
Ameren
MISSOURI

Understanding Manual J Load Calculations

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Energy Code Resources

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Energy Code Resources

Missouri Residential Building Energy Code Construction Practices Study:
https://energy.mo.gov/energy-codes/missouri-residential-building-codes-study
For additional information on other DOE Field Studies and participating states, please visit https://www.energycodes.gov/compliance/energy-code-field-studies.
Additional education resources are available at www.southfaceonlinetraining.org.

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About Southface

www.southface.org

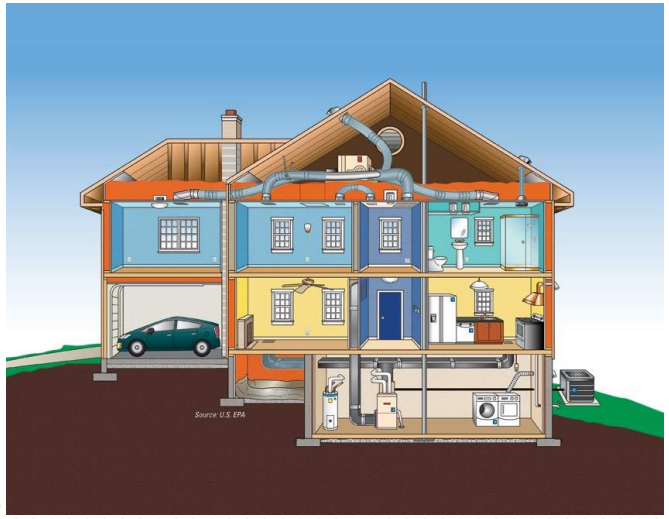
- Mike Barcik – Technical Principal
- mikeb@southface.org

Building a Regenerative Economy,
Responsible Resource Use & Social Equity
Through a Healthy Built Environment for All

Why building science?

- Employ scientific principles from a variety of fields that govern building performance
- Optimize building performance and understand, prevent and correct building failures
- Systems approach to houses
- Physics of
  - Heat
  - Air
  - Moisture

All efficiency measures should take occupants into account (e.g., air sealing & ventilation)



Who Are You?

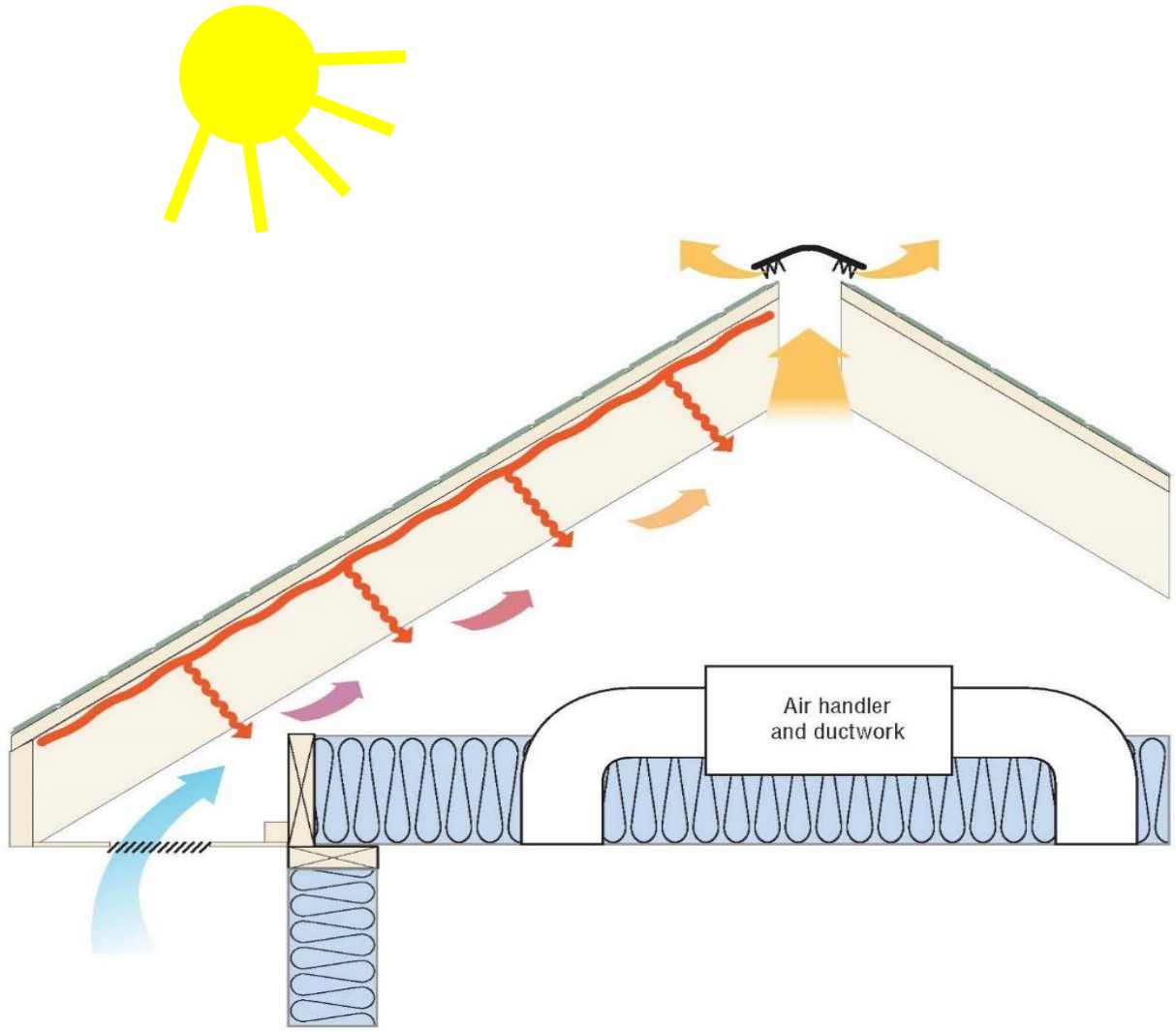
- Weatherization
- HERS Raters
- Code official
- Designer
- Contractor / Trades
- Utility
- Manufacturers / Product Rep
- Policy / Government
- Building Managers
- Home Inspectors
- Other?

Learning Objectives

- Identify code requirements regarding sizing, design, and selection of HVAC equipment and ducts
- Explain how the ACCA Manual J calculation standards are used to determine appropriate sizing of HVAC equipment
- Appreciate the consequences an improperly sized HVAC system has on moisture control and the effect excessive moisture has on building durability and occupant comfort and health
- Define sensible and latent heat
- Understand common errors and intentionally incorrect data inputs and see examples of such errors
- See software perform a load calculation

Building Science: Heat transfer

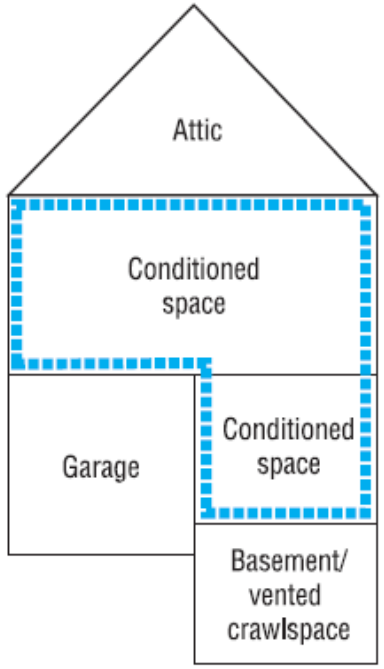
- Heat is a form of energy
- Heat moves from hot to cold
- 3 methods of heat transfer:
  - **Radiation:**
    Sun to shingles; underside of decking to other attic surfaces
  - **Conduction:**
    Through shingles and decking
  - **Convection:**
    Soffit vents through attic to ridge



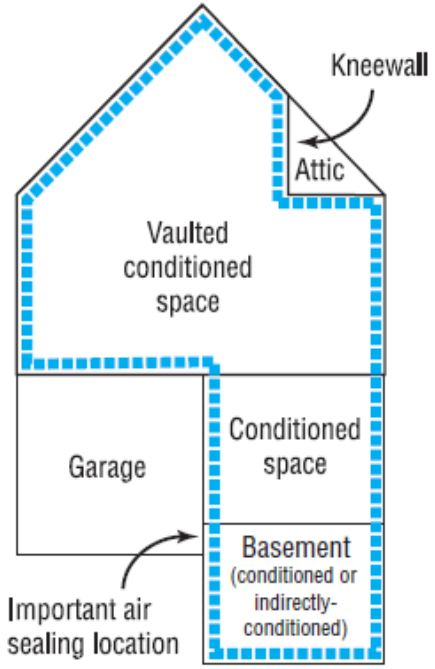
Building Thermal Envelope

- System and ducts inside building envelope
  - => Big impact on HVAC sizing and performance!

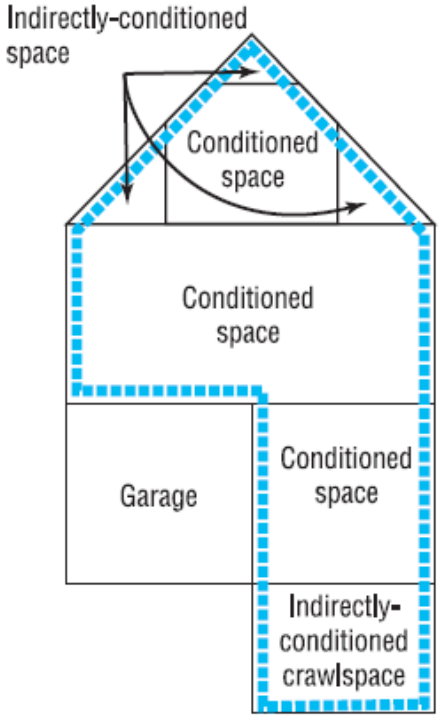
Example 1



Example 2



Example 3



HVAC 101 – Anatomy of a split System

- Air cooled by the A/C or warmed by the furnace is distributed throughout the home using an air handler
- This is a closed system
- Air is lost through leaks (convection)
- Energy is lost (conduction) through the ducts

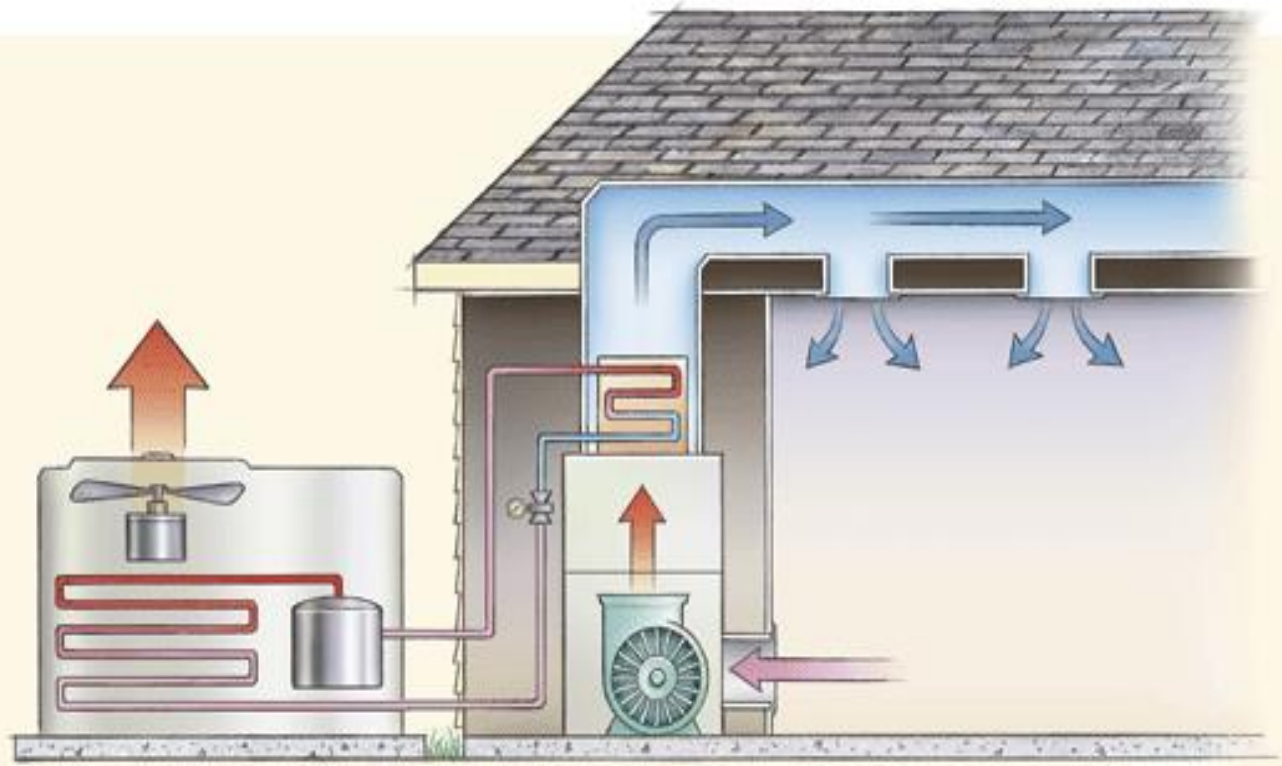


Image Credits: Don Mannes/Fine Homebuilding

HVAC Purpose

- The purpose of the HVAC system is to provide the occupants with a comfortable & healthy living environment
- It does more than just control air temperature
- It also provides moisture control
- Controlling RH is important for comfort, IAQ, and building durability
- Air filtering can be accomplished
- Ventilation may be a part

How Air Conditioning Removes Moisture

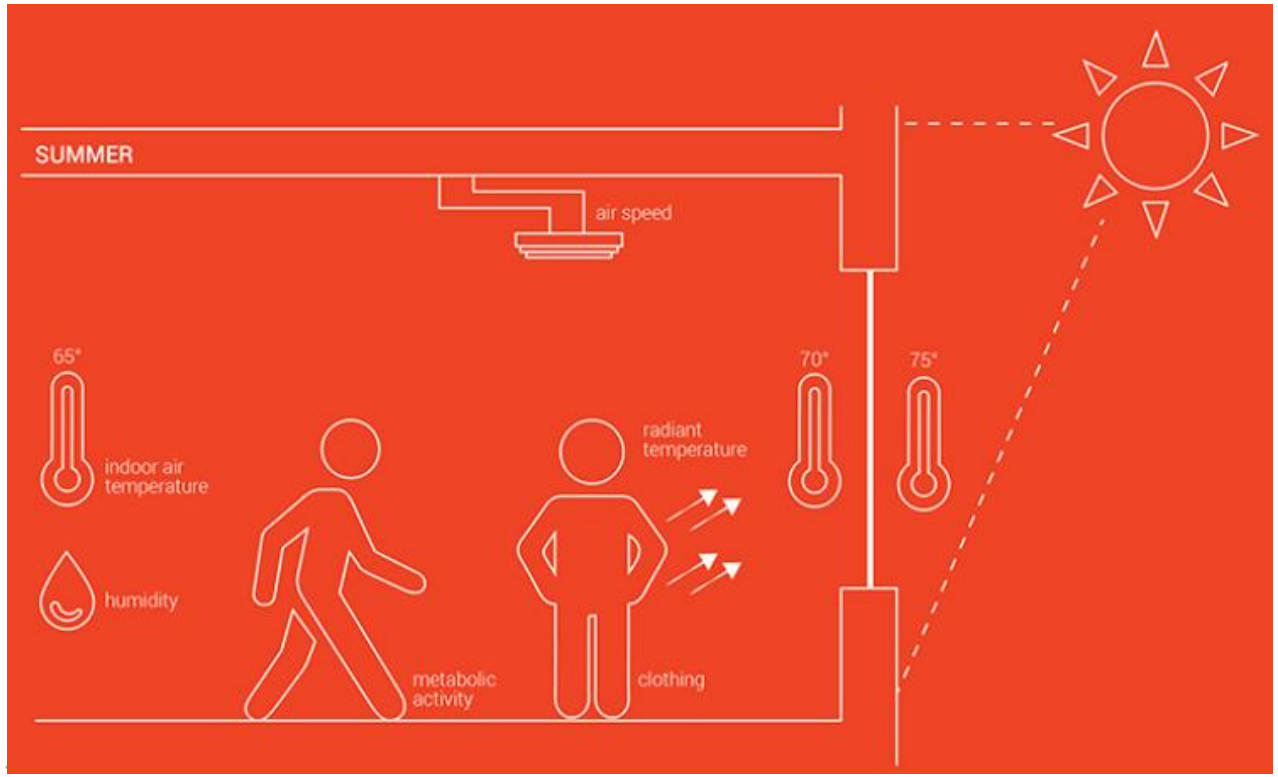
- Warm humid indoor air is blown across a cold coil
- Water vapor in the air condenses on the coil, collects, then exits the home through the condensate line
- This process takes time
- Oversized systems reach the thermostat set point before moisture is removed from home

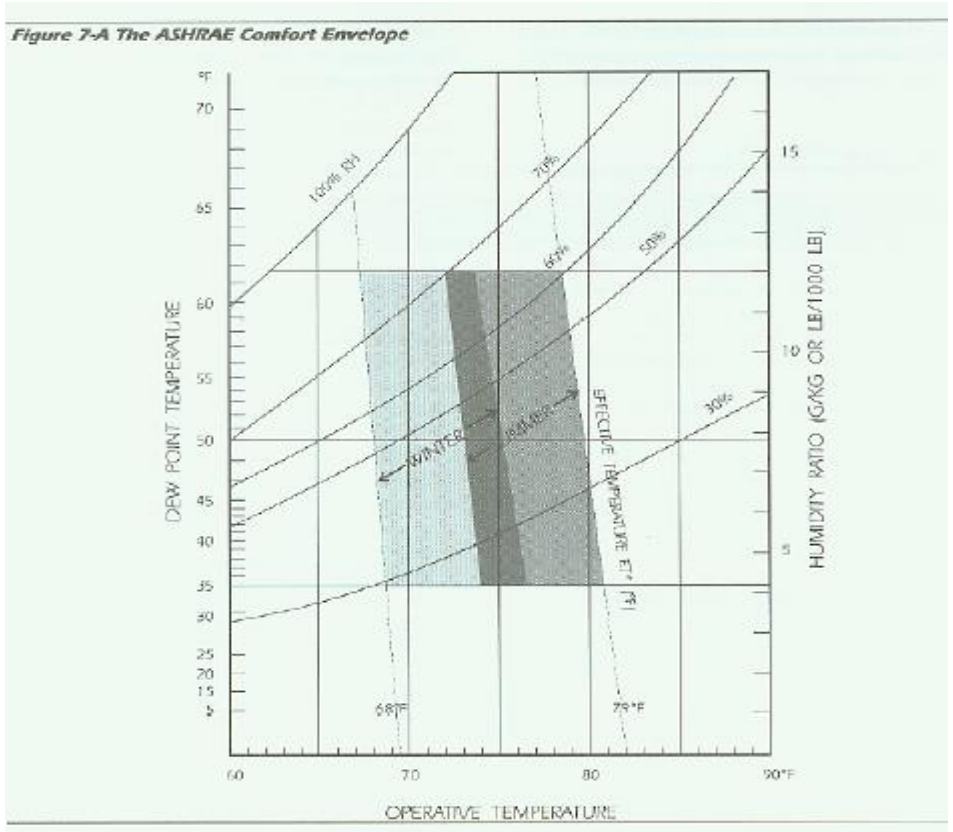
Moisture and comfort

- Human Thermal Comfort:
- Humans make poor thermometers
- Our sense of hot or cold is based on the rate heat is leaving or entering our bodies
- This is affected by a variety of factors – not just ambient air temperature
- Since we regulate our body temperature by perspiration, our comfort level is affected by the moisture level in the air around us

Moisture and comfort

Human indoor comfort is actually a pretty narrow target



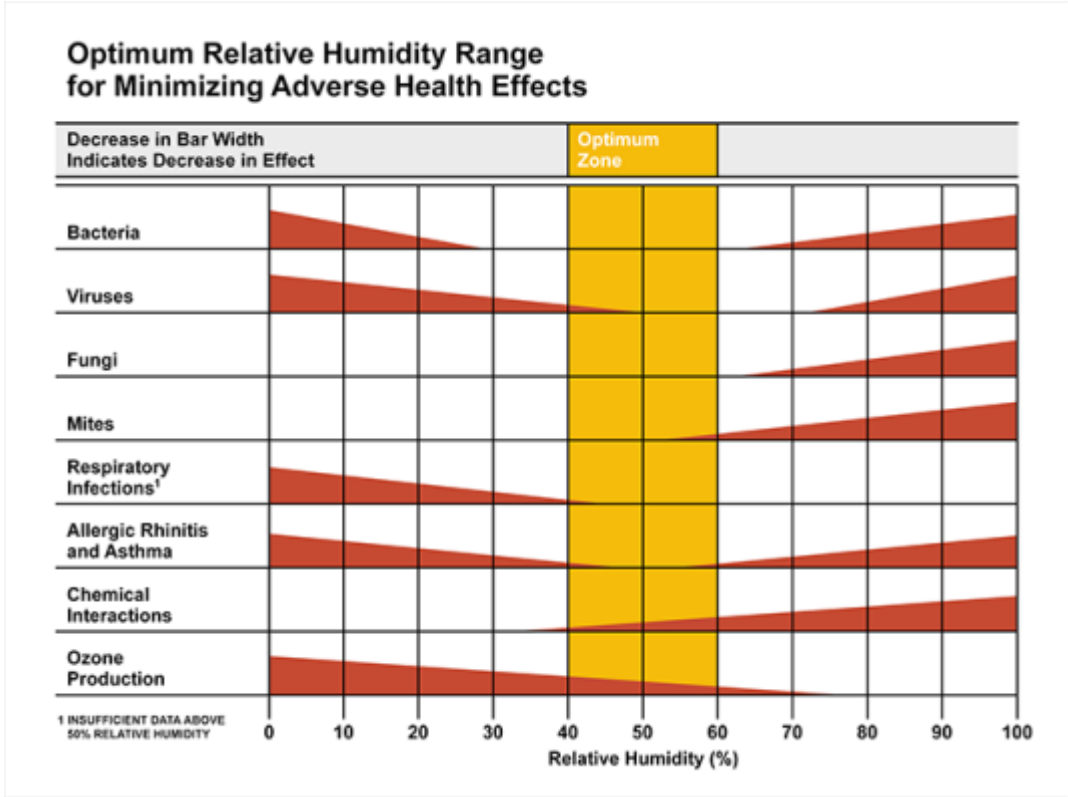


@50% RH, 30 fpm airflow	
Winter	68-74 °F
Summer	73-79 °F

Moisture and indoor air quality

- Ideal Health & Comfort is **~50% RH** at room temperature (~72°F)

- Building decay 100% RH
- Interior Mold RH > 70%
- Dust Mites RH > 50%
- Viruses RH < 40%
- Static electricity, dry sinus RH < 25%



Types of Cooling Load

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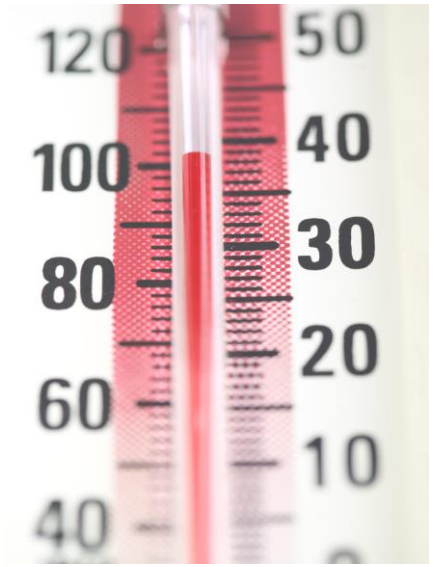
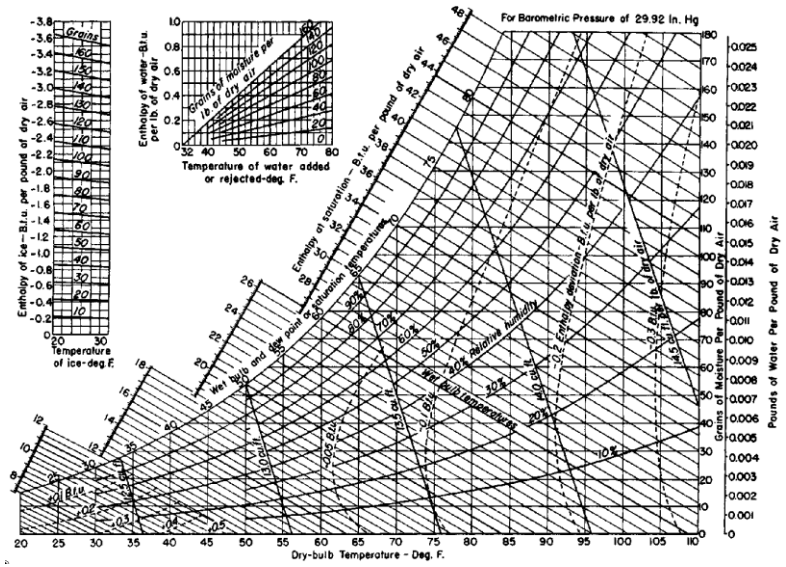
Sensible vs. Latent

Total = Sensible + Latent

Sensible Load



Latent Load



SHR = Sensible / Total

AHRI CERTIFIED™ www.ahridirectory.org

Certificate of Product Ratings

AHRI Certified Reference Number: 3251832 Date: 3/9/2011

Product: Split System: Air-Cooled Condensing Unit, Coil with Blower
Outdoor Unit Model Number: 24ABB442(A,W)30
Indoor Unit Model Number: CNPH*4221A**
Furnace Model Number: 58CV(A,X)070-12
Manufacturer: CARRIER AIR CONDITIONING
Trade/Brand name: BASE 14 PURON AC

Manufacturer responsible for the rating of this system combination is CARRIER AIR CONDITIONING

Rated as follows in accordance with AHRI Standard 210/240-2008 for Unitary Air-Conditioning and Air-Source Heat Pump Equipment and subject to verification of rating accuracy by AHRI-sponsored, independent, third party testing:

Cooling Capacity (Btuh):	39500
EER Rating (Cooling):	12.00
SEER Rating (Cooling):	14.00

Indoor/Outdoor Coil Match!

* Ratings followed by an asterisk (*) indicate a voluntary rerate of previously published data, unless accompanied with a WAS, which indicates an involuntary rerate.

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AHRI Air-Conditioning, Heating, and Refrigeration Institute

CERTIFICATE NO.: 129441915646465776

HVAC and Moisture

It's not the heat, it's the humidity

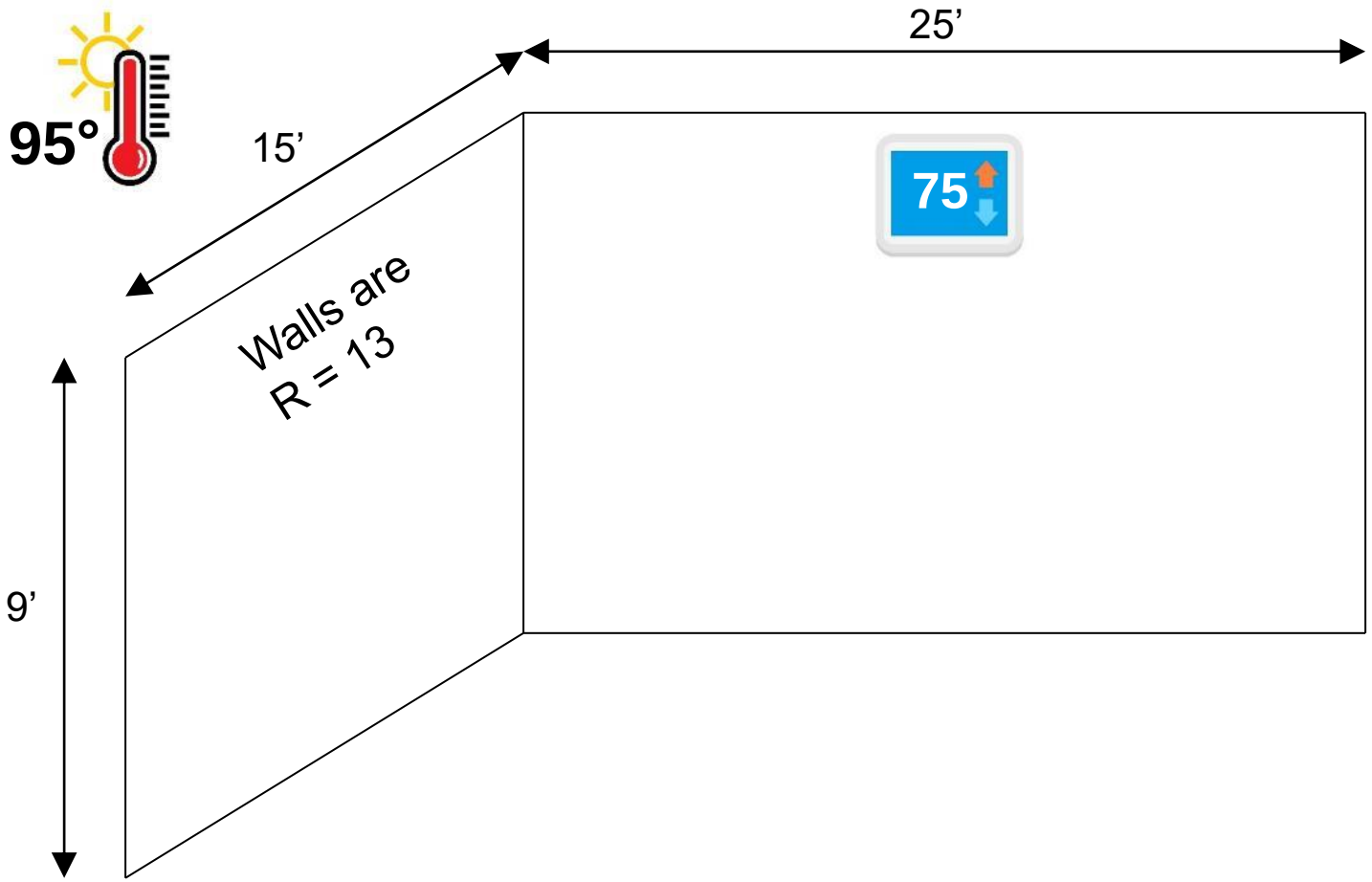
Atlanta, GA									
Bin Temperature	70-75	75-80	80-85	85-90	90-95	95-100	100-105	105-110	Total
# of Hours of Occurrence	1188	880	620	361	172	23	2	0	3246
	37%	27%	19%	11%	5%	1%	0%	0%	
	83%			**17%**					
Manual J Design, Load based on Temperature					92°	99	gr/lb		
ASHRAE Humidity Design, Load based on Moisture					82°	133	gr/lb		
Approximate Extra Moisture Added per 100 CFM Of O.S.A.					3.9	pts/hr	or	93.9	pts/day

Supply Air to house

Fresh, Outside Air

Return Air from house

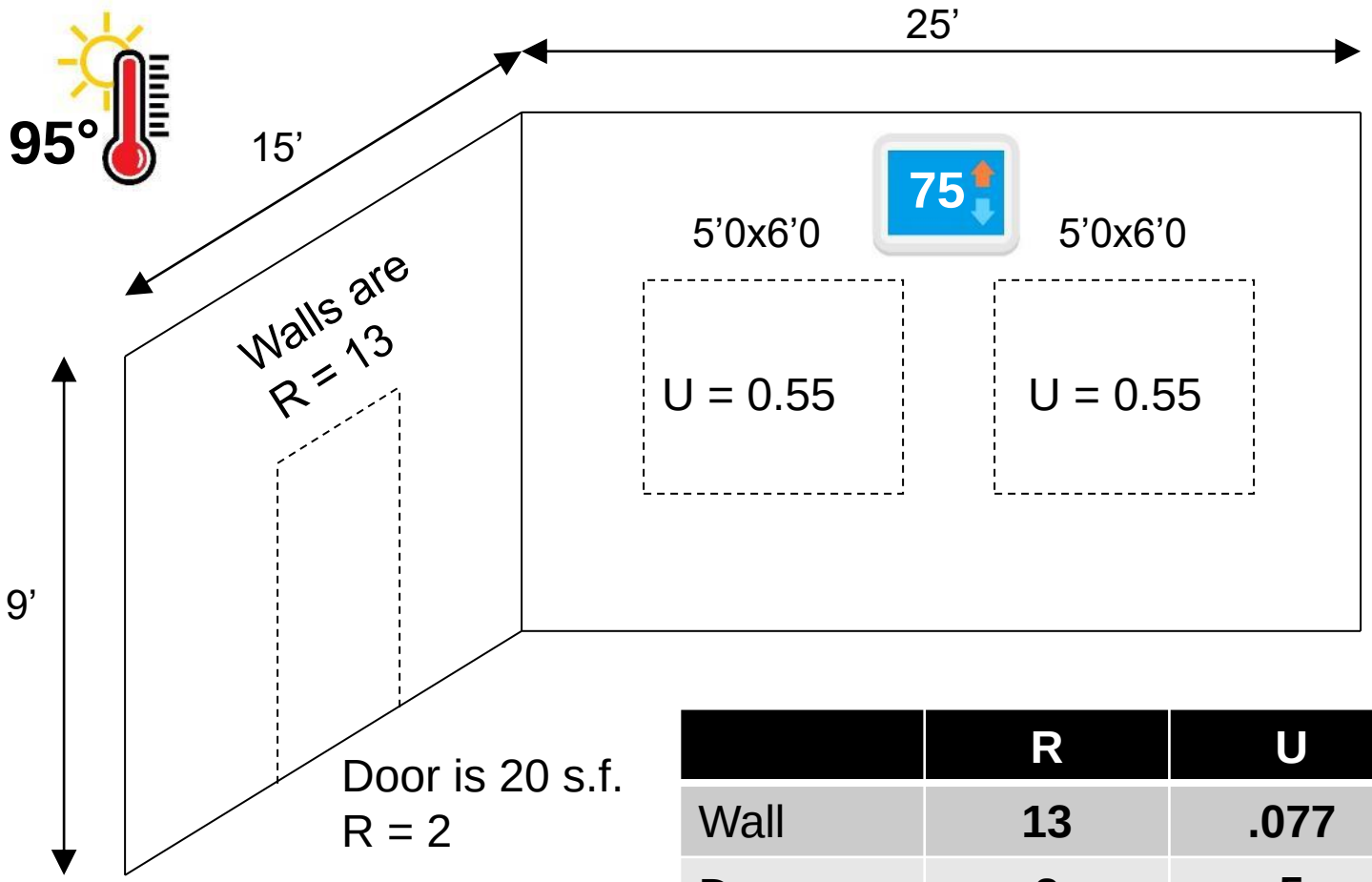
Solid Wall Area Example



(1/13) x 360 x 20 = **554 Btu/h**

$$q = U \times A \times \Delta T$$

Net Wall Area Example



(1/13) x 360 x 20 = **554**

$$q = U \times A \times \Delta T$$

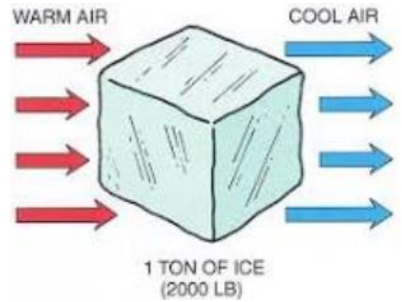
	R	U	Area	Delta T	q
Wall	**13**	**.077**	**280**	**20**	**431Btu/hr**
Door	**2**	**.5**	**20**	**20**	**200Btu/hr**
Window		**.55**	**60**	**20**	**660Btu/hr**

1291 Btu/hr

Equipment Sizing

HVAC Sizing & Selection Process

1 ton = 12,000 Btu/hr



- ACCA Manual J & S are the code required methods used to size and select heating & cooling equipment
  - Manual J – used to determine heating & cooling loads of home
  - Manual S – used to select equipment based upon Manual J

Air Conditioning Contractors of America

Man J Total Cooling Load: 28kBtu/h
(22k is Sensible, 6k is Latent)
[SHF = 22/28 = 0.79]

Option A: 29 kBtu/h
(24k is Sensible, 5k is Latent)

Option B: 35 kBtu/h
(29k is Sensible, 6k is Latent)

Option C: 29 kBtu/h
(22k is Sensible, 7k is Latent)

403.7 Equipment Sizing –

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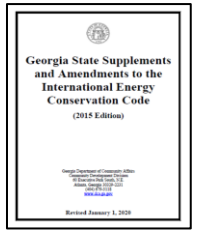
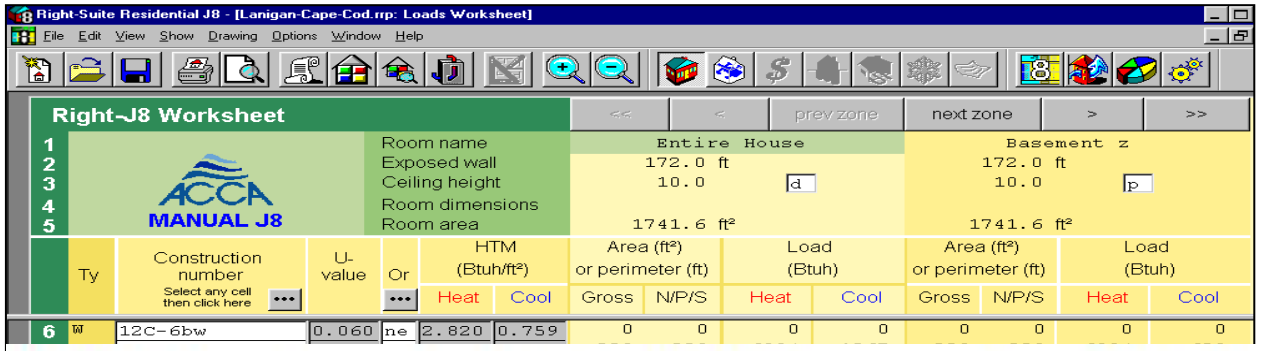
- Load Calcs & Sizing
  - ACCA Manual J or approved equivalent, i.e., ASHRAE Fundamentals
  - 302.1: Interior design temp (72ºF heating, 75ºF cooling)
  - **MUST BE ACCURATE**



GA Amendment for Variable Capacity



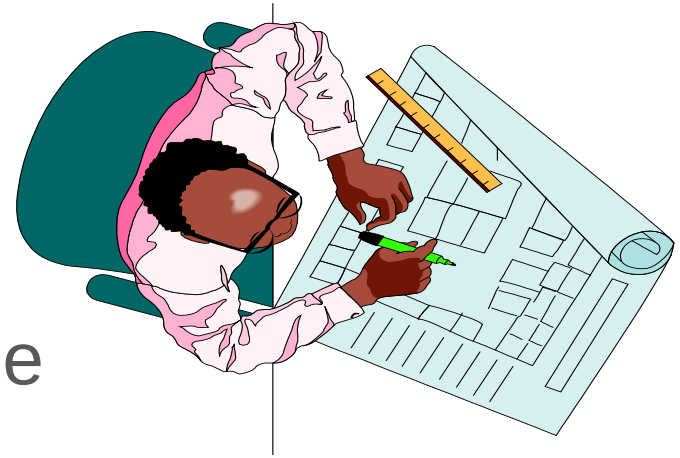
R403.7 Equipment sizing and efficiency rating (Mandatory). Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

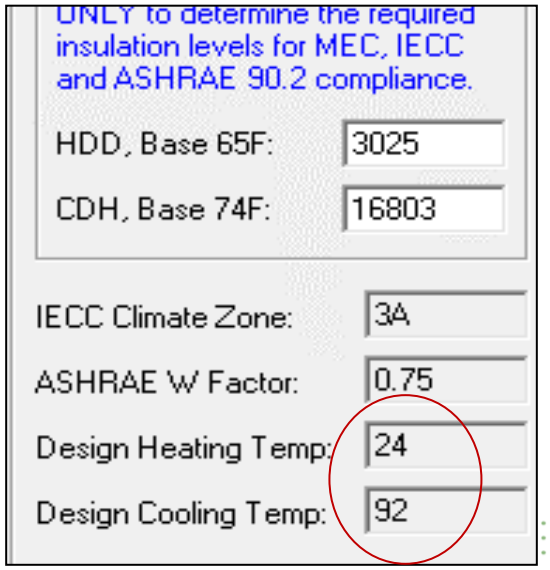
"For automatically modulating capacity heating and cooling equipment, the system shall be deemed to comply with appropriate portions of Manual S provided the lowest output capacity of the equipment is less than the peak design load as determined by

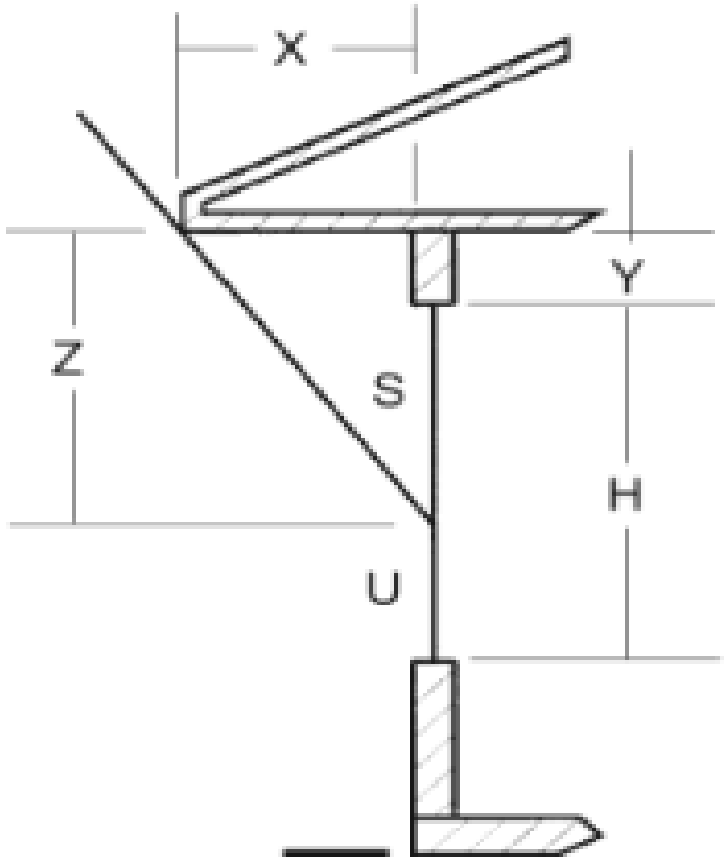
New or replacement heating and cooling equipment shall have an efficiency rating equal to or greater than the minimum required by federal law for the geographic location where the equipment is installed.

How Does Manual J work?

- Location
- Orientation
- Envelope
- Duct & envelope tightness
- Internal gains
- Ventilation







Manual J

FORM J1$_{AE}$ • ABRIDGED VERSION of MANUAL J, 8TH EDITION

Project		Design State & City	Georgia	Atlanta AP			
Indoor Design Heating db	70	Outdoor (Winter) 99% db	23	HTD	47		
Indoor Design Cooling db	75	Outdoor (Summer) 1% db	91	CTD	16		
Indoor Design Cooling RH	50%	Grains Difference	37	Daily Range	Medium		
Latitude	33	Elevation	1010	ACF	0.970		

		Glass Direction	Construction Detail	Heating HTM	Cooling HTM	Net Area	Block Load Heating BTUH	Block Load Cooling BTUH	Room-- Net Area	Room-- BTUH Heating	Room-- BTUH Cooling	Room-- Net Area	Room-- BTUH Heating	Room-- BTUH Cooling	Room-- Net Area
6A	Windows & Glass Doors														
6B	Skylights														
7	Wood & Metal Doors	a													
		b													
		c													
8	Above Grade Walls	a													
		b													
		c													
		d													
		e													
	Partition Walls	f													
		g													
9	Below Grade Walls	a													
		b													
10	Ceilings	a													
		b													
		c													
	Partition Ceilings	d													
		e													
11	Passive Floors	a													
		b													
	Exposed Floors	c													
	Slab (Perimeter Ft.)	d													
	Basement Floor	e													
	Partition Floors	f													
		g													
12	Infiltration	Envelope Leakage: Average	Heated & Cooled Floor Area = Sq. Ft.		Above Grade = Cu. Ft.				WAR	#DIV/0!		WAR	#DIV/0!		WAR
		No. of Fireplaces							#DIV/0!		#DIV/0!	#DIV/0!		#DIV/0!	#DIV/0!
13	Internal Gains	Number of Bedrooms: 3			Occupants: 4			#VALUE!							
		Appliance - 1200 BTUH						#VALUE!							

Enter Company Name Here
Enter Company Address Here
Enter Company City, State and Zip Code Here
Enter Company Phone Numbers Here
Enter Website or Email Address Here

21

Climate and Energy Efficiency

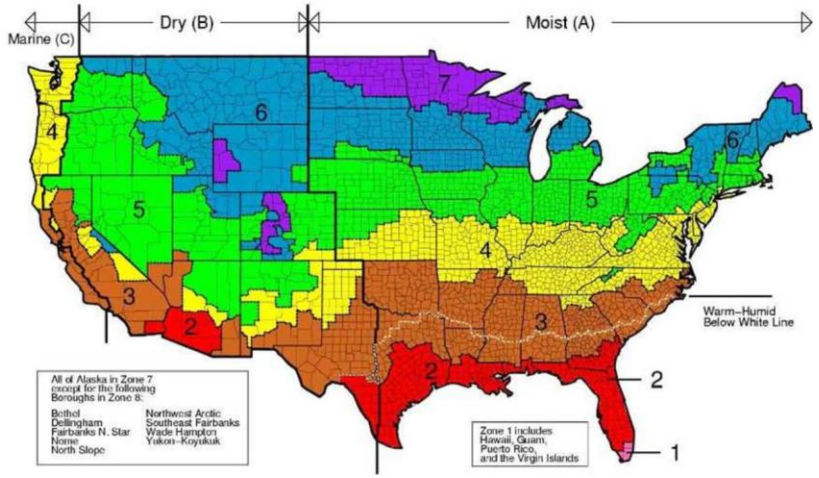
Design Temperatures

- Heating, for 99% of the season the outdoor temperature is above this value
- Only 1% of the Cooling season is hotter than this temperature

Design Temp Example

- St. Louis Winter **70** – 14 = 56 F ΔT
- St. Louis Summer 91 – **75** = 16 F ΔT

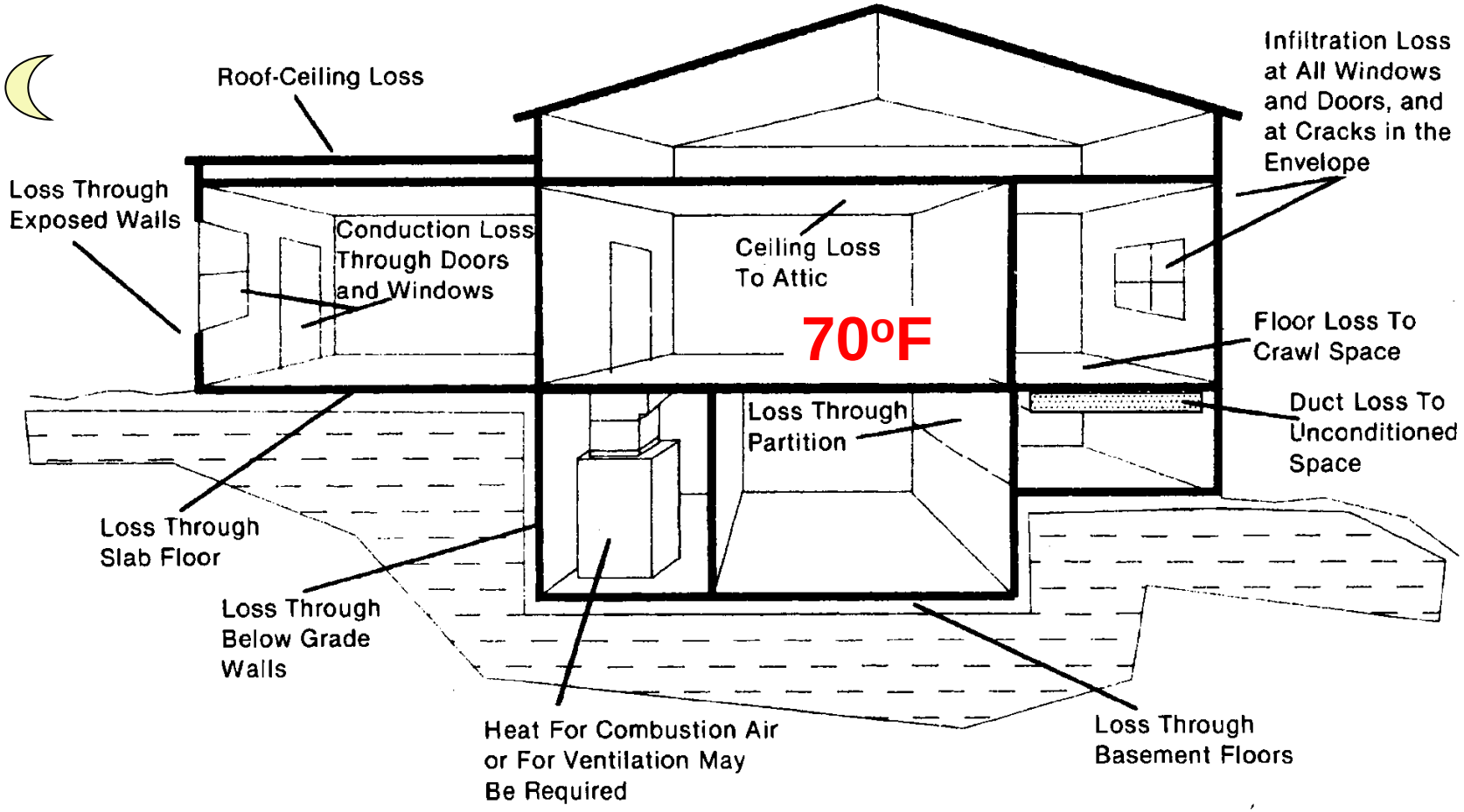
Design Temps	W / S
Atlanta	24/92
St. Louis	14/91
Fairbanks	-40/78
Miami	51/90



Load Calcs & Energy Code

- IECC Section 302.1: Interior design temperatures (up to 72°F heating, minimum 75°F cooling)
- "Heating and cooling equipment shall be sized in accordance with Section M1401.3"
- "Heating and cooling equipment shall be sized in accordance with **ACCA Manual S** based on building loads calculated in accordance with **ACCA Manual J** or other approved heating and cooling calculation methodologies."- 2015/18 IECC R403.7

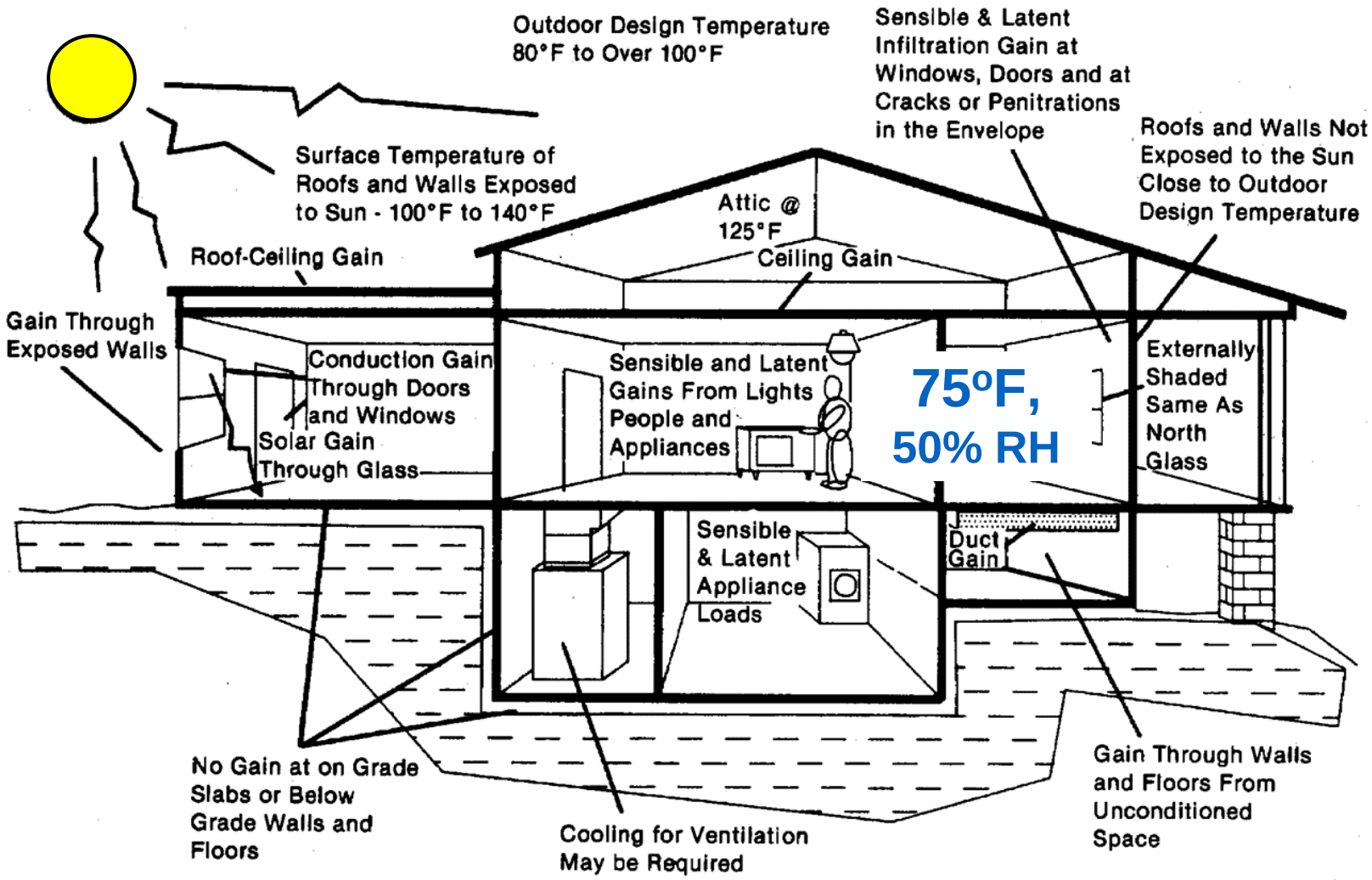
Manual J - Winter Loads



Winter Outdoor Design Temp

14ºF

Manual J - Summer Loads



Summer Outdoor Design Temp

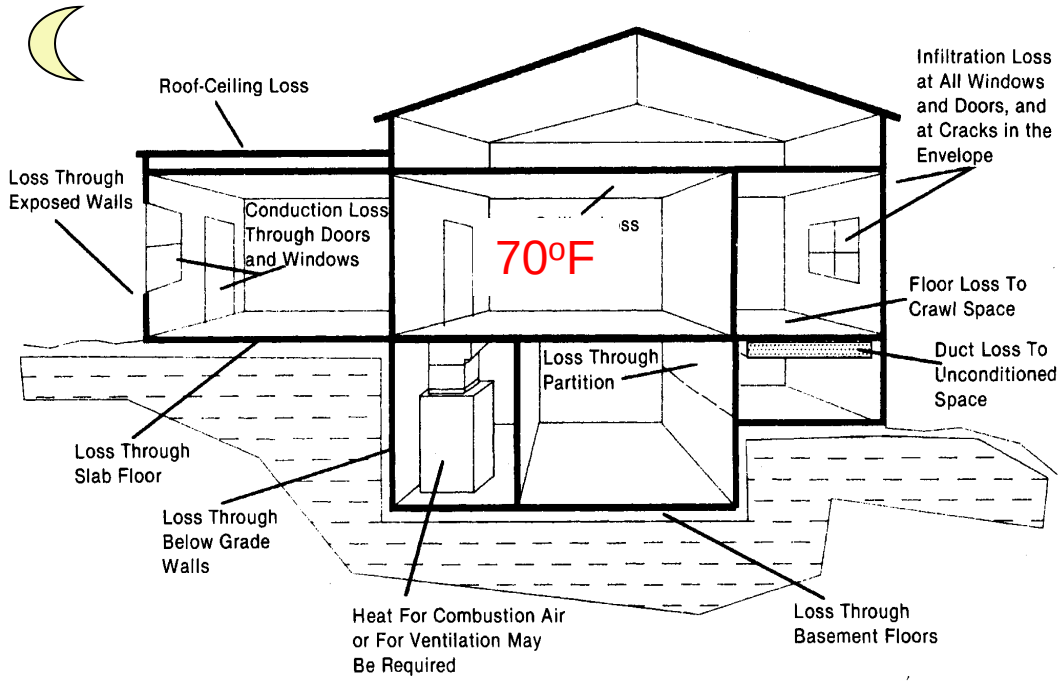
91°F

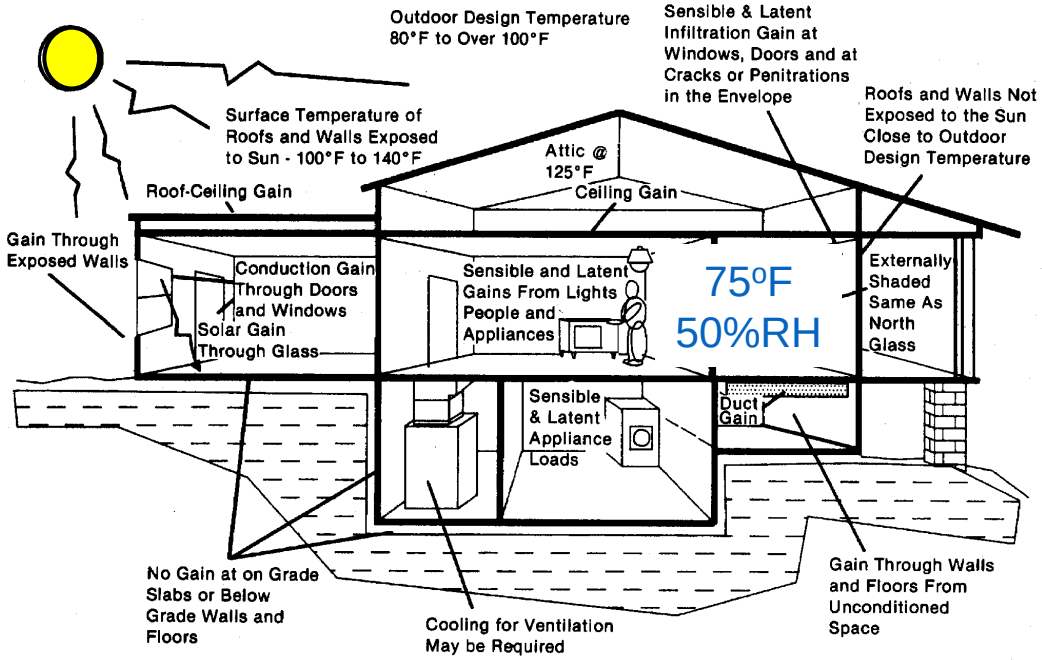
Manual J – Load Calculations

Winter Outdoor Design Temp

Load calcs are required, but there are no details about who is qualified to perform them. Enforcement varies greatly!!

Summer Outdoor Design Temp





Manual J Software

Right-Suite Residential J8 - [Lanigan-Cape-Cod.rrp: Loads Worksheet]

File Edit View Show Drawing Options Window Help

Right-J8 Worksheet

<< < prev zone next zone > >>

ACCA MANUAL J8

			Entire House	Basement z
1		Room name	Entire House	Basement z
2		Exposed wall	172.0 ft	172.0 ft
3		Ceiling height	10.0 d	10.0 p
4		Room dimensions		
5		Room area	1741.6 ft²	1741.6 ft²

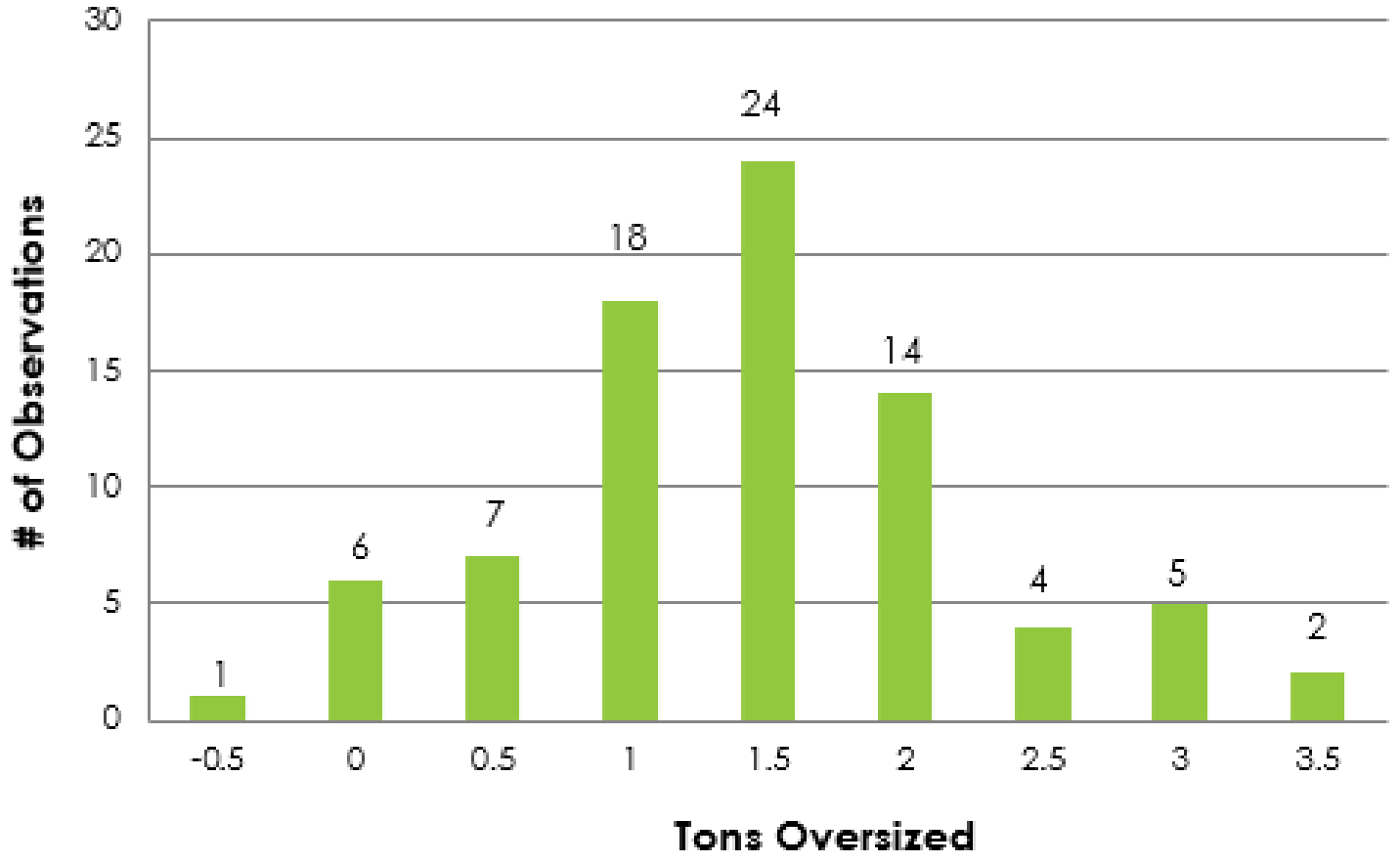
	Ty	Construction number (Select any cell then click here)	U-value	Or	HTM (Btuh/ft²) Heat	HTM (Btuh/ft²) Cool	Area (ft²) or perimeter (ft) Gross	Area (ft²) or perimeter (ft) N/P/S	Load (Btuh) Heat	Load (Btuh) Cool	Area (ft²) or perimeter (ft) Gross	Area (ft²) or perimeter (ft) N/P/S	Load (Btuh) Heat	Load (Btuh) Cool
6	W	12C-6bw	0.060	ne	2.820	0.759	0	0	0	0	0	0	0	0
.	W	15B-0c-6	0.488	ne	13.07	2.996	523	523	6834	1567	523	523	6834	658
.	W	12C-6bw	0.060	se	2.820	0.759	0	0	0	0	0	0	0	0
.	W	15B-0c-8	0.488	se	8.986	1.498	333	333	2992	499	333	333	2992	343
11	W	12C-6bw	0.060	sw	2.820	0.759	0	0	0	0	0	0	0	0
	W	15B-0c-6	0.488	sw	13.07	2.996	523	523	6834	1567	523	523	6834	1332
	W	12C-6bw	0.060	nw	2.820	0.759	333	209	588	158	333	209	588	132
	G	1D-c2ow	0.550	nw	25.85	34.40	83	0	2157	2871	83	0	2157	6231
	G	10B-w	0.600	nw	28.20	18.13	41	0	1156	743	41	0	1156	1482
	C	16B-28md	0.034	-	1.598	1.770	0	0	0	0	0	0	0	0
	F	22A-vpm	1.180	-	55.46	0.000	330	55	3050	0	330	55	3050	0
	F	21A-28t	0.022	-	1.034	0.000	1411	116	1459	0	1411	116	1459	0
	Total room load								32493	9408			32493	12629
	Air required (cfm)								467	467			467	627

Why is sizing important?

- Equipment first-cost
- Longer/more efficient run times
- Limits equipment cycling
- Better dehumidification

Installed AC Units

Tons Oversized



MO Equipment Sizing Study

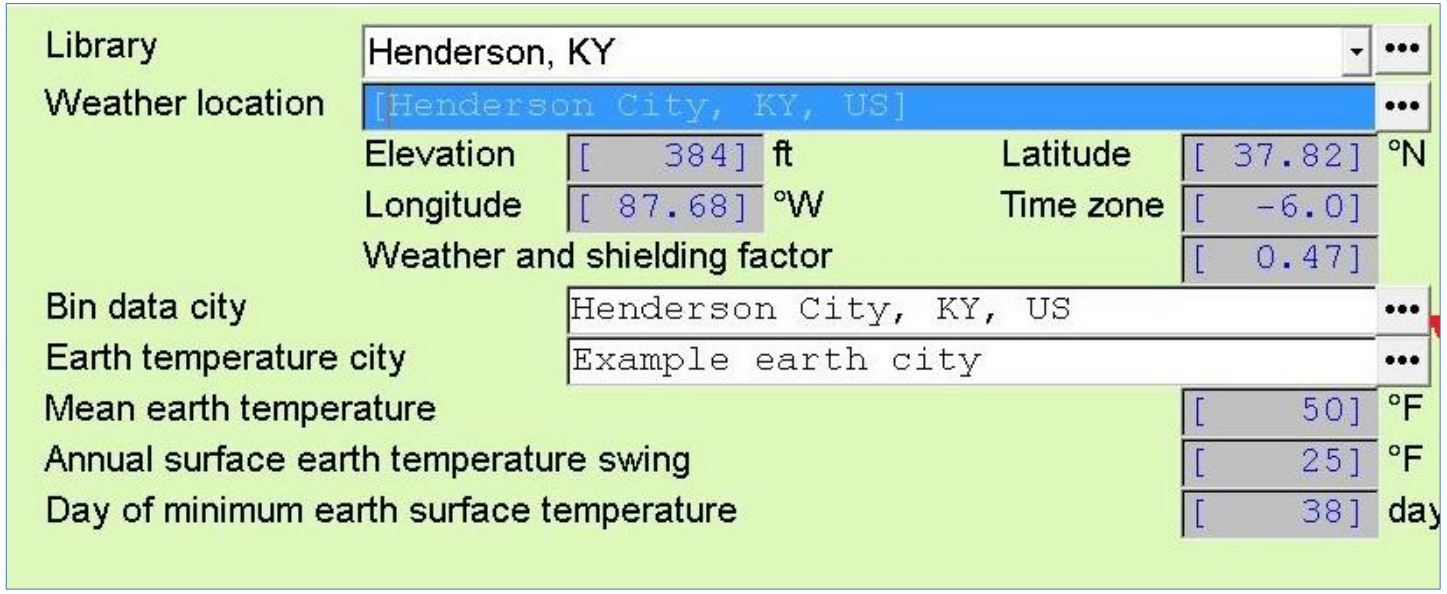
Common Problems with Manual J Inputs

- Manual Js are often not correct – both intentionally & unintentionally
- The results of a Manual J are only as meaningful as the input data (“GIGO”)
- Several common input errors are often found

The Usual Suspects

- Design temperatures
- Building orientation
- Number of occupants
- Window area & U-value
- Air leakage
- Wrong areas

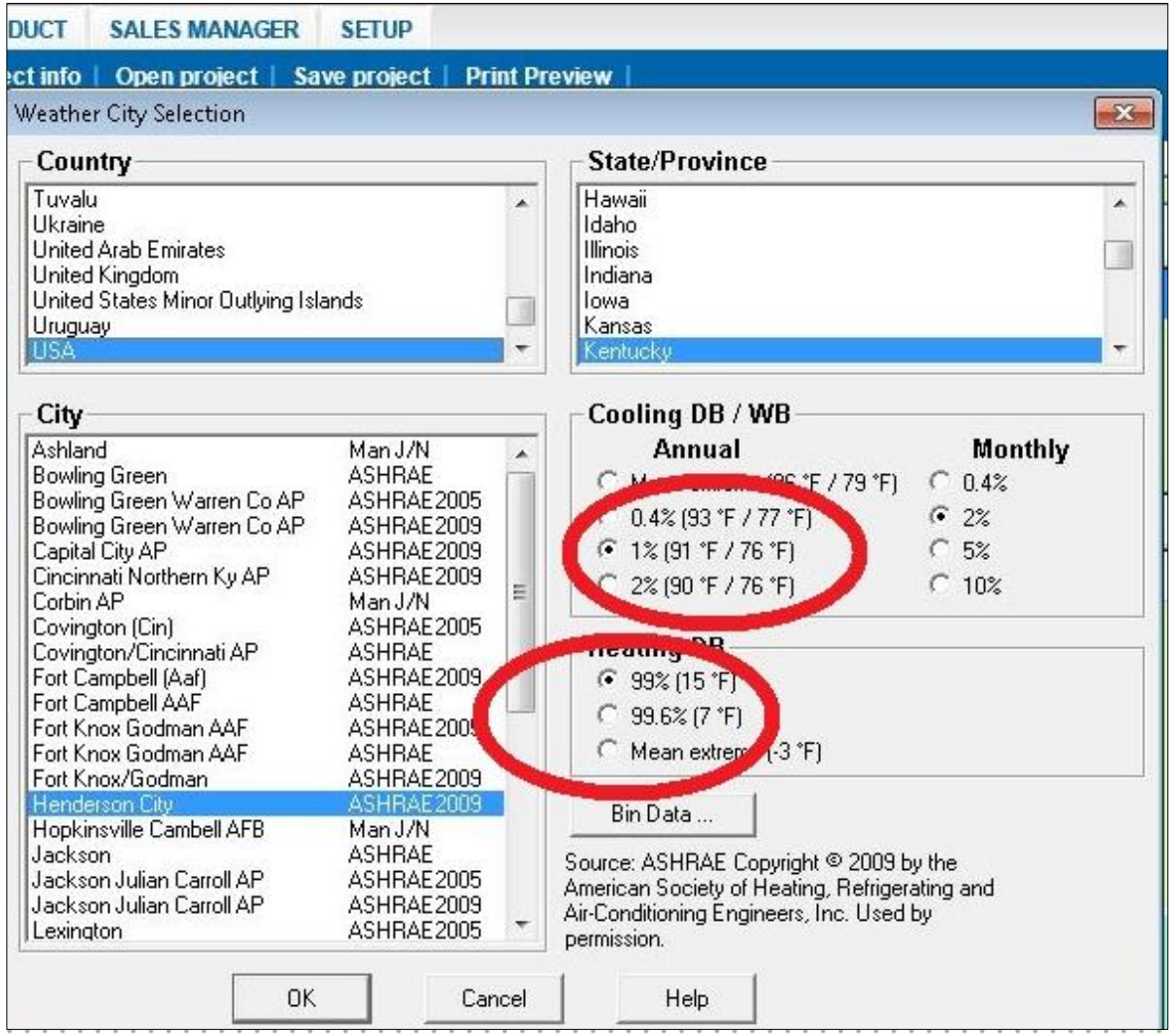
Outdoor Design Conditions



- The location & design temperatures should be accurately entered into the software
- Typically, city is selected from a menu

Outdoor Design Conditions

- Outdoor design temps are listed in a table in Manual J & within approved software databases
- The 1% & 99% design conditions should be used
- Technicians could override inputs to adjust results



MO - Outdoor Design Conditions

Location	Elevation	Latitude	Winter	Summer					
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
Missouri									
Cape Giradeau	341	37	13	94	77	44	51	57	M
Columbia AP	778	39	5	92	75	34	41	47	M
Farmington AP	946	37	8	93	75	33	40	46	M
Hannibal	712	39	3	93	76	39	46	52	M
Jefferson City	770	38	7	95	74	23	30	36	M
Joplin AP	980	37	11	94	75	31	38	44	M
Kansas City AP	791	39	4	93	75	33	40	46	M
Kirksville AP	966	40	0	93	74	27	34	40	M
Mexico	823	39	4	94	74	25	32	38	M
Moberly	867	39	3	94	74	25	32	38	M
Poplar Bluff	479	36	13	92	76	41	48	54	M
Rolla	987	38	9	91	75	36	43	49	M
St. Joseph AP	825	39	2	93	76	39	46	52	M
St. Louis AP	535	38	8	93	75	33	40	46	M
St. Louis CO	580	38	8	94	75	31	38	44	M
Sedalia, Whiteman AFB	909	38	4	92	76	41	48	54	M
Sikeston	315	36	15	95	76	36	43	49	M
Spickard/Trenton	886	40	6	93	73	20	27	33	M
Springfield AP	1268	37	9	92	74	28	35	41	M
Warrensburg, Whiteman AFB	869	38	7	93	76	39	46	52	M

Indoor Design Conditions

- ACCA specifies 70° for heating and 75° & 50% RH for cooling

Design Information

Weather: Atlanta Hartsfield Intl AP, GA, US

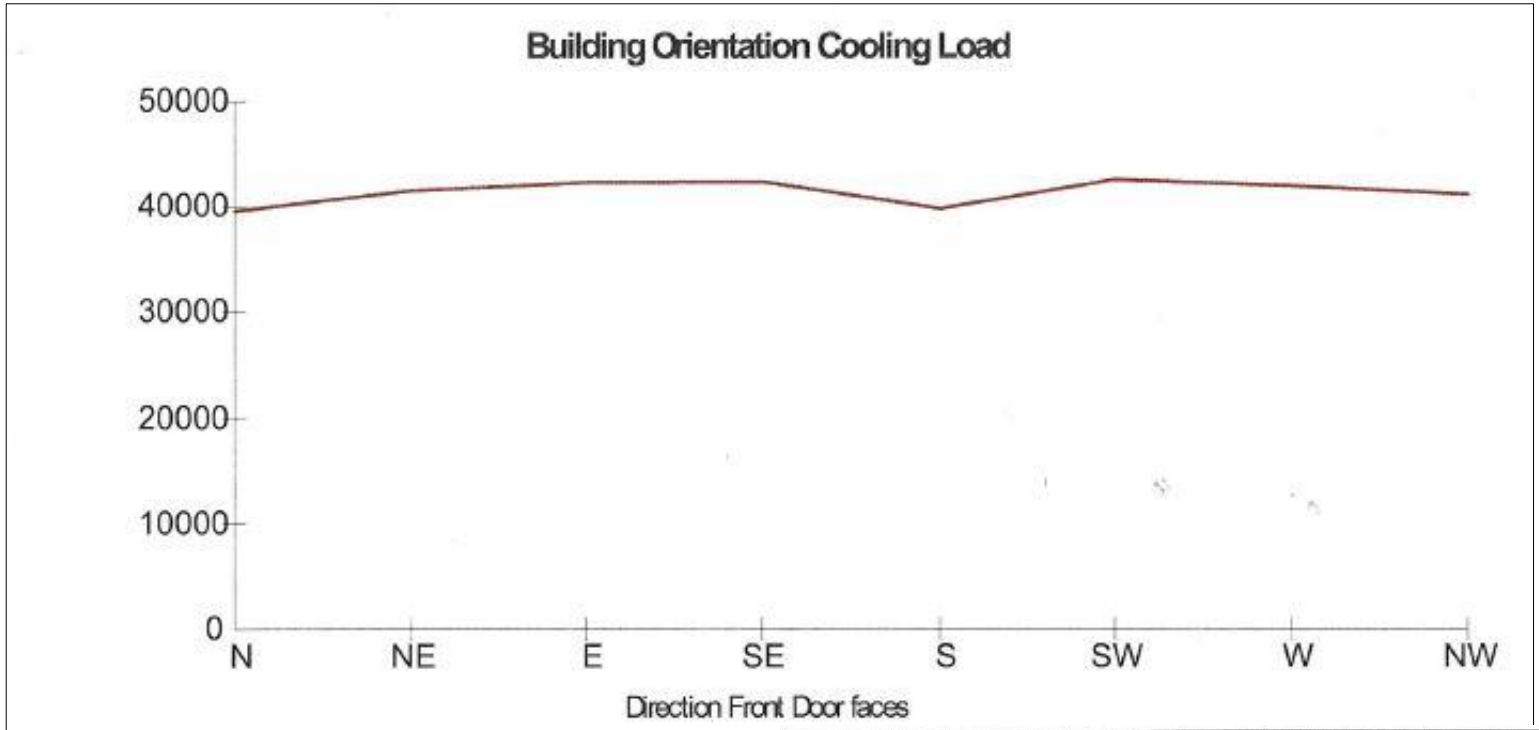
Winter Design Conditions			Summer Design Conditions		
Outside db	26	°F	Outside db	92	°F
Inside db	70	°F	Inside db	72	°F
Design TD	44	°F	Design TD	20	°F
			Daily range	M	
			Relative humidity	50	%
			Moisture difference	43	gr/lb

These numbers are often subjectively adjusted!

SECTION 302
DESIGN CONDITIONS

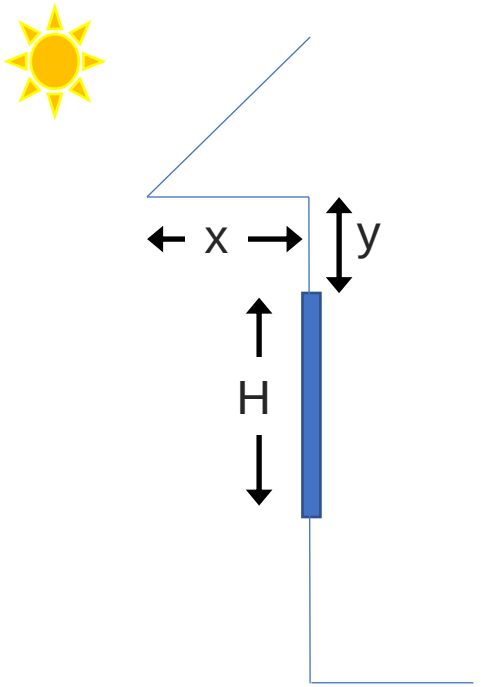
302.1 Interior design conditions. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

Orientation



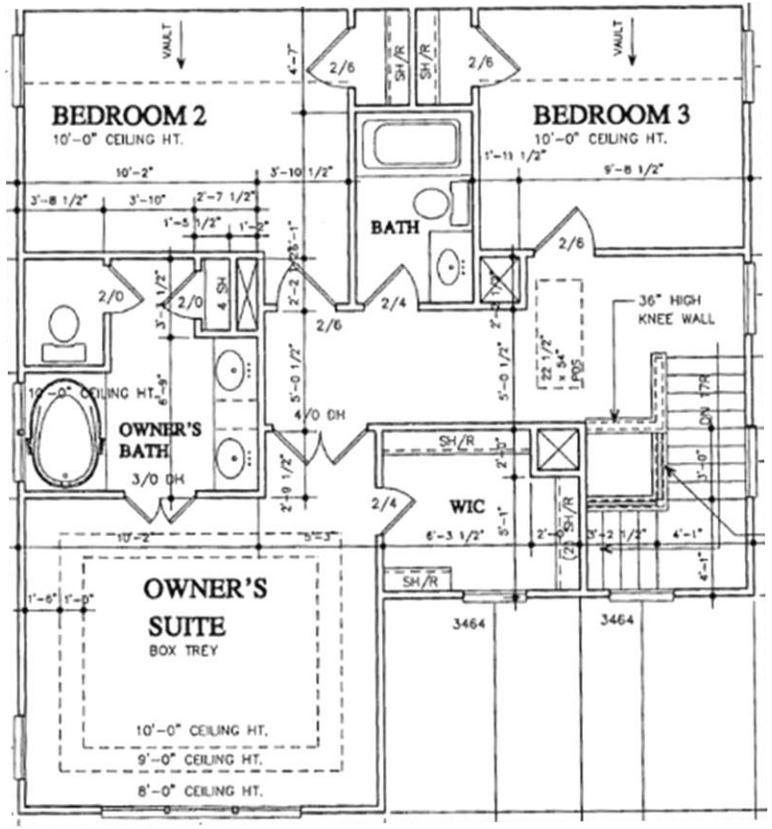
Current Orientation: Front Door faces East
Highest Cooling Load: Front Door faces Southwest

Front Door	North	Northeast	East	Southeast	South	Southwest	West	Northwest
Sensible Load (Btuh)	32977	34914	35665	35777	33215	35962	35340	34543
Latent Load (Btuh)	6559	6569	6576	6569	6562	6576	6610	6572
Total Load (Btuh)	39537	41483	42242	42345	39777	42538	41950	41115
Heating AVF (cfm)	1777	1809	1829	1808	1787	1829	1847	1818
Cooling AVF (cfm)	1777	1809	1829	1808	1787	1829	1847	1818

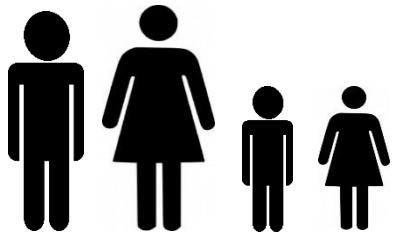


- The heating & cooling loads on a house are dependent on the orientation, especially for windows
- Compare the orientation listed on Manual J documentation to the actual orientation of the home

Number of Occupants



- Occupants represent internal gains
- ACCA specifies to use the number of bedrooms plus one
- For example, a three bedroom house should have four occupants entered into the Manual J



Q: How many Btuh does Manual J assume for each person?

A: 230 Btuh Sensible +200 Latent

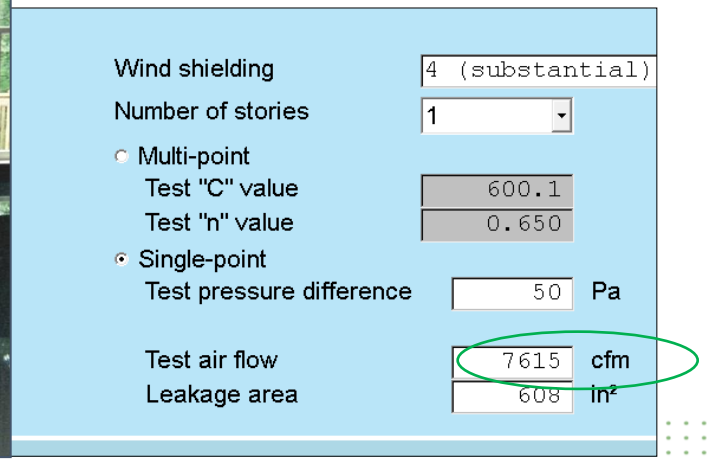
Construction Components

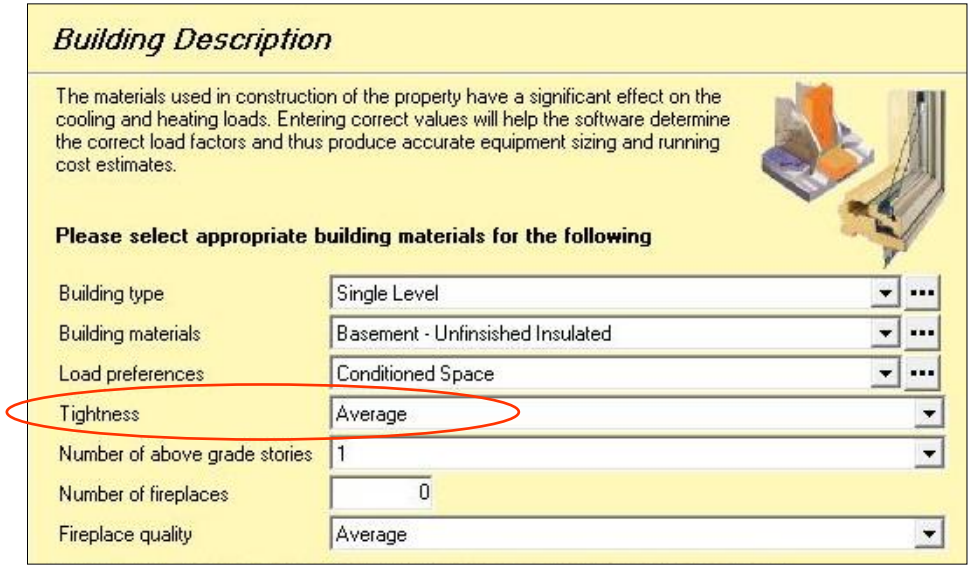
- Manual J requires detailed entry of construction data (R-value, U-value, etc.)
- If available, compare the listed components to what is actually in the house
- Pay particular attention to window areas and specifications

Construction descriptions	Or	Area ft²	U-value Btuh/ft²-°F	Insul R ft²-°F/Btuh
Walls				
12C-0bw: Frm wall, brk 4" ext, 1/2" wood shth, r-13 cav ins, 1/2" gypsum board int fnsh, 2"x4" wood frm, 16" o.c. stud	n	545	0.091	13.0
	ne	17	0.091	13.0
	e	613	0.091	13.0
	s	513	0.091	13.0
	w	486	0.091	13.0
	all	2174	0.091	13.0
15A-4s3oc-4: Bg wall, light dry soil, empty core, concrete block wall, r-4 ins, 8" thk	n	63	0.102	4.0
	n	305	0.093	4.0
	e	232	0.102	4.0
	e	350	0.093	4.0
	s	132	0.102	4.0
	s	205	0.093	4.0
	w	638	0.093	4.0
	all	1924	0.093	4.0
Partitions (none)				
Windows				
U30 S24: U30 S24; NFRC rated (SHGC=0.24); 50% blinds 45°, light; 50% outdoor insect screen; 2 ft overhang (1.5 ft window ht, 1 ft sep.); 6.8 ft head ht	n	18	0.300	0
U33 S31: U33 S31; NFRC rated (SHGC=0.31); 50% blinds 45°, light; 50% outdoor insect screen; 2 ft overhang (3 ft window ht, 1 ft sep.); 6.8 ft head ht	n	9	0.330	0
U32 S29: U32 S29; NFRC rated (SHGC=0.29); 50% blinds 45°, light; 50% outdoor insect screen; 2 ft overhang (3.3 ft window ht, 1 ft sep.); 6.8 ft head ht	e	41	0.320	0
	s	41	0.320	0
	all	83	0.320	0

Air Leakage

- Software typically has generic tightness categories that are selected from a menu
  - Tight
  - Semi-tight
  - Average
  - Semi-loose
  - Loose





- More detailed options allow input of the actual infiltration (blower door)
- Using the actual (tested) infiltration will result in a more accurate Manual J

Sensible Btu/h = CFM x 1.1. TempDifference
Latent Btu/h = CFM X 0.68 X GrainsDifference

Air Leakage with a Blower Door

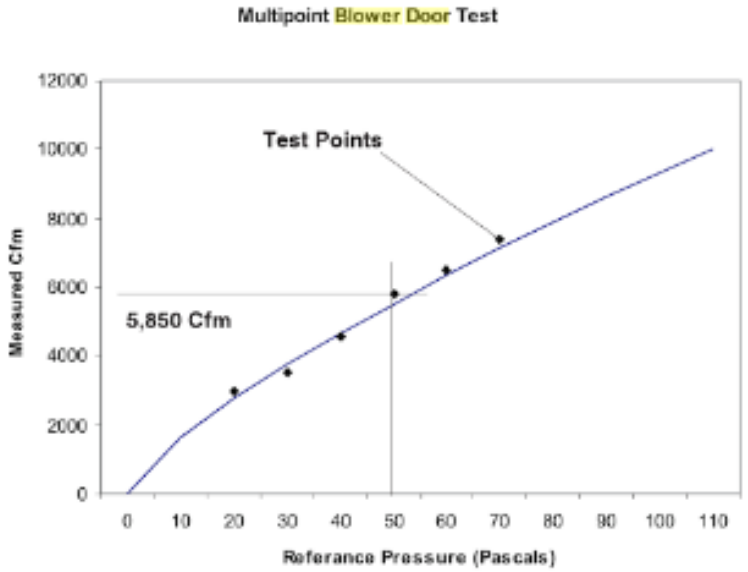


Figure 21-4

- A blower door CFM50 can be converted into values that can be entered into HVAC Res-load J
- Must determine coefficient "C" and exponent "n"

- $CFM_{Press} = C \times (DPress)^n$

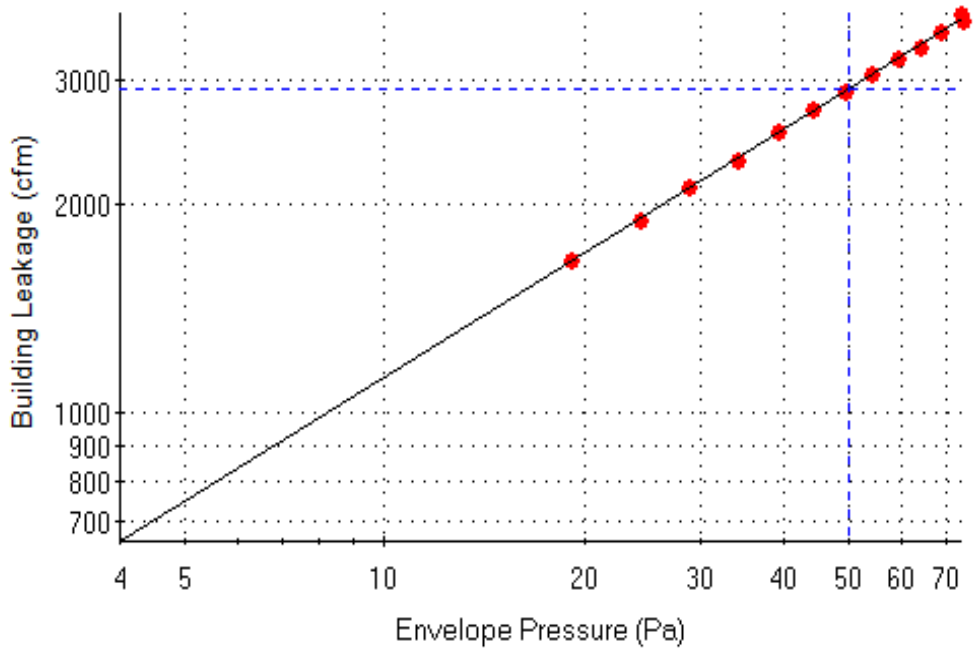
- $CFM_{50} = C \times (50)^n$

- "n" is a value between 0.5 (perfectly round holes) and 1.0 (long slit)
- Assume a default for **n = 0.65**

- $C = CFM_{50} / (50)^{0.65}$

"C" = $CFM_{50} / 12.715$

Air Leakage with a Blower Door – Multipoint Test



Reporting Pressure (Pa) 50

Test to View test 1

Test 1: Depressurization

Airflow at 50 Pascals

2929 cfm +/- 0.4 %
Range: 2916 to 2942
---- CFM @50/sq ft

Leakage Areas

EqLA (10 Pa) = 331.2 in2 +/- 1.6 %
ELA (4 Pa) = 185.7 in2 +/- 2.5 %

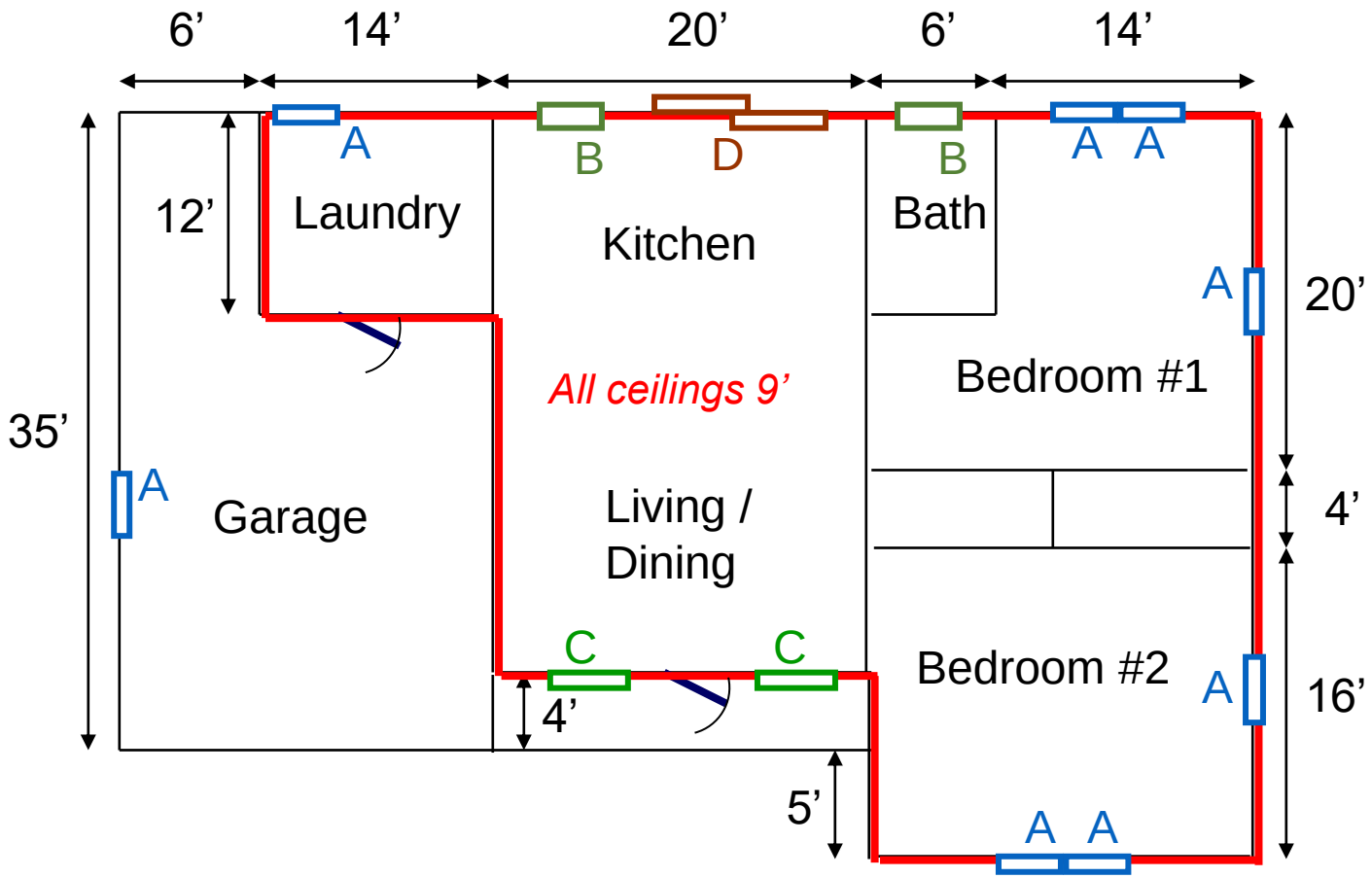
Building Leakage Curve

Coef. (C) = 287.5 cfm/Pa^n +/- 3.9 %
Exponent (n) = .593 +/- 0.010
Correlation Coef. (r) = .99967
Corr Coef Squared (r^2) = .99933

Label	Base?	start	end	nobs	Avg Pressu	Total Flow
pre depress	True	352	468	117	-1.12	0
-75Pa Leak	False	600	629	30	-74.86	3766.1

Manual J Example

Simple House



A: 3’0 x 4’0 DP low-e (U.31, SHGC.24)

B: 3’0 x 3’0 DP low-e (U.33, SHGC.26)

C: 4’0 x 5’0 DP low-e (U.32, SHGC.25)

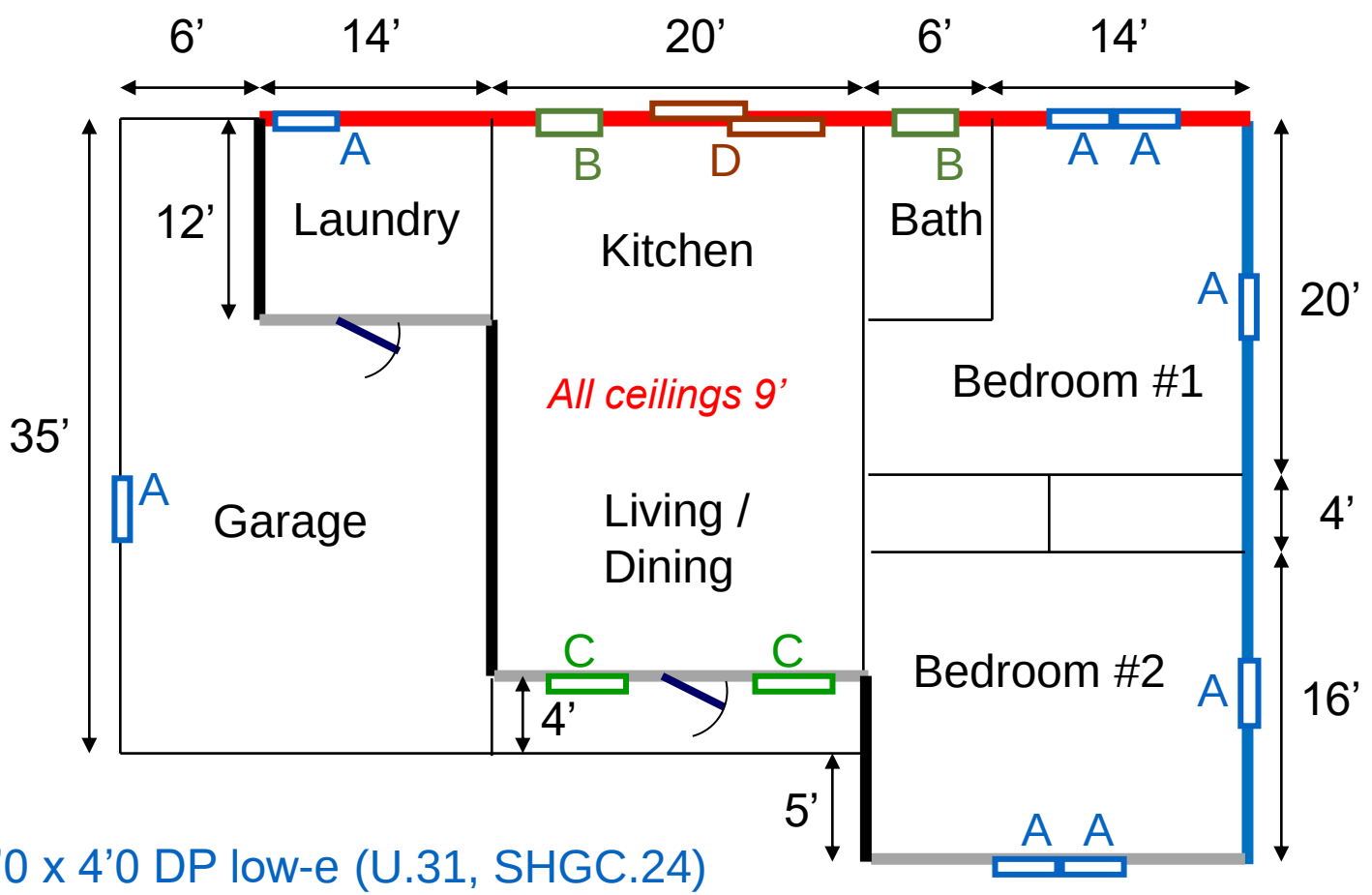
D: 6’0 x 6’8 DP Sliding Glass Door with tint (U.47, SHGC.30)

- Perimeter: 54x2 + 40x2 = *188* ft.
- Gross Wall: 188 x 9 = *1,692* sq. ft.
- Floor Area:
  12x14 +
  20x31 +
  20x40 =
  1,588 sq. ft.
- Ceiling Area: *1,588* sq. ft.
- Windows
  - A: 12 x 7 = 84 sq. ft.
  - B: 9 x 2 = 18 sq. ft.
  - C: 20 x 2 = 40 sq. ft.

  Windows: *142* sq. ft.
- Glass Doors: 20 x 2 = *40* sq. ft.
- Solid Doors: *42* sq. ft. (R-3)
- Volume: 1588x9 = 14,292 c.f.

Simple House (1588 s.f.)

Back Faces North 486 s.f.



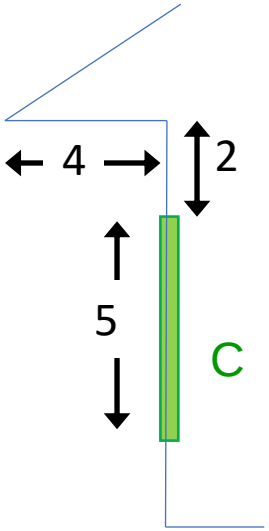
North

Left Faces West

360 s.f.

Right Faces East

360 s.f.



A: 3’0 x 4’0 DP low-e (U.31, SHGC.24)

B: 3’0 x 3’0 DP low-e (U.33, SHGC.26)

C: 4’0 x 5’0 DP low-e (U.32, SHGC.25)

D: 6’0 x 6’8 DP Sliding Glass Door with tint (U.47, SHGC.30)

Front Faces South 486 s.f.

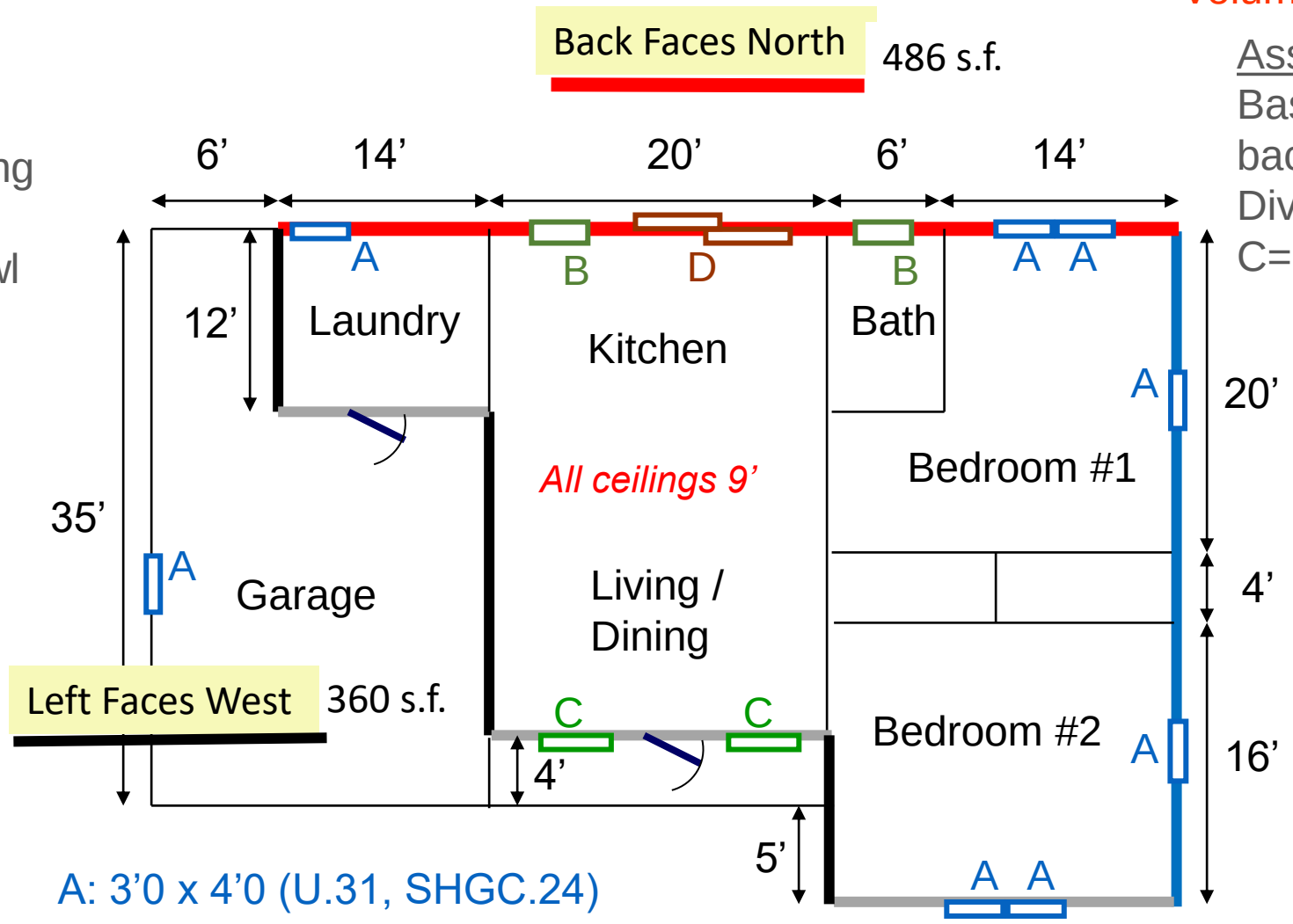
Simple House (Assumptions)

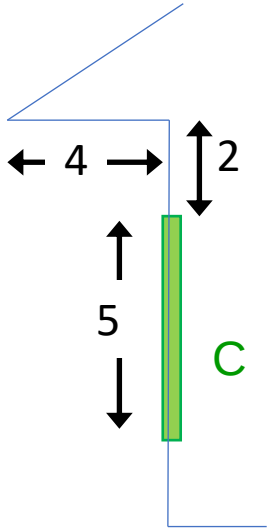
North

$ACH_{50} = \frac{CFM50 \times 60}{Volume}$

Ameren MISSOURI

Assume:
- Front faces south
- 2x4 frame walls, R-13, siding
- R-38 flat ceiling (1588 s.f.)
- R-19 floor over vented crawl
- R-8 Ducts in attic 6% leakage
- 38.5 cfm of ventilation





A: 3’0 x 4’0 (U.31, SHGC.24)

B: 3’0 x 3’0 (U.33, SHGC.26)

C: 4’0 x 5’0 (U.32, SHGC.25)

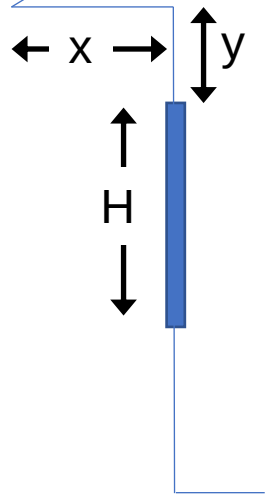
D: 6’0 x 6’8 (U.47, SHGC.30)

Assume: 5 ACH50, Based on volume, backout 1191 cfm_{50}. Divide by 12.715: C= 93.7, n=0.65

Simple House – RESULTS

Impact of House orientation for eight directions

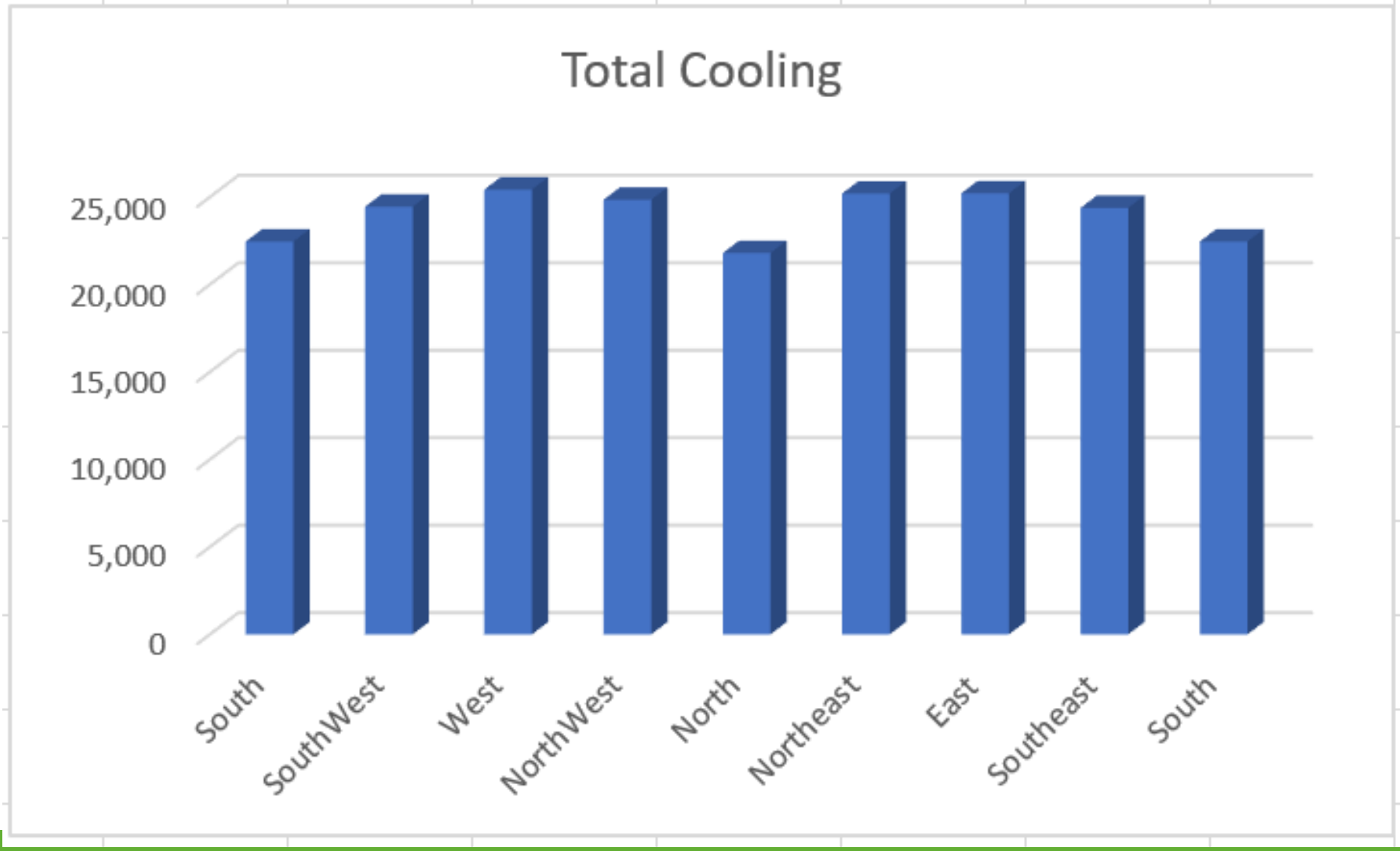
Version	Total Cooling	Sensible Load	Latent Load	AED Okay?	Heating Load	Front faces	ACH50
Base	**22,455**	**20,305**	**2150**	**yes**	**29,819**	**South**	**5**
Rotate 45º	24,443	22,294	2150	Yes	29,819	SouthWest	5
Rotate 90º	25,424	23,274	2150	Yes	29,819	West	5
Rotate 135º	24,841	22,691	2150	Yes	29,819	NorthWest	5
Rotate 180º	21,797	19,648	2150	yes	29,819	North	5
Rotate 225º	25,194	23,044	2150	**No**	29,819	Northeast	5
Rotate 270º	25,211	23,061	2150	**No**	29,819	East	5
Rotate 315º	24,378	22,228	2150	yes	29,819	Southeast	5
Base (360º)	**22,455**	**20,305**	**2150**	**yes**	**29,819**	**South**	**5**

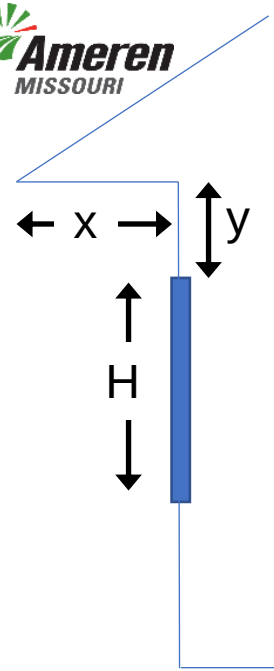


AED = Adequate Exposure Diversity

Simple House – RESULTS

Impact of House orientation for eight directions

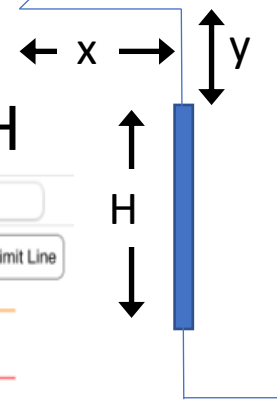




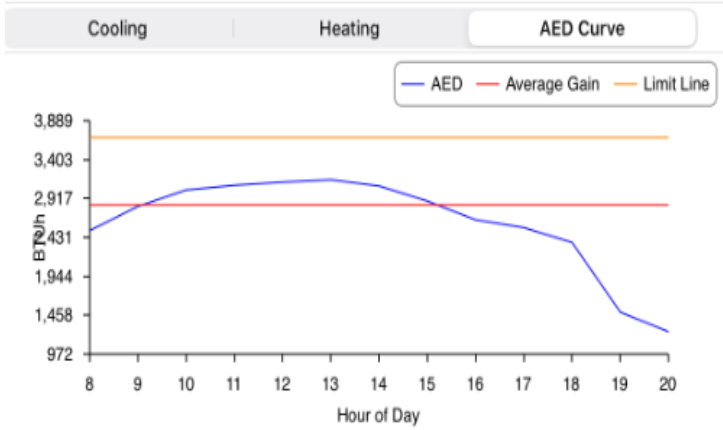
AED Curves

AED = Adequate Exposure Diversity

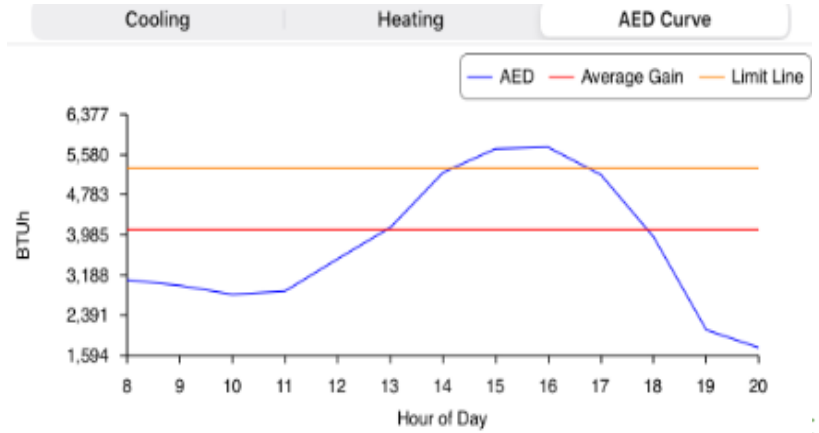
Manual J8 was developed to provide two methods of calculating residential loads; the *average load procedure* and the *peak load procedure*. The average load procedure is used to size the equipment used for homes with Adequate Exposure Diversity*.
(If the home has zoning, then the zone loads must be calculated using the peak load procedure).
*A home has AED if it is typical with about the same amount of glass facing all directions. If the home does not have AED, then the peak load procedure must be used. It may be necessary to perform a number of calculations, based on time of day or time of year, & then select the load that covers the worst-case scenario. A home does not have AED if it has a disproportional amount of glass facing any one direction.
For example, a home without AED might be one with an unusually large amount of glass facing south. Because the average load procedure is based on mid summer data, the equipment might be undersized in October when the sun gets lower and begins radiating through the large amount of south facing glass.



Front Faces SOUTH



Front Faces NORTHEAST



Simple House – RESULTS

Impact of House leakage from 3 ACH50 to 15 ACH50

Version	Total Cooling	Sensible Load	SHF	Latent Load	AED Okay?	Heating Load	Front faces	ACH50
Base (“tight”)	21,164	19,584	.93	1579	yes	26,527	South	3
Base (GA code)	**22,455**	**20,305**	**.90**	**2150**	**yes**	**29,819**	**South**	**5**
Base (leaky)	25,449	21,975	.86	3470	yes	37,158	South	10
Base (LEAKY)	28,160	23,491	.83	4,668	yes	44,303	South	15

Thank you!

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Matt@moenergycodesupport.org

Please Unmute or use the Zoom Chat function to submit any questions or comments

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