

CAE 464/517 HVAC Systems Design

Spring 2023

January 12, 2023

Intro to the course and HVAC drawings

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Illinois Institute of Technology

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RECAP AND INTRO

Recap and Intro

- HVAC stands for **H**eating, **V**entilation, and **Air-C**onditioning:
 - ❑ **H**eating: Boiler, furnace, heat pump, waste heat, heating coils
 - ❑ **V**entilation: Outdoor air required for the spaces (e.g., ASHRAE 62.1)
 - ❑ **Air-C**onditioning: Chilled-water systems, cooling coils, Direct Expansion (DX) refrigerant systems



Recap and Intro

- Primary systems are major energy consumers
 - ❑ In small buildings, we usually call them heating and cooling devices
 - ❑ In large buildings, we usually call them equipment and systems
- For large buildings sometimes they are called “plants” or “loops”
- Examples of a heating device is a boiler or furnace
- An example of a cooling system is a vapor compression

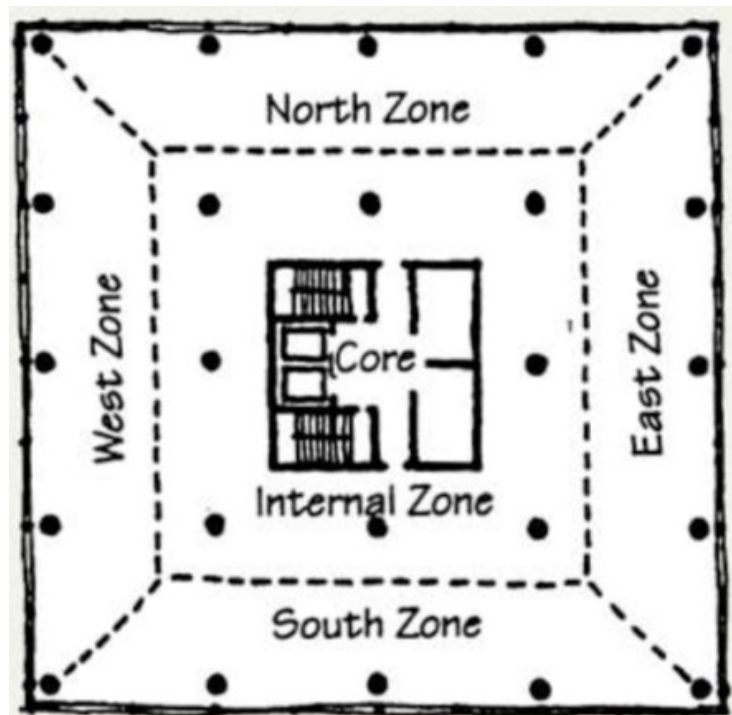
Recap and Intro

- Secondary systems distribute the cooling (or heating) produced by the primary systems (e.g., chillers or boilers) to the building spaces (e.g., specific rooms or thermal zones). Four types are:
 - All-water
 - All-air
 - Air-water systems
 - Refrigerant
 - Air-water-refrigerant
 - Air-refrigerant

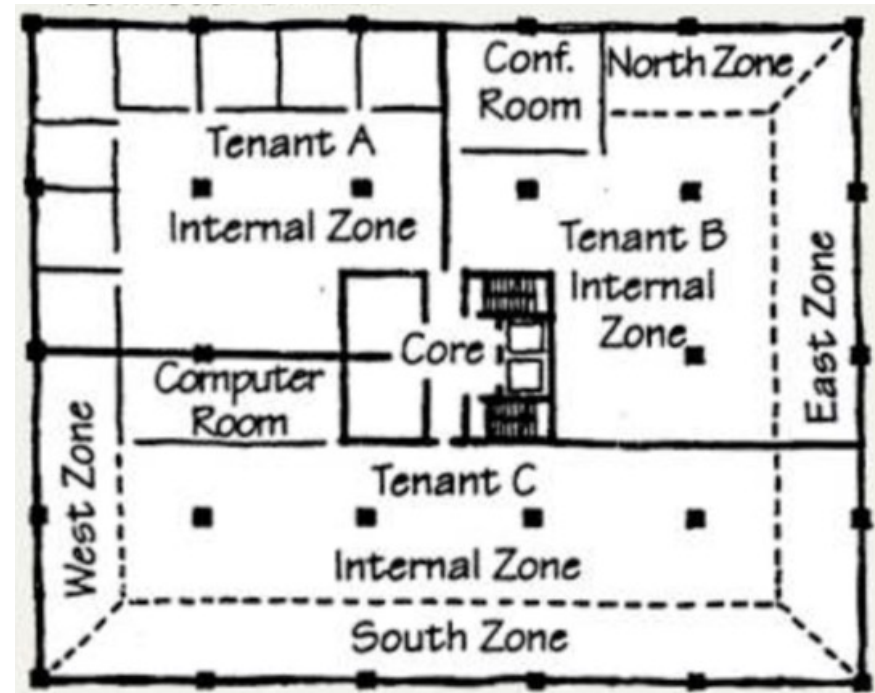
What are the advantages and disadvantages of each type?

Recap and Intro

- Thermal zone or zone:
 - ❑ Is a space or collection of spaces having similar space-conditioning requirements
 - ❑ Has the same heating and cooling setpoint



Based on orientation and floor



Based on spaces

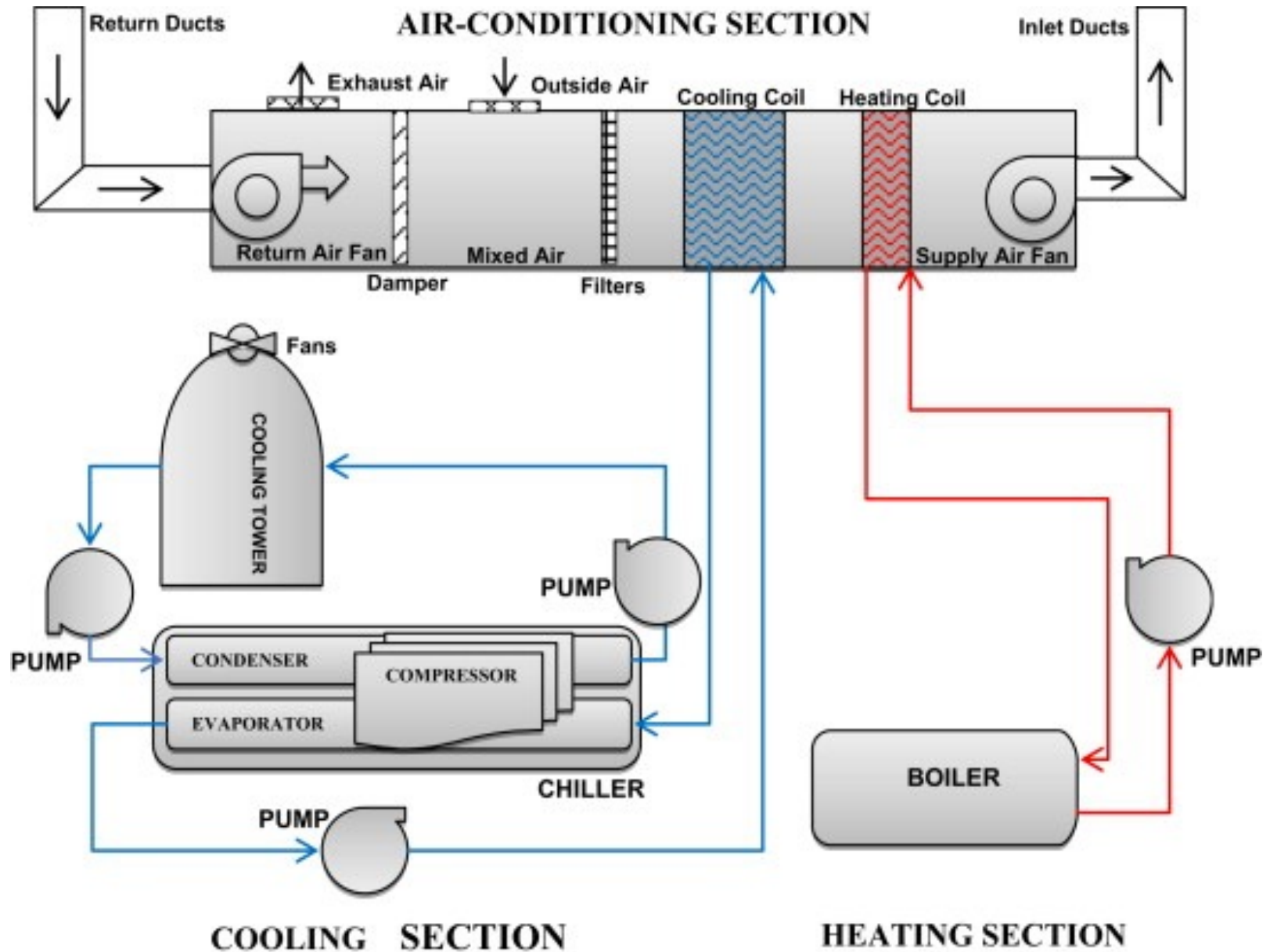
Recap and Intro

- HVAC systems categories in terms of their distribution and integration of components are categorized as:
 - ❑ Unitary
 - Local systems
 - Each room has an HVAC system
 - ❑ Centralized
 - Central systems (all HVAC equipment in one room)
 - Semi-central systems
 - ❑ District
 - Central systems (all HVAC equipment in one room)
 - Semi-central systems

Recap and Intro

- How do we select HVAC systems?
 - Performance requirements (loads, process)
 - Capacity requirements (building types, loads)
 - Spatial requirements (building types)
 - First costs (location, size of HVAC, investment)
 - Operating costs
 - Reliability
 - Flexibility
 - Maintainability

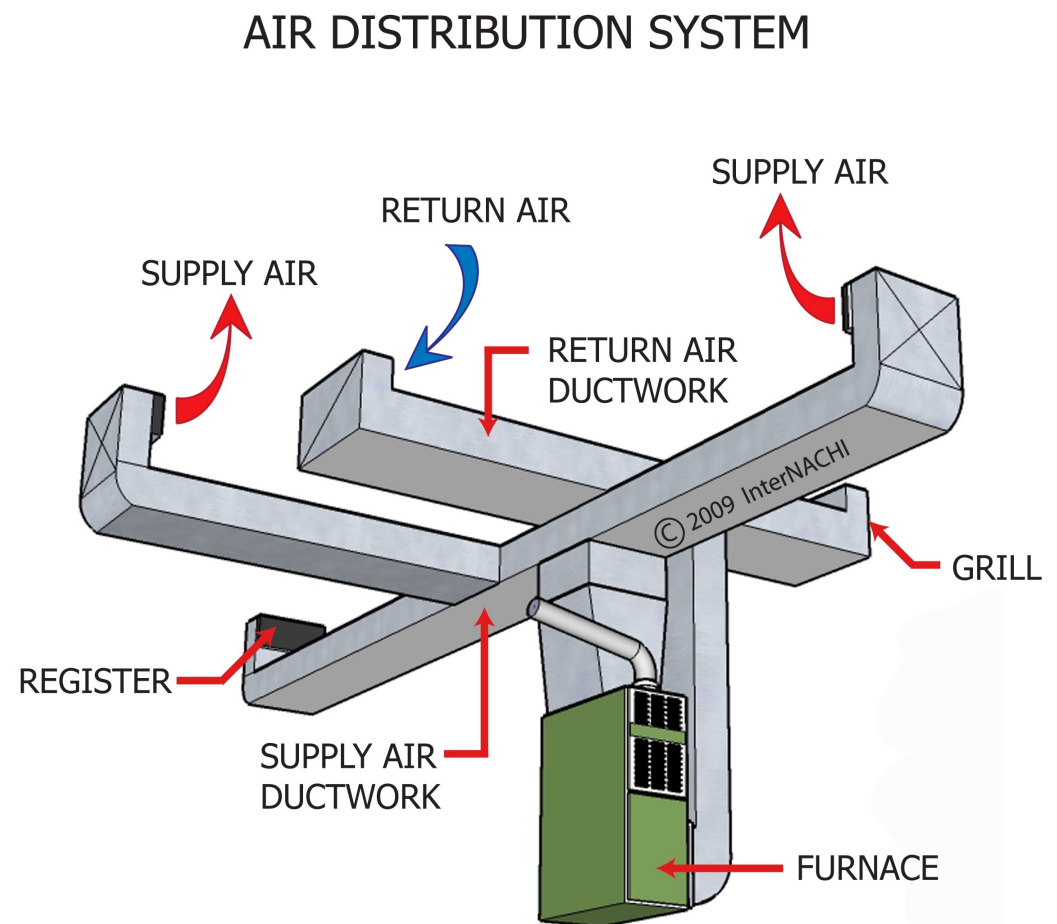
Building HVAC Systems



INTRODUCTION TO AIR DISTRIBUTION SYSTEMS

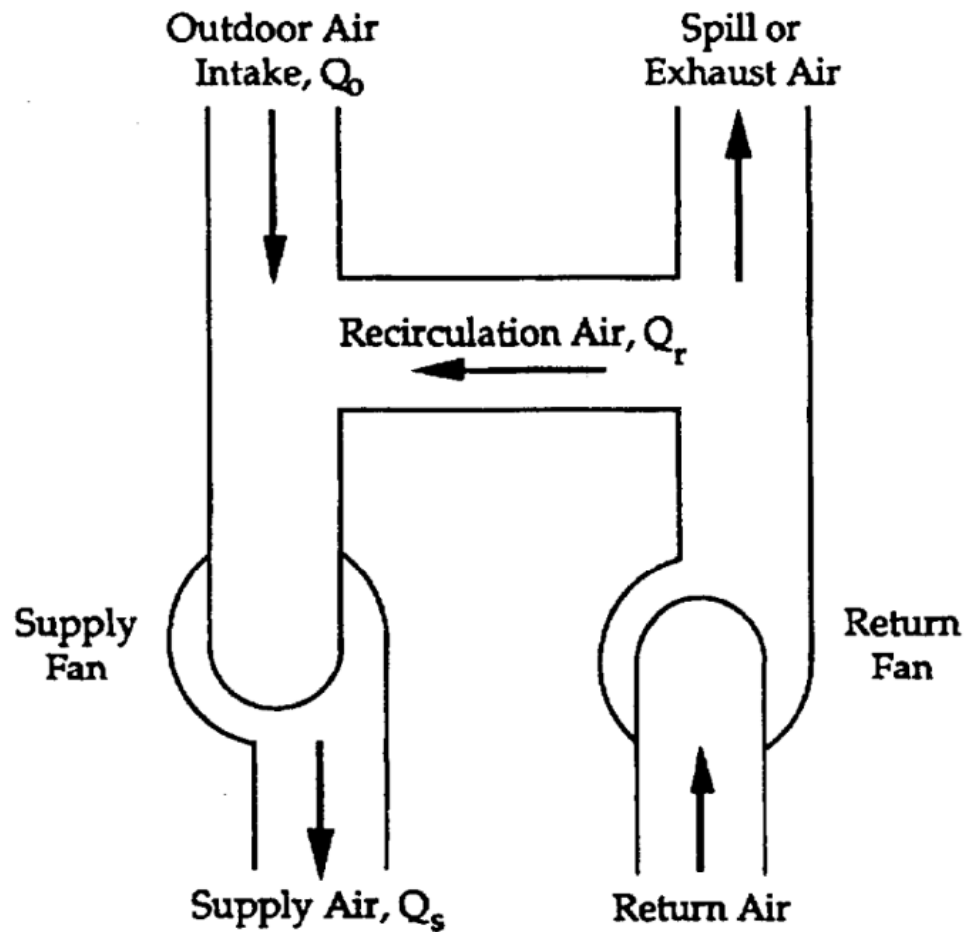
Air Distribution Systems

- Air distribution components:
 - Air handlers (known as AHU)
 - Air distribution devices
 - Ductwork
 - Heating and cooling coils
 - Dampers
 - Fans
 - Controls



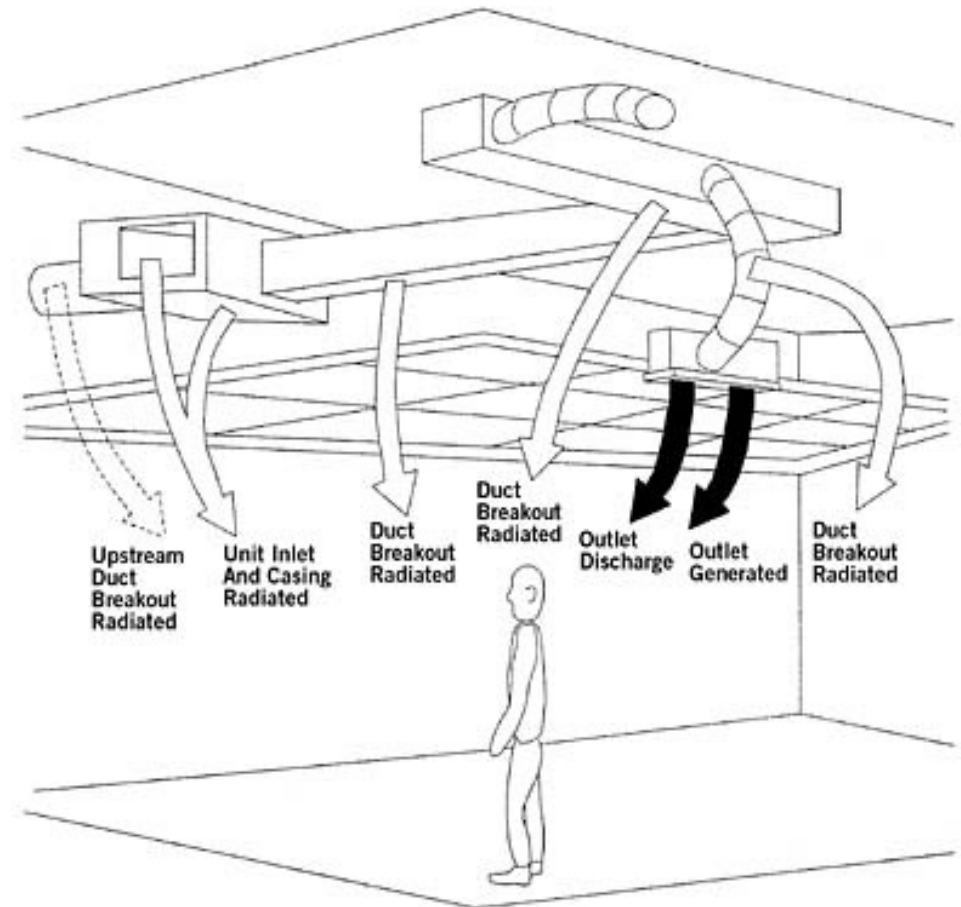
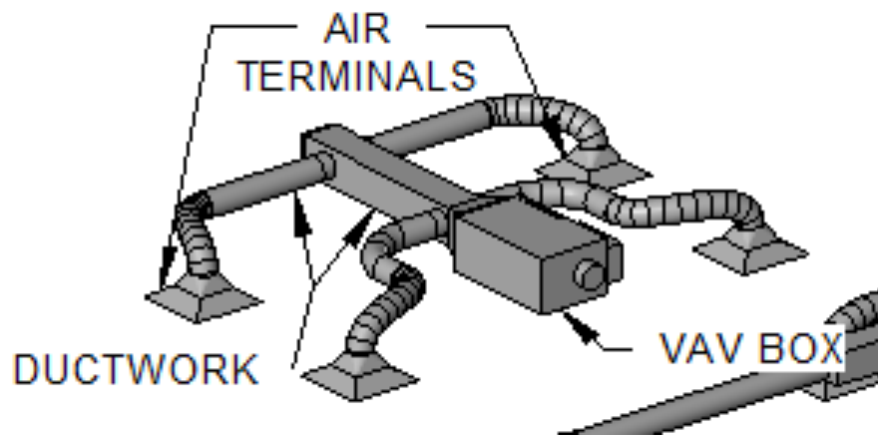
Air Distribution Systems

- An AHU system may include:



Air Distribution Systems

- Energy is transferred to the room air by
 - ❑ Terminal devices such as radiators and fan units
 - ❑ Air stream that needs to supply via terminal boxes or room diffusers

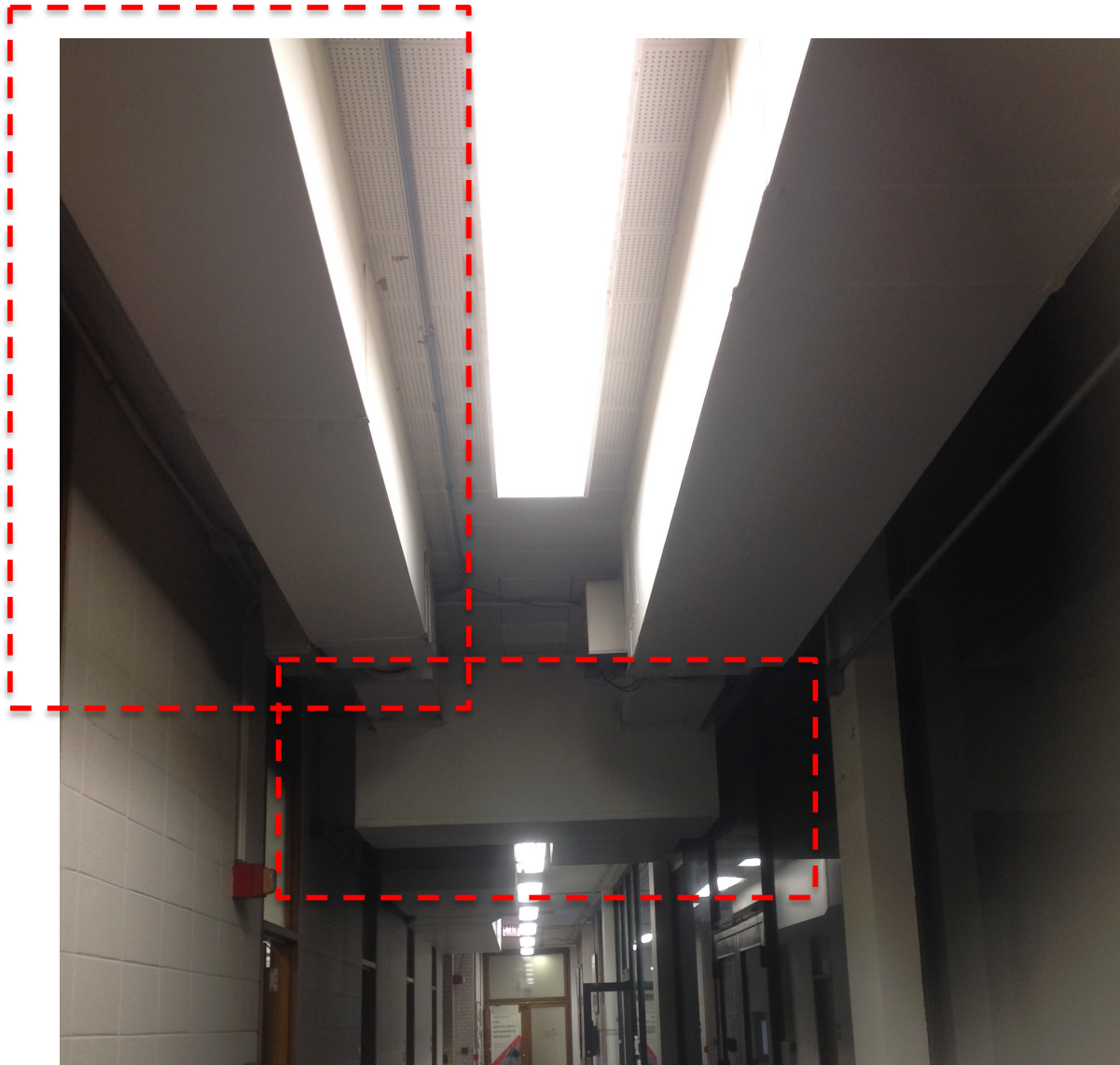


Air Distribution Systems

- Terminal boxes are located in:
 - ❑ Space above the suspended ceiling in a zone
 - ❑ Air travels from them through ductwork (flexible or rigid) to diffusers
 - ❑ There are many variations in the terminal boxes
 - ❑ The spaces above the suspended ceiling can be as a return air plenum
 - ❑ Some cases such as laboratories, there are return grills connected directly to the return air ducted named as ducted return
 - ❑ Installation of the grills need design, e.g. heat sources

Air-Distribution Systems

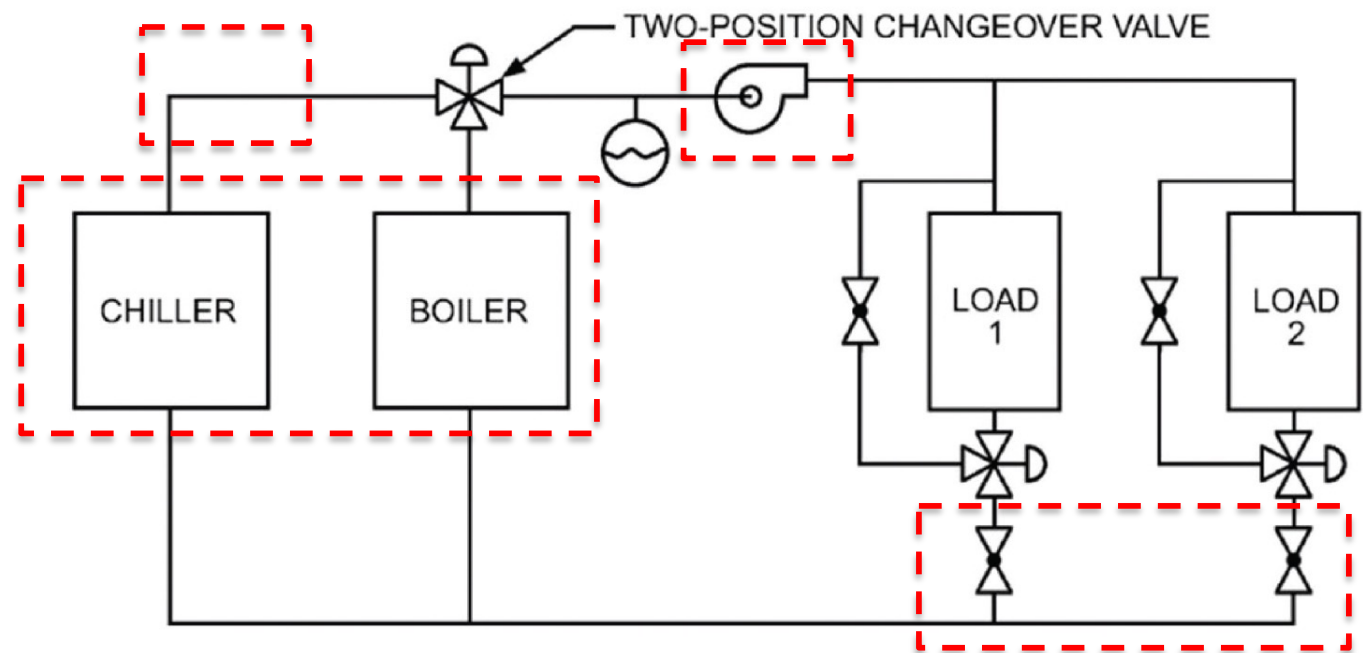
- Do we use this system at IIT?



INTRODUCTION TO AIR HYDRONIC SYSTEMS

Hydronic Systems

- **Hydronics** refers to systems focused on heating or cooling with water:
- Components of a steam or chiller water systems are:
 - Boiler or chiller
 - Piping
 - Valves
 - Pumps
 - Controls



Hydronic Systems

- Do we use this system at IIT?

Heating Plant



Ludwig Mies van der Rohe

Frank J. Kornacker; Alschuler & Sincere, associated architects; Sargent and Lundy, mechanical engineers

1945-50 (addition 1964)

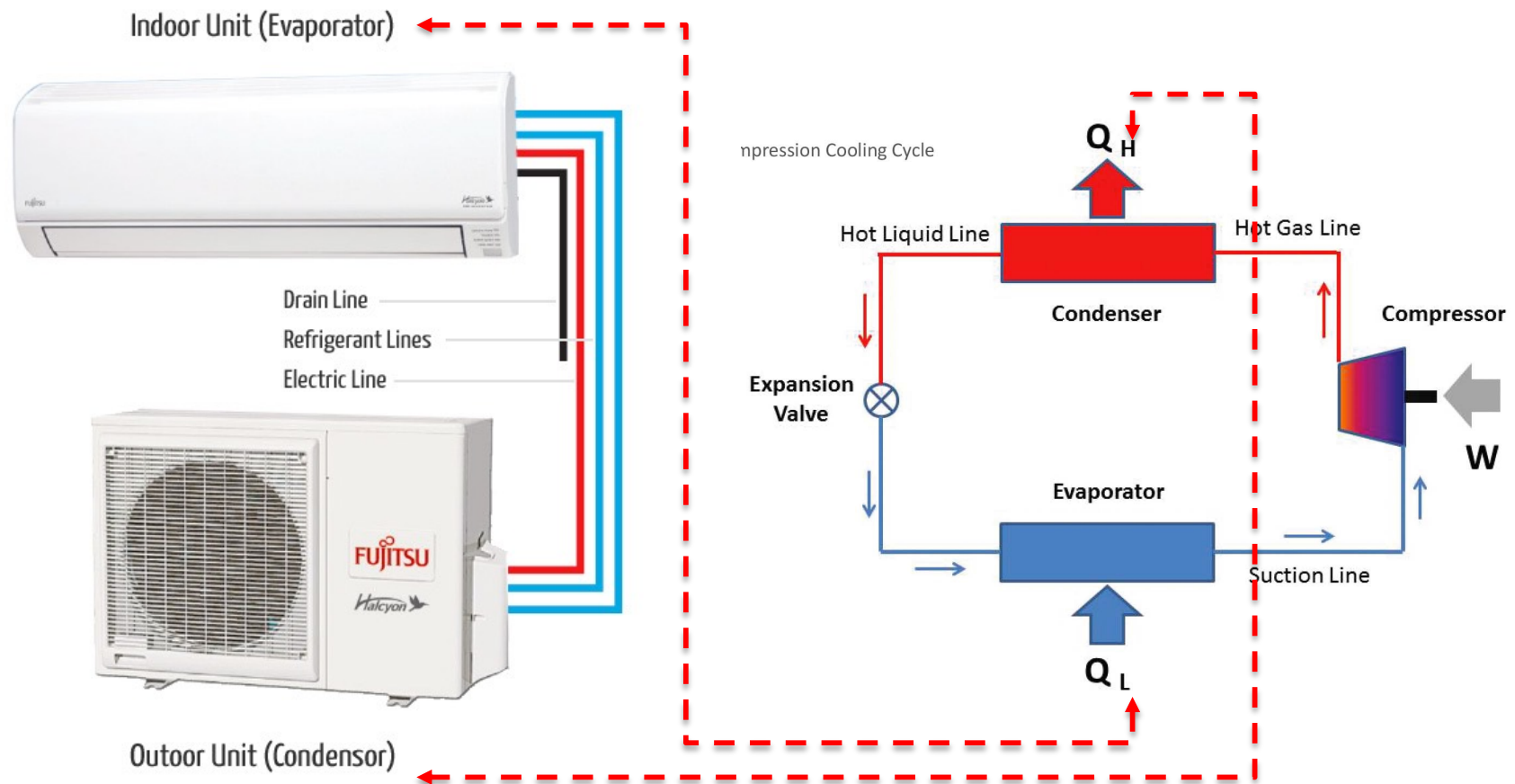
3430 South Federal Street

<http://buildinghistory.iit.edu/buildings/plant>

INTRODUCTION TO REFRIGERATION SYSTEMS

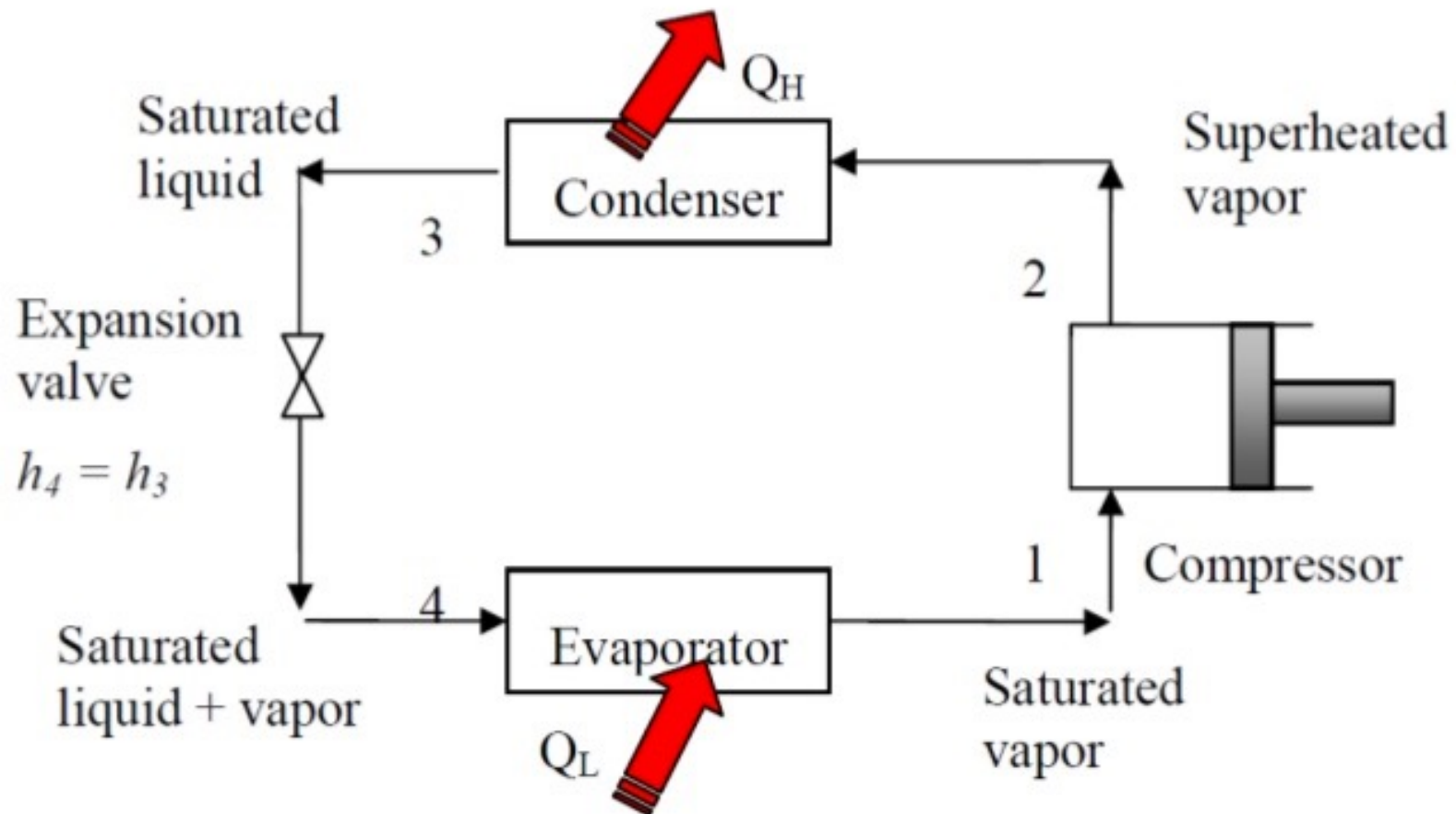
Refrigeration Systems

- **Refrigeration** refers to the process of removing heat from a low-temperature reservoir and transferring it to a high-temperature reservoir



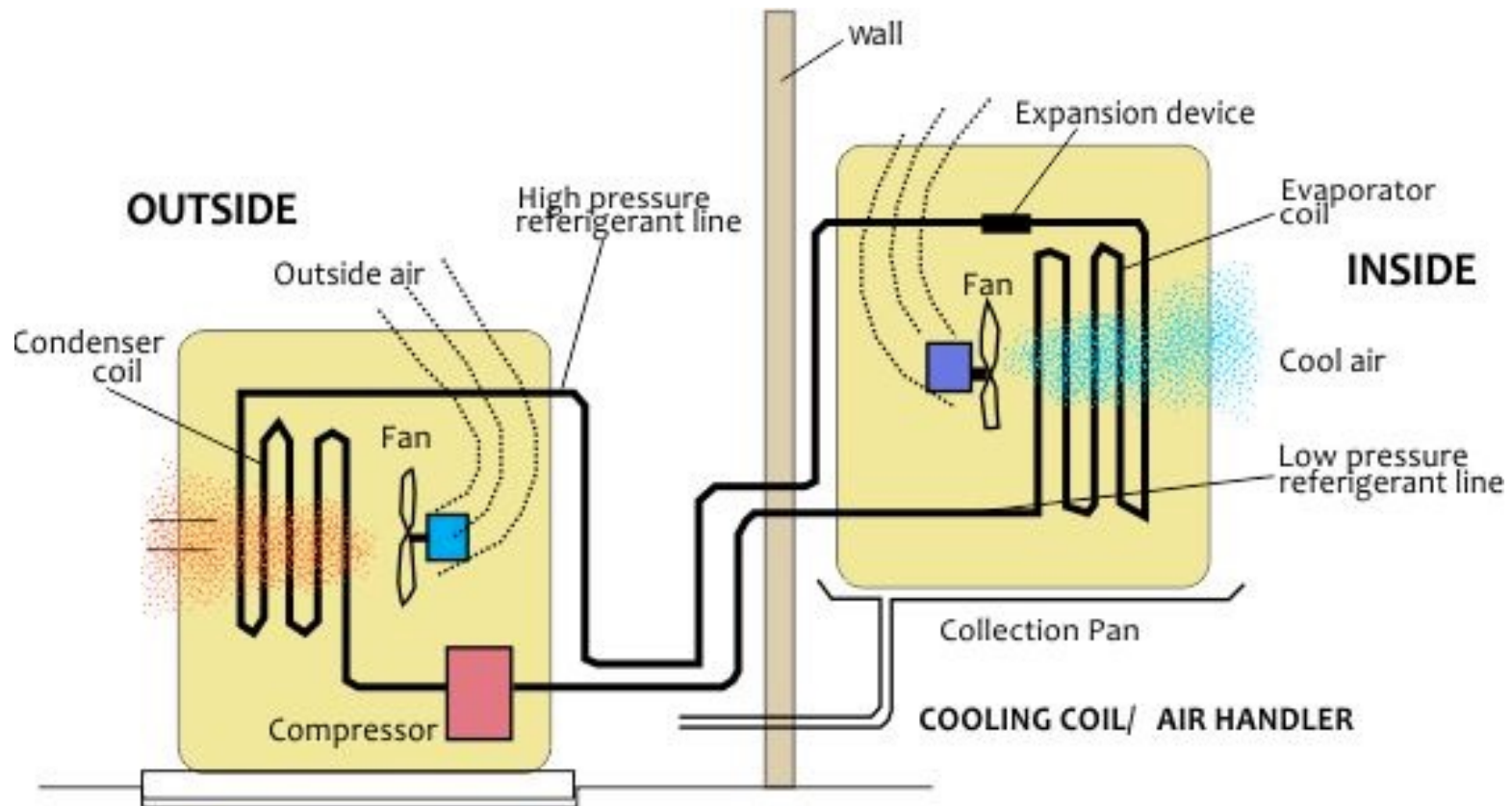
Refrigeration Systems

- A vapor compression cycle entails:



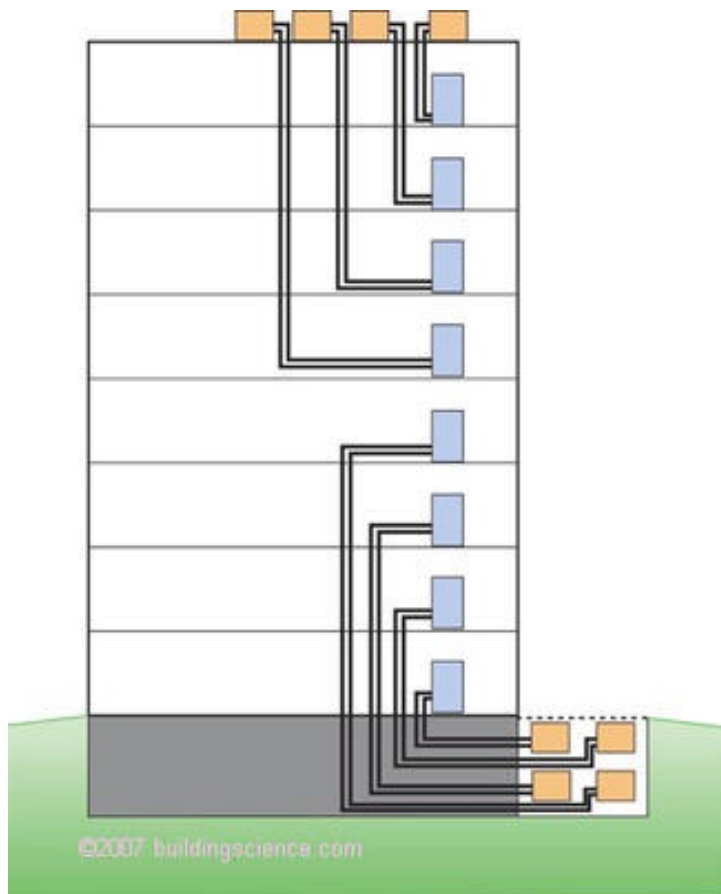
Refrigeration Systems

- An example of an application of the vapor compression cycle in a residential building is:



Refrigeration Systems

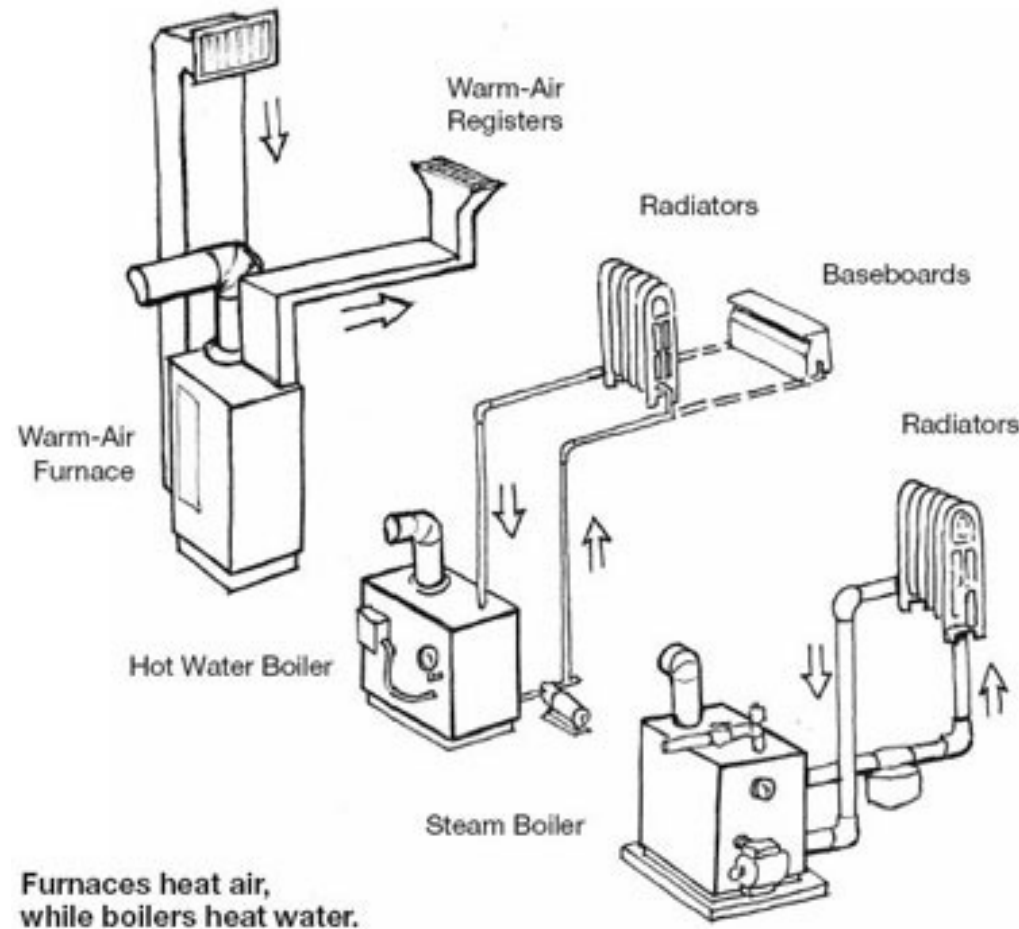
- An example of installing heat pump in a multi-family building



INTRODUCTION TO HEATING SYSTEMS

Heating Systems

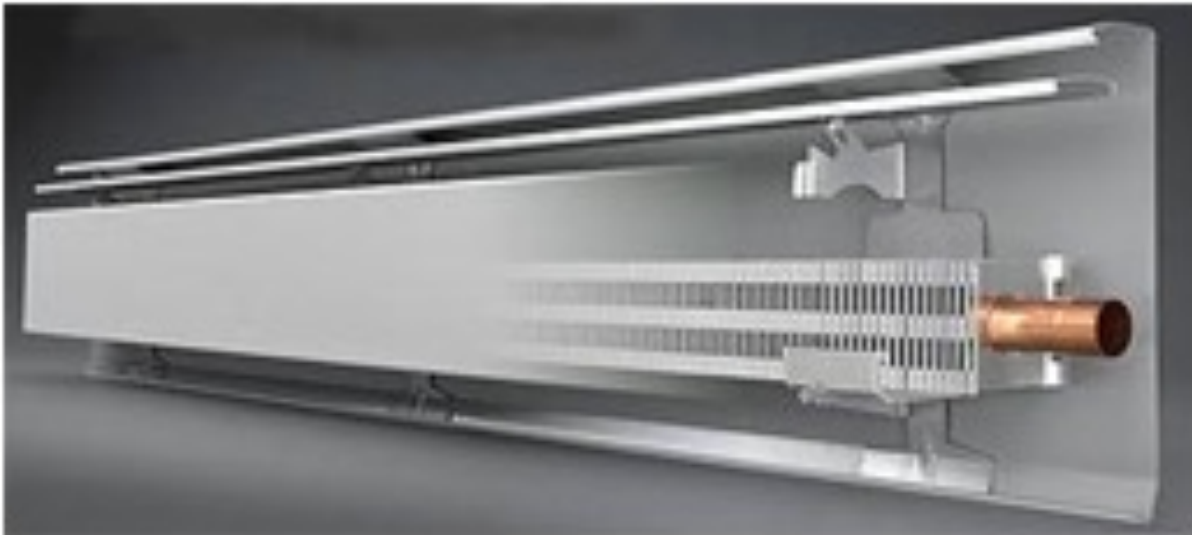
- Majority of single family homes in the U.S. use “furnace”



What's the main difference between furnace and boiler?

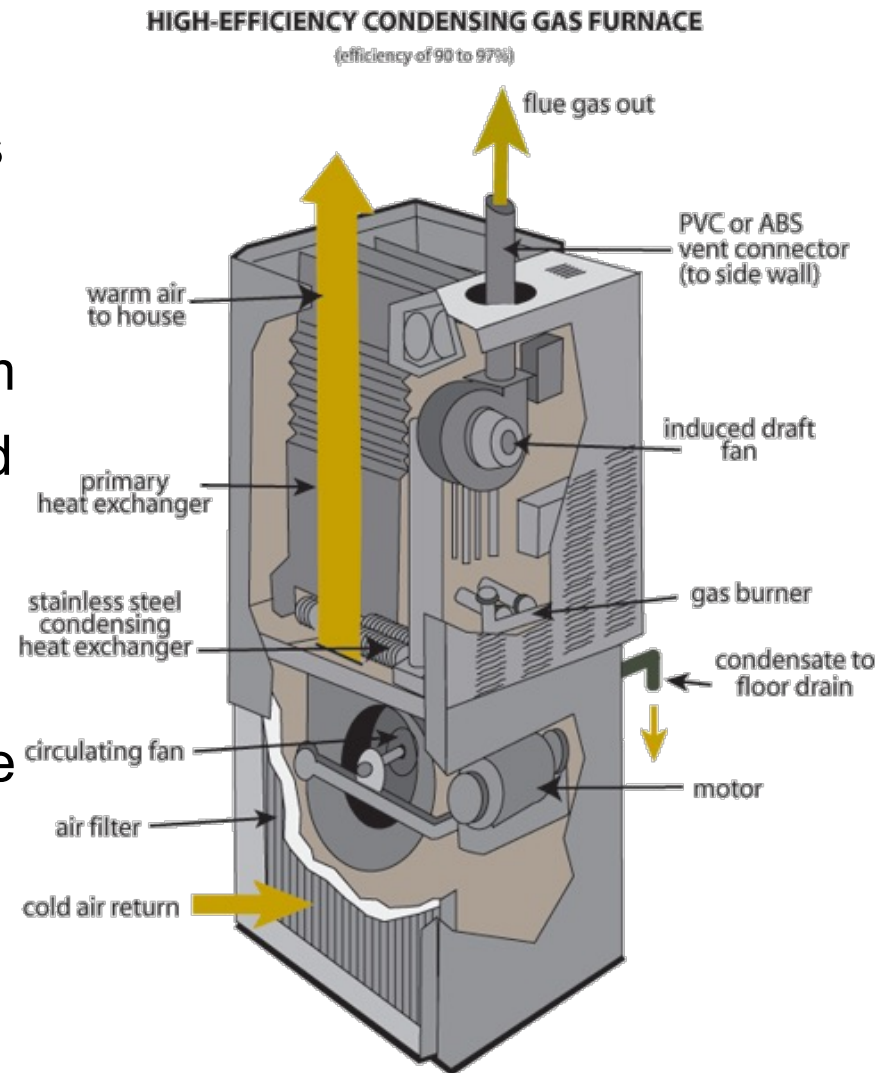
Heating Systems

- Hydronic vs electric baseboards considerations:
 - Initial cost
 - Energy efficiency
 - Performance (e.g., warm up and duration)



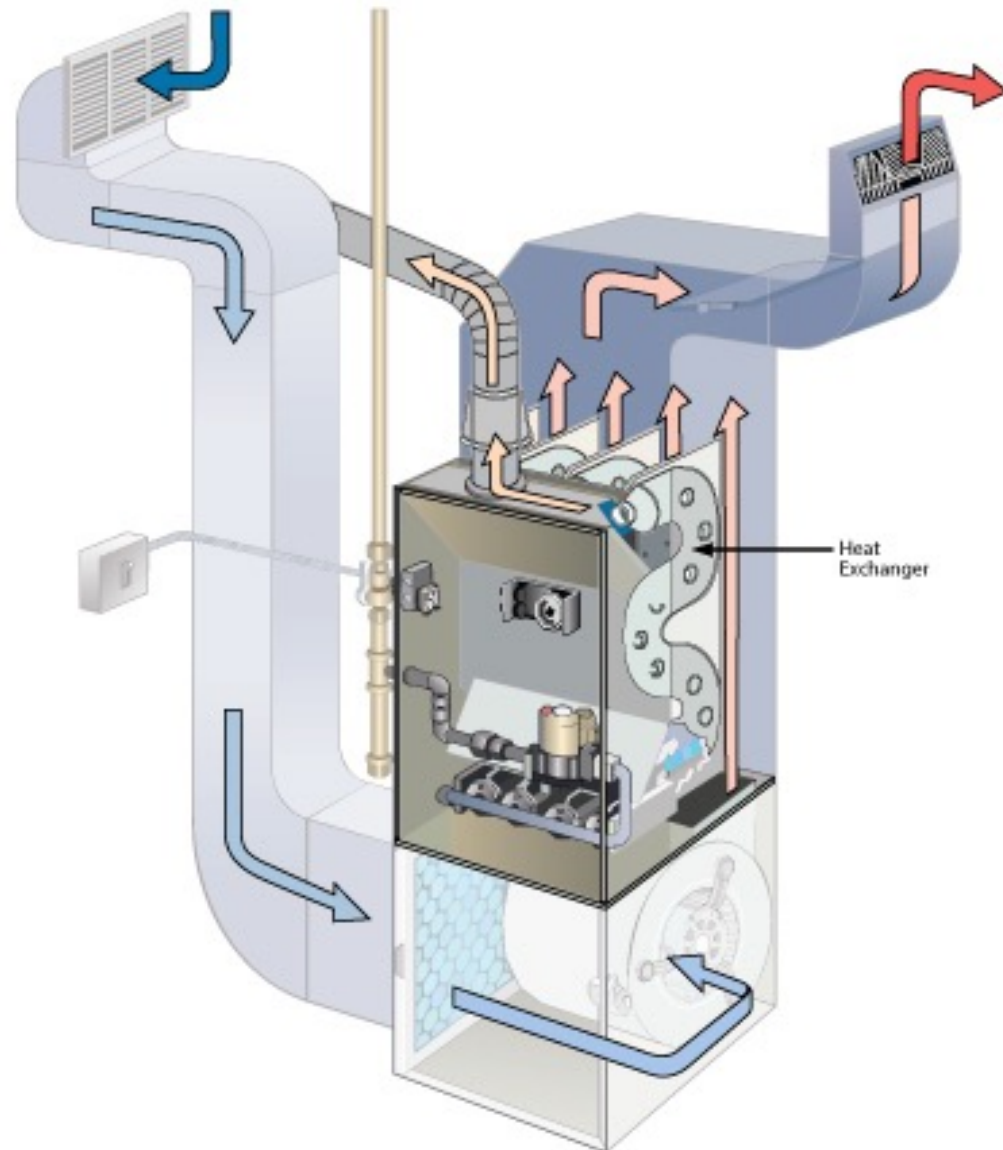
Heating Systems

- Furnace:
 - ❑ Deliver hot air through a central furnace and ductwork to the zones through registers or grills
 - ❑ Named as a ducted warm-air or a forced warm-air distribution system
 - ❑ The combustion heat is transferred via a heat exchanger to air
 - ❑ Fan or “Blower” push the air through the ductwork
 - ❑ Vent the byproducts to atmosphere
 - ❑ Use induced fan and temperature control of exhaust (140 F) to recover energy in condensing furnaces



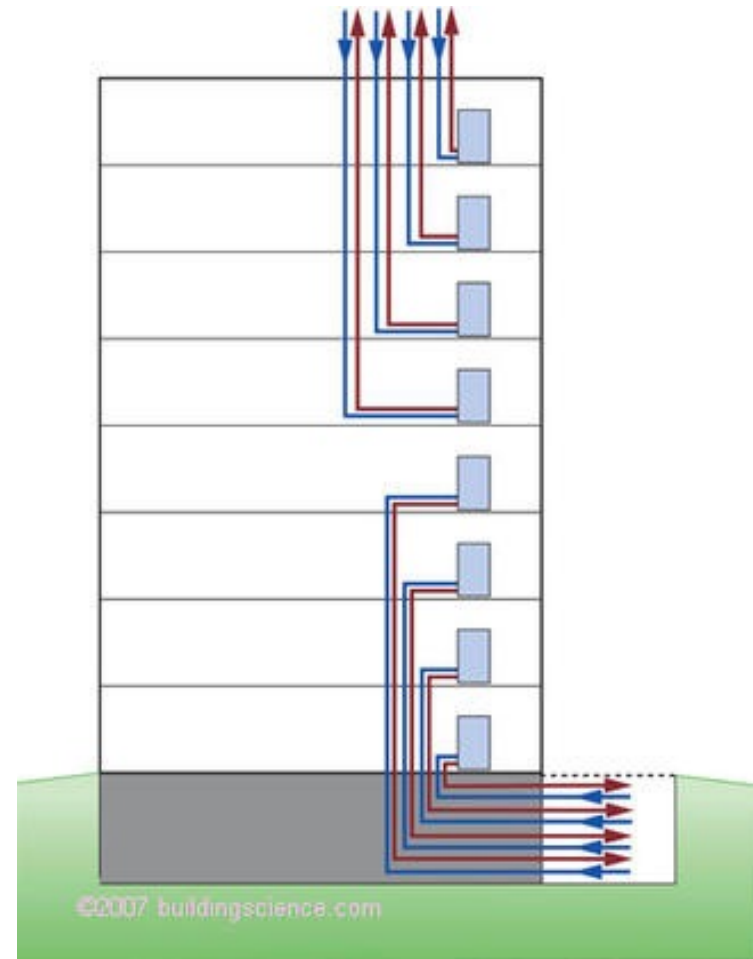
Heating Systems

- Furnace:



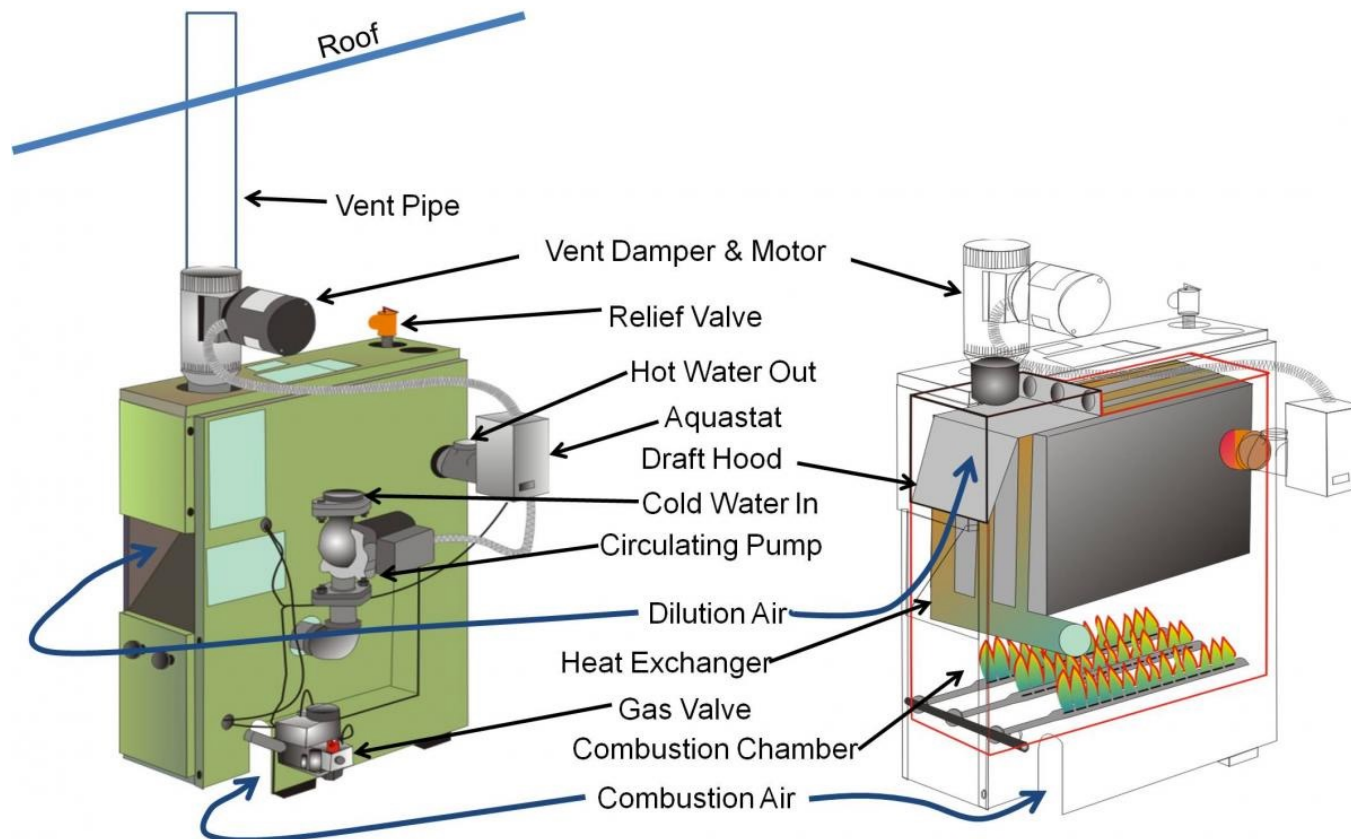
Heating Systems

- Example of installing a furnace in a multi-family building:



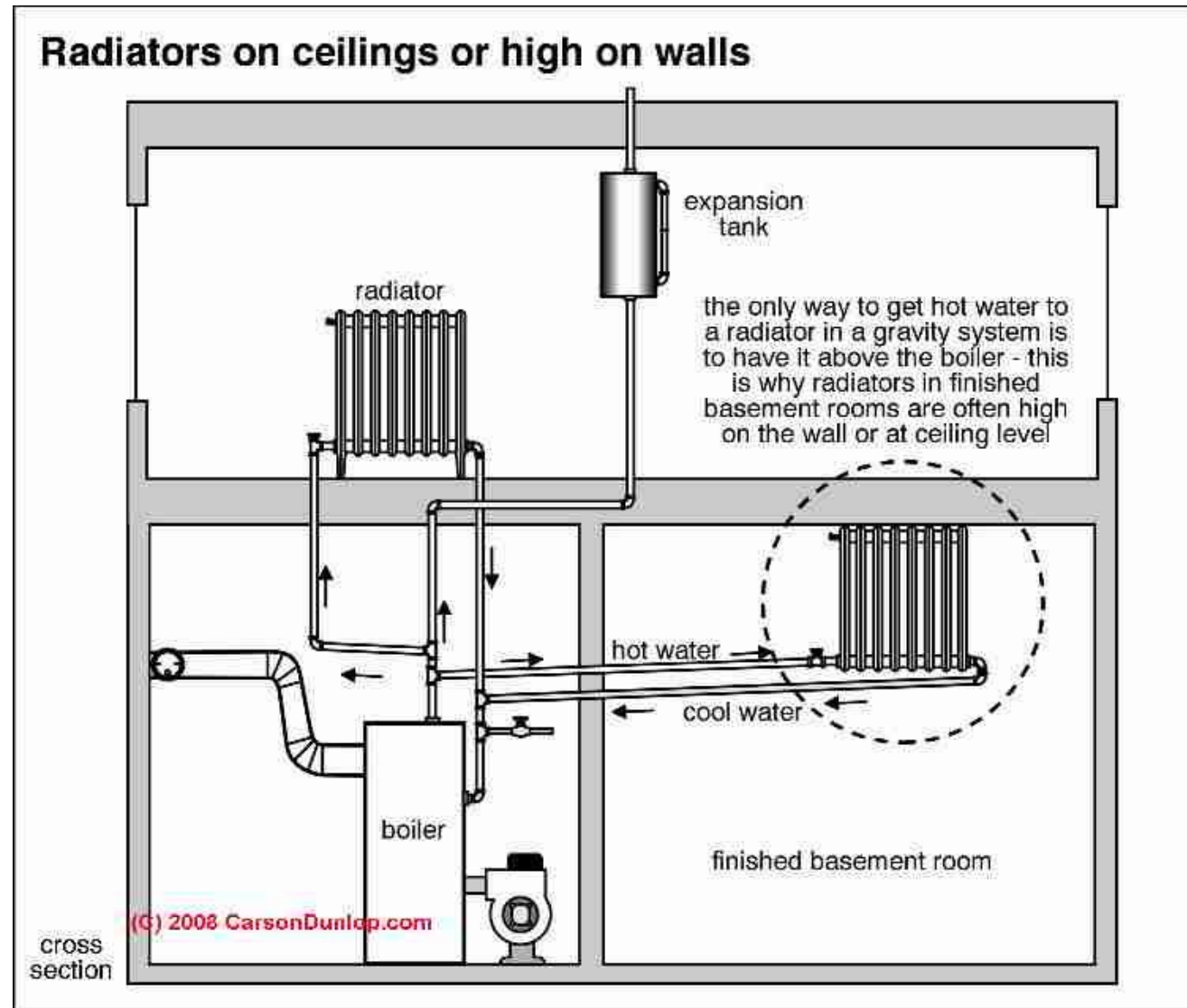
Heating Systems

- Boilers
 - ❑ Instead of air, they warm water “or steam” and distribute it
 - ❑ It is a closed system
 - ❑ Named as hydronic systems



Heating Systems

- Boilers



Heating Systems

- Heat Pumps
 - ❑ Two types of air-source and ground-source
 - ❑ Use outside as a heat sink in summer and heat source in winter



INTRODUCTION TO UNITARY SYSTEMS

Unitary

- Unitary or packaged terminal unit:
 - All components are factory assembled into major pieces (1-2 pieces)
 - Coils, fans, controls, .. are all included one major package
 - Named as decentralized system
 - Easy to install
 - Suitable for small to mid size buildings (Less than three stories)
 - Offices, motels, hotels
 - 5 to 460 kW (1.5 tons to 130 tons)
 - Lower initial cost and 10-15 years
 - Less efficient
 - Require maintenance
 - Can be used for perimeter zones

What's the main working fluid?

Can you distinguish primary and secondary systems here?

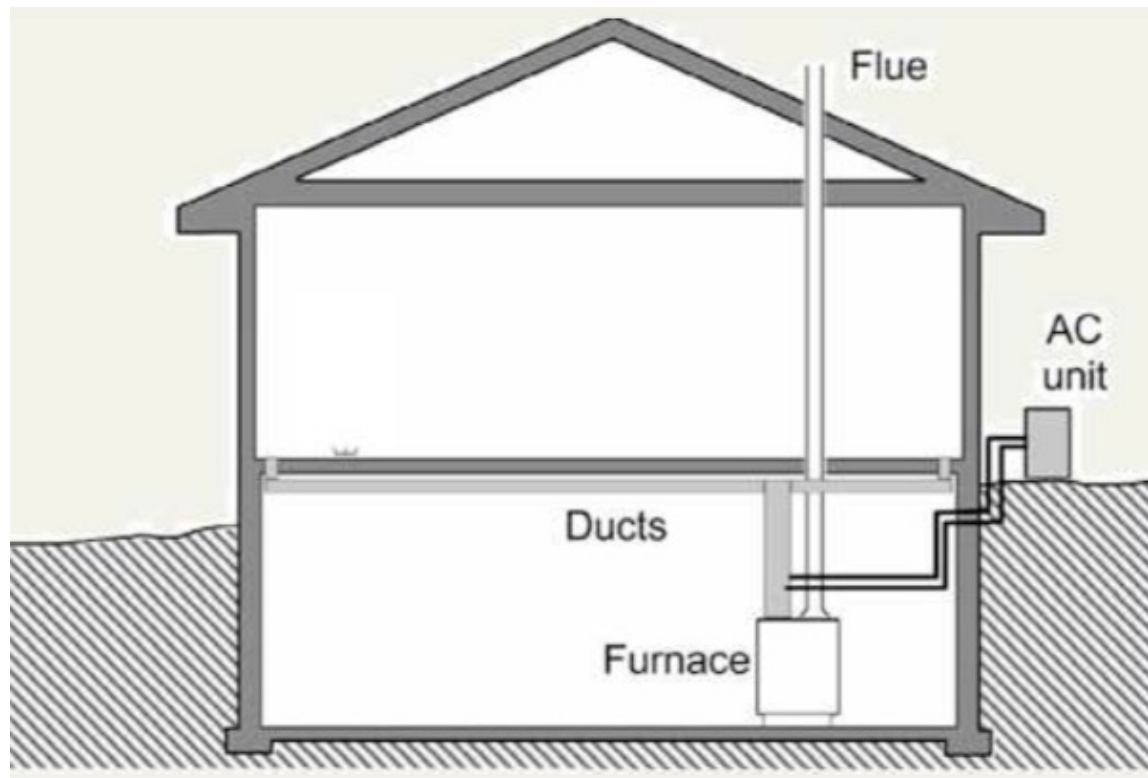
Unitary

- One type of unitary or packaged terminal unit is Packaged Terminal Air Conditioning (PTAC). For example:
 - ❑ A 15,000 BTU self-contained AC system in my office



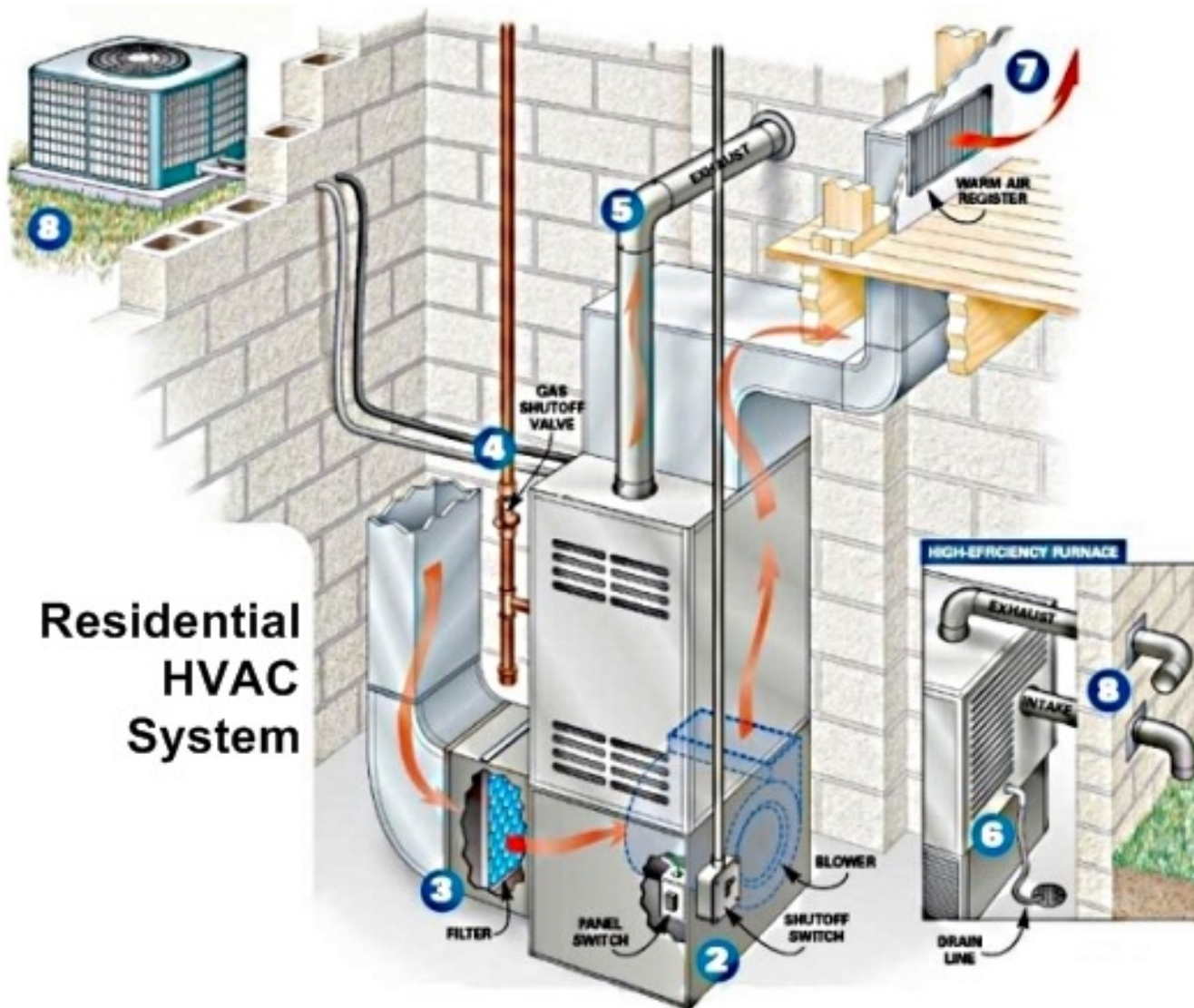
Unitary

- Residential unitary systems
 - ❑ Two separate systems:
 - Furnace: Heating
 - AC: Cooling
 - ❑ Minimum maintenance required to change filter



Unitary

- Residential unitary systems



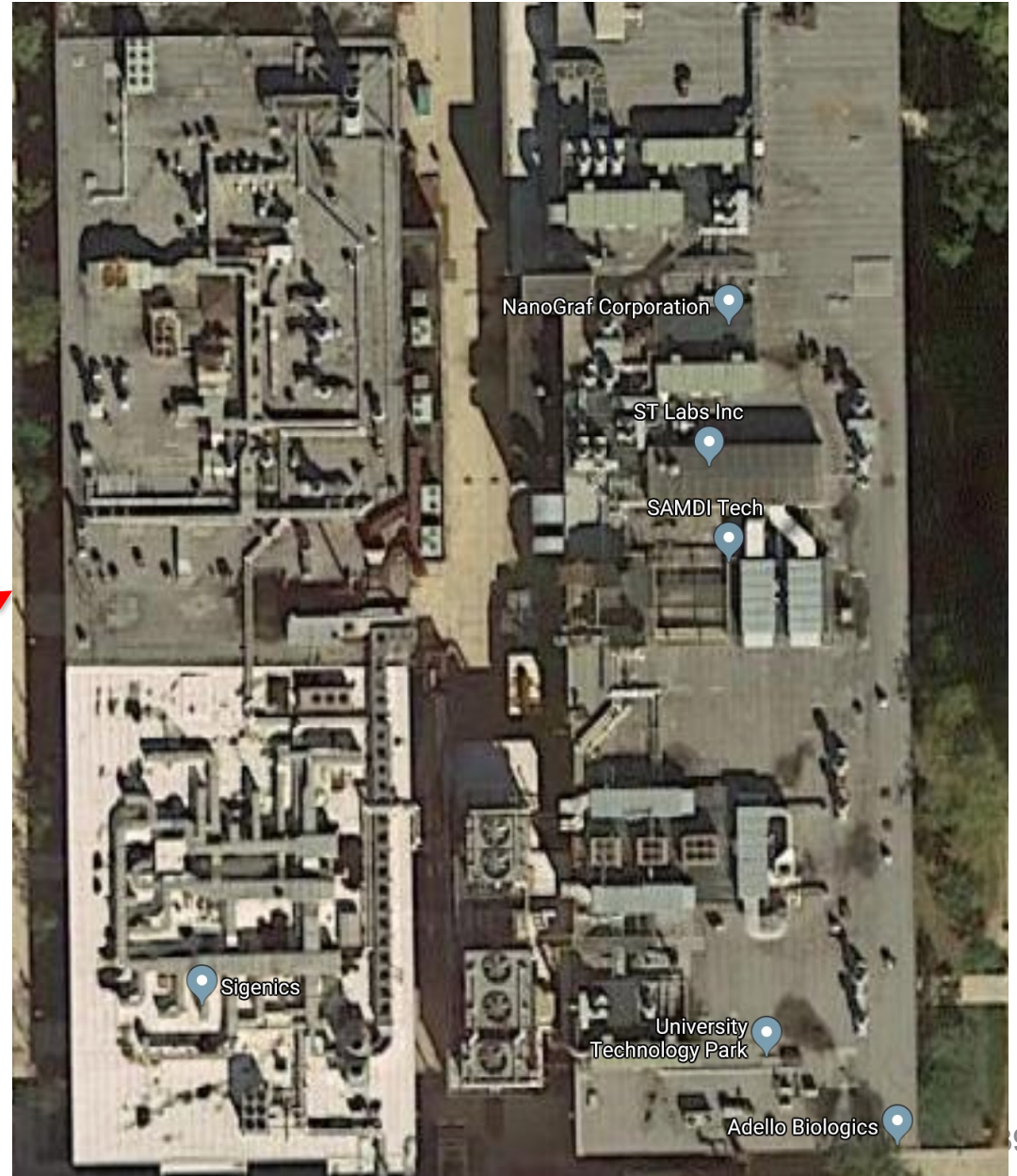
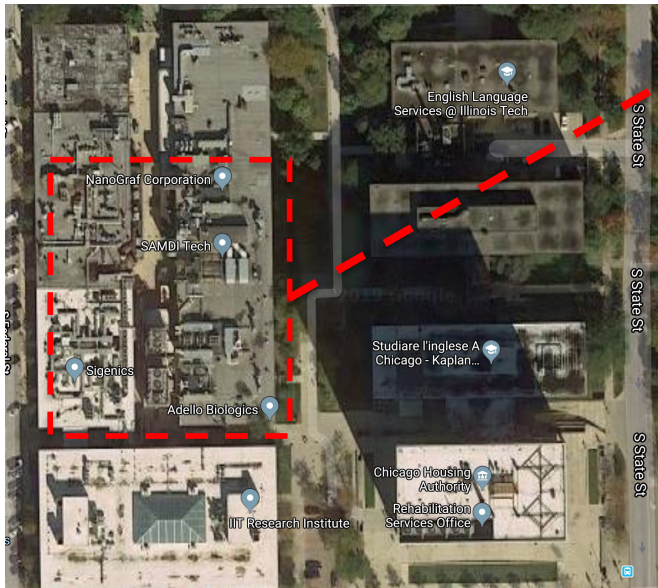
Split Systems

- Split systems:
 - ❑ Newer version of unitary systems
 - ❑ Heat transfer occurs through coils
 - ❑ Condenser coils and the compressor of the refrigerant outside
 - ❑ Evaporator coil or (DX)



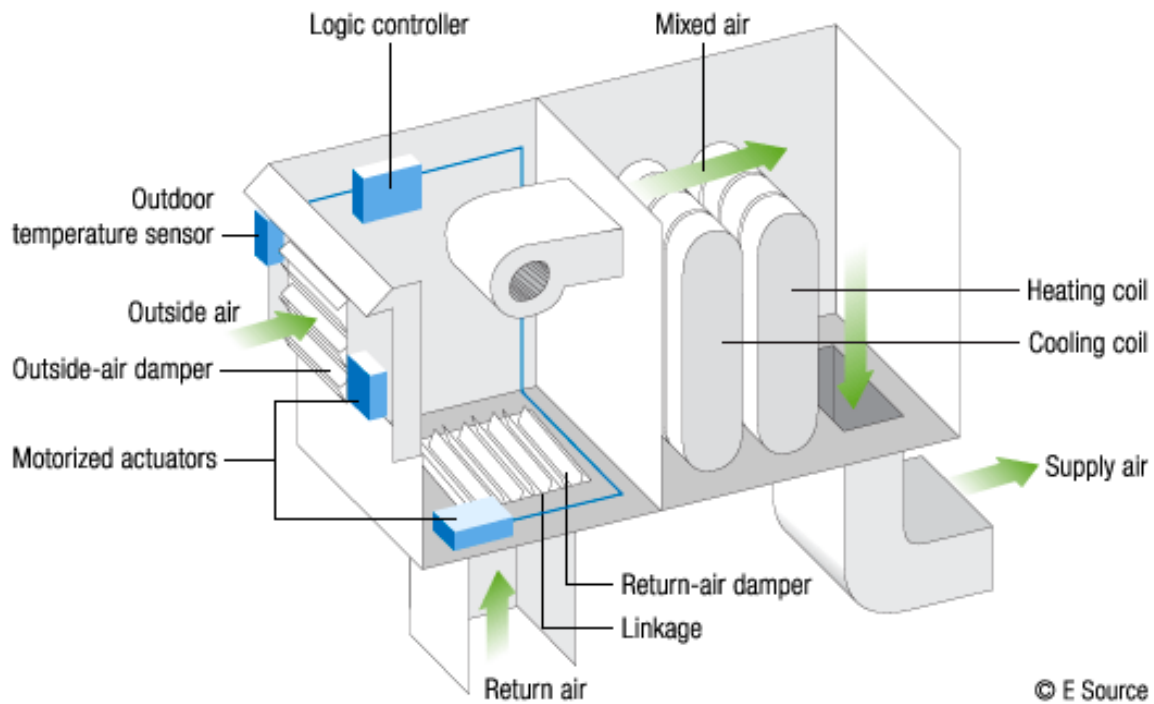
Split Systems

- What do you see here?



Unitary

- Rooftop units or packaged unit
 - ❑ DX Coil
 - ❑ Gas heating

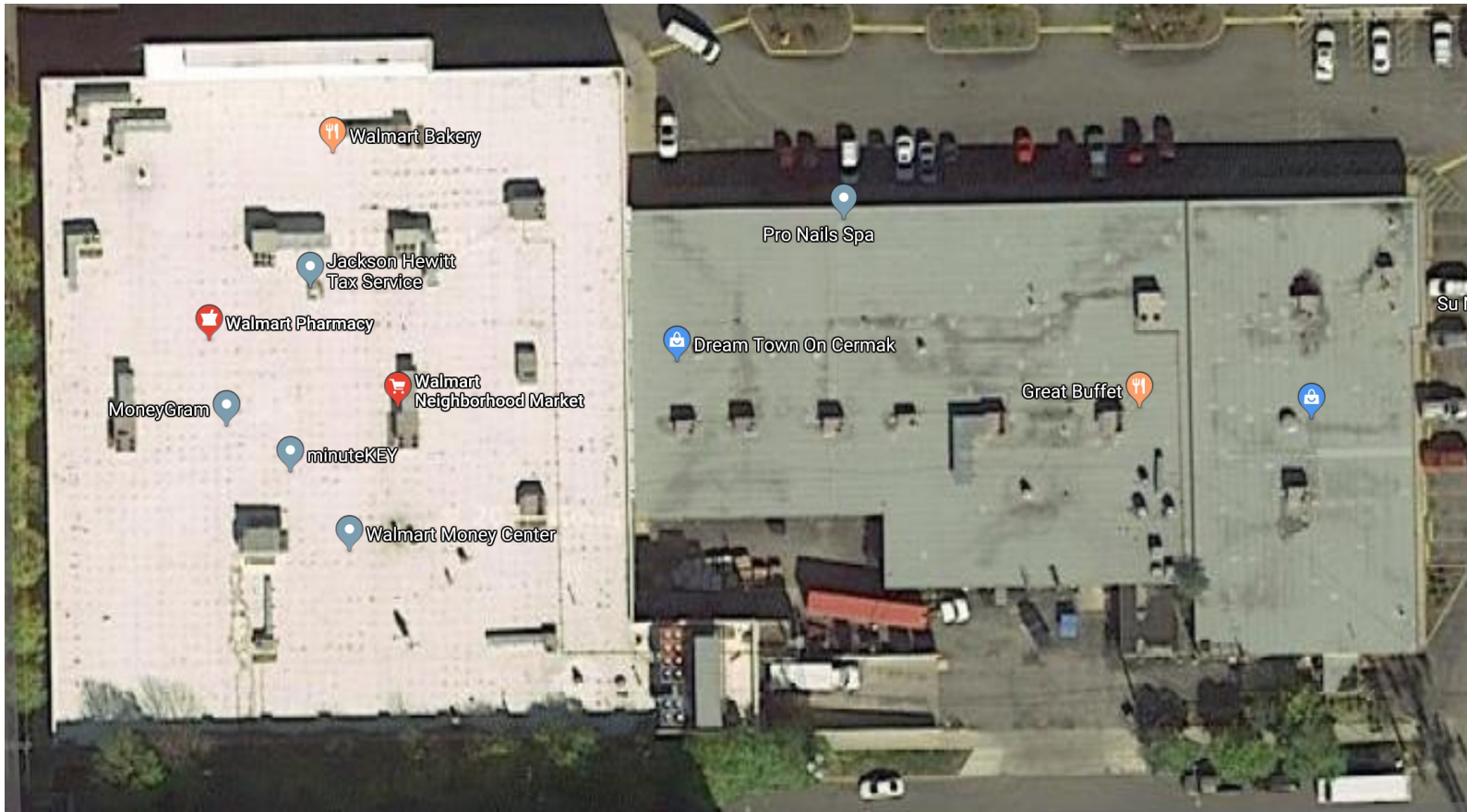


© E Source



Unitary

- Rooftop units or package unit
 - ❑ Suitable for store boxes “retail” or low-rise offices
 - ❑ Can serve different zones



Packaged Equipment

- Advantages and disadvantages of packaged equipment

Disadvantages	Advantages
Limited performance due to fixed sizing	Individual control is allowed
Limited humidity control	Simultaneous heating and cooling
Mostly on-off meaning swing in room temperature	Ventilation can be included
Short life span	Certified capacity by the manufacturer
Less efficient due to oversizing	Turn off units for unoccupied zones
Limited air distribution option	Simple operation
Complexity in using economizers	Low first cost
Noisy	No duct work
Poor aesthetics	Simple installation
Limited air filtering options	
Maintenance issues	

INTRODUCTION TO CENTRALIZED SYSTEMS

Centralized Systems

- Centralized systems:
 - Include various components and contractor needs to put together the system
 - Suitable for medium to large buildings
 - Hydronic system is an example of this system
 - Radiators are obsolete
 - More efficient heat transfer are fan coil units



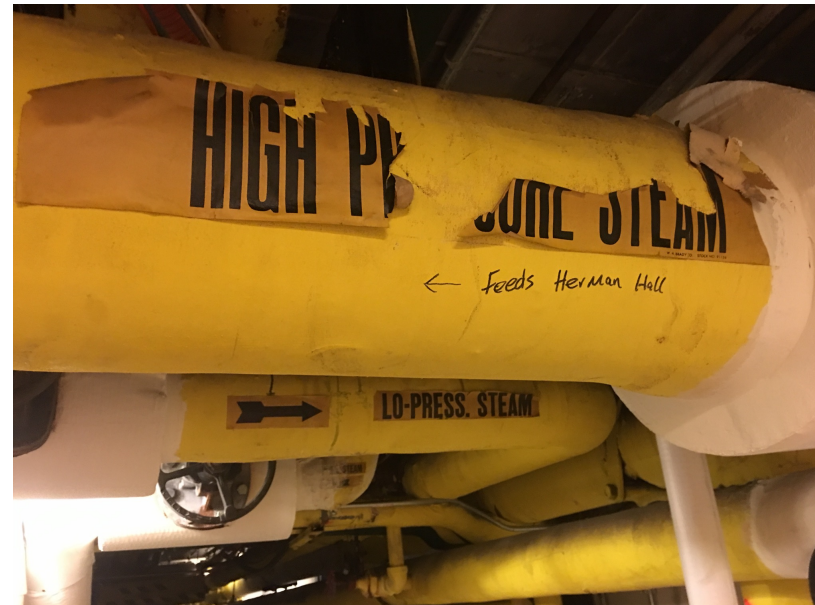
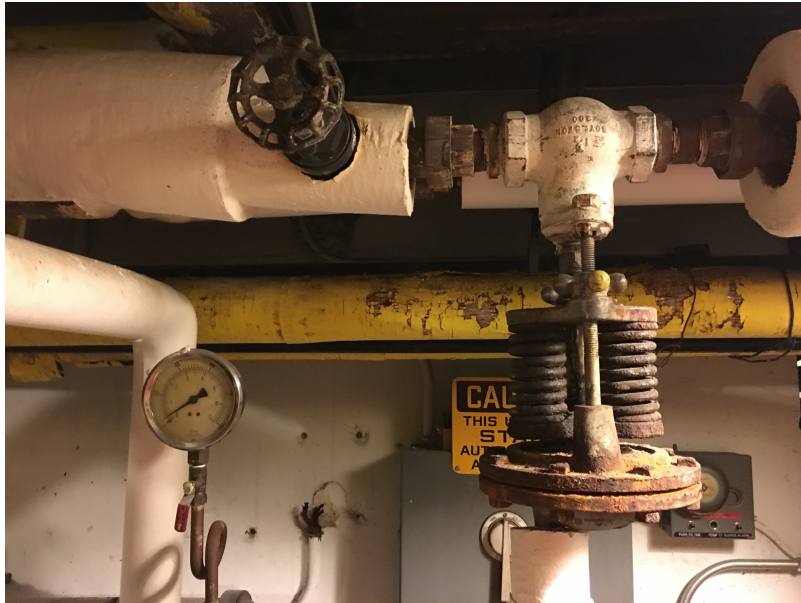
INTRODUCTION TO DISTRICT SYSTEMS

District Systems

- District systems:
 - ❑ Usually requires for campuses and neighborhoods
 - ❑ Suitable for a collection of building with different load profiles
 - ❑ Include different loops, chilled water or steam loops
 - ❑ Typically well-insulated or buried
 - ❑ Heat transfer at the building level
 - ❑ Primary loop setpoint 35 °F to 45 °F (1.7 °C to 7.2 °C) about 5 °F to 10 °F (2.7 °C to 5.5 °C) below the secondary temperature 40 °F to 50 °F (4.4 °C to 10 °C)

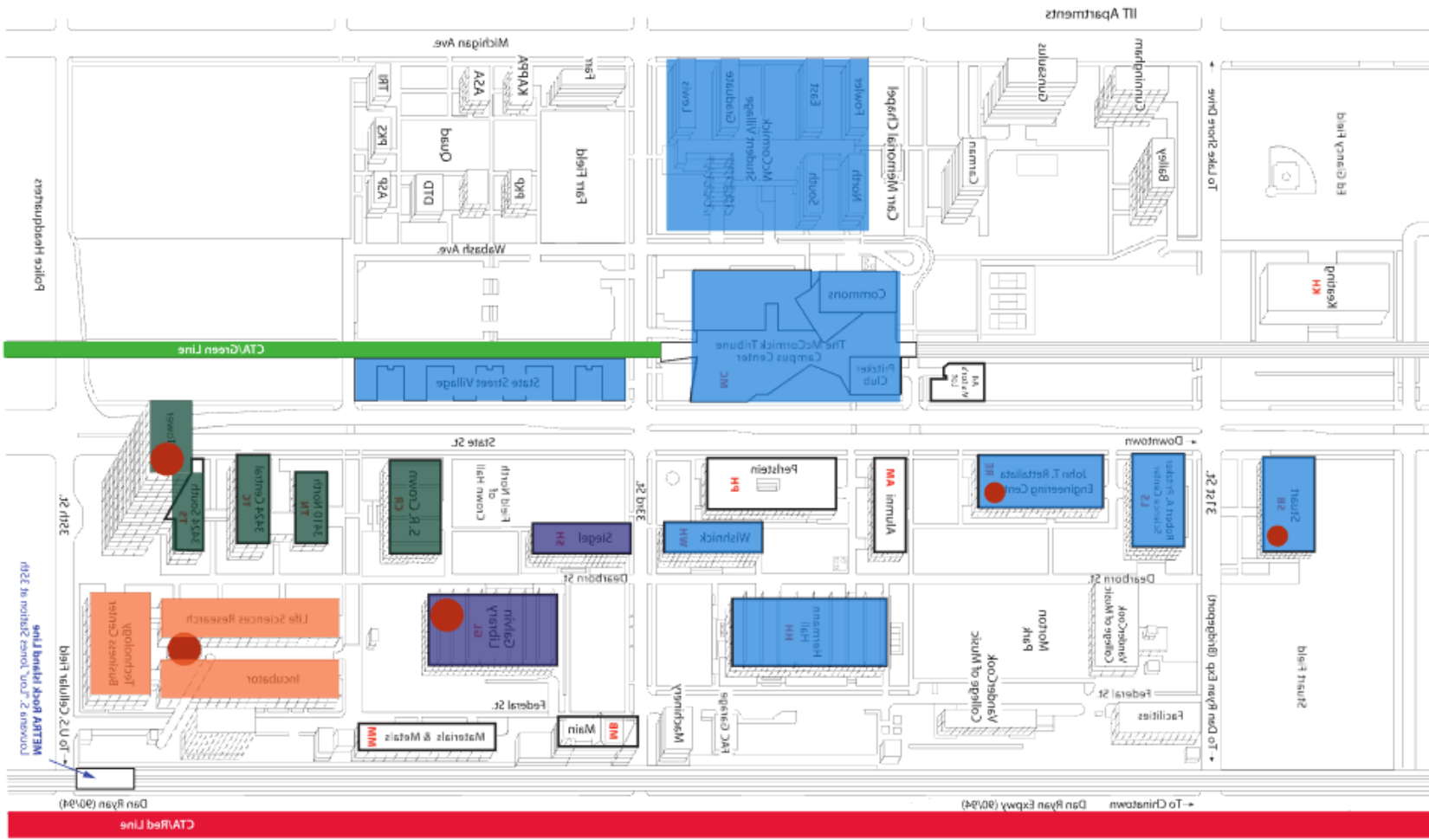
District Systems

- Alumni Memorial Hall building steam system



District Systems

- IIT Cooling plant



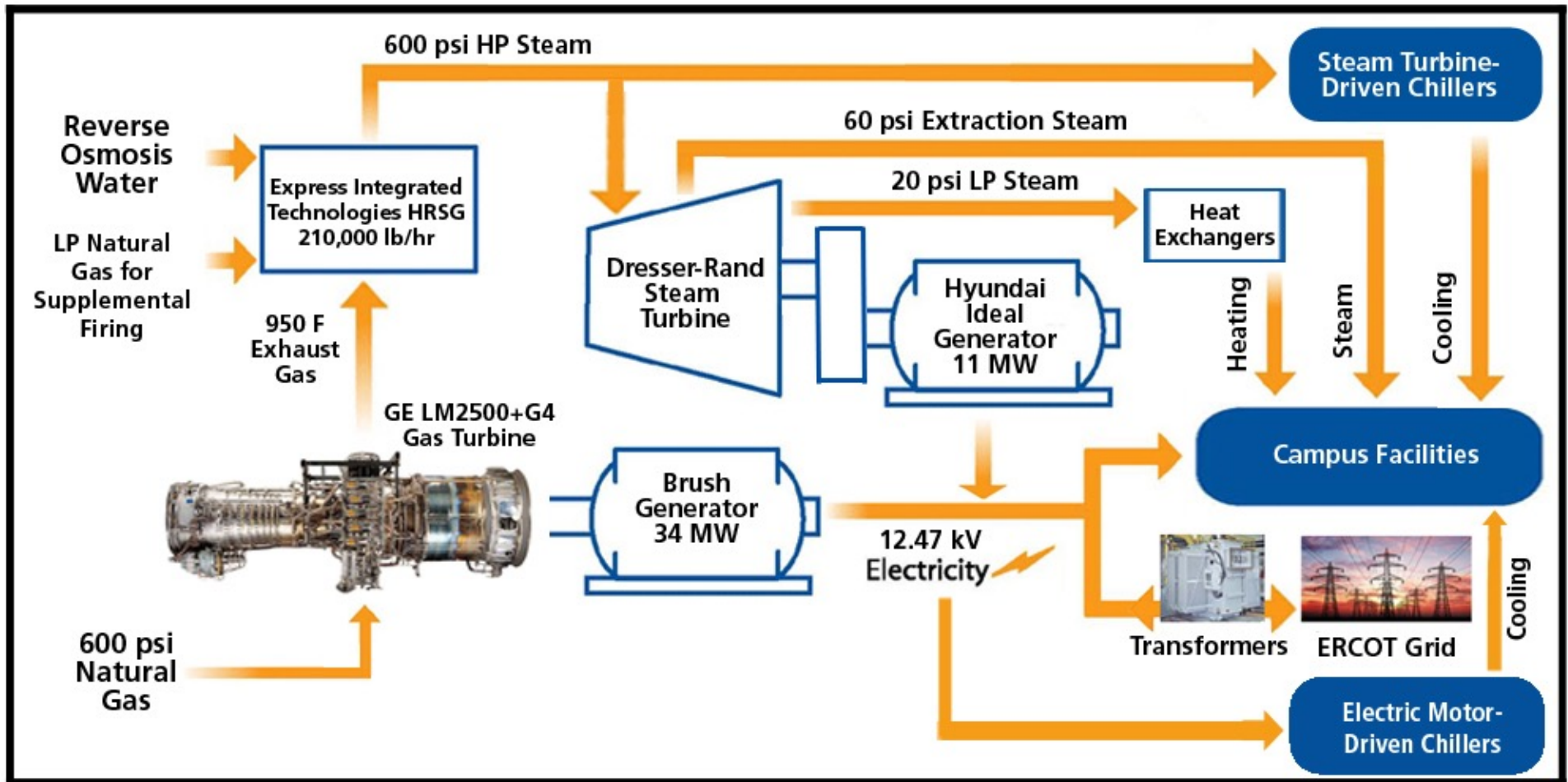
District Systems

- Example of other campuses: Hershey Medical Center
 - Three chiller plants
 - 12 chillers
 - Cool 2.6 million square feet
 - Two hospitals, five institutes and College of Medicine



District Systems

- A combined heat and power example at a campus:



HVAC SYSTEM DRAWINGS

HVAC System Drawings

- Please, see Chapter 38 of 2017 ASHRAE Fundamentals (Or Chapter 39 in the 2021 version): Abbreviations and Symbols. This chapter entails:
 - Abbreviations
 - Letter symbols
 - Graphical symbols

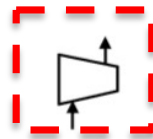
HVAC System Drawings

- Few examples of the graphical symbols:

Refrigeration

Compressors

Centrifugal



Reciprocating



Rotary

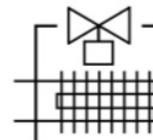


Rotary screw

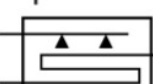


Condensers

Air cooled



Evaporative

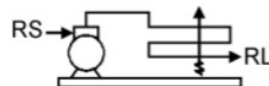


Water cooled, (specify type)



Condensing Units

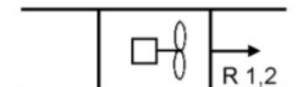
Air cooled^b



Air Moving Devices and Components

Fans (indicate use)^a

Axial flow



Centrifugal



Propeller



Roof ventilator, intake



Roof ventilator, exhaust



Roof ventilator, louvered

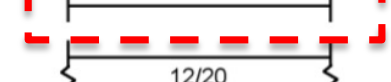


Ductwork^b

Direction of flow



Duct size, first figure is side down



Duct section, positive pressure, first figure is top



Duct section, negative pressure



Change of elevation
rise (R) drop (D)



HVAC System Drawings

- It is a good practice in the drawings to:
 - Include list of all drawing files in the drawing cover page
 - Name files based on the file number, building name, drawing type
 - A: Architectural
 - S: Structural
 - M: Mechanical
 - Pay attention to the example drawings provided for Wishnick Hall
 - Files are available on Blackboard
 - “0-0”: Symbols
 - “1-x”: Ductwork (If there is a demolition plan it is usually 1-x and the rest start at 2-x)
 - “3-x”: Piping
 - “4-x”: Sections
 - “5-x”: Controls (It can go to “6-x” and more than that)
 - “6-x”: Mechanical schedules (It is the last one usually)

HVAC System Drawings

- Wishnick Hall

WISHNICK LEARNING CENTER BUILDING RESTORATION AND RENOVATION

3255 South Dearborn Street
Illinois Institute of Technology
Chicago, Illinois 60616

PROPOSAL REQUEST #6, 06-17-05
POLYMER CENTER TENANT BUILD-OUT

ARCHITECTURAL ABBREVIATIONS **ARCHITECTURAL SYMBOLS LIST**

A ABOVE	M MACHINE	EX EXTERIOR WALL	EX EXTERIOR WALL SYMBOLS
AD ABOVE DECKING	ME MECHANICAL	EX-1 1/2" WOOD WALL	EX-1 1/2" WOOD WALL
AD-1 ABOVE FINISHED FLOOR	ME-1 MECHANICAL	EX-2 3/4" WOOD WALL	EX-2 3/4" WOOD WALL
AD-2 ABOVE FINISHED FLOOR	ME-2 MECHANICAL	EX-3 1" WOOD WALL	EX-3 1" WOOD WALL
AD-3 ABOVE FINISHED FLOOR	ME-3 MECHANICAL	EX-4 1 1/2" WOOD WALL	EX-4 1 1/2" WOOD WALL
AD-4 ABOVE FINISHED FLOOR	ME-4 MECHANICAL	EX-5 2" WOOD WALL	EX-5 2" WOOD WALL
AD-5 ABOVE FINISHED FLOOR	ME-5 MECHANICAL	EX-6 2 1/2" WOOD WALL	EX-6 2 1/2" WOOD WALL
AD-6 ABOVE FINISHED FLOOR	ME-6 MECHANICAL	EX-7 3" WOOD WALL	EX-7 3" WOOD WALL
AD-7 ABOVE FINISHED FLOOR	ME-7 MECHANICAL	EX-8 3 1/2" WOOD WALL	EX-8 3 1/2" WOOD WALL
AD-8 ABOVE FINISHED FLOOR	ME-8 MECHANICAL	EX-9 4" WOOD WALL	EX-9 4" WOOD WALL
AD-9 ABOVE FINISHED FLOOR	ME-9 MECHANICAL	EX-10 4 1/2" WOOD WALL	EX-10 4 1/2" WOOD WALL
AD-10 ABOVE FINISHED FLOOR	ME-10 MECHANICAL	EX-11 5" WOOD WALL	EX-11 5" WOOD WALL
AD-11 ABOVE FINISHED FLOOR	ME-11 MECHANICAL	EX-12 5 1/2" WOOD WALL	EX-12 5 1/2" WOOD WALL
AD-12 ABOVE FINISHED FLOOR	ME-12 MECHANICAL	EX-13 6" WOOD WALL	EX-13 6" WOOD WALL
AD-13 ABOVE FINISHED FLOOR	ME-13 MECHANICAL	EX-14 6 1/2" WOOD WALL	EX-14 6 1/2" WOOD WALL
AD-14 ABOVE FINISHED FLOOR	ME-14 MECHANICAL	EX-15 7" WOOD WALL	EX-15 7" WOOD WALL
AD-15 ABOVE FINISHED FLOOR	ME-15 MECHANICAL	EX-16 7 1/2" WOOD WALL	EX-16 7 1/2" WOOD WALL
AD-16 ABOVE FINISHED FLOOR	ME-16 MECHANICAL	EX-17 8" WOOD WALL	EX-17 8" WOOD WALL
AD-17 ABOVE FINISHED FLOOR	ME-17 MECHANICAL	EX-18 8 1/2" WOOD WALL	EX-18 8 1/2" WOOD WALL
AD-18 ABOVE FINISHED FLOOR	ME-18 MECHANICAL	EX-19 9" WOOD WALL	EX-19 9" WOOD WALL
AD-19 ABOVE FINISHED FLOOR	ME-19 MECHANICAL	EX-20 9 1/2" WOOD WALL	EX-20 9 1/2" WOOD WALL
AD-20 ABOVE FINISHED FLOOR	ME-20 MECHANICAL	EX-21 10" WOOD WALL	EX-21 10" WOOD WALL
AD-21 ABOVE FINISHED FLOOR	ME-21 MECHANICAL	EX-22 10 1/2" WOOD WALL	EX-22 10 1/2" WOOD WALL
AD-22 ABOVE FINISHED FLOOR	ME-22 MECHANICAL	EX-23 11" WOOD WALL	EX-23 11" WOOD WALL
AD-23 ABOVE FINISHED FLOOR	ME-23 MECHANICAL	EX-24 11 1/2" WOOD WALL	EX-24 11 1/2" WOOD WALL
AD-24 ABOVE FINISHED FLOOR	ME-24 MECHANICAL	EX-25 12" WOOD WALL	EX-25 12" WOOD WALL
AD-25 ABOVE FINISHED FLOOR	ME-25 MECHANICAL	EX-26 12 1/2" WOOD WALL	EX-26 12 1/2" WOOD WALL
AD-26 ABOVE FINISHED FLOOR	ME-26 MECHANICAL	EX-27 13" WOOD WALL	EX-27 13" WOOD WALL
AD-27 ABOVE FINISHED FLOOR	ME-27 MECHANICAL	EX-28 13 1/2" WOOD WALL	EX-28 13 1/2" WOOD WALL
AD-28 ABOVE FINISHED FLOOR	ME-28 MECHANICAL	EX-29 14" WOOD WALL	EX-29 14" WOOD WALL
AD-29 ABOVE FINISHED FLOOR	ME-29 MECHANICAL	EX-30 14 1/2" WOOD WALL	EX-30 14 1/2" WOOD WALL
AD-30 ABOVE FINISHED FLOOR	ME-30 MECHANICAL	EX-31 15" WOOD WALL	EX-31 15" WOOD WALL
AD-31 ABOVE FINISHED FLOOR	ME-31 MECHANICAL	EX-32 15 1/2" WOOD WALL	EX-32 15 1/2" WOOD WALL
AD-32 ABOVE FINISHED FLOOR	ME-32 MECHANICAL	EX-33 16" WOOD WALL	EX-33 16" WOOD WALL
AD-33 ABOVE FINISHED FLOOR	ME-33 MECHANICAL	EX-34 16 1/2" WOOD WALL	EX-34 16 1/2" WOOD WALL
AD-34 ABOVE FINISHED FLOOR	ME-34 MECHANICAL	EX-35 17" WOOD WALL	EX-35 17" WOOD WALL
AD-35 ABOVE FINISHED FLOOR	ME-35 MECHANICAL	EX-36 17 1/2" WOOD WALL	EX-36 17 1/2" WOOD WALL
AD-36 ABOVE FINISHED FLOOR	ME-36 MECHANICAL	EX-37 18" WOOD WALL	EX-37 18" WOOD WALL
AD-37 ABOVE FINISHED FLOOR	ME-37 MECHANICAL	EX-38 18 1/2" WOOD WALL	EX-38 18 1/2" WOOD WALL
AD-38 ABOVE FINISHED FLOOR	ME-38 MECHANICAL	EX-39 19" WOOD WALL	EX-39 19" WOOD WALL
AD-39 ABOVE FINISHED FLOOR	ME-39 MECHANICAL	EX-40 19 1/2" WOOD WALL	EX-40 19 1/2" WOOD WALL
AD-40 ABOVE FINISHED FLOOR	ME-40 MECHANICAL	EX-41 20" WOOD WALL	EX-41 20" WOOD WALL
AD-41 ABOVE FINISHED FLOOR	ME-41 MECHANICAL	EX-42 20 1/2" WOOD WALL	EX-42 20 1/2" WOOD WALL
AD-42 ABOVE FINISHED FLOOR	ME-42 MECHANICAL	EX-43 21" WOOD WALL	EX-43 21" WOOD WALL
AD-43 ABOVE FINISHED FLOOR	ME-43 MECHANICAL	EX-44 21 1/2" WOOD WALL	EX-44 21 1/2" WOOD WALL
AD-44 ABOVE FINISHED FLOOR	ME-44 MECHANICAL	EX-45 22" WOOD WALL	EX-45 22" WOOD WALL
AD-45 ABOVE FINISHED FLOOR	ME-45 MECHANICAL	EX-46 22 1/2" WOOD WALL	EX-46 22 1/2" WOOD WALL
AD-46 ABOVE FINISHED FLOOR	ME-46 MECHANICAL	EX-47 23" WOOD WALL	EX-47 23" WOOD WALL
AD-47 ABOVE FINISHED FLOOR	ME-47 MECHANICAL	EX-48 23 1/2" WOOD WALL	EX-48 23 1/2" WOOD WALL
AD-48 ABOVE FINISHED FLOOR	ME-48 MECHANICAL	EX-49 24" WOOD WALL	EX-49 24" WOOD WALL
AD-49 ABOVE FINISHED FLOOR	ME-49 MECHANICAL	EX-50 24 1/2" WOOD WALL	EX-50 24 1/2" WOOD WALL
AD-50 ABOVE FINISHED FLOOR	ME-50 MECHANICAL	EX-51 25" WOOD WALL	EX-51 25" WOOD WALL
AD-51 ABOVE FINISHED FLOOR	ME-51 MECHANICAL	EX-52 25 1/2" WOOD WALL	EX-52 25 1/2" WOOD WALL
AD-52 ABOVE FINISHED FLOOR	ME-52 MECHANICAL	EX-53 26" WOOD WALL	EX-53 26" WOOD WALL
AD-53 ABOVE FINISHED FLOOR	ME-53 MECHANICAL	EX-54 26 1/2" WOOD WALL	EX-54 26 1/2" WOOD WALL
AD-54 ABOVE FINISHED FLOOR	ME-54 MECHANICAL	EX-55 27" WOOD WALL	EX-55 27" WOOD WALL
AD-55 ABOVE FINISHED FLOOR	ME-55 MECHANICAL	EX-56 27 1/2" WOOD WALL	EX-56 27 1/2" WOOD WALL
AD-56 ABOVE FINISHED FLOOR	ME-56 MECHANICAL	EX-57 28" WOOD WALL	EX-57 28" WOOD WALL
AD-57 ABOVE FINISHED FLOOR	ME-57 MECHANICAL	EX-58 28 1/2" WOOD WALL	EX-58 28 1/2" WOOD WALL
AD-58 ABOVE FINISHED FLOOR	ME-58 MECHANICAL	EX-59 29" WOOD WALL	EX-59 29" WOOD WALL
AD-59 ABOVE FINISHED FLOOR	ME-59 MECHANICAL	EX-60 29 1/2" WOOD WALL	EX-60 29 1/2" WOOD WALL
AD-60 ABOVE FINISHED FLOOR	ME-60 MECHANICAL	EX-61 30" WOOD WALL	EX-61 30" WOOD WALL
AD-61 ABOVE FINISHED FLOOR	ME-61 MECHANICAL	EX-62 30 1/2" WOOD WALL	EX-62 30 1/2" WOOD WALL
AD-62 ABOVE FINISHED FLOOR	ME-62 MECHANICAL	EX-63 31" WOOD WALL	EX-63 31" WOOD WALL
AD-63 ABOVE FINISHED FLOOR	ME-63 MECHANICAL	EX-64 31 1/2" WOOD WALL	EX-64 31 1/2" WOOD WALL
AD-64 ABOVE FINISHED FLOOR	ME-64 MECHANICAL	EX-65 32" WOOD WALL	EX-65 32" WOOD WALL
AD-65 ABOVE FINISHED FLOOR	ME-65 MECHANICAL	EX-66 32 1/2" WOOD WALL	EX-66 32 1/2" WOOD WALL
AD-66 ABOVE FINISHED FLOOR	ME-66 MECHANICAL	EX-67 33" WOOD WALL	EX-67 33" WOOD WALL
AD-67 ABOVE FINISHED FLOOR	ME-67 MECHANICAL	EX-68 33 1/2" WOOD WALL	EX-68 33 1/2" WOOD WALL
AD-68 ABOVE FINISHED FLOOR	ME-68 MECHANICAL	EX-69 34" WOOD WALL	EX-69 34" WOOD WALL
AD-69 ABOVE FINISHED FLOOR	ME-69 MECHANICAL	EX-70 34 1/2" WOOD WALL	EX-70 34 1/2" WOOD WALL
AD-70 ABOVE FINISHED FLOOR	ME-70 MECHANICAL	EX-71 35" WOOD WALL	EX-71 35" WOOD WALL
AD-71 ABOVE FINISHED FLOOR	ME-71 MECHANICAL	EX-72 35 1/2" WOOD WALL	EX-72 35 1/2" WOOD WALL
AD-72 ABOVE FINISHED FLOOR	ME-72 MECHANICAL	EX-73 36" WOOD WALL	EX-73 36" WOOD WALL
AD-73 ABOVE FINISHED FLOOR	ME-73 MECHANICAL	EX-74 36 1/2" WOOD WALL	EX-74 36 1/2" WOOD WALL
AD-74 ABOVE FINISHED FLOOR	ME-74 MECHANICAL	EX-75 37" WOOD WALL	EX-75 37" WOOD WALL
AD-75 ABOVE FINISHED FLOOR	ME-75 MECHANICAL	EX-76 37 1/2" WOOD WALL	EX-76 37 1/2" WOOD WALL
AD-76 ABOVE FINISHED FLOOR	ME-76 MECHANICAL	EX-77 38" WOOD WALL	EX-77 38" WOOD WALL
AD-77 ABOVE FINISHED FLOOR	ME-77 MECHANICAL	EX-78 38 1/2" WOOD WALL	EX-78 38 1/2" WOOD WALL
AD-78 ABOVE FINISHED FLOOR	ME-78 MECHANICAL	EX-79 39" WOOD WALL	EX-79 39" WOOD WALL
AD-79 ABOVE FINISHED FLOOR	ME-79 MECHANICAL	EX-80 39 1/2" WOOD WALL	EX-80 39 1/2" WOOD WALL
AD-80 ABOVE FINISHED FLOOR	ME-80 MECHANICAL	EX-81 40" WOOD WALL	EX-81 40" WOOD WALL
AD-81 ABOVE FINISHED FLOOR	ME-81 MECHANICAL	EX-82 40 1/2" WOOD WALL	EX-82 40 1/2" WOOD WALL
AD-82 ABOVE FINISHED FLOOR	ME-82 MECHANICAL	EX-83 41" WOOD WALL	EX-83 41" WOOD WALL
AD-83 ABOVE FINISHED FLOOR	ME-83 MECHANICAL	EX-84 41 1/2" WOOD WALL	EX-84 41 1/2" WOOD WALL
AD-84 ABOVE FINISHED FLOOR	ME-84 MECHANICAL	EX-85 42" WOOD WALL	EX-85 42" WOOD WALL
AD-85 ABOVE FINISHED FLOOR	ME-85 MECHANICAL	EX-86 42 1/2" WOOD WALL	EX-86 42 1/2" WOOD WALL
AD-86 ABOVE FINISHED FLOOR	ME-86 MECHANICAL	EX-87 43" WOOD WALL	EX-87 43" WOOD WALL
AD-87 ABOVE FINISHED FLOOR	ME-87 MECHANICAL	EX-88 43 1/2" WOOD WALL	EX-88 43 1/2" WOOD WALL
AD-88 ABOVE FINISHED FLOOR	ME-88 MECHANICAL	EX-89 44" WOOD WALL	EX-89 44" WOOD WALL
AD-89 ABOVE FINISHED FLOOR	ME-89 MECHANICAL	EX-90 44 1/2" WOOD WALL	EX-90 44 1/2" WOOD WALL
AD-90 ABOVE FINISHED FLOOR	ME-90 MECHANICAL	EX-91 45" WOOD WALL	EX-91 45" WOOD WALL
AD-91 ABOVE FINISHED FLOOR	ME-91 MECHANICAL	EX-92 45 1/2" WOOD WALL	EX-92 45 1/2" WOOD WALL
AD-92 ABOVE FINISHED FLOOR	ME-92 MECHANICAL	EX-93 46" WOOD WALL	EX-93 46" WOOD WALL
AD-93 ABOVE FINISHED FLOOR	ME-93 MECHANICAL	EX-94 46 1/2" WOOD WALL	EX-94 46 1/2" WOOD WALL
AD-94 ABOVE FINISHED FLOOR	ME-94 MECHANICAL	EX-95 47" WOOD WALL	EX-95 47" WOOD WALL
AD-95 ABOVE FINISHED FLOOR	ME-95 MECHANICAL	EX-96 47 1/2" WOOD WALL	EX-96 47 1/2" WOOD WALL
AD-96 ABOVE FINISHED FLOOR	ME-96 MECHANICAL	EX-97 48" WOOD WALL	EX-97 48" WOOD WALL
AD-97 ABOVE FINISHED FLOOR	ME-97 MECHANICAL	EX-98 48 1/2" WOOD WALL	EX-98 48 1/2" WOOD WALL
AD-98 ABOVE FINISHED FLOOR	ME-98 MECHANICAL	EX-99 49" WOOD WALL	EX-99 49" WOOD WALL
AD-99 ABOVE FINISHED FLOOR	ME-99 MECHANICAL	EX-100 49 1/2" WOOD WALL	EX-100 49 1/2" WOOD WALL
AD-100 ABOVE FINISHED FLOOR	ME-100 MECHANICAL	EX-101 50" WOOD WALL	EX-101 50" WOOD WALL

Holabird & Root
 Architecture Engineering Interiors LLC
 300 WEST ADAMS STREET OFFICE: 312.726.9960
 CHICAGO, ILLINOIS 60606 COMMISSION NO.: 14379

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RESTORATION AND RENOVATION

COVER ARCHITECTURAL ABBREVIATIONS, SYMBOLS LIST, SITE PLAN & INDEX OF DRAWINGS

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ARCHITECTURAL

AD-1 LEVELS 000, 100 & 200 EXISTING PLANS

AD-2 LEVELS 300 & 400 ROOF PLANS EXISTING PLANS

AD-3 LEVELS 000, 100 & 200 EXISTING PLANS

AD-4 LEVELS 300 & 400 ROOF PLANS EXISTING PLANS

AD-5 LEVEL 000 FLOOR PLAN & REFLECTED CEILING PLAN

AD-6 LEVEL 100 FLOOR PLAN & REFLECTED CEILING PLAN

AD-7 LEVEL 200 FLOOR PLAN & REFLECTED CEILING PLAN

AD-8 LEVEL 300 FLOOR PLAN & REFLECTED CEILING PLAN

AD-9 ROOF PLAN & DETAILS

AD-10 WINDOW ELEVATIONS

AD-11 EXTERIOR ELEVATIONS

AD-12 EXTERIOR ELEVATIONS

AD-13 EXTERIOR ELEVATIONS

AD-14 EXTERIOR ELEVATIONS

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ME-1 MECHANICAL - GENERAL NOTES

ME-2 MECHANICAL - GENERAL NOTES

ME-3 MECHANICAL - GENERAL NOTES

ME-4 MECHANICAL - GENERAL NOTES

ME-5 MECHANICAL - GENERAL NOTES

ME-6 MECHANICAL - GENERAL NOTES

ME-7 MECHANICAL - GENERAL NOTES

ME-8 MECHANICAL - GENERAL NOTES

ME-9 MECHANICAL - GENERAL NOTES

ME-10 MECHANICAL - GENERAL NOTES

ME-11 MECHANICAL - GENERAL NOTES

- Wishnicl

VENTILATION SYMBOLS		MECHANICAL SYMBOLS	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	NEW DUCTWORK		PRESSURE GAGE & COCK
	DUCT SECTION - SUPPLY UP		STRAINER
	DUCT SECTION - SUPPLY DOWN		STRAINER WITH BLOW OFF VALVE
	DUCT SECTION - RETURN UP		THERMOMETER
	DUCT SECTION - RETURN DOWN		PRESSURE/TEMPERATURE SENSOR
	DUCT SECTION - EXHAUST UP		CAP
	DUCT SECTION - EXHAUST DOWN		UNION
	DUCT SECTION - OUTSIDE AIR UP		FLEXIBLE CONNECTION
	DUCT SECTION - OUTSIDE AIR DOWN		PRESSURE REDUCING VALVE
	INCLINED RISE WITH RESPECT TO AIRFLOW		RELIEF VALVE
	INCLINED DROP WITH RESPECT TO AIRFLOW		GATE VALVE
	FLEXIBLE CONNECTION TO EQUIPMENT		BUTTERFLY WHEN VALVE IS 4" OR MORE BALL VALVE WHEN VALUE IS 3" OR LESS
	LOUVER & SCREEN WXD GROSS OPENING		GAS COCK
	FLEXIBLE DUCT		PRESSURE/TEMPERATURE TAP
	VOLUME DAMPER WITH QUADRANT LOCKING		UNIT HEATER VERTICAL
	MOTORIZED DAMPER		UNIT HEATER HORIZONTAL
	SPLITTER DAMPER		PIPE DOWN
	BACKDRAFT DAMPER (GRAVITY)		PIPE UP
	FIRE DAMPER, SLEEVE & ACCESS DOOR		NEW PIPING
	AIR EXTRACTING VANES		PIPING ASSEMBLY (SEE DETAIL)
	TURNING VANES, DOUBLE THICKNESS AIRFOIL TYPE		AIR VENT
	RISER MARK		EQUIPMENT (SPECIFIED BY TAG BELOW)
	THERMOSTAT (G) W/ GUARD		EQUIPMENT TAG
	SENSOR		SMOKE DETECTOR
	HUMIDISTAT		FIRE / SMOKE DETECTOR
	CONNECTION TO EXISTING PIPING, DUCTWORK, ETC.		
	700-R 20x12 EXHAUST OR RETURN AIR REGISTER		
	800-S 20x12 RECTANGULAR CEILING SUPPLY DIFFUSER		
	800-S 20x12 ROUND CEILING SUPPLY DIFFUSER		
	800-S 20x12 SIDE WALL, SUPPLY REGISTER W/ VOLUME DAMPER		
	24x12 DG DOOR GRILLE W/ BUILT-IN FIRE DAMPER IF LOCATED ON A FIRE DOOR		
	AIR VALVE		
	TERMINAL UNIT, VARIABLE VOLUME INTEGRAL DIFFUSER		

HVAC System Drawings

- Cunningham Hall

VENTILATION SYMBOLS		MECHANICAL SYMBOLS	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	NEW DUCTWORK		PRESSURE GAGE & COCK
	DUCT SECTION - SUPPLY UP		STRAINER
	DUCT SECTION - SUPPLY DOWN		STRAINER WITH BLOW OFF VALVE
	DUCT SECTION - RETURN UP		THERMOMETER
	DUCT SECTION - RETURN DOWN		PRESSURE/TEMPERATURE SENSOR
	DUCT SECTION - EXHAUST UP		CAP
	DUCT SECTION - EXHAUST DOWN		UNION
	DUCT SECTION - OUTSIDE AIR UP		FLEXIBLE CONNECTION
	DUCT SECTION - OUTSIDE AIR DOWN		PRESSURE REDUCING VALVE
	INCLINED RISE WITH RESPECT TO AIRFLOW		RELIEF VALVE
	INCLINED DROP WITH RESPECT TO AIRFLOW		GATE VALVE
	FLEXIBLE CONNECTION TO EQUIPMENT		BUTTERFLY WHEN VALVE IS 4" OR MORE BALL VALVE WHEN VALVE IS 3" OR LESS
	LOUVER & SCREEN VXD GROSS OPENING		GAS COCK
	FLEXIBLE DUCT		PRESSURE/TEMPERATURE TAP
	VOLUME DAMPER WITH QUADRANT LOCKING		UNIT HEATER VERTICAL
	MOTORIZED DAMPER		UNIT HEATER HORIZONTAL
	SPLITTER DAMPER		PIPE DOWN
	BACKDRAFT DAMPER (GRAVITY)		PIPE UP
	FIRE DAMPER, SLEEVE & ACCESS DOOR		NEW PIPING
	AIR EXTRACTING VANES		PIPING ASSEMBLY (SEE DETAIL)
	TURNING VANES, DOUBLE THICKNESS AIRFOIL TYPE		AIR VENT
	RISER MARK		EQUIPMENT (SPECIFIED BY TAG BELOW)
	THERMOSTAT (G) W/ GUARD		EQUIPMENT TAG
	SENSOR		SMOKE DETECTOR
	HUMIDISTAT		FIRE / SMOKE DETECTOR
	CONNECTION TO EXISTING PIPING, DUCTWORK, ETC.		
	700-R 20x12 EXHAUST OR RETURN AIR REGISTER		
	800-S 20x12 RECTANGULAR CEILING SUPPLY DIFFUSER		
	800-S 20x12 ROUND CEILING SUPPLY DIFFUSER		
	800-S 20x12 SIDE WALL SUPPLY REGISTER W/ VOLUME DAMPER		
	24x12 DG DOOR GRILLE W/ BUILT-IN FIRE DAMPER IF LOCATED ON A FIRE DOOR		
	AIR VALVE		
	TERMINAL UNIT, VARIABLE VOLUME INTEGRAL DIFFUSER		

ANNOUNCEMENTS

Announcement

- ASHRAE IL Chapter Scholarship
 - ❑ Application Link: <https://illinoisashrae.org/Scholarship>



Illinois Chapter of ASHRAE

Apply for Chapter Engineering Scholarships by January 31st

The deadline for annual Illinois Chapter ASHRAE Scholarships in 2023 is January 31st. The Chapter plans to award **up to four \$1,500 scholarships** to deserving college students interested in pursuing studies in engineering, science or mathematics that are fundamental for a career in the HVAC field. **It's quick and simple to apply** for one of these scholarships. Applicants do not need to belong to an ASHRAE student chapter.

Don't let this opportunity to lower the educational expenses of the college student (and future engineer) in your life pass you by. [For additional information and application form, click here.](#)

Please submit your application by January 31, 2023. The Chapter plans to announce scholarship winners in the spring of 2022.