
Introduction to Commercial Building Audits

Course No. ENRG 50

Outline

A. Introduction to concept of commercial building energy auditing

1. Why energy efficiency (EE) is important
2. Energy use and waste in commercial building operations
3. Prioritizing energy efficiency over renewable energy generation

B. Ordinances, policies and standards governing commercial building audits

1. San Francisco Existing Commercial Buildings Performance Ordinance
2. State of California energy goals
3. ASHRAE standards, including Building Energy Assessment Professional (BEAP)
4. Other audit standards

C. Three ASHRAE audit levels

1. Preliminary energy use analysis
2. Level 1, Walk-through analysis
3. Level 2, Intermediate, energy survey and energy analysis
4. Level 3, Detailed analysis of capital-intensive modifications

D. Developing the scope of work in a commercial building audit

1. Objectives of the audit, including needed data and

resources

2. Assessment management
3. Responsibilities of audit team members

E. Elements in preliminary analysis of building performance data

1. Engineering and architectural document review
2. Geographical and climatic review
3. Review and analysis of current energy use and costs
4. Benchmarking procedures

F. Factors in on-site building assessment

1. Common safety hazards and field safety techniques
2. Occupant interviews and assessment of building operations
3. Building envelope
4. Electrical systems
5. HVAC&R systems
6. Lighting systems and use
7. Miscellaneous other energy use systems
8. Domestic water systems and use
9. Indoor environmental quality

G. Analysis of data collected

1. Identify opportunities for efficiency improvement
2. Calculate value of efficiency improvements and return on investment
3. Prioritize options based on client criteria

H. Audit completion activities

1. Prepare and present written report
2. Assist with development of implementation plan

F. Factors in on-site building assessment

1. Common safety hazards and field safety techniques
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- 4. Electrical systems**
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Electrical systems

- The electrical system in a building comprises the infrastructure that brings in electrical supply, including:
 - electrical substation
 - transformers
 - distribution systems
 - circuit breakers
 - electrical meters
 - capacitors, etc



An electrical distribution system provides power to the entire facility.

Electrical systems

A typical electrical distribution facility in a building will generally include the following:

- Power distribution systems for equipments, including indoor substation, transformers, building distribution, process control system, building electrical service systems, and protection systems
- Power outlet system for movable equipments, material-handling systems, and transportation system
- Auxiliary systems, like air conditioning and refrigeration, compressed air systems, lighting, fire alarm systems, communication and computer-based equipments
- DG sets/cogeneration equipments/UPS/inverter

Electrical systems

- Lighting systems are the most complex part of an electrical design, including:
 - all the lighting fixtures and their controls
 - have very detailed requirement as per the NEC and require documentation



Guidelines on selection of electrical motors

- Select more energy-efficient motors
- Motor horsepower ratings shall not exceed 20% of the calculated maximum load
- Motor nameplates shall list the nominal full load motor efficiencies and the full load power factor
- Insist on proper rewinding practices for rewound motors
- obtain certificates and keep record of the motor efficiency.
- Install soft start energy savers and variable speed drives based on the application requirement

CEE PREMIUM-EFFICIENCY MOTORS INITIATIVE EFFICIENCY SPECIFICATIONS

(Terms of Usage follow)

CEE Specification aligned with NEMA PREMIUM™ on June 13, 2001

CEE Contact: Ted Jones, 617-589-3949, Ext. 230, E-mail: tjones@cee1.org
Initiative Web page: www.cee1.org/ind/motrs/motrs-main.php3

Nominal Full Load Efficiencies for EPart -covered equipment: 1-200 horsepower NEMA design A and B, three phase, integral horsepower, general purpose motors (1200, 1800, 3600 RPM).

Open Drip-Proof (ODP)							Totally Enclosed Fan-Cooled (TEFC)						
	1200 RPMs		1800 RPMs		3600 RPMs			1200 RPMs		1800 RPMs		3600 RPMs	
	EPACT Efficiency Standard*	NEMA Premium Efficiency	EPACT Efficiency Standard*	NEMA Premium Efficiency	EPACT Efficiency Standard*	NEMA Premium Efficiency		EPACT Efficiency Standard*	NEMA Premium Efficiency	EPACT Efficiency Standard*	NEMA Premium Efficiency	EPACT Efficiency Standard*	NEMA Premium Efficiency
HP							HP						
1	80	82.5	82.5	85.5	N/A	77.0	1	80	82.5	82.5	85.5	75.5	77.0
1.5	84	86.5	84	86.5	82.5	84.0	1.5	85.5	87.5	84	86.5	82.5	84.0
2	85.5	87.5	84	86.5	84	85.5	2	86.5	88.5	84	86.5	84	85.5
3	86.5	88.5	86.5	89.5	84	85.5	3	87.5	89.5	87.5	89.5	85.5	86.5
5	87.5	89.5	87.5	89.5	85.5	86.5	5	87.5	89.5	87.5	89.5	87.5	88.5
7.5	88.5	90.2	88.5	91	87.5	88.5	7.5	89.5	91.0	89.5	91.7	88.5	89.5
10	90.2	91.7	89.5	91.7	88.5	89.5	10	89.5	91.0	89.5	91.7	89.5	90.2
15	90.2	91.7	91	93	89.5	90.2	15	90.2	91.7	91	92.4	90.2	91.0
20	91	92.4	91	93	90.2	91.0	20	90.2	91.7	91	93	90.2	91.0
25	91.7	93.0	91.7	93.6	91	91.7	25	91.7	93.0	92.4	93.6	91	91.7
30	92.4	93.6	92.4	94.1	91	91.7	30	91.7	93.0	92.4	93.6	91	91.7
40	93	94.1	93	94.1	91.7	92.4	40	93	94.1	93	94.1	91.7	92.4
50	93	94.1	93	94.5	92.4	93.0	50	93	94.1	93	94.5	92.4	93.0
60	93.6	94.5	93.6	95	93	93.6	60	93.6	94.5	93.6	95	93	93.6
75	93.6	94.5	94.1	95	93	93.6	75	93.6	94.5	94.1	95.4	93	93.6
100	94.1	95.0	94.1	95.4	93	93.6	100	94.1	95.0	94.5	95.4	93.6	94.1
125	94.1	95.0	94.5	95.4	93.6	94.1	125	94.1	95.0	94.5	95.4	94.5	95.0
150	94.5	95.4	95	95.8	93.6	94.1	150	95	95.8	95	95.8	94.5	95.0
200	94.5	95.4	95	95.8	94.5	95.0	200	95	95.8	95	96.2	95	95.4



























* This standard, equivalent to NEMA Table 12-10, went into effect in October 1997. New motors manufactured and imported for the U.S. market must meet or exceed these full load nominal efficiencies.

Electrical systems
























- Energy accounting
 - To analyze the current equipment energy consumption, and justify savings after EEMs implementation
 - To help identify the optimum usage of demand allocation, improve the load factor
- Monitoring and control
 - major equipment/system (HVAC, pumping system etc) may need to be monitored by energy meters
 - proper control strategies will save significantly

Electrical symbol list

OUTLETS

	SINGLE RECEPTACLE (120 VOLT)
	DUPLEX RECEPTACLE (120 VOLT)
	WEATHERPROOF RECEPTACLE
	GROUND FAULT RECEPTACLE
	ISOLATED GROUND RECEPTACLE
	DRINKING FOUNTAIN
	SWITCHED RECEPTACLE
	HALF HOT RECEPTACLE
	DOUBLE DUPLEX RECEPTACLE
	CLOCK RECEPTACLE
	FLUSH FLOOR RECEPTACLE, DUPLEX
	SURFACE FLOOR RECEPTACLE, DUPLEX
	SPECIAL EQUIPMENT RECEPTACLE
	LOCKING RECEPTACLE
	TELEPHONE OUTLET
	FAX OUTLET
	FLUSH FLOOR TELEPHONE OUTLET, DUPLEX
	SURFACE FLOOR TELEPHONE OUTLET
	DATA OUTLET
	TELEPHONE/POWER POLE
	FIXTURE/DEVICE OUTLET BOX
	CEILING JUNCTION BOX
	WALL JUNCTION BOX
	JUNCTION BOX WITH FLEX PIGTAIL
	PULL JUNCTION BOX
	UNDERFLOOR JUNCTION BOX

FIXTURES

	SURFACE FLUOR. FIXTURE W/BOX
	RECESSED FLUORESCENT FIXTURE
	FLUORESCENT STRIP FIXTURE
	OTHER FLUORESCENT FIXTURE
	NIGHT LIGHT (ON 24 HRS)
	FIXTURE ON EMERGENCY CIRCUIT
	RECESSED DOWNLIGHT
	RECESSED WALL WASHER
	SPOTLIGHT (NUMBER OF HEADS SHOWN)
	KEYLESS LAMPHOLDER
	PULLCHAIN LAMPHOLDER
	EXIT FIXTURE (ARROWS INDICATE NUMBER OF ARROWS)
	EXIT FIXTURE, WALL MOUNTED
	INCANDESCENT WALL BRACKET
	INCANDESCENT CEILING MOUNT
	TRACK LIGHT
	TRACK LIGHT FIXTURE
	STREET TYPE POLE FIXTURE
	NEMA TYPE POLE MTD. FIXTURE (ARROW INDICATES ORIENTATION)
	NEMA TYPE III POLE MTD. FIXTURE
	NEMA TYPE III WALL MTD. FIXTURE
	H.I.D. FIXTURE
	EMERGENCY EGRESS LIGHT (NUMBER OF HEADS SHOWN)

Electrical symbol list

SWITCHES

S	SINGLE POLE SWITCH
S ₂	DOUBLE POLE SWITCH
S ₃	THREE WAY SWITCH
S ₄	FOUR WAY SWITCH
S _P	SWITCH WITH PILOT LIGHT
S _{DB}	COMB. SWITCH/RECEPTACLE
S _{TO}	THERMAL OVERLOAD SWITCH
S _M	MANUAL MOTOR SWITCH
S _L	LOW VOLTAGE SWITCH
S _D	DOOR OPERATED SWITCH
S _K	KEY SWITCH
S _{VP}	WEATHERPROOF SWITCH
S _T	TIME SWITCH
S _{OS}	OCCUPANCY SENSOR SWITCH
OS	OCCUPANCY SENSOR
S _D	DIMMER SWITCH (WATTAGE SHOWN)

CIRCUITRY AND RACEWAYS

----	CONDUIT INSTALLED CONCEALED
----	CONDUIT INSTALLED EXPOSED
- - - -	CONDUIT INSTALLED UNDERGROUND
—○—	CIRCUIT UP
—●—	CIRCUIT DOWN
→ 'P1' 1,3	'P1' HOME RUN (CIRCUITS, PANEL)
—//—	# OF CONDUCTORS
—	END OF CONDUIT RUN
—	END OF CONDUIT RUN , CAP
—	"RUN CONTINUES"
—OR—	FLEXIBLE CONDUIT
—WM—	WIREMOLD
—PM—	PLUGMOLD
—BD—	BUSS DUCT
—UFD—	UNDERFLOOR DUCT

SERVICE AND EQUIPMENT

	TRANSFORMER, PAD MOUNTED
	TRANSFORMER, DRY (KVA SHOWN)
	DISCONNECT SWITCH (FUSE SIZE SHOWN)
	NON-FUSED DISCONNECT (SWITCH SIZE SHOWN)
	MAGNETIC MOTOR STARTER
	COMBINATION MOTOR STARTER
	PANELBOARD, SURFACE MOUNT
	PANELBOARD, FLUSH MOUNT
	WEATHERHEAD
	UTILITY METER, AS REQUIRED
	CURRENT TRANSFORMERS
	GENERATOR (KW SHOWN)
	TELEPHONE TERMINAL BOARD
	TELEPHONE TERMINAL CABINET
	GROUND CONNECTION AS PER N.E.C.
	WIREWAY
	TRANSFER SWITCH
	CIRCUIT BREAKER
	ENCLOSED CIRCUIT BREAKER
	CAPACITOR
	SWITCHBOARD, SHOWN WITH FUSIBLE SWITCHES
	MOTOR CONTROL CENTER, SHOWN WITH FUSIBLE STARTERS

F. Factors in on-site building assessment

1. Common safety hazards and field safety techniques
2. Occupant interviews and assessment of building operations
3. Building envelope
4. Electrical systems
- 5. HVAC&R systems**
6. Lighting systems and use
7. Miscellaneous other energy use systems
8. Domestic water systems and use
9. Indoor environmental quality

What is HVAC&R

H: Heating

V: Ventilation

A: Air

C: Conditioning/Cooling

R : Refrigeration

What does the owner want?

- Thermal comfort
- Indoor air quality
- Low first cost
- Problem free
- Low operating cost
- Green, energy efficiency

What does an owner get?

- Ducts
- Fans
- Pipes
- Pumps
- Motors
- Coils
- Compressors
- Boilers
- Controls (thermostat)
- Contractor



Heating: boiler, furnace, heat pump, electric resistance

- Heat is thermal energy and is quantified by the temperature
- Heating is to deliver heat to an area
- Byproduct: reduction in relative humidity
- Can be delivered w/o ventilation
- Measured in BTU
 - Raise 1 lb water 1°F



Ventilation

- Fresh Air must be provided (Make-up Air)
- Some air may be re-circulated (Return Air)
- Exhaust Air
- Why?
 - Odors & Vapors
 - Air-borne pathogens
 - Oxygen supply
 - Carbon oxides removal: CO & CO₂



Air Conditioning: direct expansion (DX), chilled water

- Cool is the absence of heat (removing heat)
- Cooling is the removal of heat to somewhere else
- Byproduct: increase in relative humidity
- Can be delivered w/o ventilation
- Measured in tons or 12,000 Btu/hr
 - Freeze one ton water in 1 day



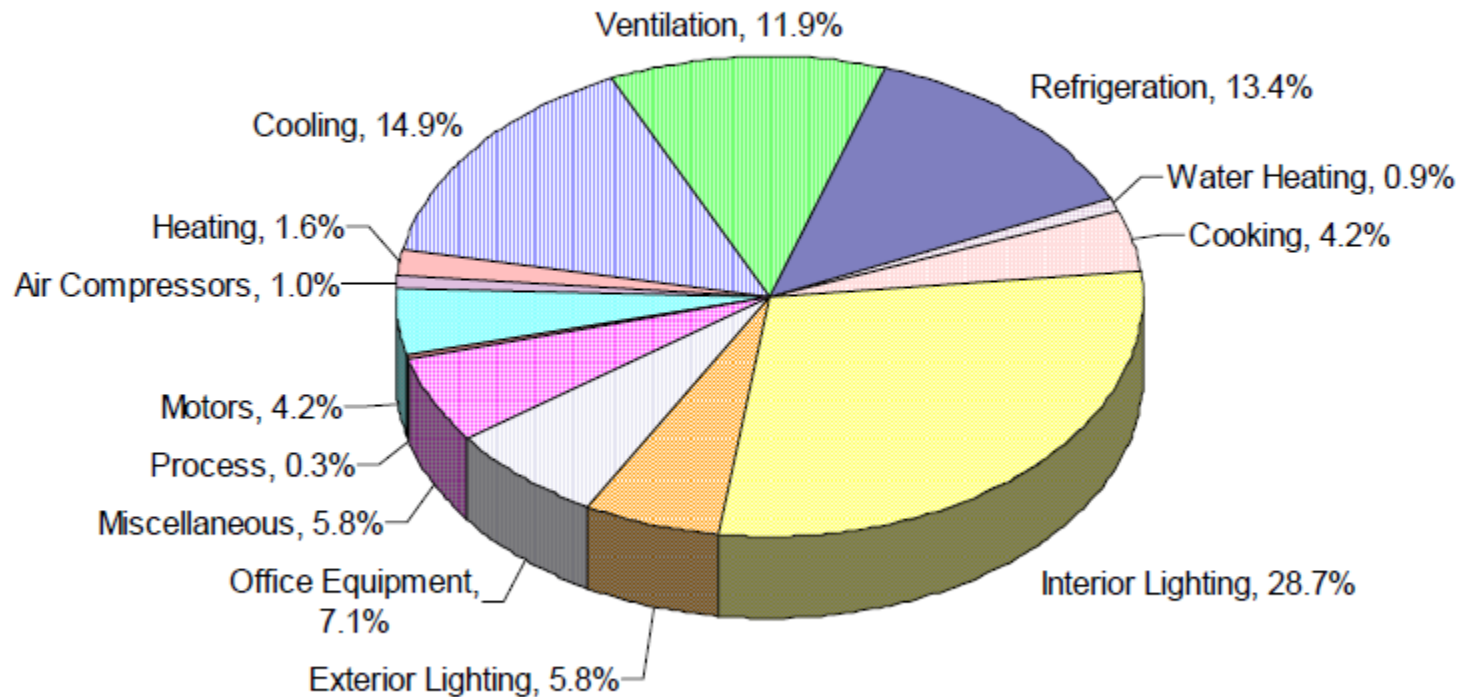
Refrigeration

- Cooling or maintaining the temperature of a product not people
- Designed for specific conditions for specific products
 - Freezer - 10 - 5 °F
 - Refrigerator 34-40°F



Electric usage by end use

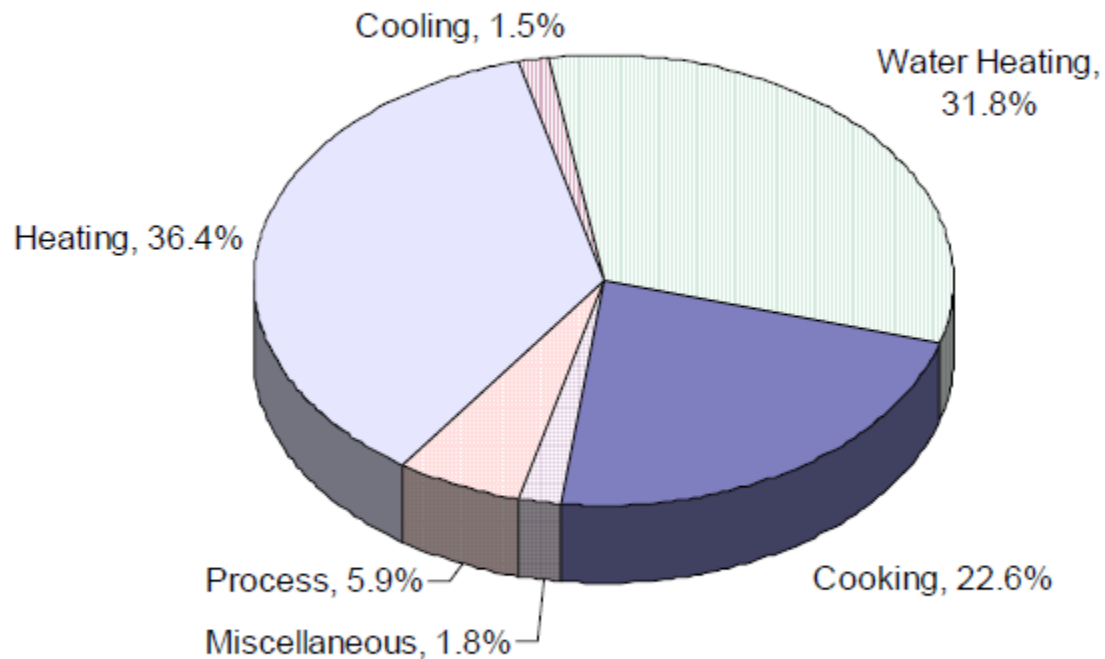
California Commercial End-use Survey



<http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF>

Natural gas usage by end use

California Commercial End-use Survey



<http://www.energy.ca.gov/2006publications/CEC-400-2006-005/CEC-400-2006-005.PDF>

Energy Cost Factors

- Occupied hours
- Climate zone
- Building shell & fenestration
- End-use of HVAC-R
 - Interior temperature requirements set-points
 - IAQ requirements
- Equipment efficiency
- Equipment control schemes
- Equipment maintenance
- Commissioning and retro-commissioning

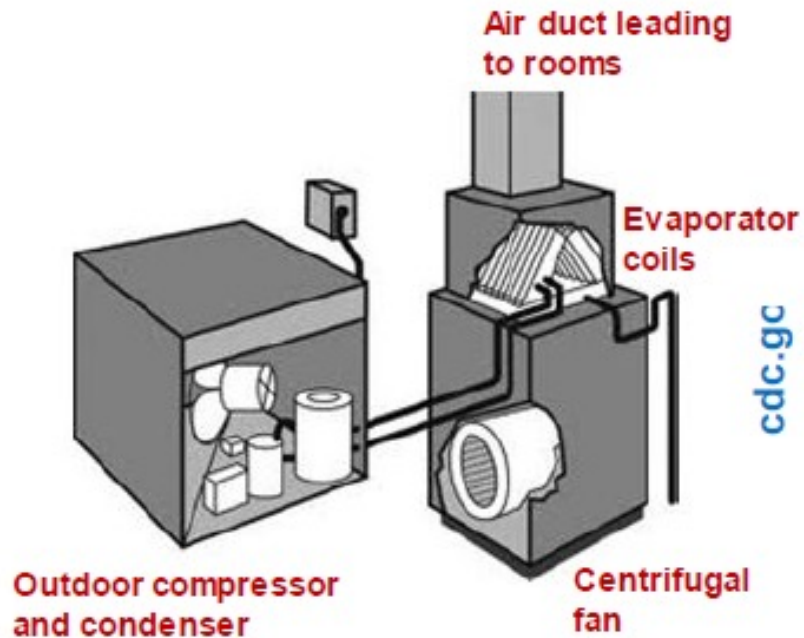
HVAC system types:

- Common system types
 - Single zone:
 - Split system
 - Packaged single zone (PSZ)
 - Fan-coil (FC)
 - Water loop heat pump (WLHP)
 - Multi-zone
 - Constant volume reheat
 - Variable air volume (VAV) with reheat: parallel/series boxes
 - Dual duct

HVAC system types:

- Advanced system types
 - Displacement ventilation (DV)
 - Under-floor air distribution (UFAD)
 - Chilled beams
 - Dedicated outside air system (DOAS)
 - Variable refrigerant flow

HVAC system type: split system

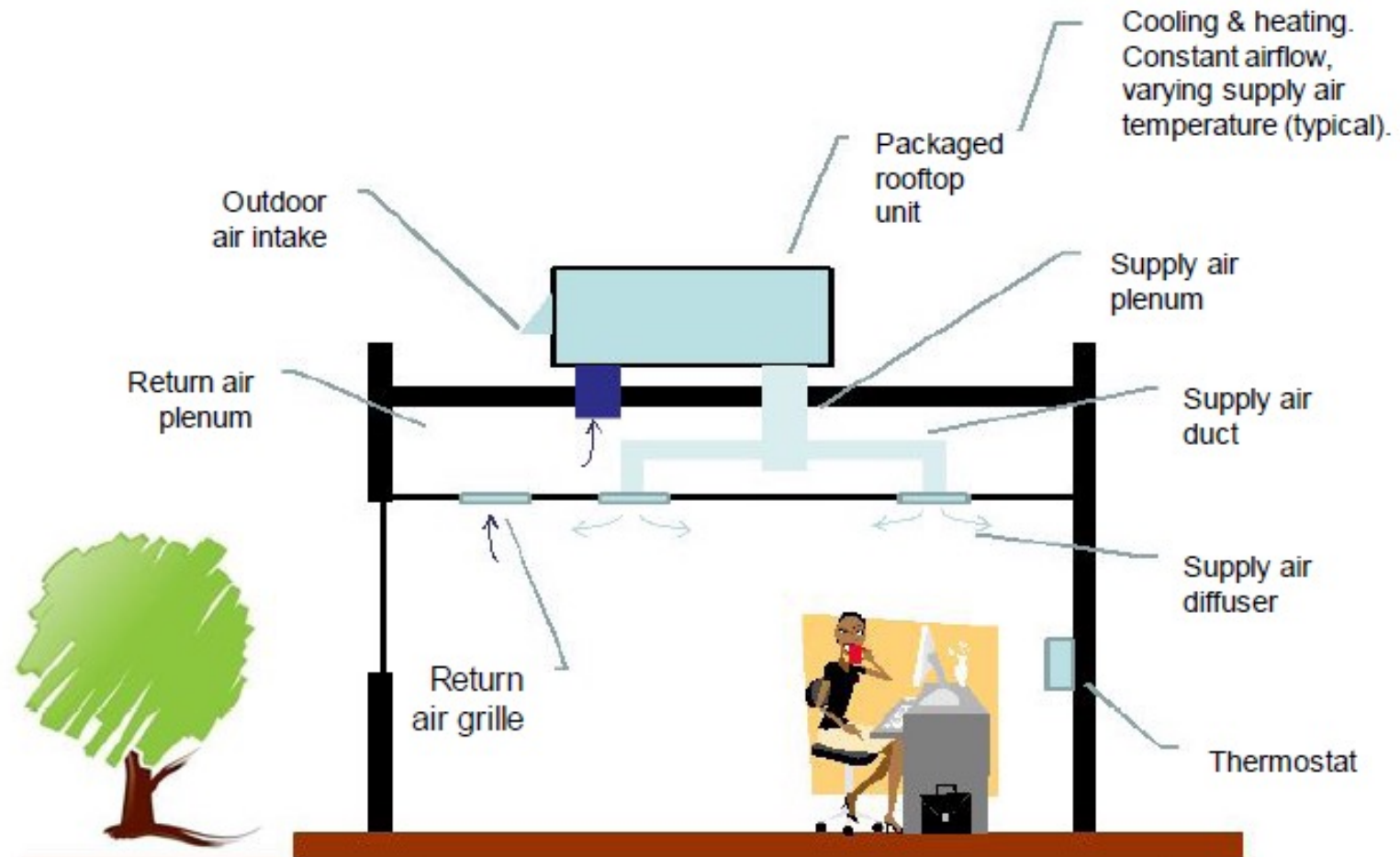


Common Split System

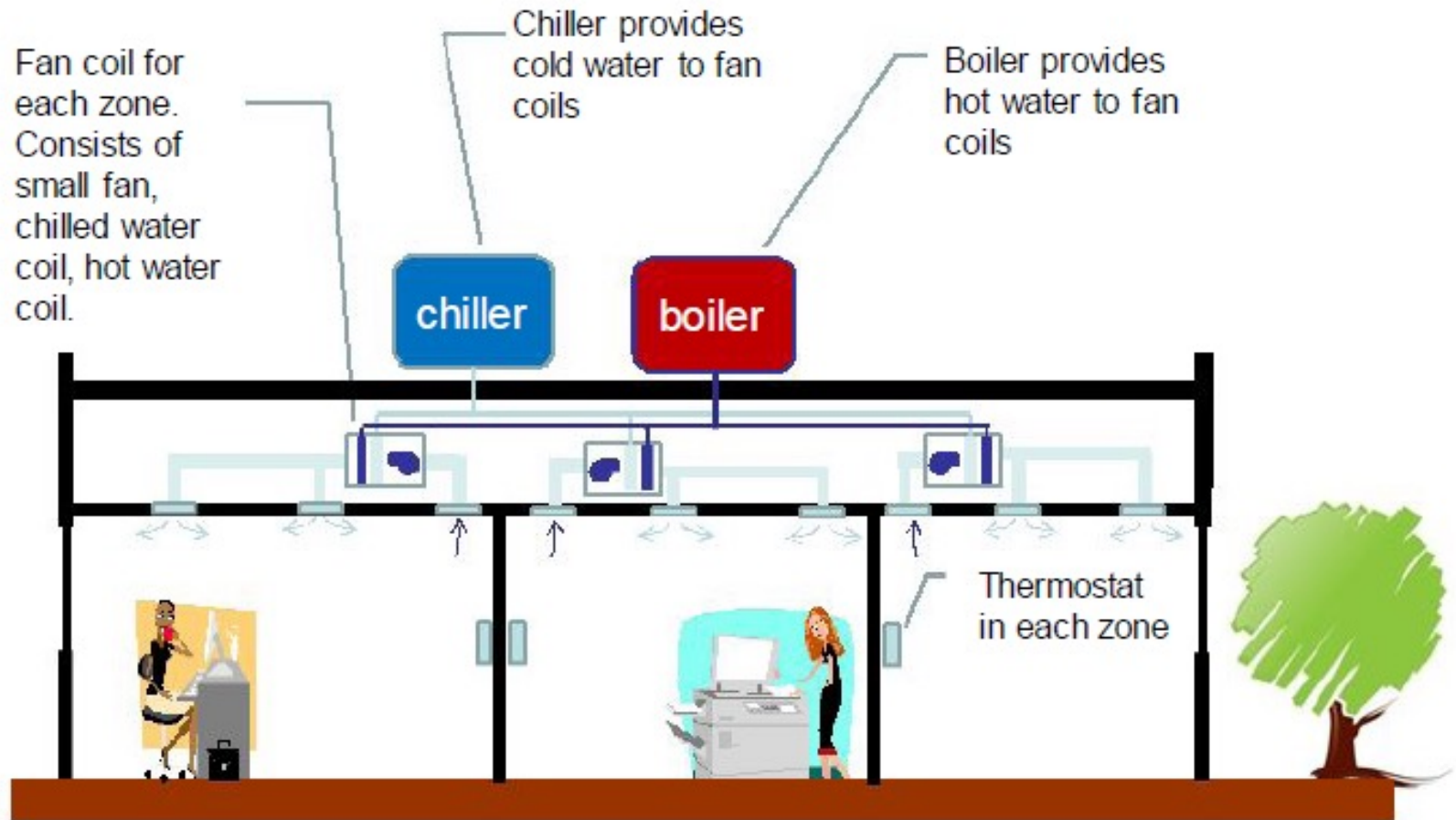


Mini-Split System

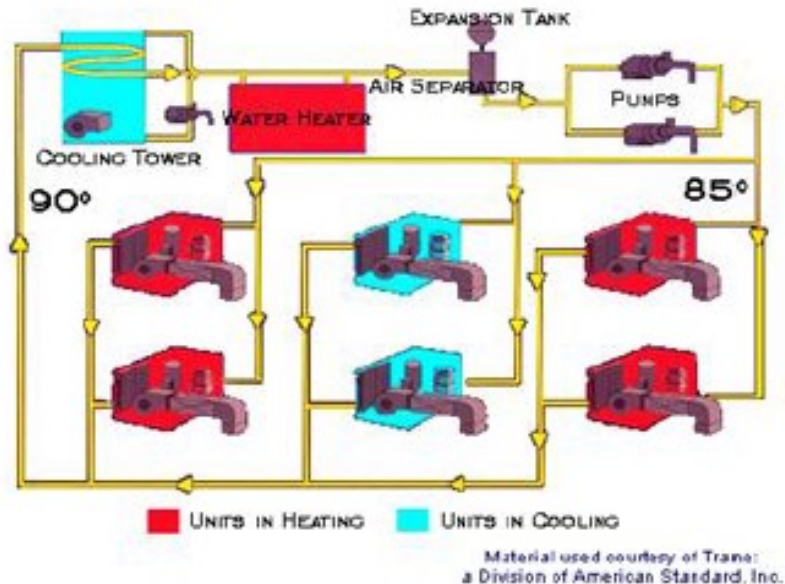
HVAC system type: package single zone (PSZ) system



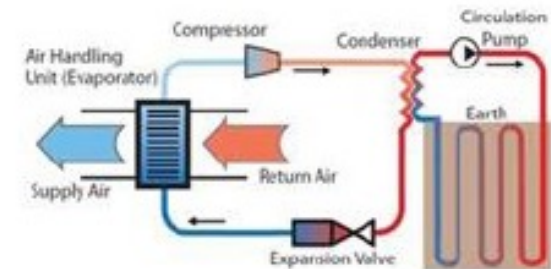
HVAC system type: Fan coil (FC) system



HVAC system type: Water-loop heat pump (WLHP)



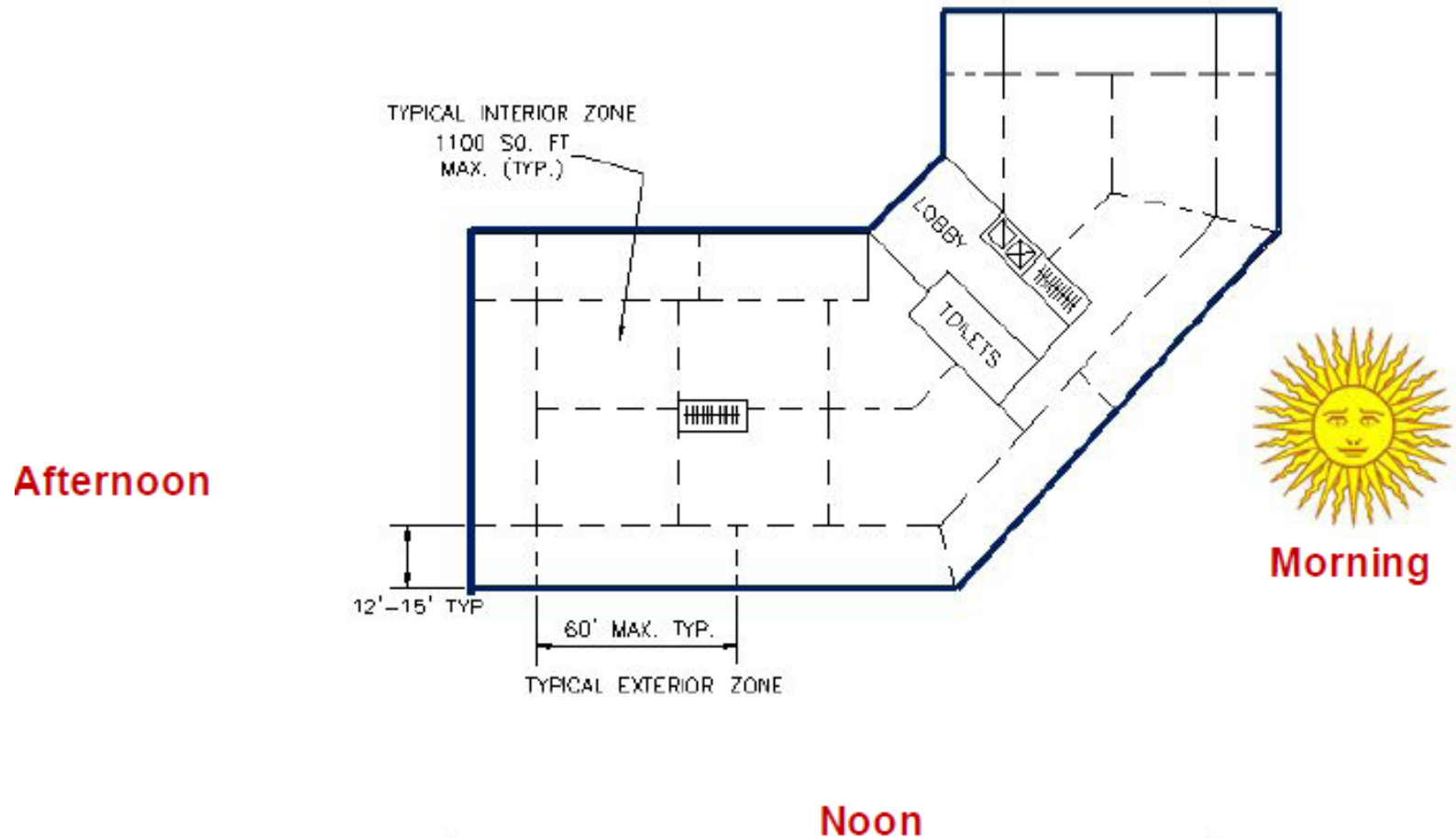
Water Furnace International



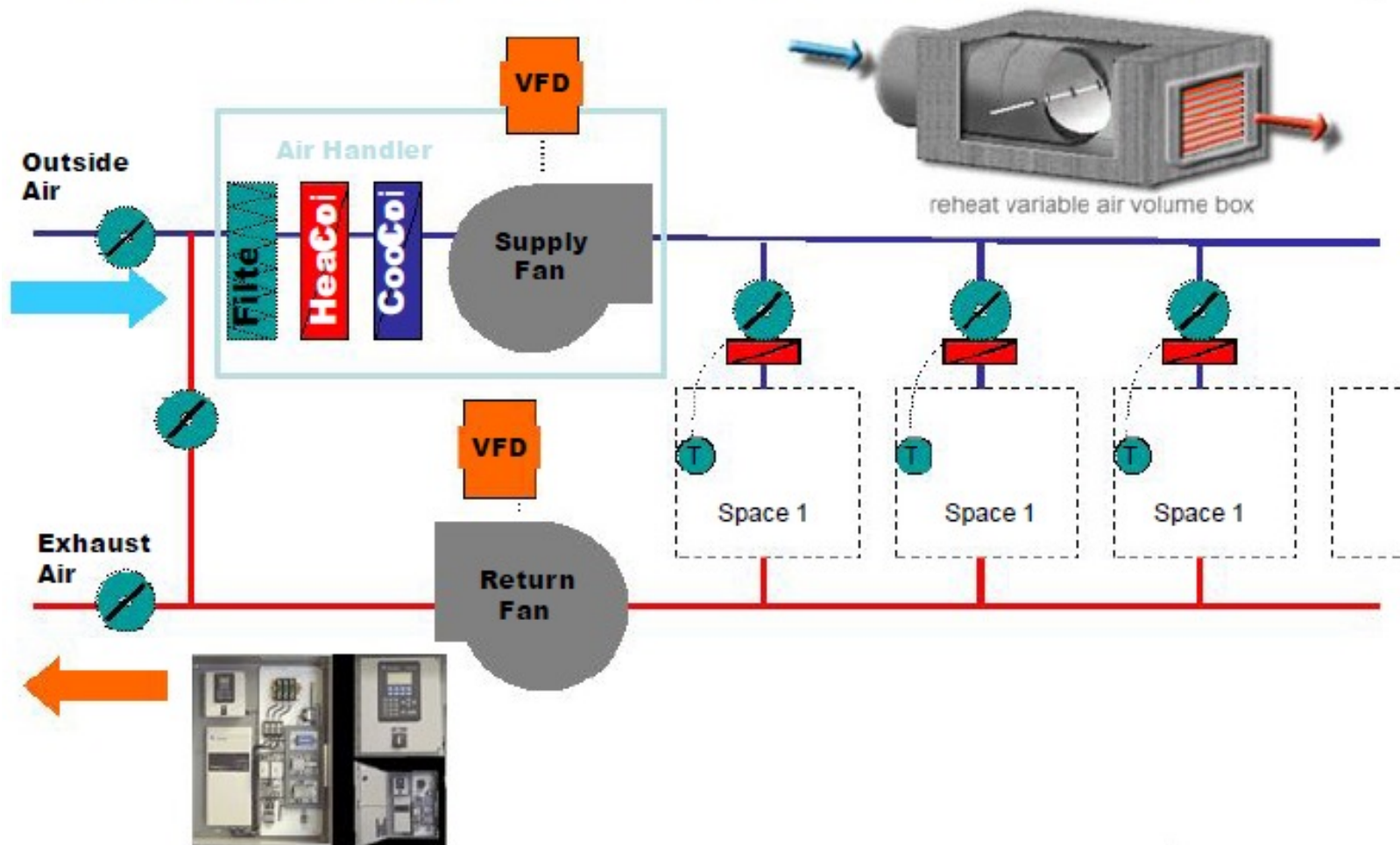
EnergyDesignResources.com

HVAC system type: multi-zone systems

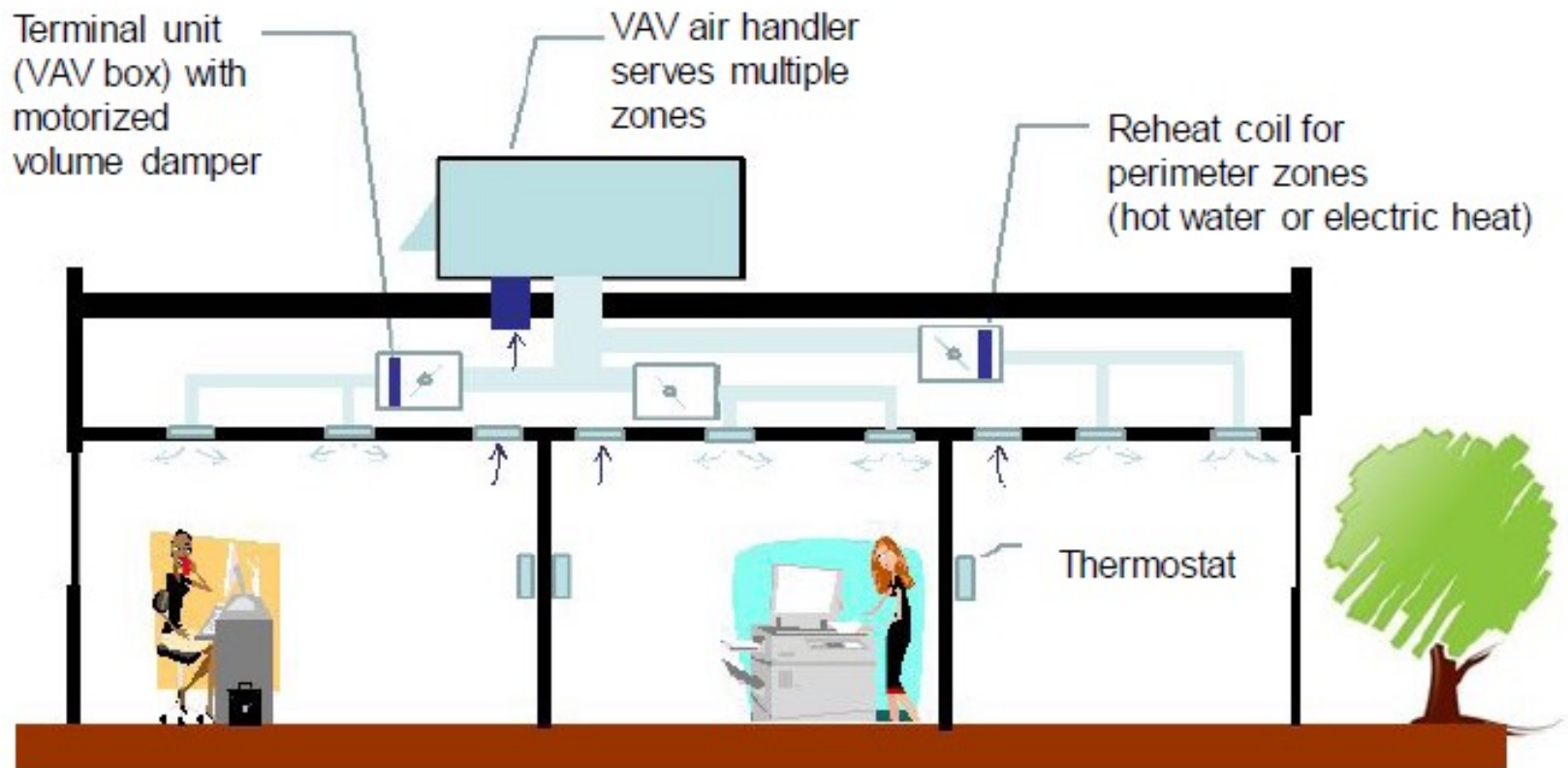
The Challenge of Multi-Zone Systems



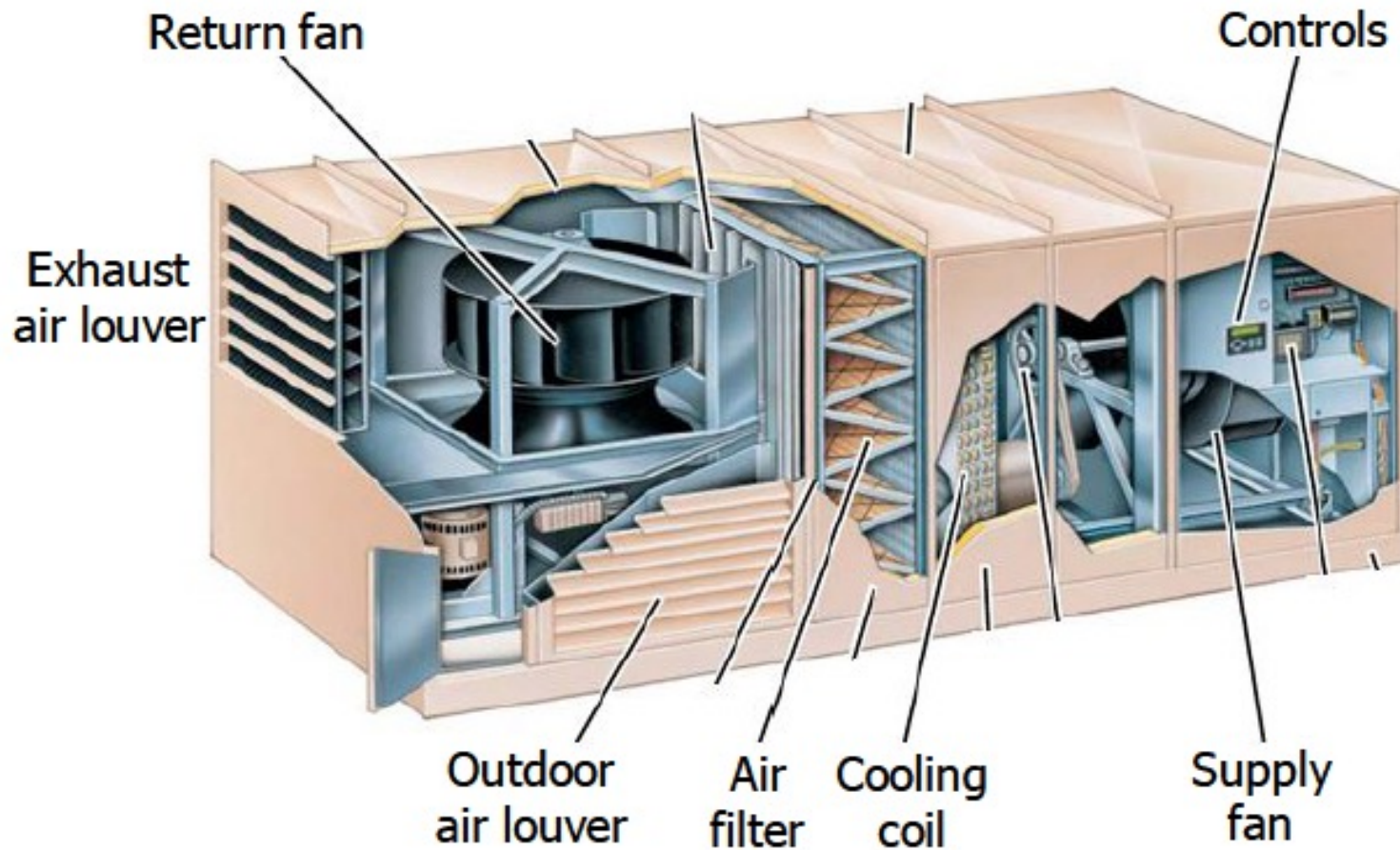
HVAC type: constant volume and VAV multi-zone system



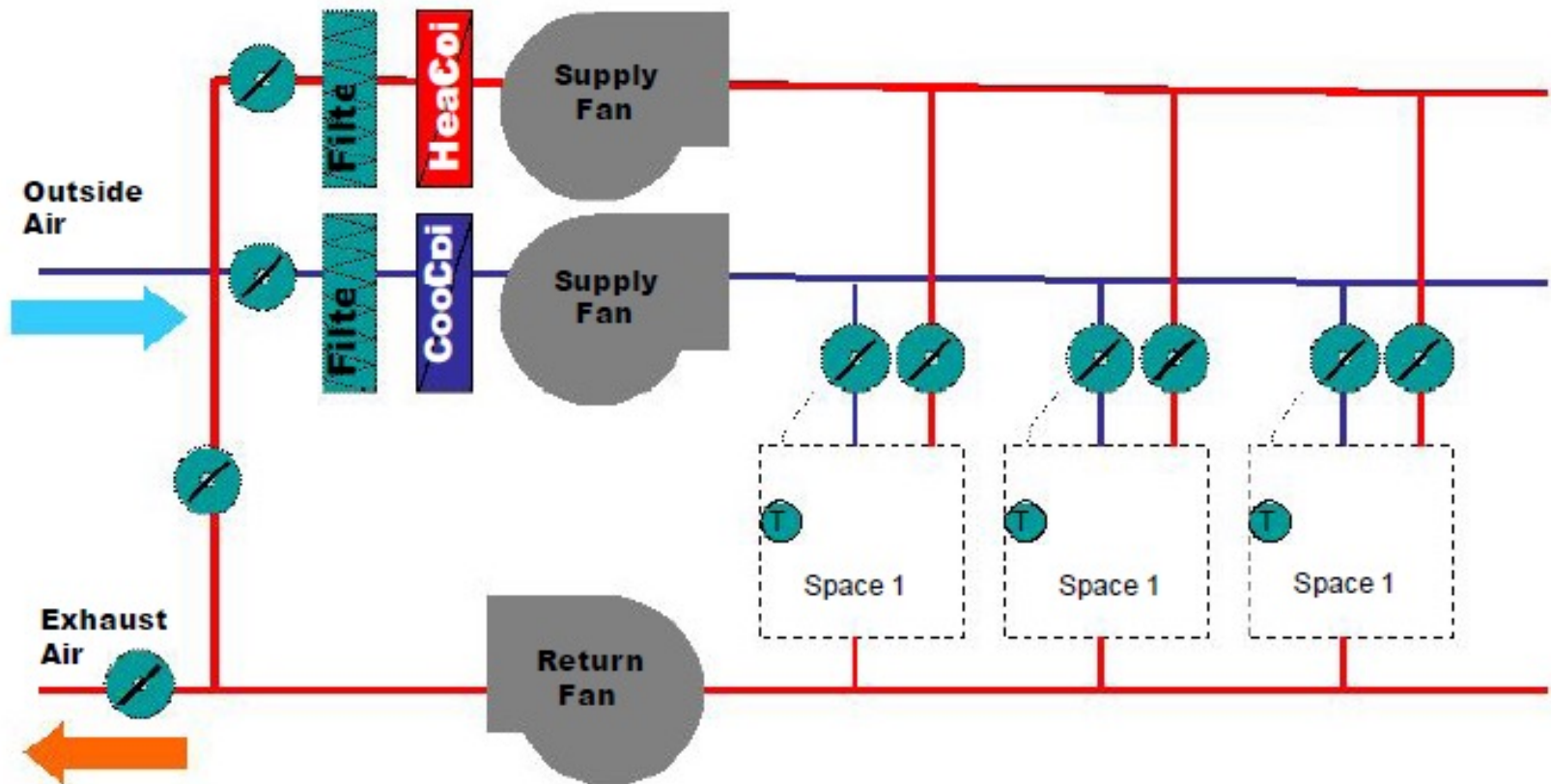
HVAC type: package Variable Air Volume (PVAV) system



HVAC system type: packaged air handler



HVAC system type: Dual-duct VAV system



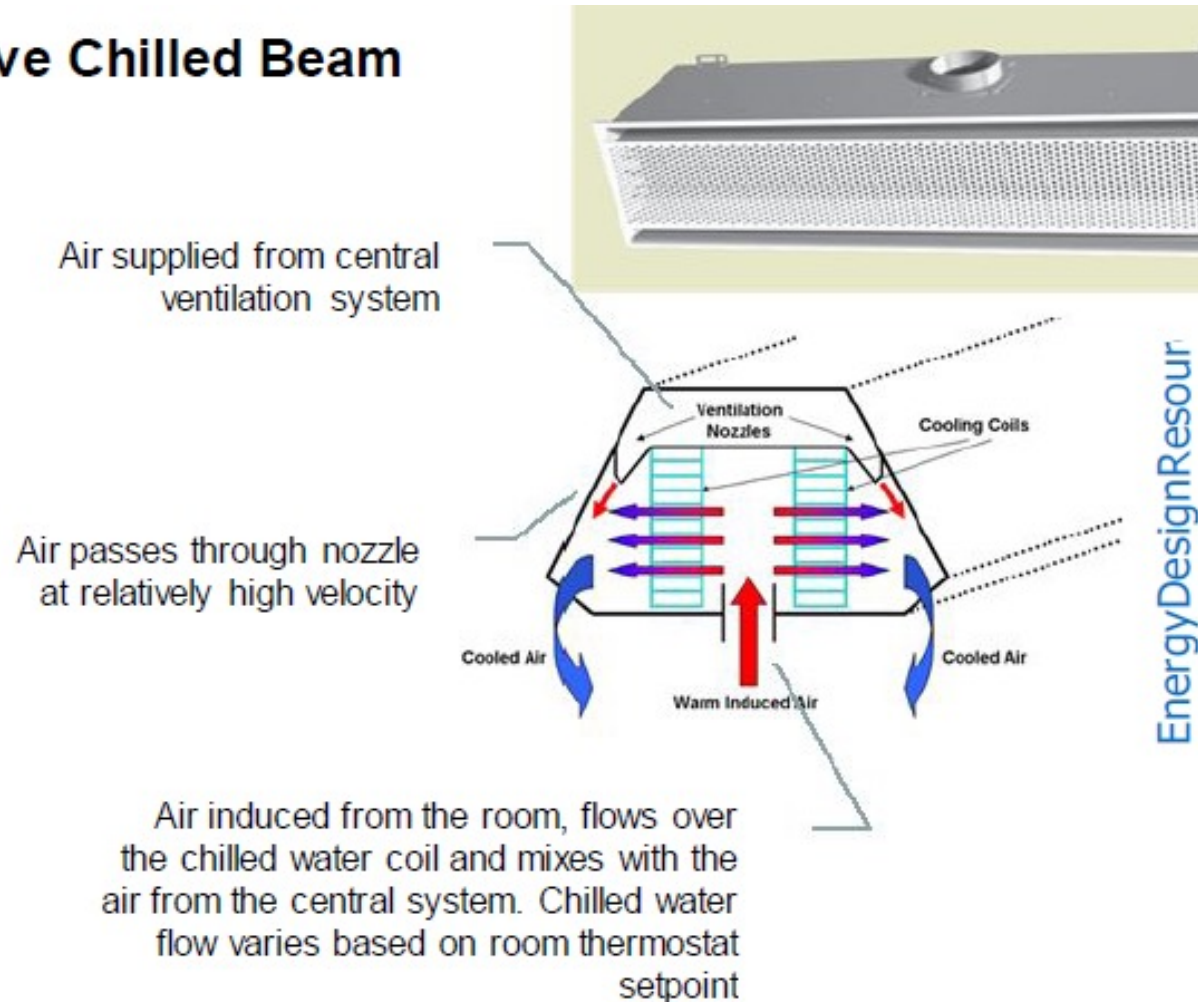
HVAC system type: under floor air distribution (UFAD)

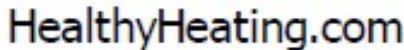


Source: www.tateaccessfloors.com

HVAC system type: Active chilled beam

Active Chilled Beam





Typically used in combination with another system such as chilled beams or radiant heating

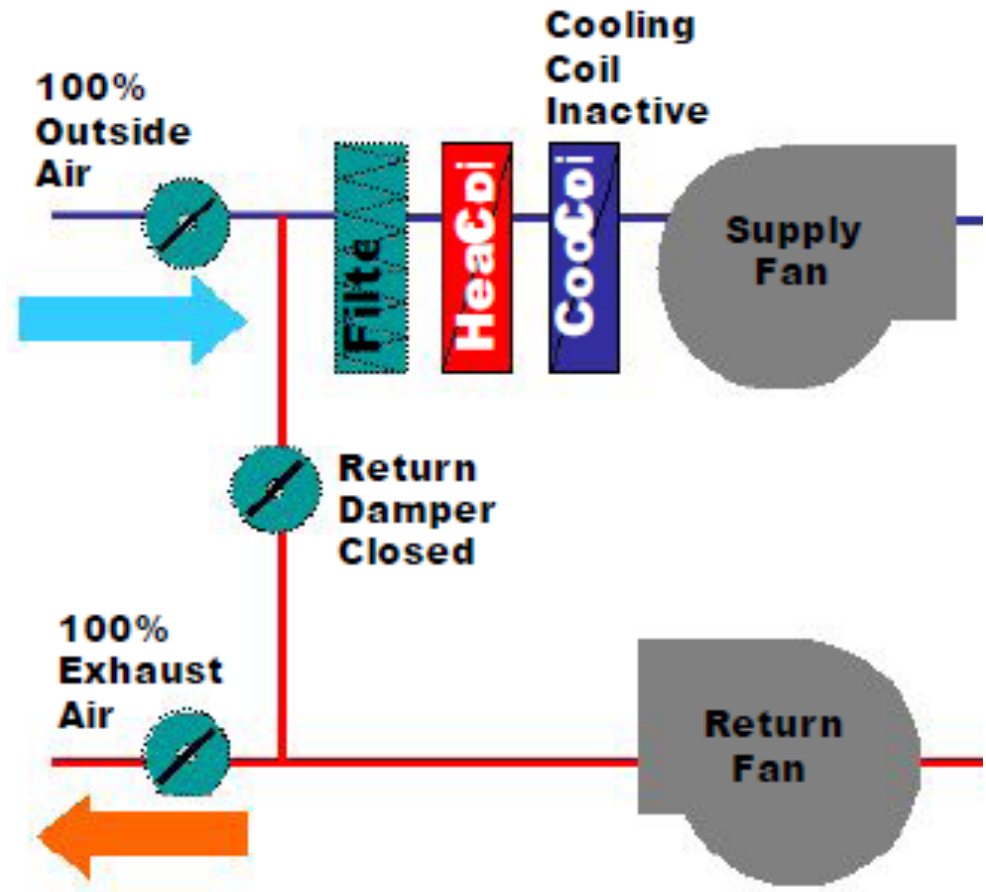
HVAC system type: variable refrigerant flow



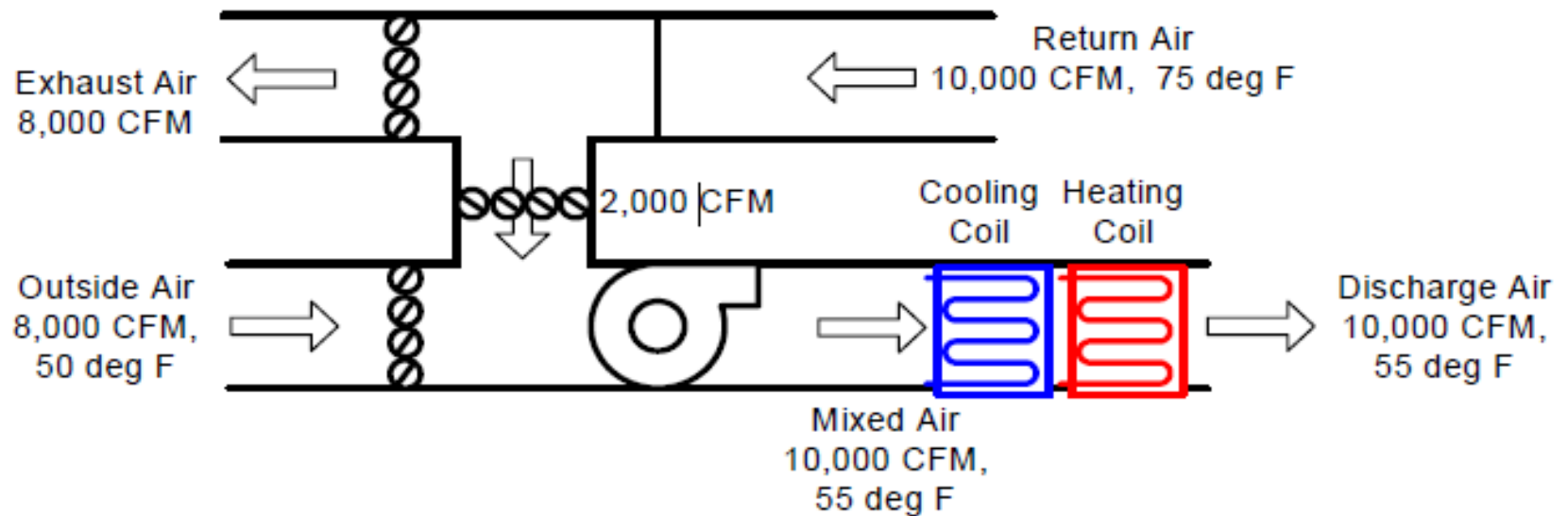
<http://www.roycmartin.com/category/articles/>

Economizers

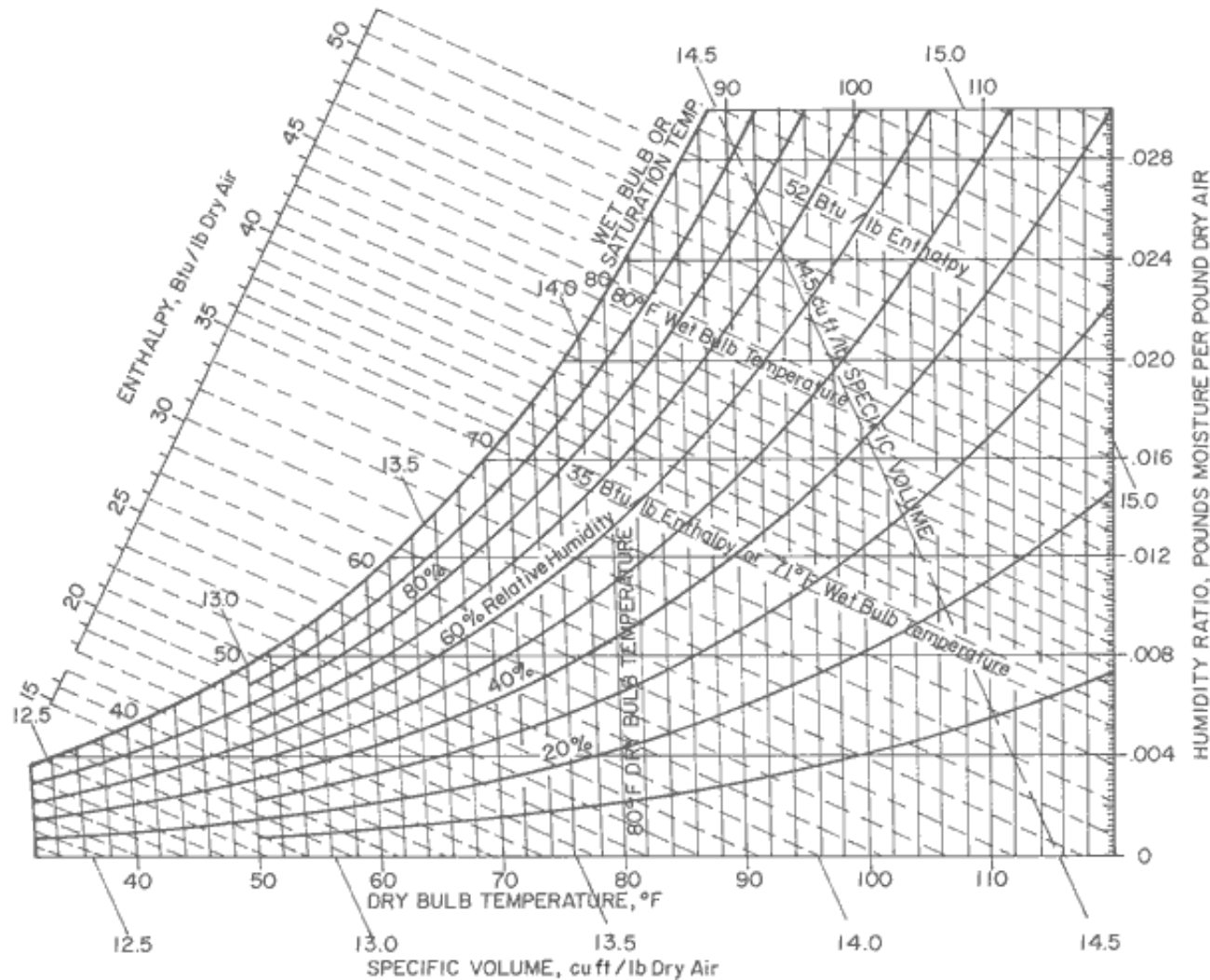
- The economizer cycle refers to using controls and dampers to make use of outside air for “free” cooling when it makes sense
- Controls used to bring in outside air instead of return air
- An “economizer” is generally not a single piece of equipment, although people may refer to it as such



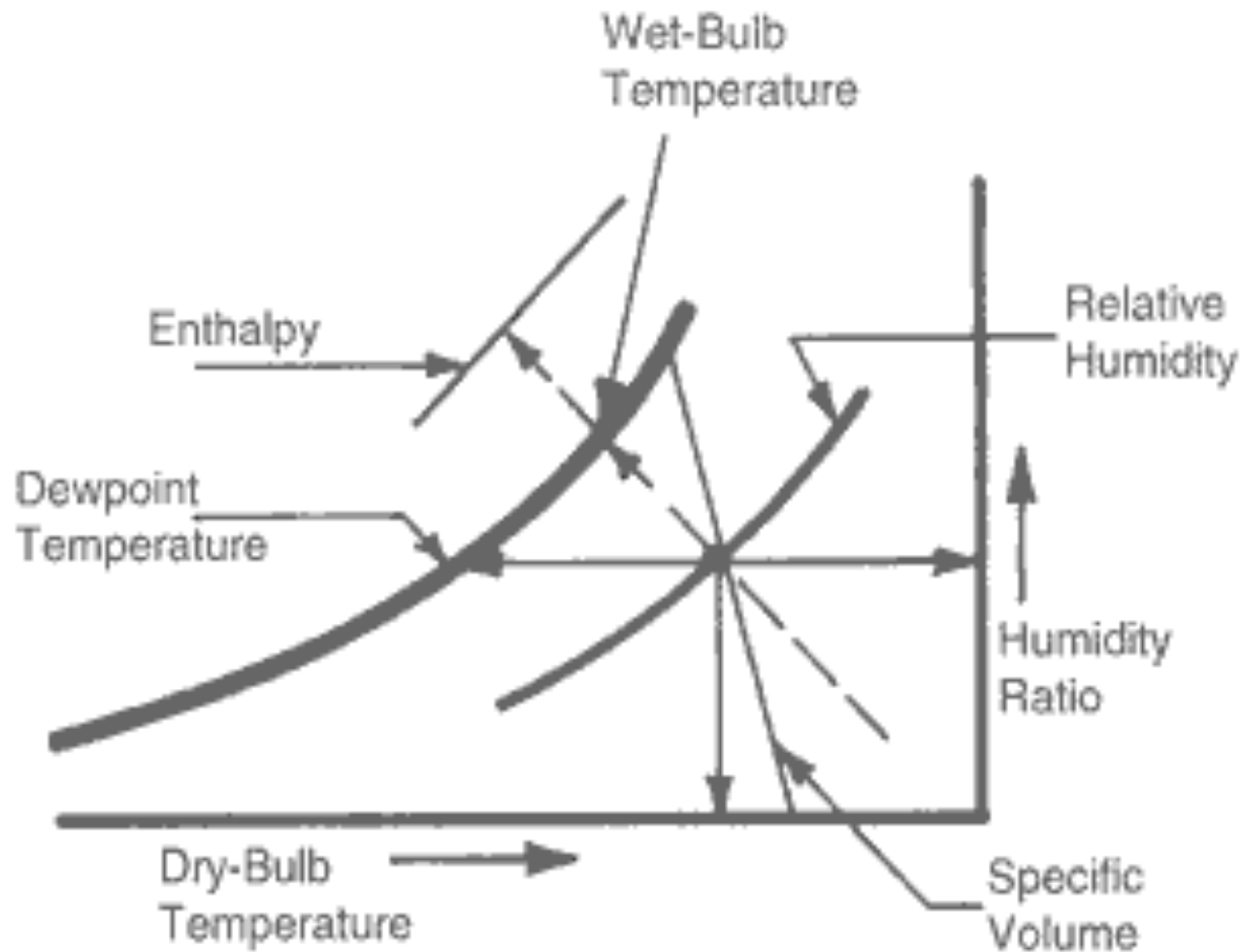
Economizer operation



Psychrometric Chart

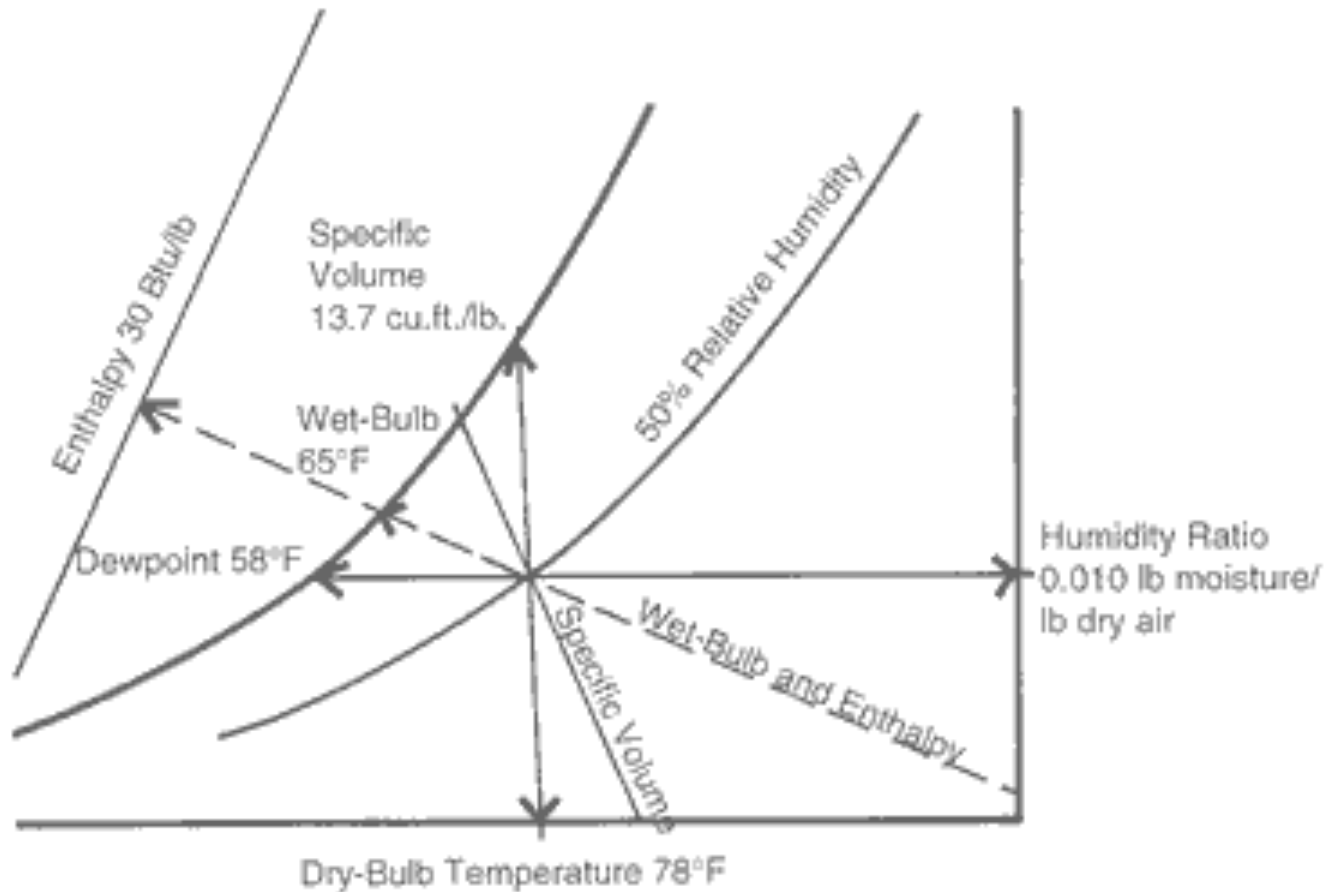


Psychrometric Chart



http://www.sp.uconn.edu/~mdarre/NE-127/NewFiles/psychrometric_inset.html

Psychrometric Chart

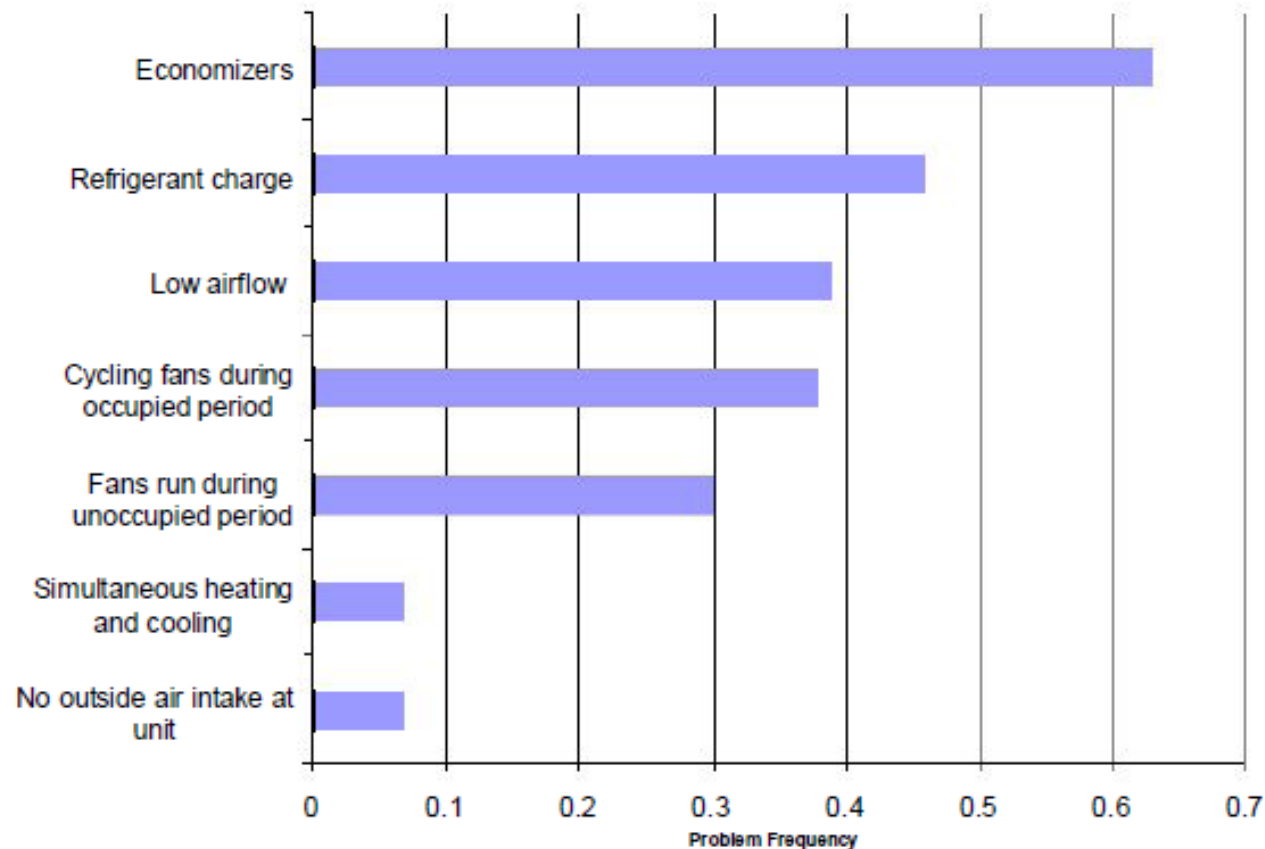


Reading material: http://www.ohio.edu/mechanical/thermo/Applied/Chapt.7_11/Chapter10b.html

Components

- Compressor
- Evaporator
- Condenser
- Throttling valve
- Steam boiler
- Hot water boiler
- Cooling tower
- Evaporative condenser
- Filters
- Dampers
- Fans
- Pumps
- Duct
- Coils (heat exchangers)
- Diffusers
- Humidifiers

Common packaged system problems



Source: Small HVAC System Design Guide, CEC PIER Program, 2003

Field Identification an HVAC Zone

- Ask facility staff/engineer
- Review as-built mechanical drawings
- Inventory the number of thermostats and HVAC units
- Observe placement of units to thermostats
- Go after hours and observe response to changed set-points



Unitary HVAC Nameplate

- Brand/Model #
- Age
- Voltage/Amperage/kW
- Other information:
 - rated efficiency?
 - Heating/cooling capacity
 - Air flow rate
 - Liquid flow rate
 - Pressure rise
 - Refrigerant

Carrier
Air Conditioning

Division of Carrier Corporation Syracuse, N.Y. 13221

Carrier

MODEL 48HJD005500 SERIES SERIAL 0793G19704 FACTORY CHARGED

QTY	VOLTS AC	PH	HZ	RLA	LRA	REFRIGERANT SYSTEM	TEST PRESSURE GAGE
1	208/230	3	60	13.5	99	8.5 LBS 3.9 kg R22	HI PSI 350 kPa 2410
COMPR						LBS kg R22	LO PSI 200 kPa 1379

FAN MTR	QTY	VOLTS AC	PH	HZ	FLA
OUTDOOR	1	208/230	1	60	1.9
INDOOR	1	208/230	1	60	5.7
OTHER					
COMBUST	1	208/230	1	60	5.7

CHARGE SYSTEM PER INSTALLATION INSTRUCTIONS FOR OUTDOOR INSTALLATION ONLY

MINIMUM CLEARANCES TO COMBUSTIBLE MATERIALS

TOP	BOTTOM	SIDES	FLUE SIDE
0 0	0 0	0 0	36 IN 915MM

★ FOR INSTALLATION ON COMBUSTIBLE FLOORING OR CLASS A, B OR C ROOFING MATERIAL
★★ 18 INCHES (457mm) WITH ACCESSORY FLUE DISCHARGE DEFLECTOR

MIN CKT AMPS 24.5

MAX FUSE OR HACR BREAKER 30

PROTECTIVE DEVICE AMPS 24

MIN UNIT DISCONNECT 116

DESIGN CERTIFIED AS A FORCED AIR FURNACE WITH COOLING UNIT
CSA APPROVED FOR NON-RESIDENTIAL USE TO -4°F (-20°C)
DESIGNED MAXIMUM OUTLET AIR TEMPERATURE 155°F 68.3°C

MAX EXTERNAL STATIC PRESSURE

AIR TEMP RISE 25-55°F 13.9-30.6°C

INPUT MAX 74000

OUTPUT CAP 40500/39940

THEORETICAL EFFICIENCY 11.8/17.4

DESIGNED FOR NATURAL GAS

GAS SUPPLY PRESSURE 13.6K 3.23KPa

MANIFOLD PRESSURE 2.5K 0.67KPa

UL LISTED

UNDERWRITERS LABORATORIES INC.

Model number nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4	8	T	C	D	A	0	4	A	1	A	5	-	0	A	0	A	0
Unit Heat Type 48 = Gas heat plug rooftop			Tier / Model TC = Entry tier (with Puron refrigerant)			Heat Size D = Low heat E = Medium heat F = High heat L = Low NO _x low heat M = Low NO _x medium heat N = Low NO _x high heat S = Stainless steel, low heat R = Stainless steel, medium heat T = Stainless steel, high heat			Refrig. System Options A = Standard refrigeration system			Cooling Tons 04 = 3 Ton 05 = 4 Ton 06 = 5 Ton 07 = 6 Ton 08 = 7.5 Ton 09 = 8.5 Ton 12 = 10 Ton			Sensor Options A = None B = RA smoke detector C = SA smoke detector D = RA & SA smoke detector E = CO ₂ sensor ¹ F = RA smoke detector & CO ₂ ¹ G = SA smoke detector & CO ₂ ¹ H = RA & SA smoke detector & CO ₂ ¹		
Brand / Packaging 0 = Standard 1 = LTL			Electrical Options A = None C = Non-fused disc D = Thru the base F = Non-fused & thru the base			Service Options 0 = None 1 = Unpowered convenience outlet 2 = Powered convenience outlet			Intake / Exhaust Options A = None B = Temp econo w/ baro relief F = Enthalpy econo w/ baro relief			Base Unit Controls 0 = Electromechanical 1 = PremierLink DDC controller 2 = RTU-MP multi protocol controller			Design Rev Factory assigned		
Voltage 1 = 575/3/60 3 = 208-230/1/60 5 = 208-230/3/60 6 = 460/3/60			Coil Options (Outdoor Coil - Indoor Coil) A = Al/Cu - Al/Cu B = Precoat Al/Cu - Al/Cu C = E coat Al/Cu - Al/Cu D = E coat Al/Cu - E coat Al/Cu E = Cu/Cu - Al/Cu F = Cu/Cu - Cu/Cu M = Al/Cu - Al/Cu - Louvered Hail Guards N = Precoat Al/Cu - Al/Cu - Louvered Hail Guards P = E coat Al/Cu - Al/Cu - Louvered Hail Guards Q = E coat Al/Cu - E coat Al/Cu - Louvered Hail Guards R = Cu/Cu - Al/Cu - Louvered Hail Guards S = Cu/Cu - Cu/Cu - Louvered Hail Guards			Indoor Fan Options 1 = Standard static option 2 = Medium static option 3 = High static option											



<http://www.docs.hvacpartners.com/idc/groups/public/documents/techlit/48tc-02pd.pdf>

Model number nomenclature

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4	8	T	C	D	A	0	4	A	1	A	5	-	0	A	0	A	0
Unit Heat Type 48 = Gas heat pkg rooftop			Tier / Model TC = Entry tier (with Puron refrigerant)			Heat Size D = Low heat E = Medium heat F = High heat L = Low NO _x , low heat M = Low NO _x , medium heat N = Low NO _x , high heat S = Stainless steel, low heat R = Stainless steel, medium heat T = Stainless steel, high heat			Refrig. System Options A = Standard refrigeration system			Cooling Tons 04 = 3 Ton 08 = 7.5 Ton 05 = 4 Ton 09 = 8.5 Ton 06 = 5 Ton 12 = 10 Ton 07 = 6 Ton			Brand / Packaging 0 = Standard 1 = LTL		
															Electrical Options A = None C = Non-fused disc D = Thru the base F = Non-fused & thru the base		
															Service Options 0 = None 1 = Unpowered convenience outlet 2 = Powered convenience outlet		
															Intake / Exhaust Options A = None B = Temp econo w/ baro relief F = Enthalpy econo w/ baro relief		
															Base Unit Controls 0 = Electromechanical 1 = PremierLink DDC controller 2 = RTU-MP multi protocol controller		
															Design Rev Factory assigned		

Energy Efficiency Opportunities

- **Retrofits**

- High efficiency units
- Evaporative cooling

- **Controls**

- Scheduling/reduce operating hours
- Programmable thermostats
- Economizer operation
- Demand control ventilation

- **Operations**

- Reduce cooling loads
- Keep units maintained

The opportunity: controls

- controls are generally the most cost effective of EEMs
- What ever doesn't have controls probably needs it
- Control reduce opportunity for human “enhancements”
- Limit hours of operation
- Use to maximize system efficient

Scheduling

- Mechanical time clocks
- Consider twist timers to reduce usage during off-hours
- Some have seasonal/astronomical timers and/or multiple channels



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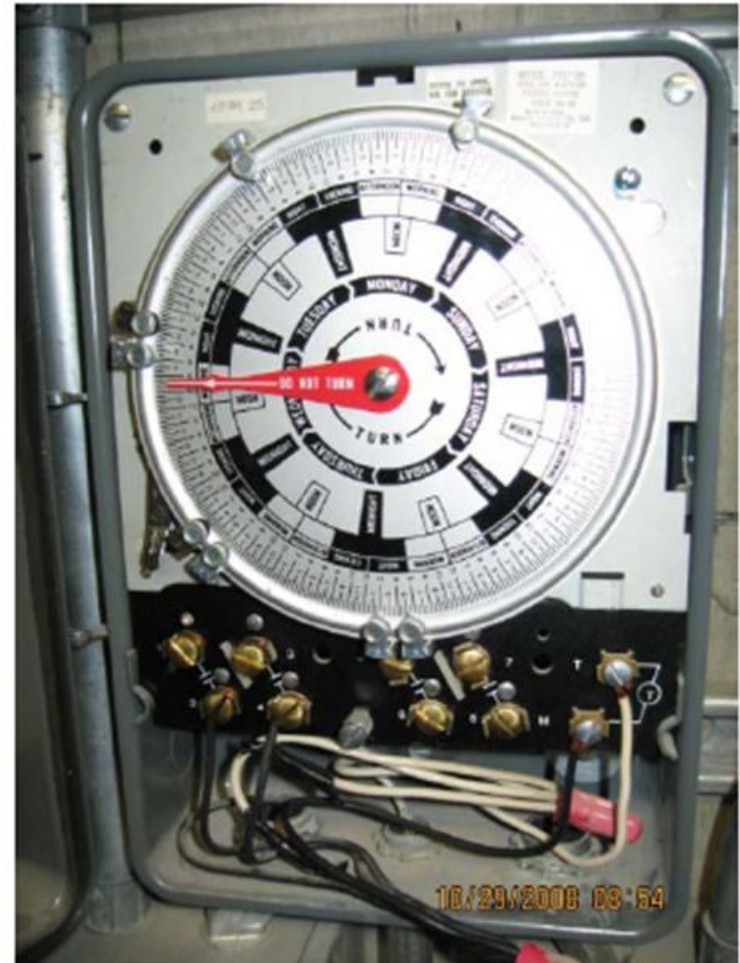
Setbacks and programmable thermostats

- Install programmable thermostats on all units
- Scroll through settings during audit



Commissioning is important!

Even with simple equipment



ENRG 55 A and B will cover more
comprehensive knowledge of HAVC

BEST Center Curricula, Resources & Recordings

Academic Programs

Georgia Piedmont Technical College - Building Automation Systems

Milwaukee Area Technical College - Sustainable Facilities Operations

Laney College - Commercial HVAC Systems

City College San Francisco - Commercial Building Energy Analysis & Audits

Professional Development Materials, Presentations & Videos

National Institutes

Building Automation Systems Instructor Workshops

Webinars (e.g., BEST Talks)

Faculty Profile Videos

Reports & Case Studies

Marketing Resources

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