

What Grade?



What
Grade?



What
Grade?



What
Grade
?



What
Grade?



Voids & Gaps

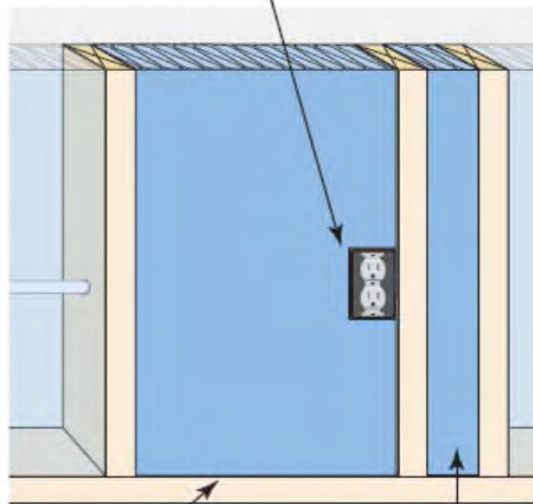
Installing Insulation

Wall Insulation key points

Voids / Gaps

Passing Grade

Insulation is notched and completely surrounds electrical box



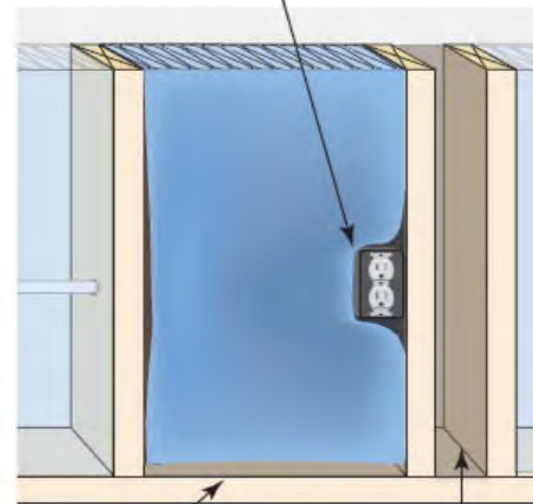
Insulation fully fills cavity at top and bottom

Narrow cavity fully insulated

Good!!!

Unacceptable Installation

Incomplete insulation coverage around electrical box



Insulation does not extend to bottom of cavity

Narrow cavity not insulated

Bad!!!

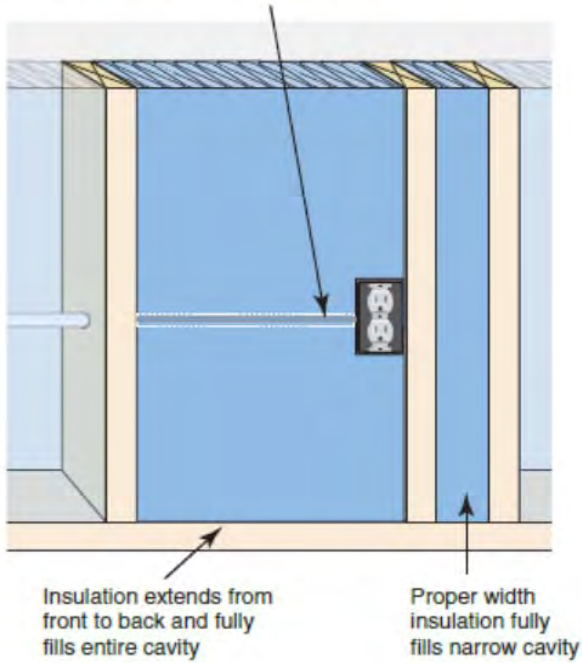


Compression & Incomplete Fill

Installing
Insulation

Passing Grade

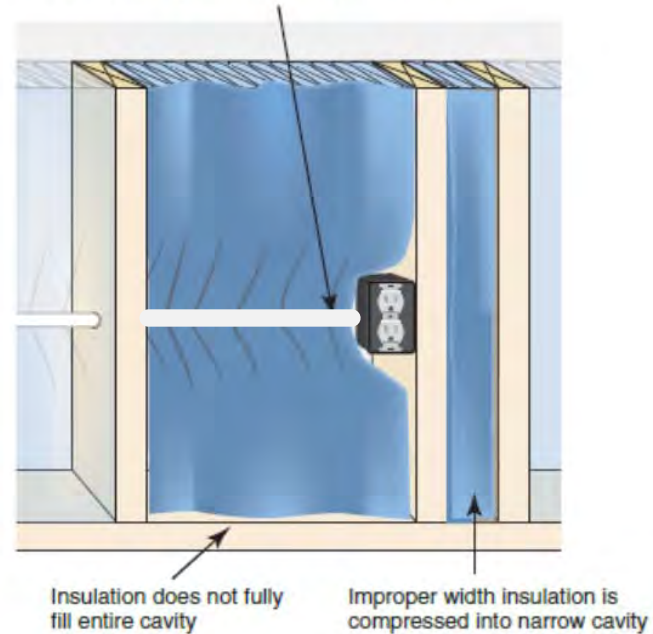
Insulation is slit around electrical wire



Good!

Unacceptable Installation

Insulation is compressed behind electrical wire

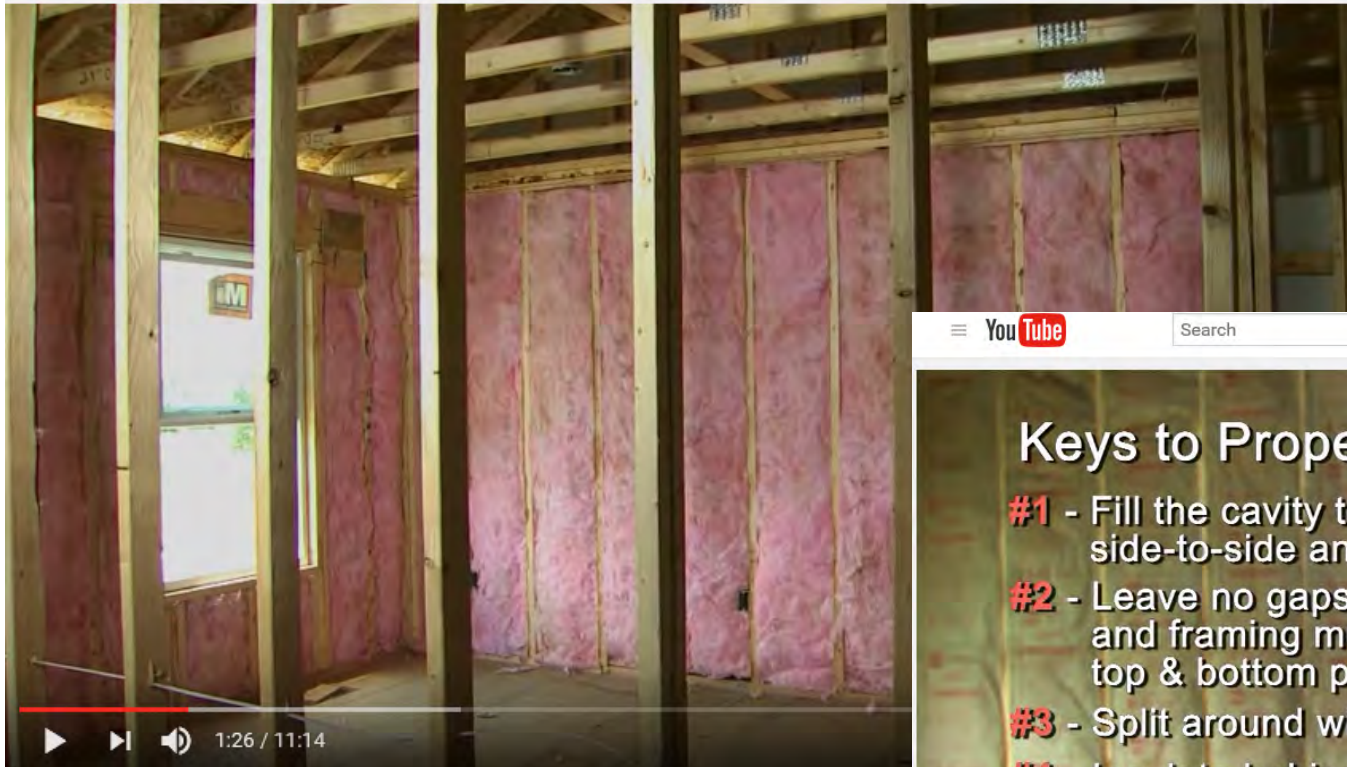


Bad!



Installation Videos



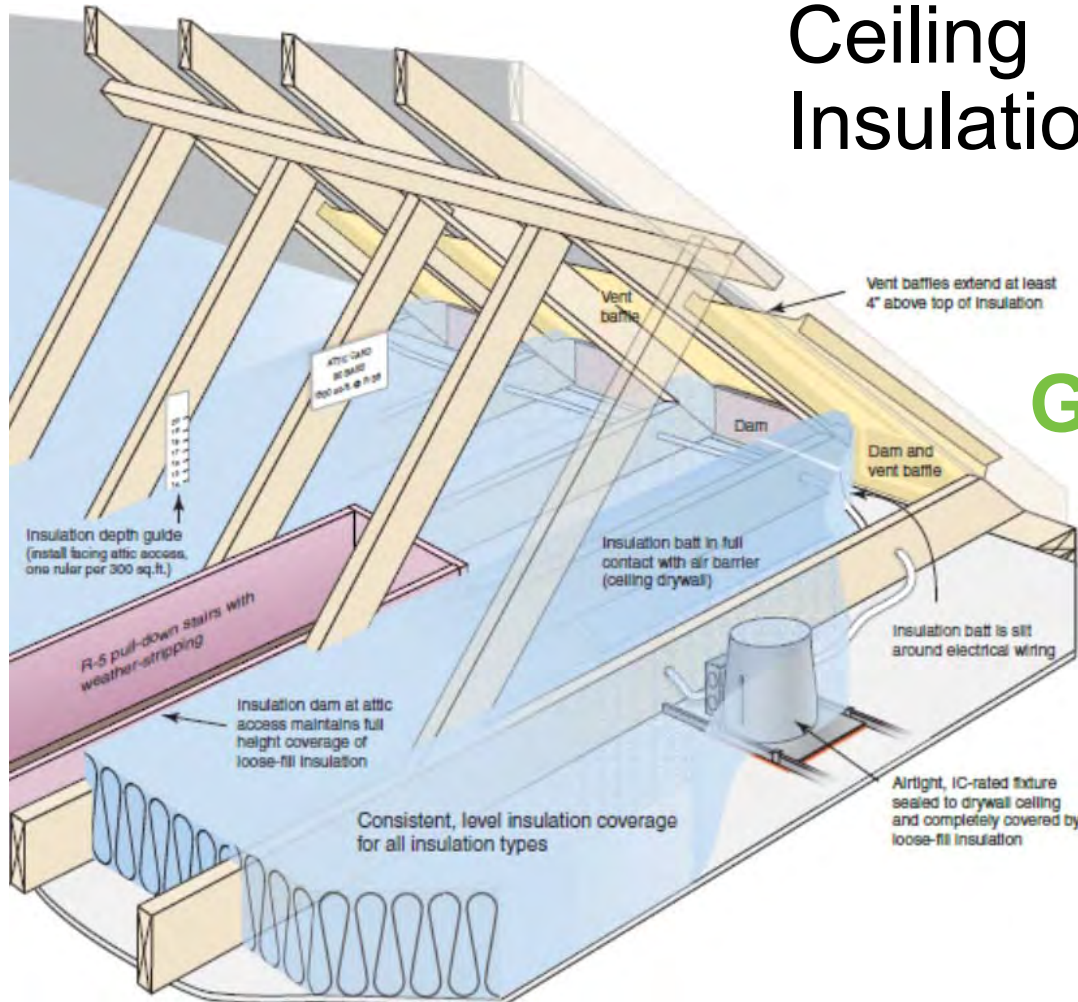


Installation Videos

Keys to Proper Batt Installation

- #1** - Fill the cavity top-to-bottom, side-to-side and back-to-front
- #2** - Leave no gaps between insulation and framing members - studs and top & bottom plates
- #3** - Split around wiring
- #4** - Insulate behind electrical boxes and other voids created by cavity obstructions

Ceiling Insulation



GOOD!

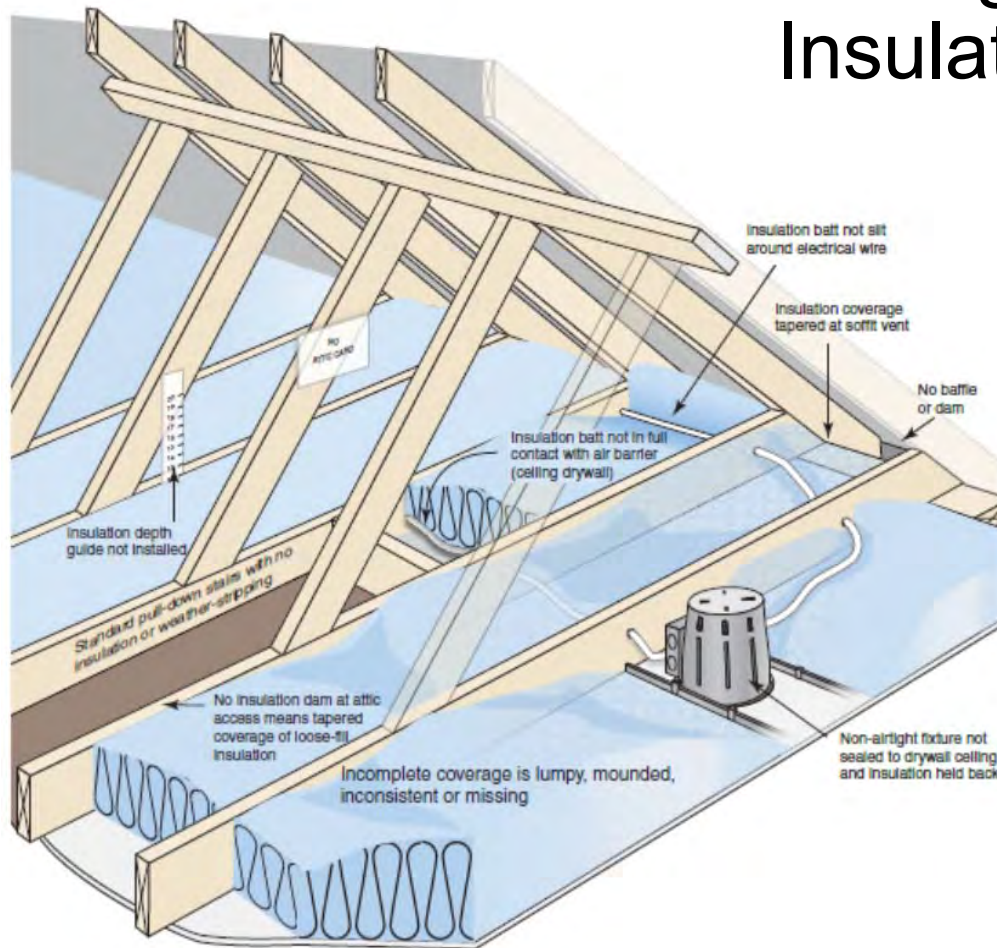
See IECC
R303.1



Unacceptable installation

Ceiling Insulation

BAD!





Ugly Ceiling Insulation



Conduction Heat Flow

Heat transfer through a solid object: the formula for calculating conduction heat transfer is $q = U \times A \times \Delta T$

q = heat flow (Btu/hr)

U = inverse of R-Value [$U=1/R$, $R=1/U$] (Btu/hr ft² °F)

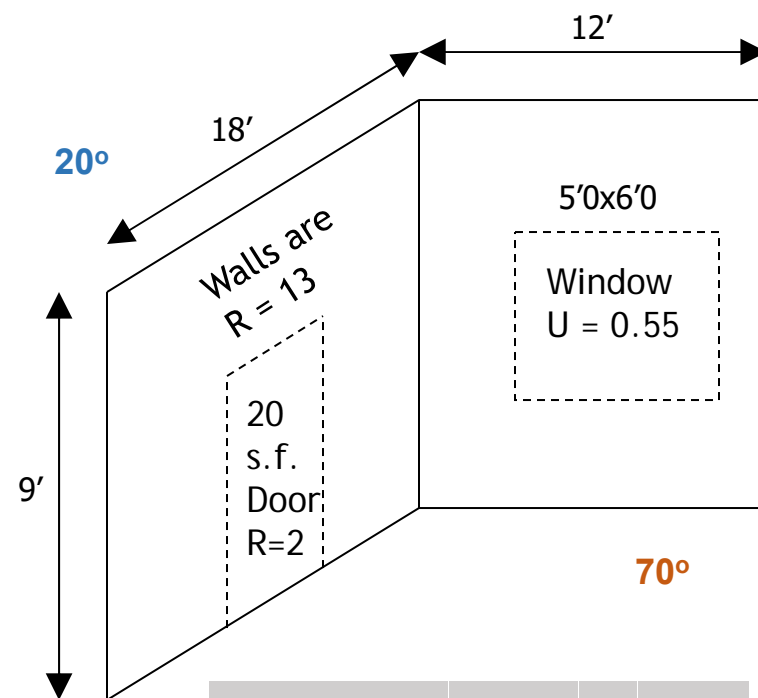
A = area (square feet)

ΔT = temperature difference across component (°F)

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

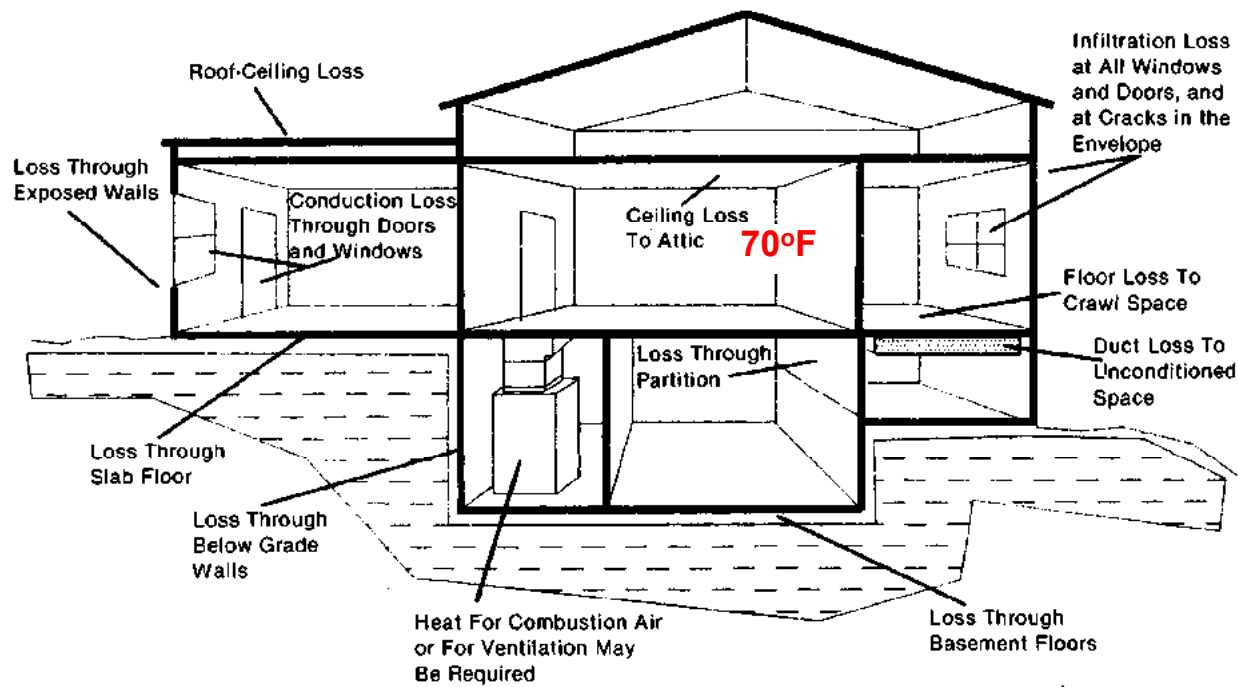
Manual J: $q = A \times HTM$

where $HTM = U \times \Delta T$



		(1/13) x 270	x 50	=	1038
R	U	Area	Delta T		q
13	1/13	220	50		846
2	1/2	20	50		500
-	0.55	30	50		825
					2171

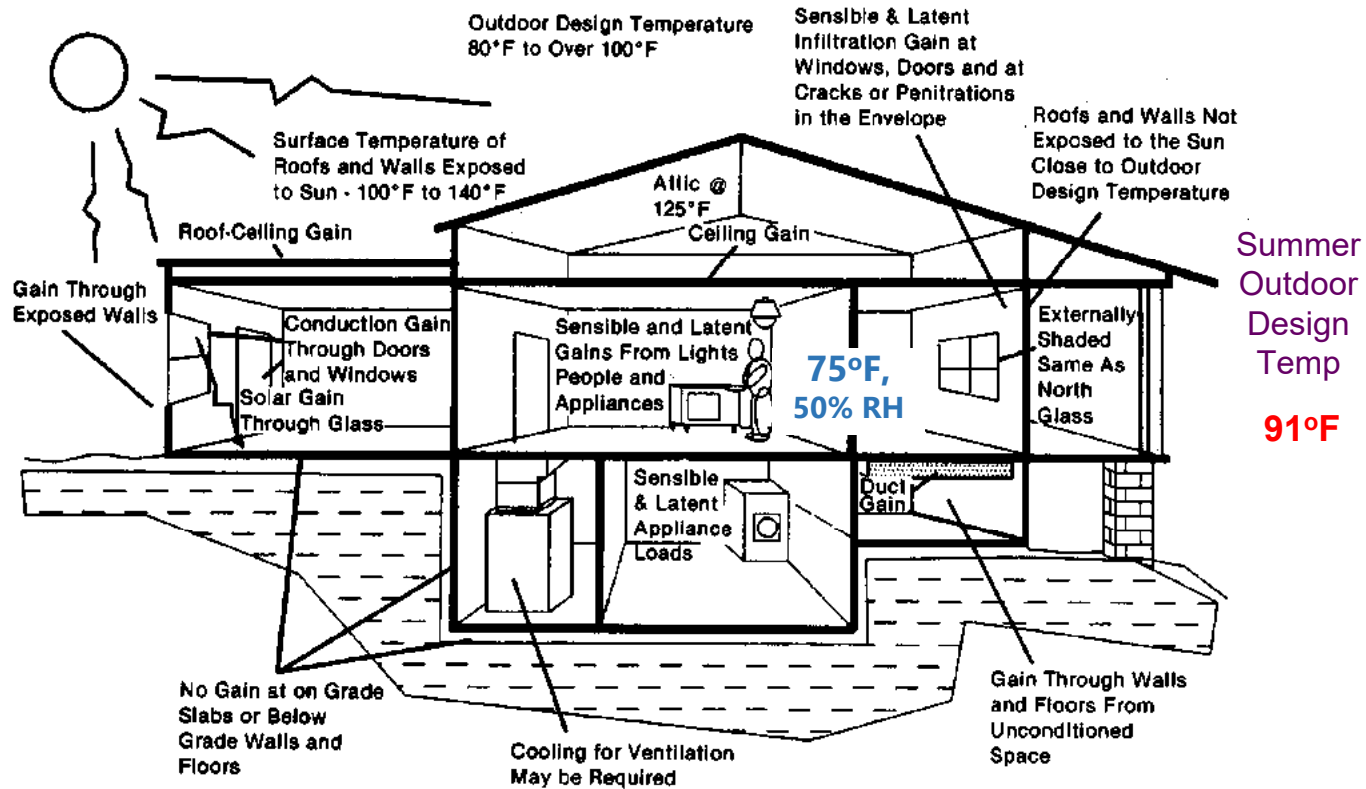
Manual J - Winter Loads



Winter
Outdoor
Design
Temp

14°F

Manual J- Summer Loads



Sizing the System

“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 IECC R403.7



- **Building orientation**
- **Glazing, walls, foundation & roof**
- **Design conditions**
- **Infiltration**
- **Internal loads**
- **Ventilation load**

Manual J Software

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

File Edit View Show Drawing Options Window Help

Right-J8 Worksheet

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

Ty	Construction number Select any cell then click here	U-value	Or	HTM (Btuh/ft ²)		Area (ft ²) or perimeter (ft)		Load (Btuh)		Area (ft ²) or perimeter (ft)		Load (Btuh)	
				Heat	Cool	Gross	N/P/S	Heat	Cool	Gross	N/P/S	Heat	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 proper equipment sizing important?

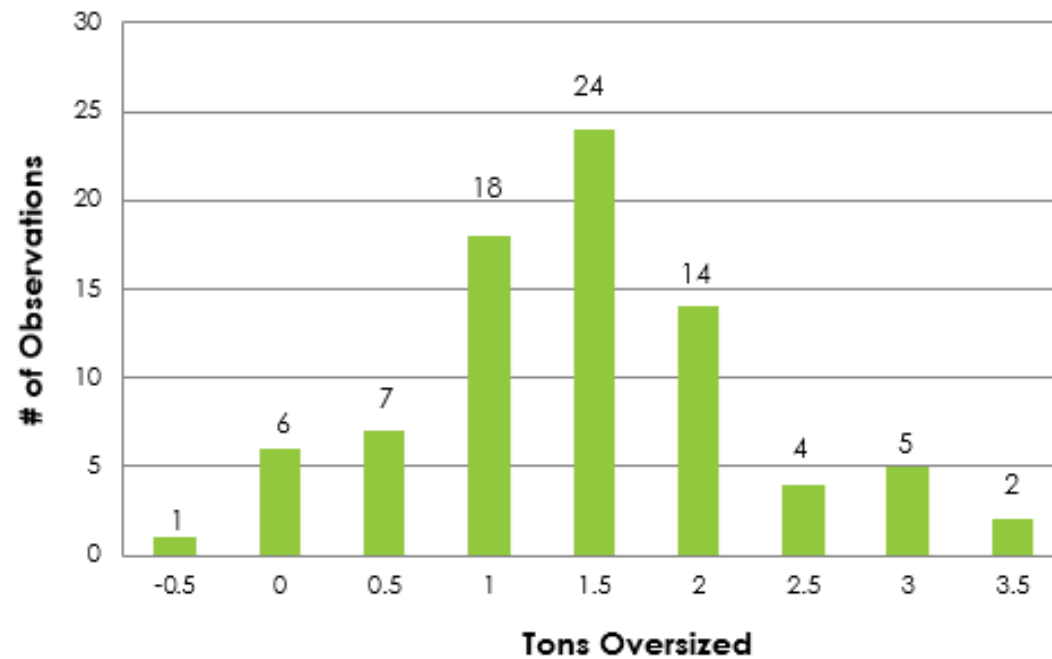
- Equipment first-cost
- Longer/more efficient run times
- Limits equipment cycling
- Better dehumidification



MO Equipment Sizing Study

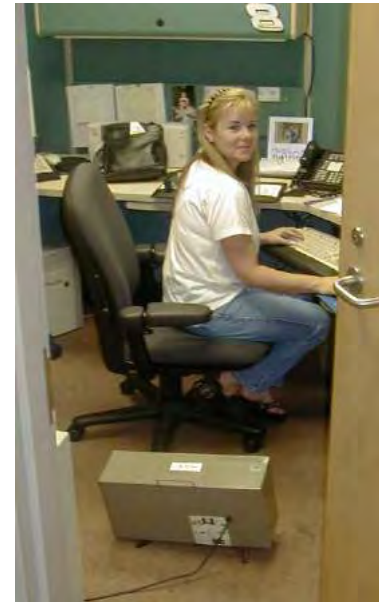
Installed AC Units

Tons Oversized

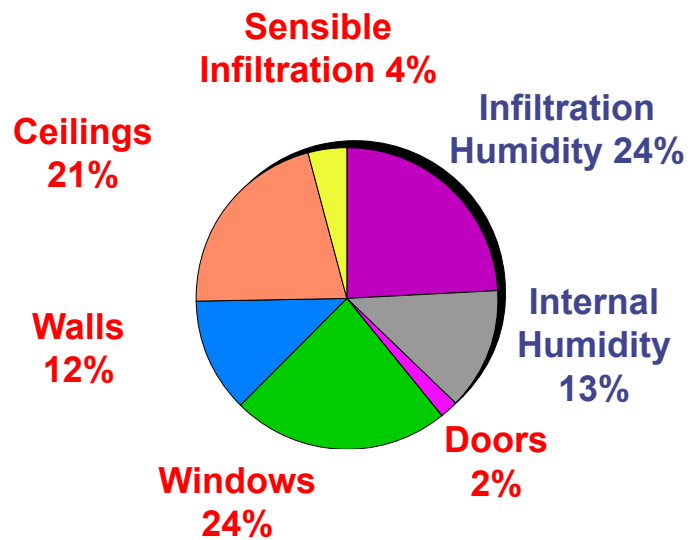


4 Factors Affecting Comfort

- Air Temperature – around the person
- Relative Humidity – ~50% is best
- Air flow - affects how easily evaporative cooling occurs
- Mean Radiant Temperature – the temperature of the surfaces surrounding people



Cooling Load Breakdown



- Sensible = Δ Temperature
- Latent = Δ Moisture
- Total = Sensible + Latent
- $SHF = S / Total$

Variable Speed Blowers

- Allow slower fan speeds in A/C mode to improve dehumidification
- Utilize ECM motors
 - Reduce fan wattage up to 1/10 at low speeds
 - Must operate most of the time at low for energy savings
 - Will consume more energy to satisfy flow if duct restrictions are high
- Permit modest upsizing
 - *Moisture removal is a function of the condensing unit, indoor coil, & fan speed (airflow)*
 - *Proper refrigerant charge is also critical*



Equipment Location

- Locate the air handler within conditioned space to reduce energy penalty from leakage.
- Don't have leaky air handler next to an atmospheric combustion appliance!!!



- Design Goal:
Get all the ducts and the
air handler within
conditioned space so no
energy penalty from
leakage

How does duct leakage affect
combustion safety?



- Types
- Design
- Sealing
- Insulation



Ductwork

