IMC & IECC and Existing Structures

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What is the problem?

- Thermal
- Air quality
- Humidity
- Energy consumption

HEATING SYSTEMS

COAL

- 14,600 BTU/lb, efficiency=65% 75%
- Requires storage stock piles
- Handling
- Pollutants

No2 Fuel Oil

- 141,000 BTU/gal, efficiency=70% - 80%+
- Storage tanks
- Transportation
- Pollutants

No 2 Fuel Oil

Tanks

- Double wall
- Leak detection
- Gauges
- Fill pipe
- Vent
- Hold down strap & pad (counteracts buoyancy)

Burner

- Provide proper air/fuel mixture
- Force draft fan
- Leak monitor

Natural Gas

- Natural Gas
- 1052 BTU/ft 3 , efficiency = 70% - 80%+
- Availability
- Pressure
  - High for transportation
  - Low for use
- Pressure regulator (7 psi down to 7”) [1 psi = 14”]
- Meter

Electricity

- 3.413 BTU/watt, efficiency=95% - 100%
- Availability
- Clean and efficient (at point of use)
- Source energy
  - Fuel conversion
  - Transmission
  - Source energy efficiency= 33%

Heating Mode - Radiant

- Radiant ceiling
  - Electric cables
- Radiant floor
  - Electric
  - Hot water (hydronic)
- Infrared radiant heaters
  - Electric
  - Gas
- Cast iron radiators
  - Hot water
  - Steam

Heating Mode - Convectors

- Convectors
  - Finned tube
  - Convectors

Heating Mode – Forced Air

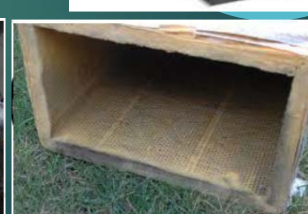
- Gas furnace
- Oil furnace
- Electric furnace
- Electric heat pumps
  - Transport heat from outside to inside

Systems

	Air	Hydronic	Steam	Electric
1. Heat Generation	Furnace	Boiler	Boiler	Electric
2. Distribution	Fan	Pump	Pressure*	Base
3. Diffusion	Diffuser/ Register	Coil/ Radiator	Coil/ Radiator	Board

Ducted Systems

- Furnace (Direct heat)
- Fain coil units
- Air handlers (large)
- Registers/Diffusers
- Ducts (Sheet metal, Fiberglass duct board)



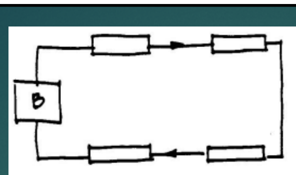
Ducted Systems

- Objective
  - Offset heat loss
  - Good diffusion mixing with room air
  - Minimum friction loss in duct work
  - Balance distribution

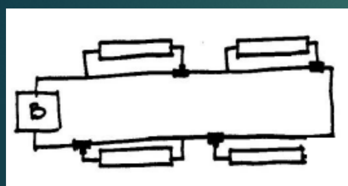
Hydronic Systems

- 1. Pressure relief
  - Eliminate overpressure, safety device
- 2. Air separator
  - Eliminate gases
- 3. Expansion tank
  - Allow for volumetric expansion

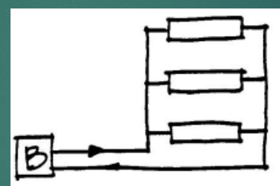
Series Perimeter
- Hot at beginning of loop
- Cool at the end
- Not preferred



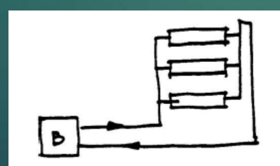
1 pipe system



Direct return



Reverse return
- Self balancing

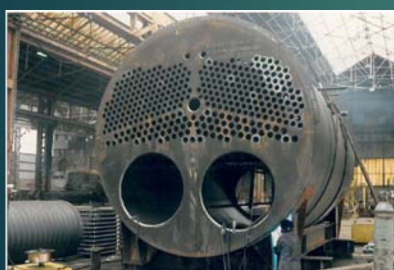


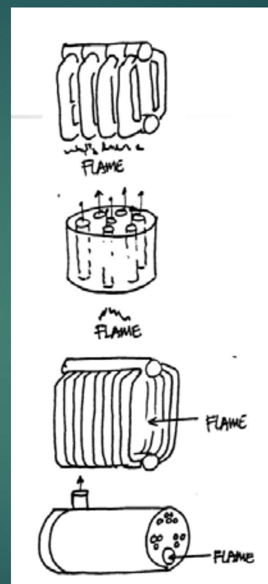
Steam Systems

- One pipe systems
  - Oversized piping
- Two pipe systems
  - Air vent air inlet to eliminate vacuum
  - Trap only passes condensed water. Traps steam
  - Condensate pump

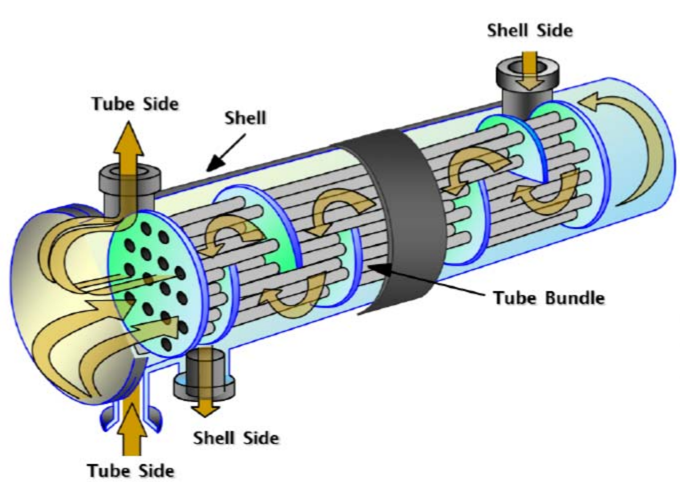
Boilers

- Cast iron - sectional
- Steel
- Water tube
- Fire tube - Scotch marine boiler



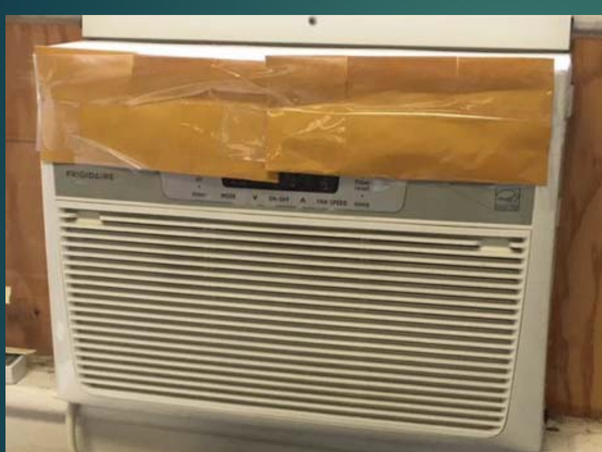


Heat Exchangers



Cooling

Refrigeration



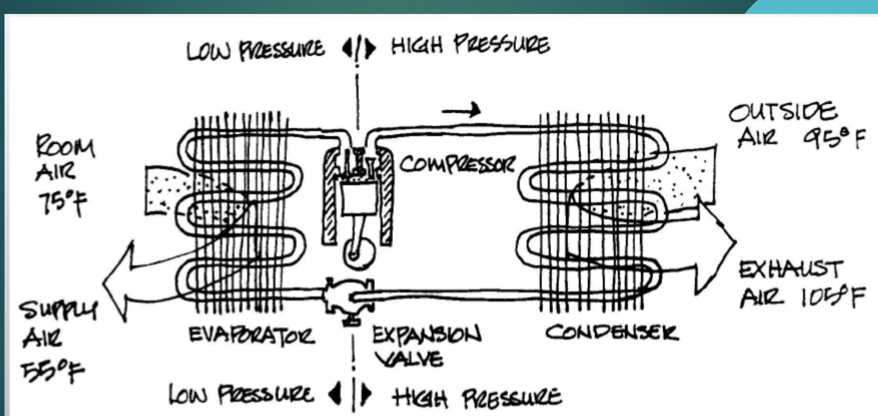
Refrigeration

Ancient methods – Run air over water

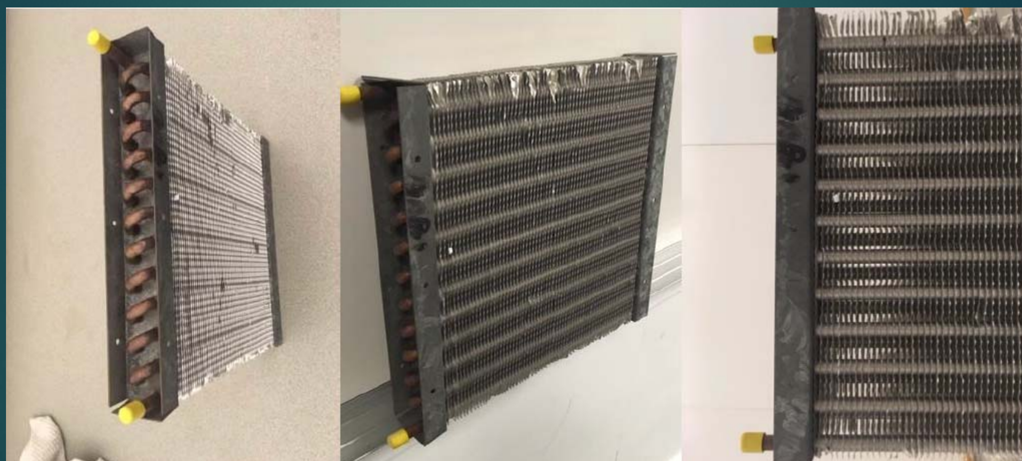
1758 – Ben Franklin and John Hadley (Cambridge Professor of Chemistry proofed rapid evaporation of volatile liquids, alcohol or ether, would absorb heat from surrounding air.

A RESIDENT PHYSICIAN IN FLORIDA TRIED TO USE COMPRESS AIR TO COOL THE FLORIDA HOSPITAL TO INCREASE PATIENT COMFORT. HE BUILT A ICE-MAKING MACHINE BY COMPRESSING AIR AND THEN EXPANSING IT AROUND WATER TUBES.

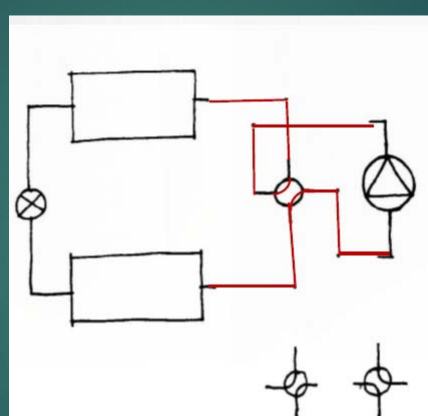
Vapor-Compression Cycle Air Conditioner



Coil



Heat Pump

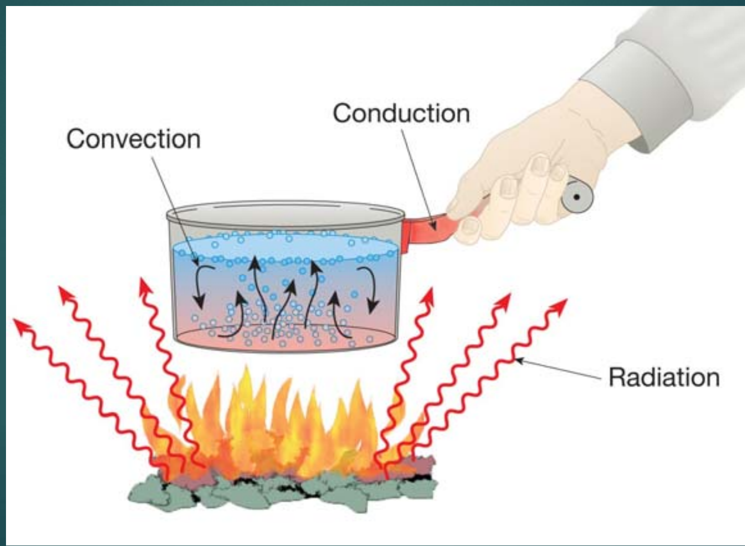


Heat Pump

- Air – Air
- Air – Water (Water source heat pumps)
- Water – Air
- Water - Water

DIRECT EXPANSION (DX) AN EVAPORATOR COIL WHERE THE FLUID INSID E THE COIL IS REFRIGERANT

Heat transfer



Conditioning of the Interior Environment

Thermal Control

- Temperature
- Humidity
- Air Quality
- Air Motion
- Mean Radiant Temperature

The HVAC Problem

- Sensible Load – Mean Temperature
- Latent Load – Relative Humidity

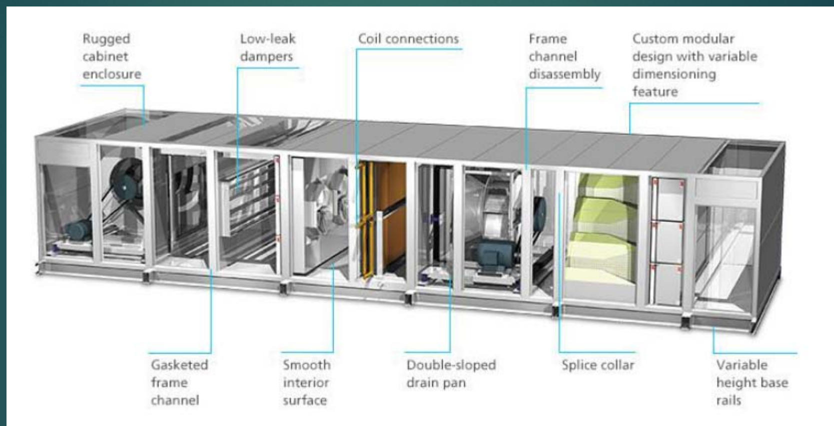
Ventilation for Healthier Indoor Environment

- Outside air for dilution of contaminants
- Exhaust air for removal of contaminants
- Improved filter effectiveness (MERV)

Unitary Systems – Package Terminal Air Conditioners (PTAC)

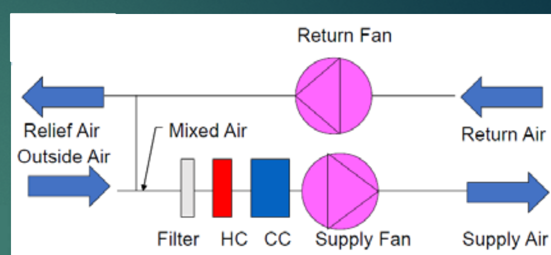
- Window Air Conditioners
- Through Wall Air Conditioners
- Through Wall AC with Heat (electric or Hot water coils)
- Through Water Heat Pumps
- Water Source Heat pumps
- Geothermal Heat Pumps
- Unit Heaters
- Finned Tubes and Convectors

Air Handling Units - AHU

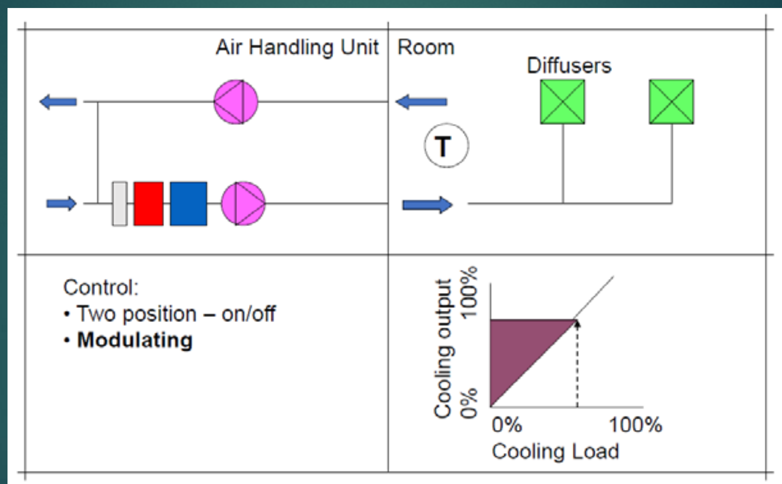


Air Handling Units - AHU

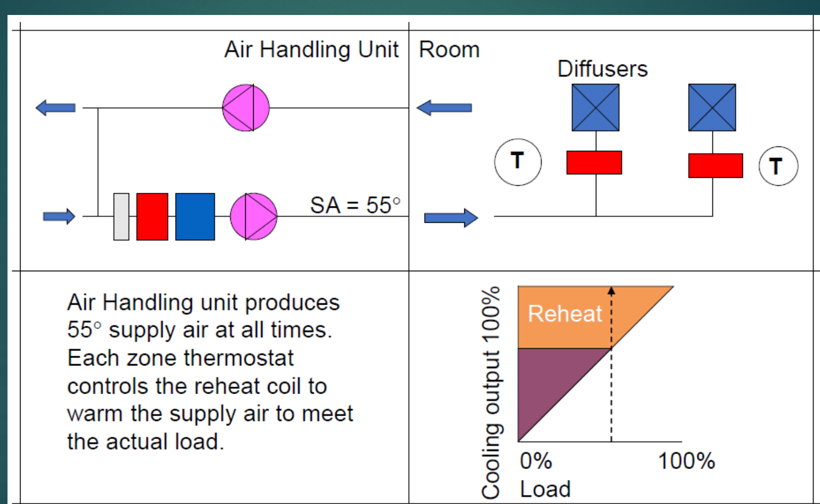
- Fan to move air
- Filters to take out particulate matters
- Heating coil to heat air
- Cooling coil to cool and dehumidify air
- Humidifier to add humidity
- Return air
- Outside air
- Mixed air = return air + outside air
- Supply air = conditioned air



Single Zone Systems

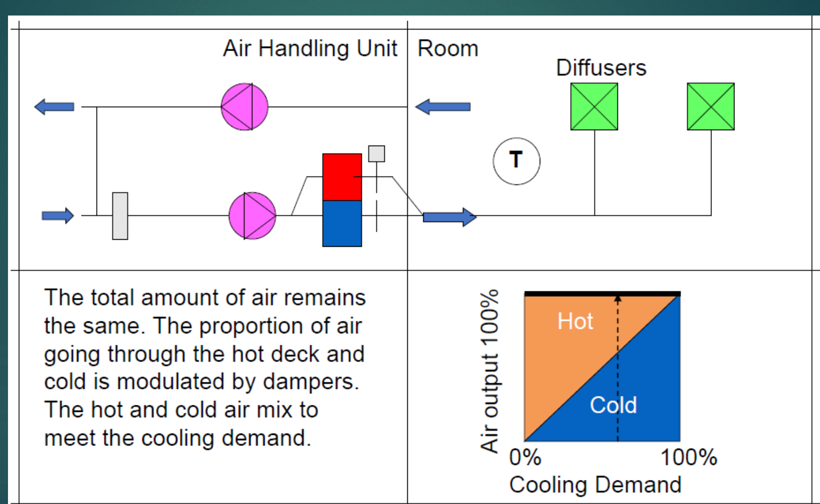


Reheat Systems

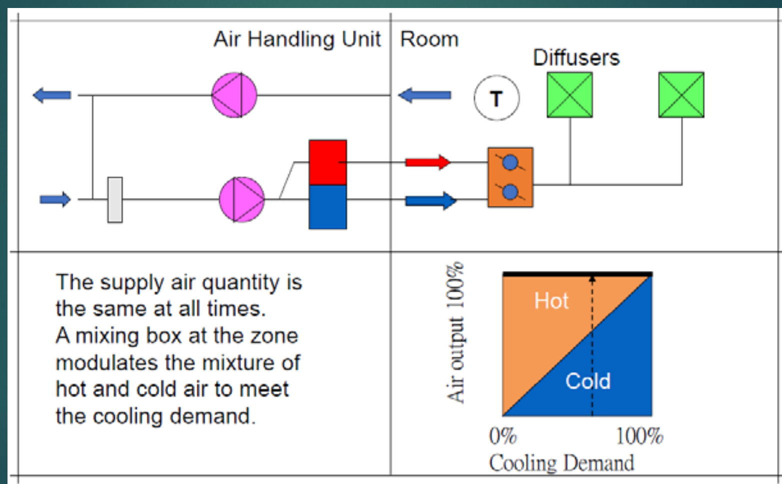


Reheat Coil

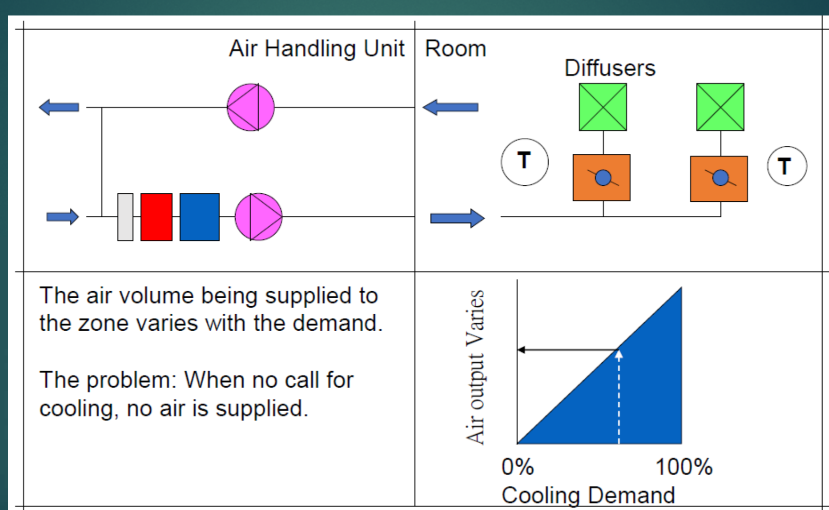
Multizone Systems



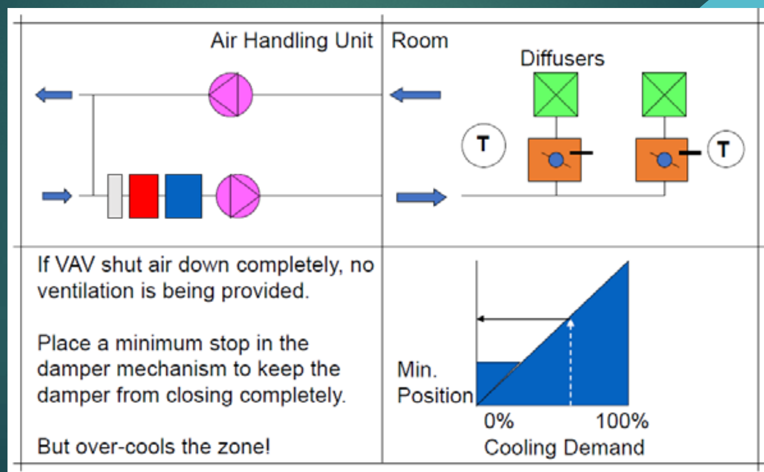
Dual Duct Systems



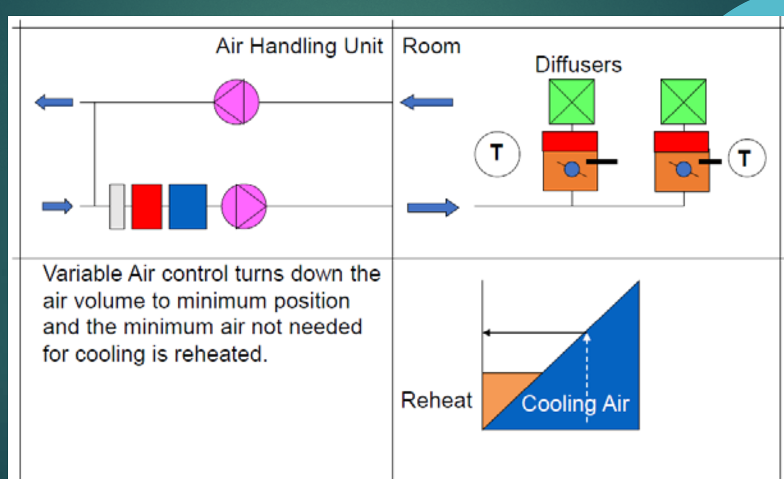
Variable Air Volume Systems



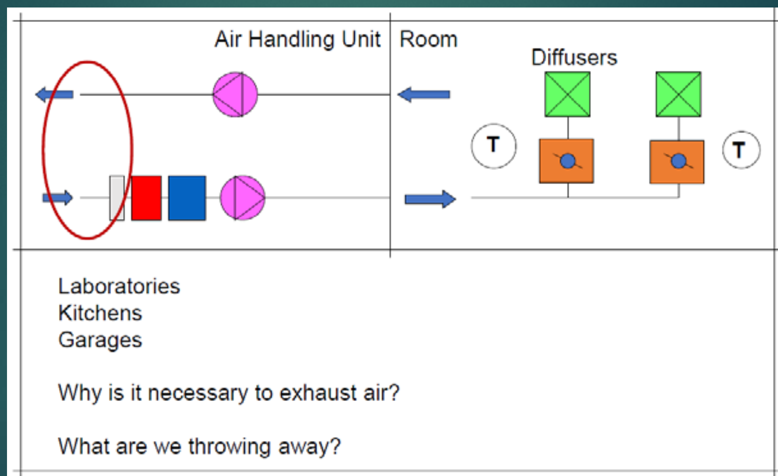
Variable Air Volume Systems w/ Minimum Stop



Variable Air Volume Systems w/ Reheat

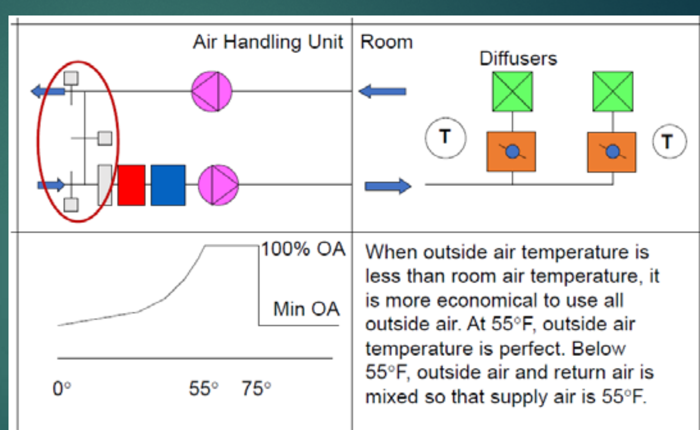


100 % Outdoor Air Systems

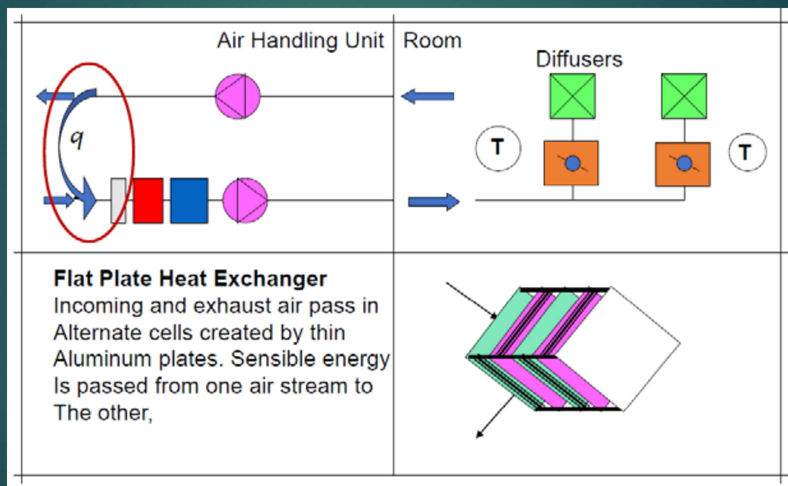


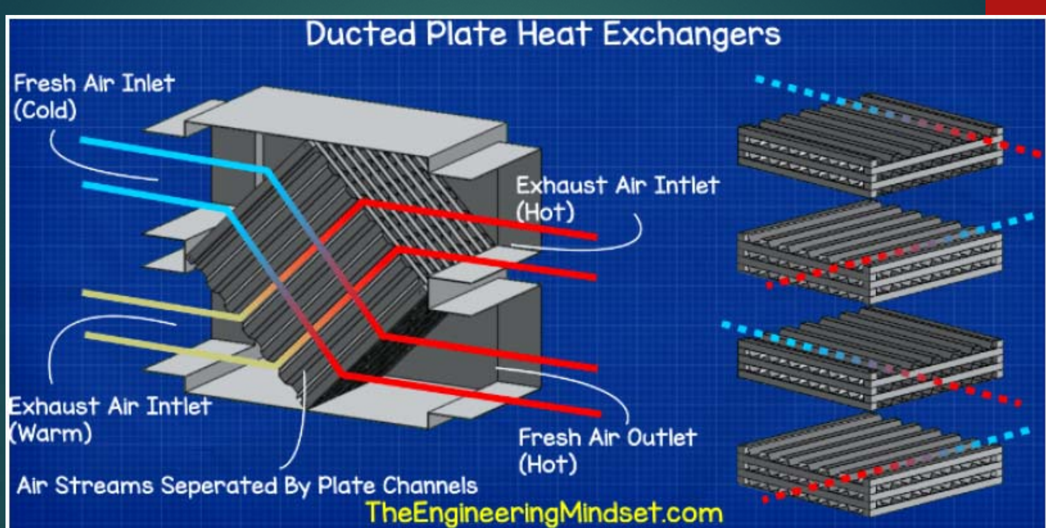
Economizer Cycle

- Use the least amount of energy to deliver the supply air at the conditions required. AKA minimize cooling..

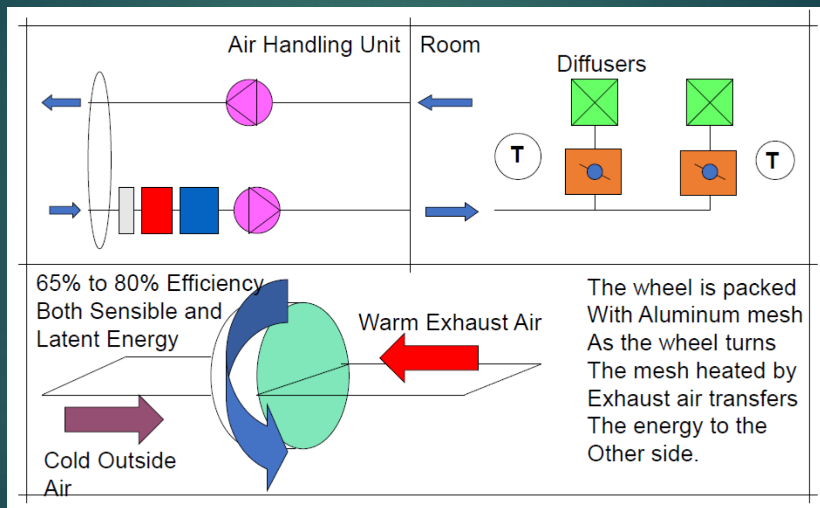


Heat Recovery System





Heat Recovery Wheel



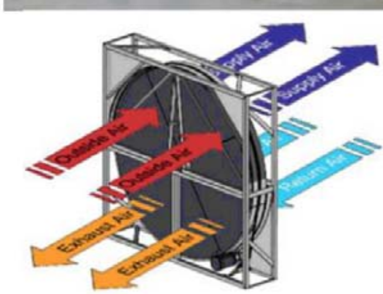
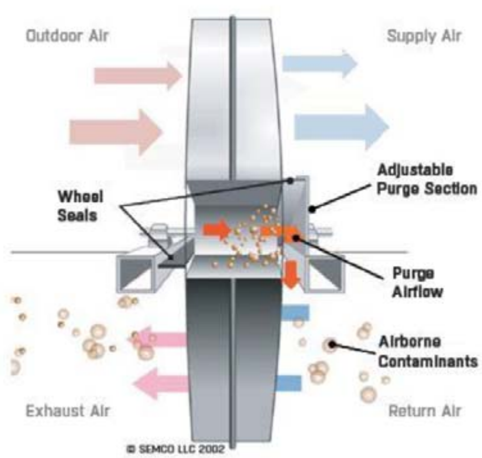
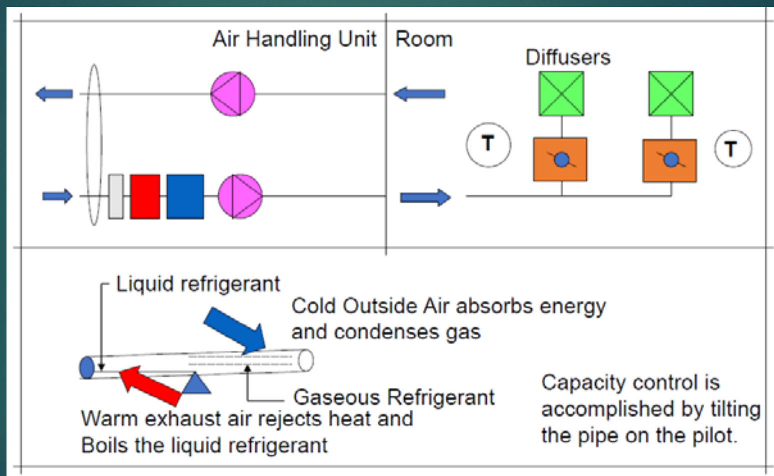


FIGURE 1. Schematic showing the basic operation of the SEMCO adjustable purge section (TE/Fusion wheel shown)



Heat Pipe Heat Recovery



INSULATION

Materials

- Fiberglass
- Mineral wool
- Cellulose
- Natural fibers
- Polystyrene
- Polyisocyanurate
- Polyurethane
- Perlite
- Cementitious foam
- Phenolic foam
- Insulation facings

Fiberglass

Fiberglass insulation is made from molten glass that is spun or blown into fibers. Most manufacturers use up tp 40% to 60% recycled glass content. Loose-fill insulation must be applied using an insulation-blowing machine in either open-blow applications (such as attic spaces) or closed-cavity applications (such as those found inside existing walls or covered attic floors).

Comes in batts and loose-fill

Mineral Wool

- Rock wool, a man-made material consisting of natural minerals like basalt or diabase.
- Slag wool, a man-made material from blast furnace slag (the waste matter that forms on the surface of molten metal).
- Available in blankets, batts, and loose-fill

Cellulose

- Cellulose insulation is made from recycled paper products, primarily newsprint, and has a very high recycled material content, generally 82% to 85%. The paper is first reduced to small pieces and then fiberized, creating a product that packs tightly into building cavities.
- Manufacturers add the mineral borate, sometimes blended with the less costly ammonium sulfate, to ensure fire and insect resistance. Cellulose insulation, when installed at proper densities, cannot settle in a building cavity.
- Loose-fill

Natural Fibers

- Cotton - consists of 85% recycled cotton and 15% plastic fibers that have been treated with borate--the same flame retardant and insect/rodent repellent used in cellulose insulation. One product uses recycled blue jean manufacturing trim waste. As a result of its recycled content, this product uses minimal energy to manufacture. Cotton insulation is available in batts.
- Sheep's Wool - for use as insulation, sheep's wool is also treated with borate to resist pests, fire, and mold. Sheep's wool batts for a 2 by 4-inch and 2 by 6-inch stud-framed wall offer an R-13 and R-19 value, respectively.

Natural Fibers

- Straw - Straw bale construction, popular 150 years ago on the Great Plains of the United States, has received renewed interest. The process of fusing straw into boards without adhesives was developed in the 1930s. Panels are usually 2 to 4 inches (5 to 102 mm) thick and faced with heavyweight kraft paper on each side. The boards also make effective sound-absorbing panels for interior partitions. Some manufacturers have developed structural insulated panels from multiple-layered, compressed-straw panels.
- Hemp - Hemp insulation is relatively unknown and not commonly used in the United States. Its R-value is similar to other fibrous insulation types.

Polystyrene

Polystyrene--a colorless, transparent thermoplastic--is commonly used to make foam board or beadboard insulation, concrete block insulation, and a type of loose-fill insulation consisting of small beads of polystyrene.

Molded expanded polystyrene (MEPS), commonly used for foam board insulation, is also available as small foam beads. These beads can be used as a pouring insulation for concrete blocks or other hollow wall cavities, but they are extremely lightweight, take a static electric charge very easily, and are notoriously difficult to control.

Other polystyrene insulation materials similar to MEPS are expanded polystyrene (EPS) and extruded polystyrene (XPS). EPS and XPS are both made from polystyrene, but EPS is composed of small plastic beads that are fused together and XPS begins as a molten material that is pressed out of a form into sheets. XPS is most commonly used as foam board insulation. EPS is commonly produced in blocks, which can easily be cut to form board insulation. Both EPS and XPS are often used as the insulation for structural insulating panels (SIPs) and insulating concrete forms (ICFs). Over time, the R-value of XPS insulation can drop as some of the low-conductivity gas escapes and air replaces it--a phenomenon is known as thermal drift or aging.

Polyisocyanurate

Polyisocyanurate or polyiso is a thermosetting type of plastic, closed-cell foam that contains a low-conductivity, hydrochlorofluorocarbon-free gas in its cells.

Polyisocyanurate insulation is available as a liquid, sprayed foam, and rigid foam board. It can also be made into laminated insulation panels with a variety of facings. Foamed-in-place applications of polyisocyanurate insulation are usually cheaper than installing foam boards, and can perform better because the liquid foam molds itself to all of the surfaces.

Over time, the R-value of polyisocyanurate insulation can drop as some of the low-conductivity gas escapes and air replaces it -- a phenomenon is known as thermal drift or ageing. Experimental data indicates that most thermal drift occurs within the first two years after the insulation material is manufactured.

Polyurethane

Polyurethane is a thermoset foam insulation material that contains a low-conductivity gas in its cells. Polyurethane foam insulation is available in closed-cell and open-cell formulas. With closed-cell foam, the high-density cells are closed and filled with a gas that helps the foam expand to fill the spaces around it. Open-cell foam cells are not as dense and are filled with air, which gives the insulation a spongy texture and a lower R-value.

Like polyiso foam, the R-value of closed-cell polyurethane insulation can drop over time as some of the low-conductivity gas escapes and air replaces it in a phenomenon known as thermal drift or ageing. Most thermal drift occurs within the first two years after the insulation material is manufactured, after which the R-value remains unchanged unless the foam is damaged.

Perlite

Perlite consists of very small, lightweight pellets, which are made by heating rock pellets until they pop. This creates a type of loose-fill insulation made of pellets that can be poured into place or mixed with cement to create a lightweight, less heat-conductive concrete.

Cementitious Foam

Cementitious insulation material is a cement-based foam used as sprayed-foam or foamed-in-placed insulation. One type of cementitious spray foam insulation known as aircrete® contains magnesium silicate and has an initial consistency similar to shaving cream. Air krete® is pumped into closed cavities. Cementitious foam costs about as much as polyurethane foam, is nontoxic and nonflammable, and is made from minerals (like magnesium oxide) extracted from seawater.

Phenolic Foam

Phenolic (phenol-formaldehyde) foam was somewhat popular years ago as rigid foam board insulation. It currently has limited availability as a board insulation and is also available as a foamed-in-place insulation.

Phenolic foamed-in-place insulation uses air as the foaming agent. One major disadvantage of phenolic foam is that it can shrink up to 2% after curing, which makes it less popular today.

Insulation Facings

- Facings are fastened to insulation materials during the manufacturing process. A facing protects the insulation's surface, holds the insulation together, and facilitates fastening to building components. Some types of facing can also act as an air barrier, radiant barrier, and/or vapor barrier and some even provide flame resistance.

Common facing materials include:

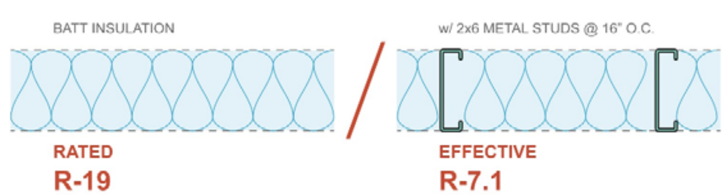
- kraft paper
- white vinyl sheeting
- aluminum foil

Insulation

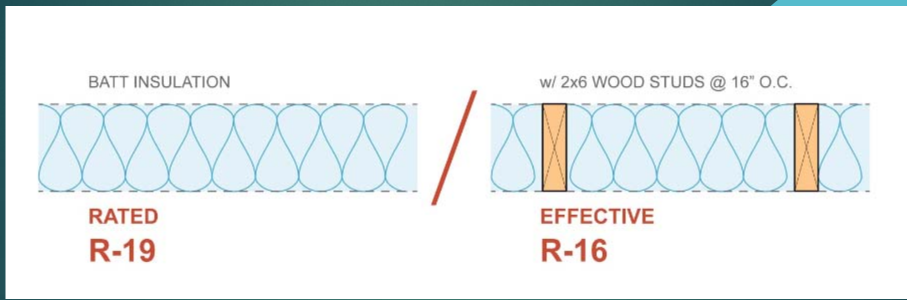
Structural framing will diminish the effectiveness of the thermal barrier. Whether steel or wood, there will be an impact. All building materials conduct heat at different rates. There is not a threshold beyond which a material becomes categorized as "insulation." However, both wood and steel framing will conduct heat more readily than cavity insulation products, .

Steel framing conducts a great deal of heat. According to ASHRAE, a layer of R-19 batt insulation is reduced by a staggering 63 percent to an effective R-7.1 when 2x6 metal studs are spaced at 16 inches-on-center.

Wood framing also induces thermal bridging, but it is not as bad a metal studs. Although less conductive than steel, wood will still diminish the effective R-value of batt insulation somewhere between 14 - 18 percent.



Insulation



Effective Insulation/Framing Layer R-Values

Steel-framed wall information adapted from ANSI/ASHRAE/IESNA Standard 90.1-2007 Table A9.2B.

Stud Wall Framing Type	Nominal Cavity Depth (inches)	Actual Cavity Depth (inches)	Rated R-Value	Effective R-Value at 16 in. on Center[1]	% Change (Rated vs Effective)	Effective R-Value at 24 in. on Center[2]	% Change (Rated vs Effective)
Batt Insulated Cavity							
Steel	4	3.50	R-11	R-5.5	-50%	R-6.6	-40%
Steel	4	3.50	R-13	R-6.0	-54%	R-7.2	-45%
Steel	4	3.50	R-15	R-6.4	-57%	R-7.8	-48%
Steel	6	6.00	R-19	R-7.1	-63%	R-8.6	-55%
Steel	6	6.00	R-21	R-7.4	-65%	R-9.0	-57%
Steel	8	8.00	R-25	R-7.8	-69%	R-9.6	-62%
Wood	4	3.50	R-11	R-9.3	-15%	R-9.5	-14%
Wood	4	3.50	R-13	R-10.8	-17%	R-11.1	-15%
Wood	4	3.50	R-15	R-12.3	-18%	R-12.7	-15%
Wood	6	5.50	R-19	R-16.0	-16%	R-16.3	-14%
Wood	6	5.50	R-21	R-17.5	-17%	R-17.9	-15%
Wood	8	7.50	R-25	R-21.1	-16%	R-21.5	-14%

Assemblies

If there are several unbroken layers of different materials forming a wall assembly, the R-value of the entire assembly can be found simply by adding the layers:

R total=R1+R2+R3+…

With u-factors, it is not so simple. Since a u-factor is the inverse of an R-value, to find the overall u-factor, one needs the following equation:

1/u total =1/u1 +1/u2 +1/u3 +…

U total=1/(1/u1 +1/u2 +1/u3 +…)

Assemblies

As mentioned earlier, this only applies to the part of a wall with unbroken layers, such as the wall cavity. To account for the framing in the wall, a separate u-factor calculation must be done, and then the two u-factors can be combined to get an overall value for the entire assembly. If one tries to do this using R-values, the answer will be wrong. R-values of different heat flow pathways through an assembly cannot be added together, averaged, or area-weighted to get the overall assembly performance.

Assemblies

For wood walls, the "parallel path" method is appropriate

U=ff framing*1/R framing +ff cavity*1/R cavity

Steel Stud Correction Factors

	OC Stud Spacing			
	406 mm (16 in.)		610 mm (24 in.)	
Stud Depth	Cavity Insulation	Correction Factor	Cavity Insulation	Correction Factor
89 mm (3.5 in.)	R-13	0.46	R-13	0.55
	R-15	0.43	R-15	0.52
152 mm (6 in.)	R-19	0.37	R-19	0.45
	R-21	0.35	R-21	0.43
203 mm (8 in.)	R-25	0.31	R-25	0.38

Insulation

AIR FILMS	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BTU)
Exterior Air Film		0.17
Interior Wall Air Film		0.68
Interior Ceiling Air Film		0.61

AIR SPACE	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BTU)
Minimum 1/2" up to 4" Air Space		1.00

Insulation

BUILDING BOARD	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BTU)
Gypsum Wall Board	1/2"	0.45
Gypsum Wall Board	5/8"	0.5625
Plywood	1/2"	0.62
Plywood	1"	1.25
Fiber board sheathing	1/2"	1.32
Medium Density Particle Board	1/2"	0.53

Insulation

INSULATING MATERIALS	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BTU)
R-11 Mineral Fiber with 2x4 metal studs @ 16" OC		5.50
R-11 Mineral Fiber with 2x4 wood studs @ 16" OC		12.44
R-11 Mineral Fiber with 2x4 metal studs @ 24" OC		6.60
R-19 Mineral Fiber with 2x6 metal studs @ 16" OC		7.10
R-19 Mineral Fiber with 2x6 metal studs @ 24" OC		8.55
R-19 Mineral Fiber with 2x6 wood studs @ 24" OC		19.11
Expanded Polystyrene (Extruded)	1"	5.00
Polyurethane Foam (Foamed on site)	1"	6.25
Polyisocyanurate (Foil Faced)	1"	7.20
Vermiculite (WARNING: may contain asbestos)	1"	~2.13

Insulation

MASONRY AND CONCRETE	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BTU)
Common Brick	4"	0.80
Face Brick	4"	0.44
Concrete Masonry Unit (CMU)	4"	0.80
Concrete Masonry Unit (CMU)	8"	1.11
Concrete Masonry Unit (CMU)	12"	1.28
Concrete 60 pounds per cubic foot	1"	0.52
Concrete 70 pounds per cubic foot	1"	0.42
Concrete 80 pounds per cubic foot	1"	0.33
Concrete 90 pounds per cubic foot	1"	0.26
Concrete 100 pounds per cubic foot	1"	0.21
Concrete 120 pounds per cubic foot	1"	0.13
Concrete 150 pounds per cubic foot	1"	0.07
Granite	1"	0.05
Sandstone / Limestone	1"	0.08

Insulation

SIDING	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BT
Aluminum / Vinyl Siding (not insulated)		0.61
Aluminum / Vinyl Siding (1/2" insulation)		1.80

FLOORING	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BT
Hardwood	3/4"	0.68
Tile		0.05
Carpet with fiber pad		2.08
Carpet with rubber pad		1.23

ROOFING	THICKNESS	R-VALUE (F° · SQ.FT. · HR/BT
Asphalt Shingles		0.44
Wood Shingles		0.97

2018 IEBC

IEBC Definitions

CHANGE OF OCCUPANCY. A change in the use of a building or a portion of a building that results in any of the following:

1. A change of occupancy classification.

2. A change from one group to another group within an occupancy classification.

3. Any change in use within a group for which there is a change in application of the requirements of this code.

IEBC CLASSIFICATION OF WORK

- Level 1 alterations include the removal and replacement or the covering of existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose.
- Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.
- Level 3 alterations apply where the work area exceeds 50 percent of the building area.

2018 IEBC Moved/Relocated Buildings

1402.1 Location on the lot. The building shall be located on the lot in accordance with the requirements of the International Building Code or the International Residential Code as applicable.

Most think fire.. Don't forget intake and exhaust

2018 IEBC Level I

SECTION 707 ENERGY CONSERVATION

707.1 Minimum requirements. Level 1 alterations to existing buildings or structures do not require the entire building or structure to comply with the energy requirements of the International Energy Conservation Code or International Residential Code. The alterations shall conform to the energy requirements of the International Energy Conservation Code or International Residential Code as they relate to new construction only.

2018 IEBC Level II

SECTION 808 MECHANICAL

808.1 Reconfigured or converted spaces. Reconfigured spaces intended for occupancy and spaces converted to habitable or occupiable space in any work area shall be provided with natural or mechanical ventilation in accordance with the International Mechanical Code.

Exception: Existing mechanical ventilation systems shall comply with the requirements of Section 808.2.

2018 IEBC Level II

808.2 Altered existing systems. In mechanically ventilated spaces, existing mechanical ventilation systems that are altered, reconfigured, or extended shall provide not less than 5 cubic feet per minute (cfm) (0.0024 m3/s) per person of outdoor air and not less than 15 cfm (0.0071 m3/s) of ventilation air per person; or not less than the amount of ventilation air determined by the Indoor Air Quality Procedure of ASHRAE 62.1.

808.3 Local exhaust. Newly introduced devices, equipment, or operations that produce airborne particulate matter, odors, fumes, vapor, combustion products, gaseous contaminants, pathogenic and allergenic organisms, and microbial contaminants in such quantities as to affect adversely or impair health or cause discomfort to occupants shall be provided with local exhaust.

2018 IEBC Level II

SECTION 810 ENERGY CONSERVATION

810.1 Minimum requirements. Level 2 *alterations* to *existing buildings* or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the *International Energy Conservation Code* or *International Residential Code*. The *alterations* shall conform to the energy requirements of the *International Energy Conservation Code* or *International Residential Code* as they relate to new construction only.

2018 IEBC Level III

SECTION 907 ENERGY CONSERVATION

907.1 Minimum requirements. Level 3 alterations to existing buildings or structures are permitted without requiring the entire building or structure to comply with the energy requirements of the International Energy Conservation Code or International Residential Code. The alterations shall conform to the energy requirements of the International Energy Conservation Code or International Residential Code as they relate to new construction only.

2018 IEBC Change of Occupancy

1008.1 Mechanical requirements. Where the occupancy of an existing building or part of an existing building is changed such that the new occupancy is subject to different kitchen exhaust requirements or to increased mechanical ventilation requirements in accordance with the International Mechanical Code, the new occupancy shall comply with the respective International Mechanical Code provisions.

2018 IEBC Change of Occupancy

1010.1 Light and ventilation. Light and ventilation shall comply with the requirements of the International Building Code for the new occupancy.

2018 IEBC Additions

1107.1 Minimum requirements. Additions to existing buildings shall conform to the energy requirements of the International Energy Conservation Code or International Residential Code as they relate to new construction.

2018 IMC

2018 IMC

102.2 Existing installations. Except as otherwise provided for in this chapter, a provision in this code shall not require the removal, *alteration* or abandonment of, nor prevent the continued utilization and maintenance of, a mechanical system lawfully in existence at the time of the adoption of this code.

102.2.1 Existing buildings. Additions, alterations, renovations or repairs related to building or structural issues shall be regulated by the *International Existing Building Code*.

2018 IECC

2018 IECC

C501.1 Scope. The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing buildings and structures.

C501.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

2018 IECC Additions

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building. Additions shall comply with Sections C402, C403, C404, C405 and C502.2.

Additions complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

2018 IECC Additions

C502.2 Prescriptive compliance. Additions shall comply with Sections C502.2.1 through C502.2.6.2.

C502.2.1 Vertical fenestration.

C502.2.2 Skylight area.

2018 IECC Additions

C502.2.3 Building mechanical systems. New mechanical systems and equipment that are part of the *addition* and serve the building heating, cooling and ventilation needs shall comply with Section C403.

2018 IECC Additions

C502.2.6 Lighting power and systems. New lighting systems that are installed as part of the addition shall comply with Section C405.

C502.2.6.1 Interior lighting power. The total interior lighting power for the addition shall comply with Section C405.3.2 for the addition alone, or the existing building and the addition shall comply as a single building.

C502.2.6.2 Exterior lighting power. The total exterior lighting power for the addition shall comply with Section C405.4.2 for the addition alone, or the existing building and the addition shall comply as a single building

2018 IECC Alterations

C50.1 General. Alterations to any building or structure shall comply with the requirements of Section C503 and the code for new construction. Alterations shall be such that the existing building or structure is not less conforming to the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

2018 IECC Alterations

C503.2 Change in space conditioning. Any nonconditioned or low-energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

Exceptions:

1. Where the component performance alternative in Section C402.1.5 is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.

2. Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

2018 IECC Alterations

C503.3 Building envelope. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.5.

Exception: Where the existing building exceeds the fenestration area limitations of Section C402.4.1 prior to alteration, the building is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.

C503.3.1 Roof replacement. Roof replacements shall comply with Section C402.1.3, C402.1.4, C402.1.5 or C407 where the existing roof assembly is part of the building thermal envelope and contains insulation entirely above the roof deck.

2018 IECC Alterations

C503.3.2 Vertical fenestration.

C503.3.3 Skylight area.

2018 IECC Alterations

C503.4 Heating and cooling systems. New heating, cooling and duct systems that are part of the *alteration* shall comply with Sections C403.

C503.4.1 Economizers. New cooling systems that are part of *alteration* shall comply with Section C403.5.

C503.5 Service hot water systems. New service hot water systems that are part of the *alteration* shall comply with Section C404.

C503.6 Lighting systems. New lighting systems that are part of the *alteration* shall comply with Section C405.

Exception. *Alterations* that replace less than 10 percent of the luminaires in a space, provided that such *alterations* do not increase the installed interior lighting power.

2018 IECC Repairs

C504.1 General. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C501.3 and this section. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered to be part of the repair and shall not be subject to the requirements for alterations in this chapter. Routine maintenance required by Section C501.3, ordinary repairs exempt from permit and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.

Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1, repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

2018 IECC Change of Use

- **C505.1 General.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.3.2(1) or C405.3.2(2) to another use in Table C405.3.2(1) or C405.3.2(2), the installed lighting wattage shall comply with Section C405.3. Where the space undergoing a change in occupancy or use is in a building with a fenestration area that exceeds the limitations of Section C402.4.1, the space is exempt from Section C402.4.1 provided that there is not an increase in fenestration area.
- **Exceptions:**
- 1. Where the component performance alternative in Section C402.1.5 is used to comply with this section, the proposed UA shall be not greater than 110 percent of the target UA.
- 2. Where the total building performance option in Section C407 is used to comply with this section, the annual energy cost of the proposed design shall be not greater than 110 percent of the annual energy cost otherwise permitted by Section C407.3.

Questions