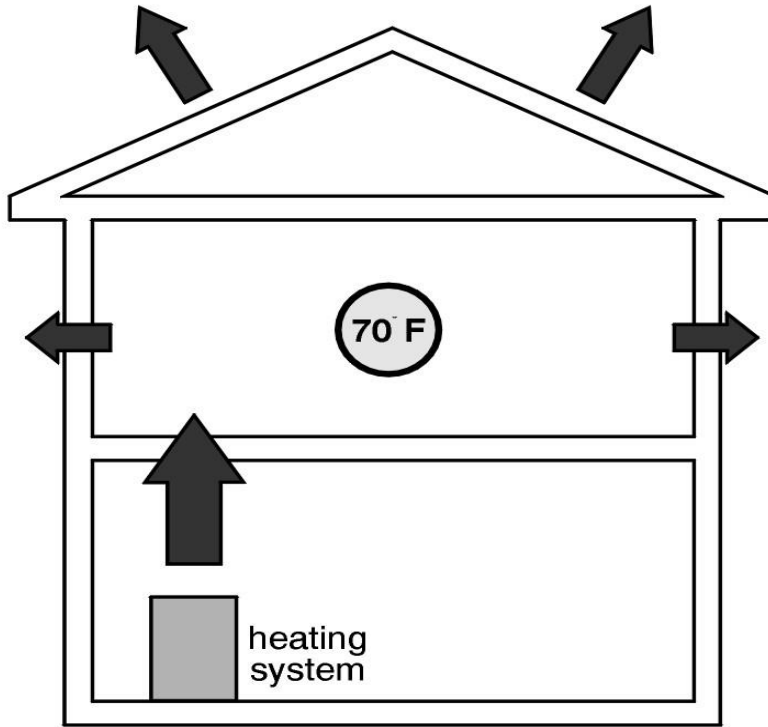


Stack effect



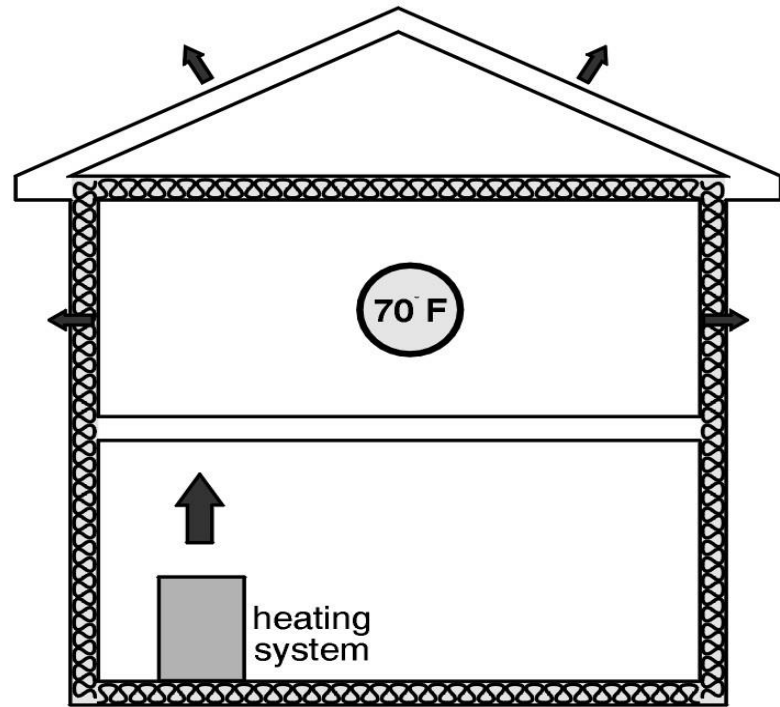
Insulation

Two comfort strategies



poorly insulated house

heating system has to work harder (use more fuel/higher costs) because a lot more heat is escaping to the outside but, the house is still maintained at a comfortable 70 F



well insulated house

less fuel is required to keep the house at 70 F because the insulation reduces heat loss - keeping heat inside the house longer

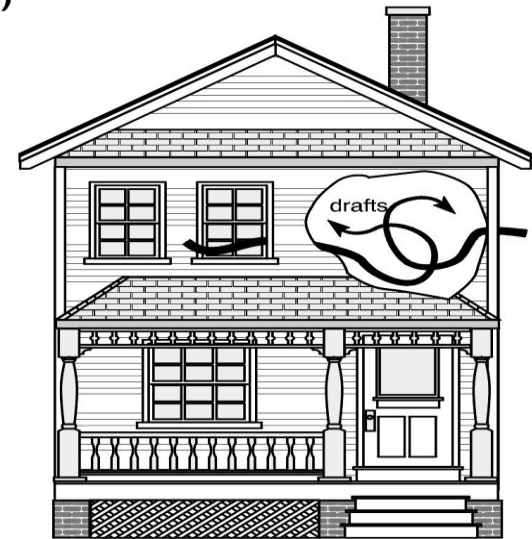
Insulation

Drafty is good (for houses)

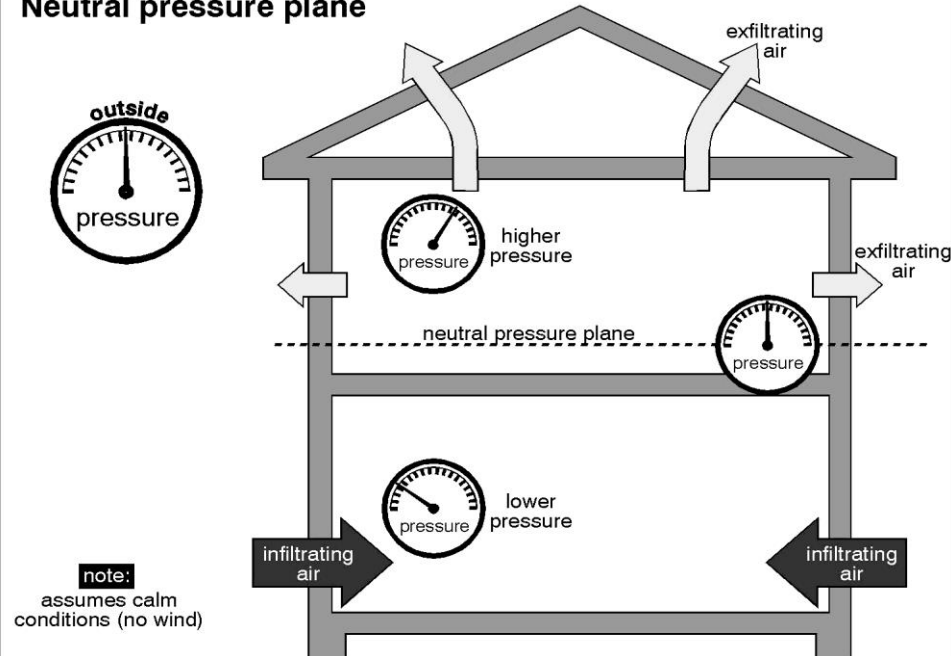
old houses were drafty (loose siding, loose windows, no air/vapor barriers)
they had many air changes per hour that brought in fresh air (with its good drying ability)

wall cavities were warm - moisture did not condense in wall cavities

while houses enjoyed this situation, people didn't appreciate the cold drafts and dry air

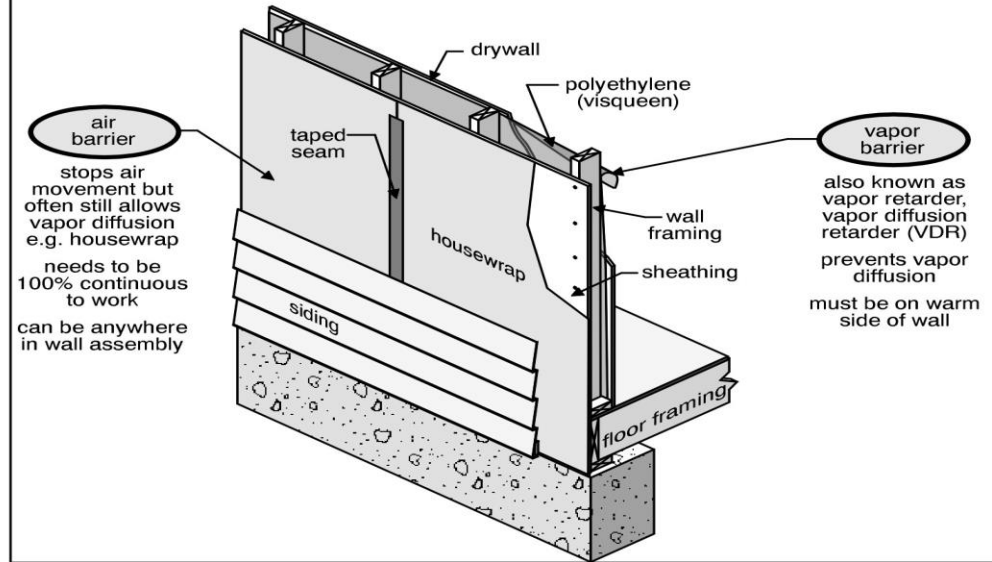


Neutral pressure plane

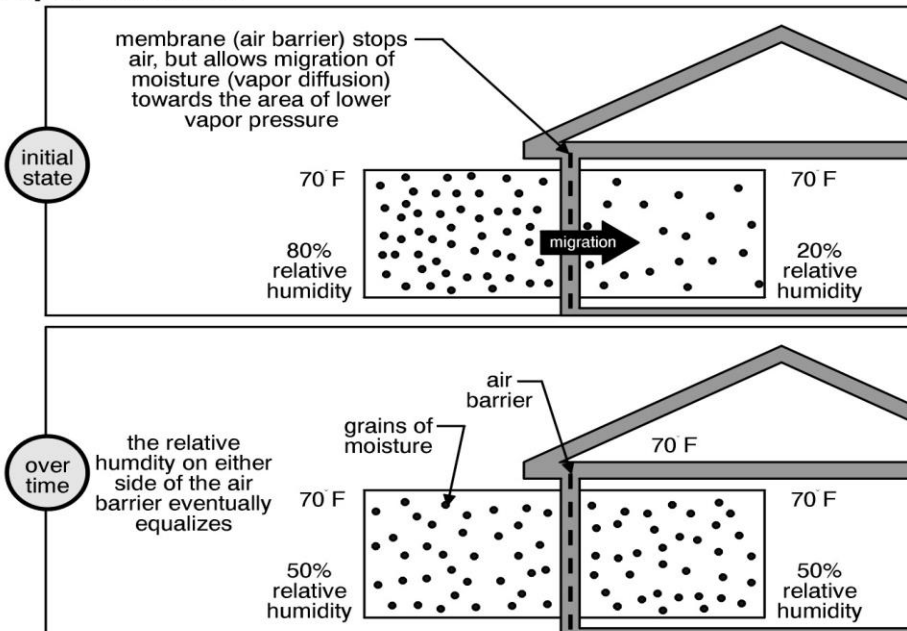


Insulation

Air barrier versus vapor barrier

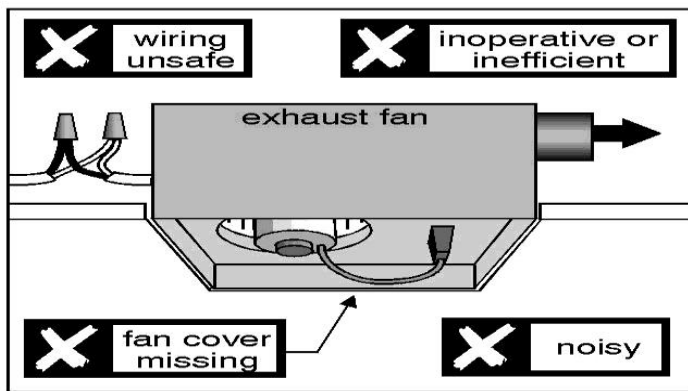
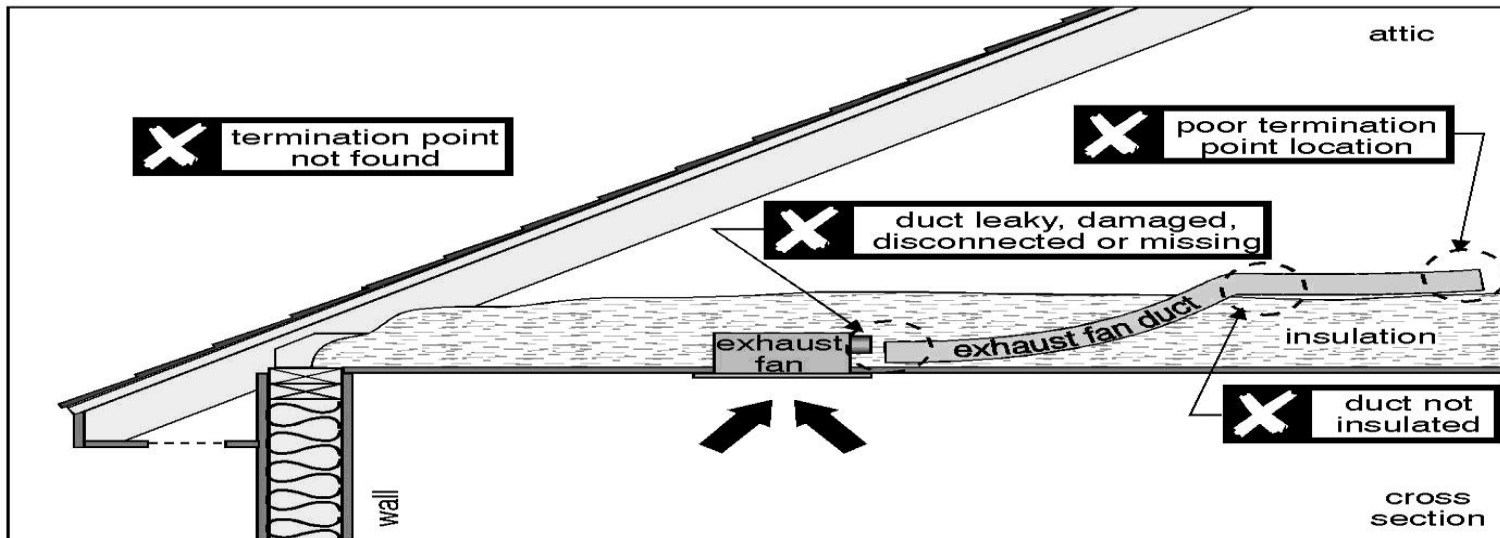


Vapor diffusion



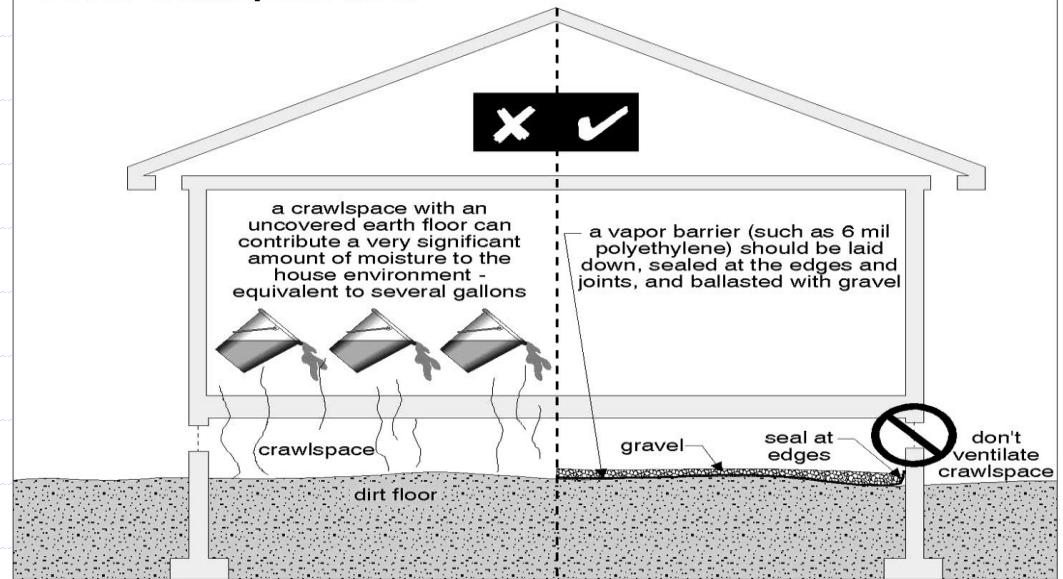
Insulation

Exhaust fan conditions



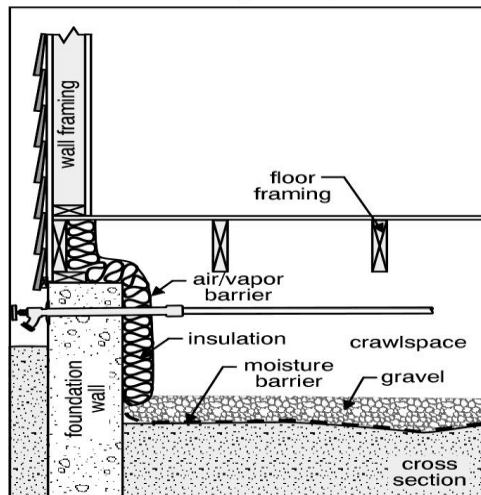
Insulation

Cover crawlspace floor

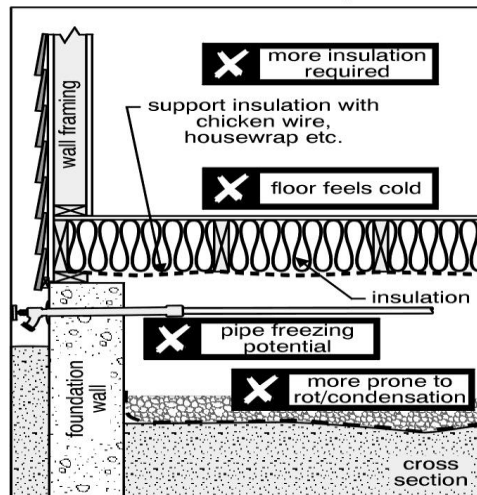


Insulating crawlspaces

heated crawlspace - preferable



unheated crawlspace



Insulation

