

HVAC LOAD CALCULATIONS AND THE ENERGY RATER

Dennis J Stroer

CALCS-PLUS

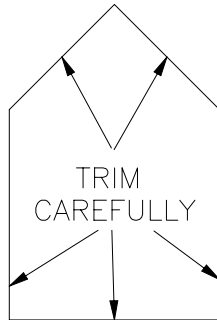
Venice Florida

BUBBA'S PROFESSIONAL HVAC LOAD CALCULATION

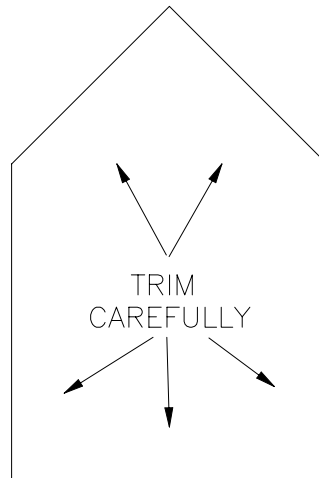
SIZING CHART

AIR CONDITIONING OR HEAT PUMP

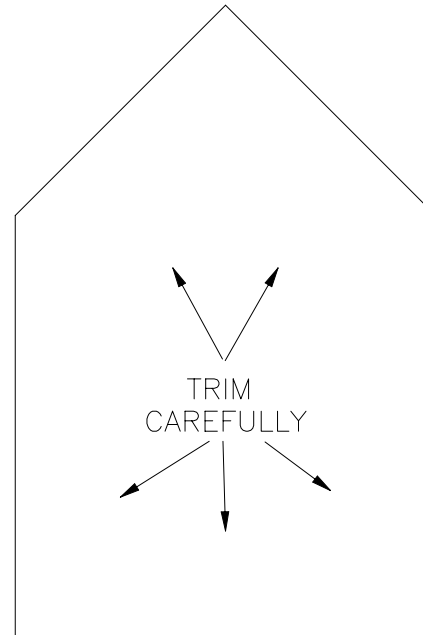
TRIM OUT VERY CAREFULLY ON BLACK LINES, THEN FOLLOW INSTRUCTIONS BELOW



1.5 TO
2-TON



2.5 TO
3.5-TON



4 TO
5-TON

INSTRUCTIONS:

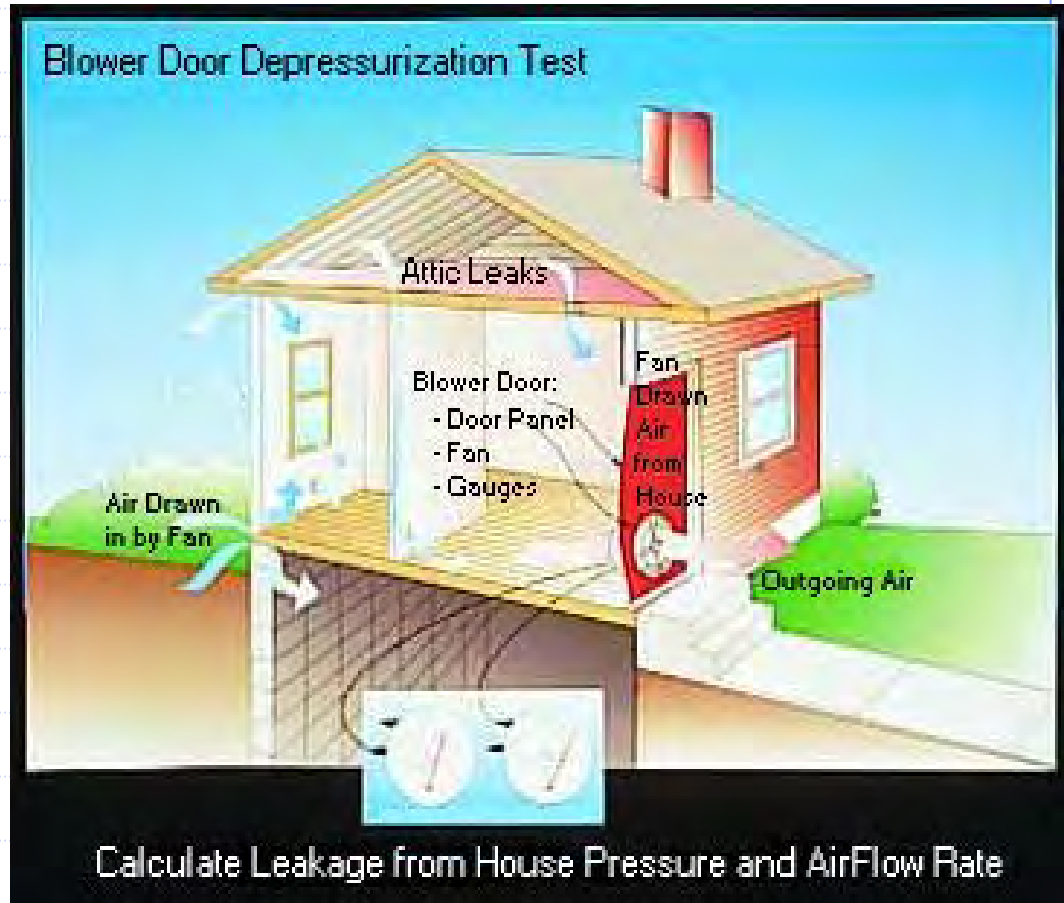
Stand on the curb and look through Sizing Holes,
what ever Hole the house fits into that's the size unit to use.
(For larger homes and or zoning use multiple Sizing Holes.)

HVAC Load Calculations.

- ◆ Why should an Energy Rater perform HVAC Load Calculations?
- ◆ What is meant by a Room x Room calculation?
- ◆ Why use ACCA Manual J Version 8?
- ◆ MJ8 Sensitivities.
- ◆ How can an Energy Rater benefit?

Energy Raters and Air Flow

Energy raters are already familiar with airflow. We use air flow as a tool to do energy ratings.



Two types of Airflow.

With respect to residential and commercial construction there are two kinds of airflow.

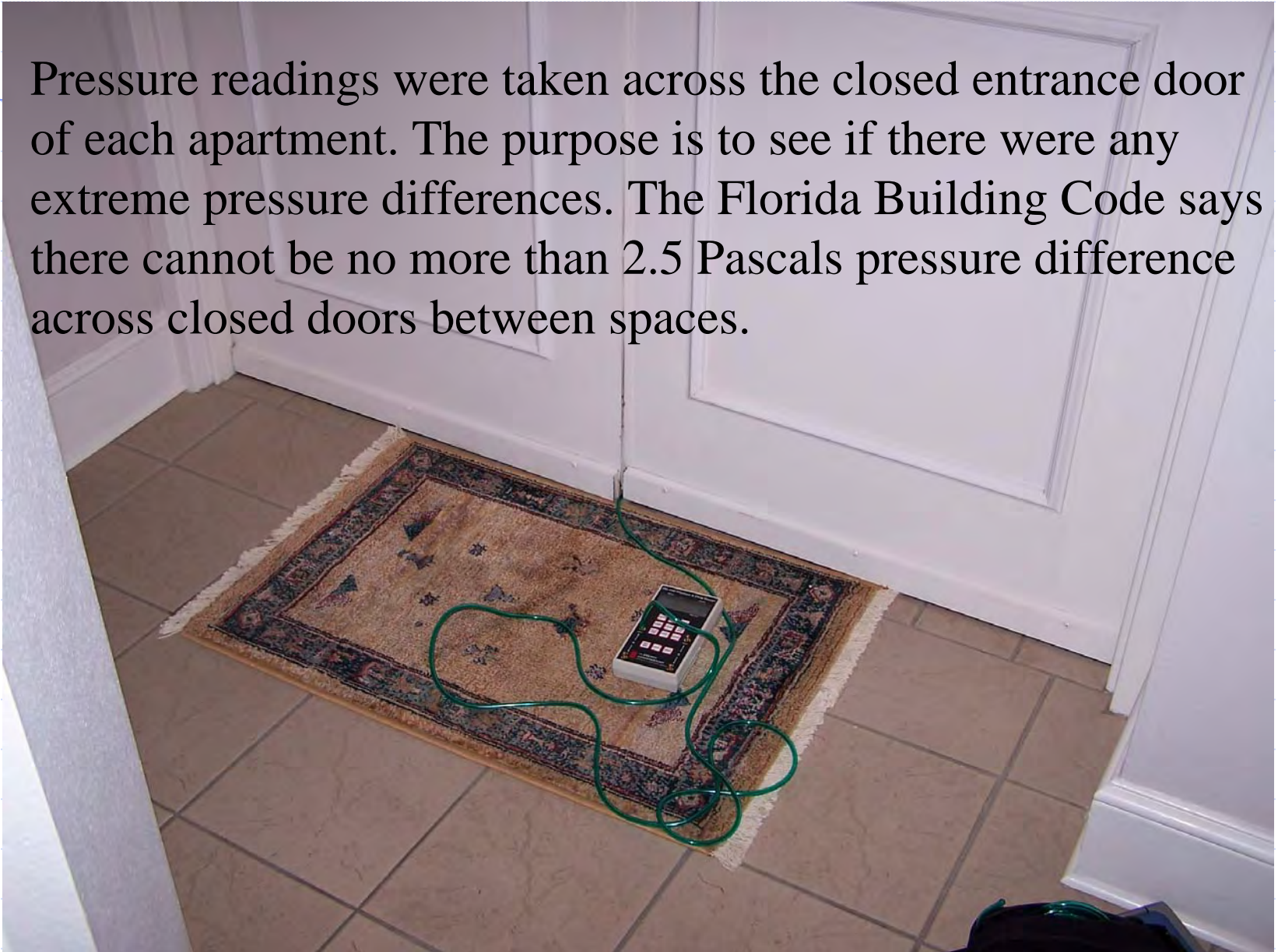
Controlled and Uncontrolled



Energy Raters use controlled airflow to estimate the amount of uncontrolled airflow.

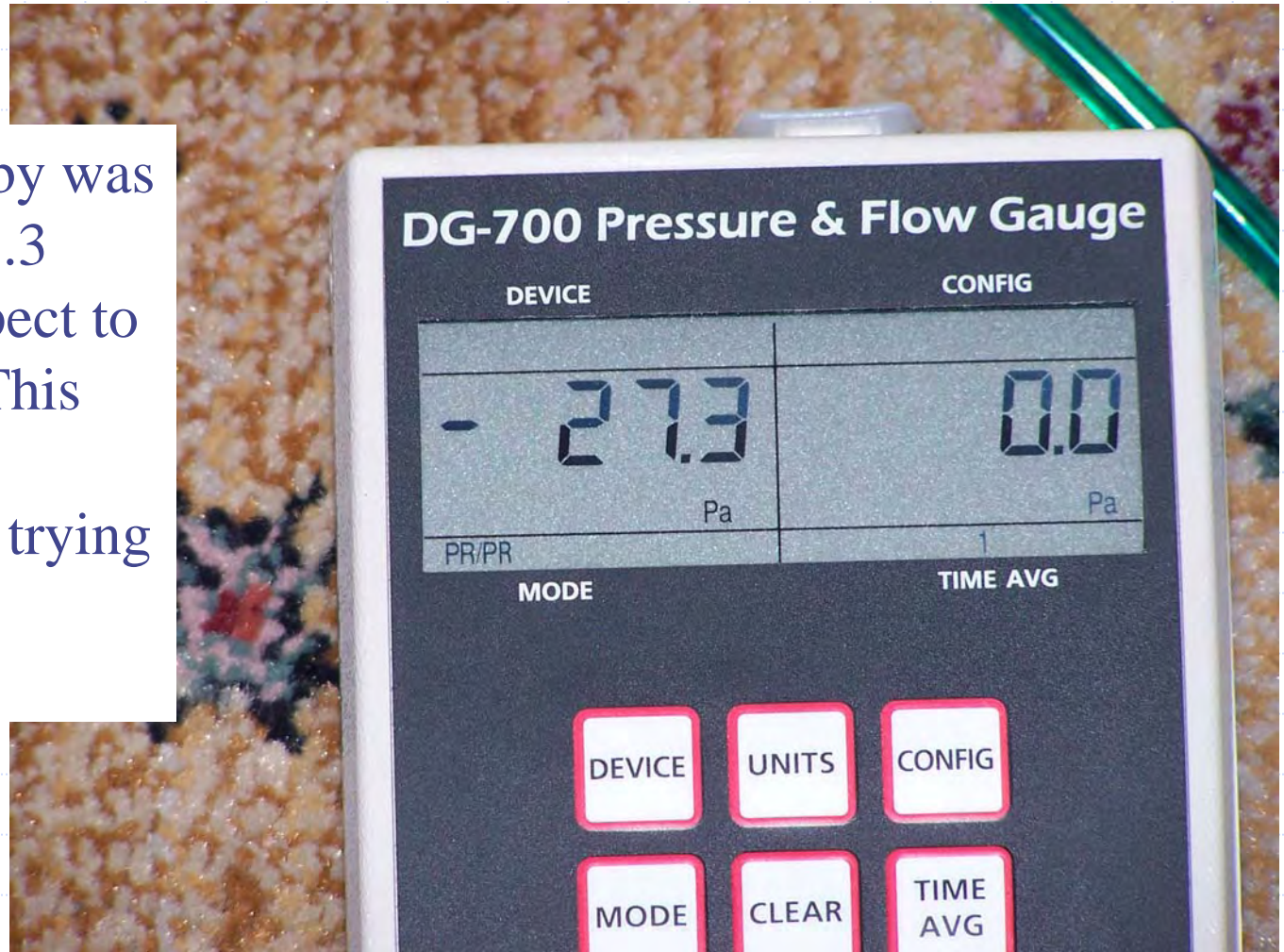
Uncontrolled Airflow

Pressure readings were taken across the closed entrance door of each apartment. The purpose is to see if there were any extreme pressure differences. The Florida Building Code says there cannot be no more than 2.5 Pascals pressure difference across closed doors between spaces.



Uncontrolled Airflow

The elevator lobby was found to be a -27.3 Pascals with respect to the apartments. This means air in the elevator lobby is trying to go into the apartment.

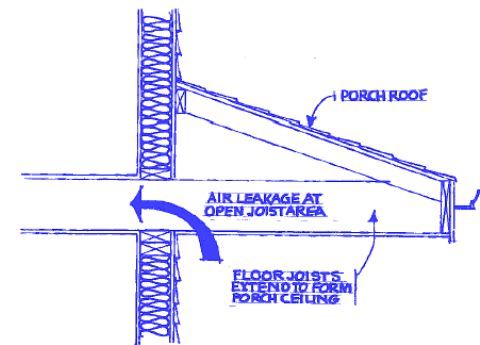


Uncontrolled Airflow

Leaky buildings

Leaky Duct Systems

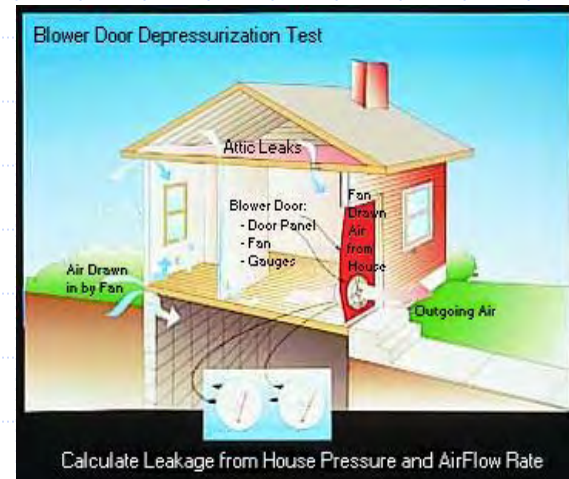
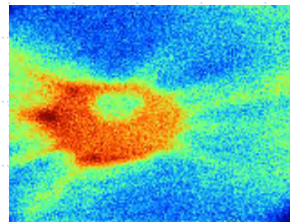
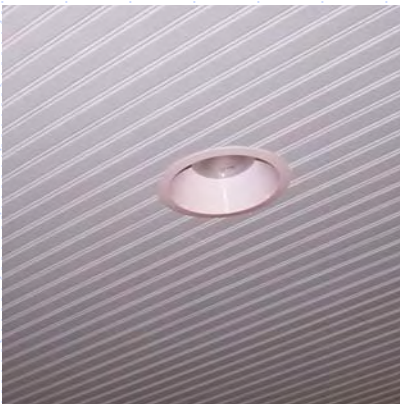
Unbalanced building pressures.



Uncontrolled Airflow = Infiltration

Infiltration influences how the building reacts in terms of health, safety, durability, comfort, and energy efficiency.

- Can be estimated with a high degree of accuracy.
- Can be tested with a high degree of accuracy.
- Can be eliminated or controlled.



Duct Leakage

Influences how the building reacts in terms of health, safety, durability, comfort, and energy efficiency.

- Can be estimated with a high degree of accuracy.
- Can be tested with a high degree of accuracy.
- Can be eliminated.



But,
as Energy Raters we
understand uncontrolled
airflow.

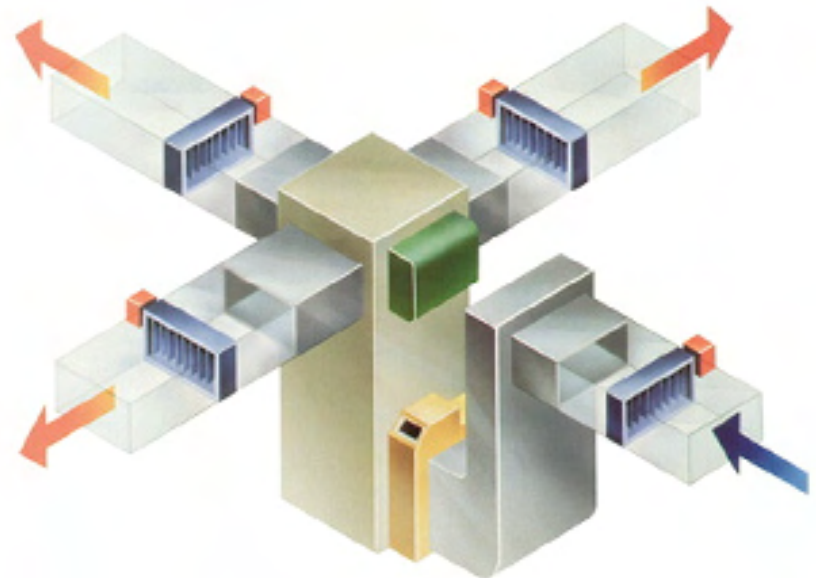
So lets talk about controlled airflow.

Controlled Airflow

Open and closing windows

Table fan

Air conditioning systems.



Room Airflow

Determined by the estimated Heat Gain/Loss; Cooling or heating which ever has been chosen to dominate the system design.

HVAC Load calculations performed on a Room x Room basis.

Based on the Heat Loss/Gain through the building envelope relative to each room.

Room x Room Loads

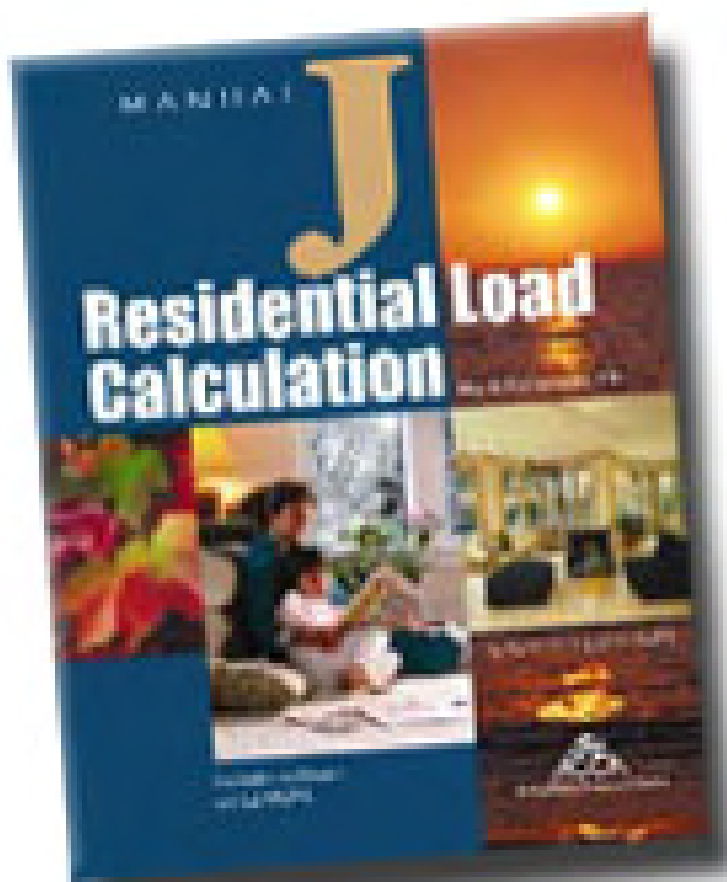
If the HVAC system is the backbone of the house as a system. The HVAC load calculation is the backbone of the HVAC system

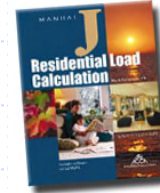
- ◆ Required to determine supply CFM for each room
- ◆ Required to select Supply Outlets
- ◆ Required to select Return Inlets
- ◆ Required to design a Duct System
- ◆ Required to diagnose comfort problems

Estimating Required Room Airflow

Perform a Room x Room HVAC load calculation using procedures as determined by a recognized industry standard determined by local code or the EPA.

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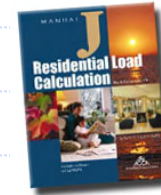


Why Use MJ8

The heating and cooling load estimates affect every aspect of the system design procedure

- From system selection
- To equipment selection procedures
- To placement and selection of air distribution hardware
- To duct routing and airway sizing or pipe layout and sizing

Because of this the load calculation must be as accurate as possible



Value of Manual J

- ◆ Eliminate Under-sizing of Heating & Cooling Equipment
- ◆ Eliminate Over-sizing of Heating & Cooling Equipment
- ◆ Humidity Control During the Cooling Season
- ◆ Eliminate Comfort Problems

Under Sizing Equipment

The obvious problem with undersized equipment is that it will not maintain the desired temperature. However, slightly undersized cooling equipment (by a margin of 10% or less) may actually provide more comfort at a lower cost.



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Oversized Equipment Causes

- ◆ short-cycles
- ◆ marginalized temperature control
- ◆ pockets of stagnate air
- ◆ degrades humidity control during the cooling season
- ◆ requires larger duct runs

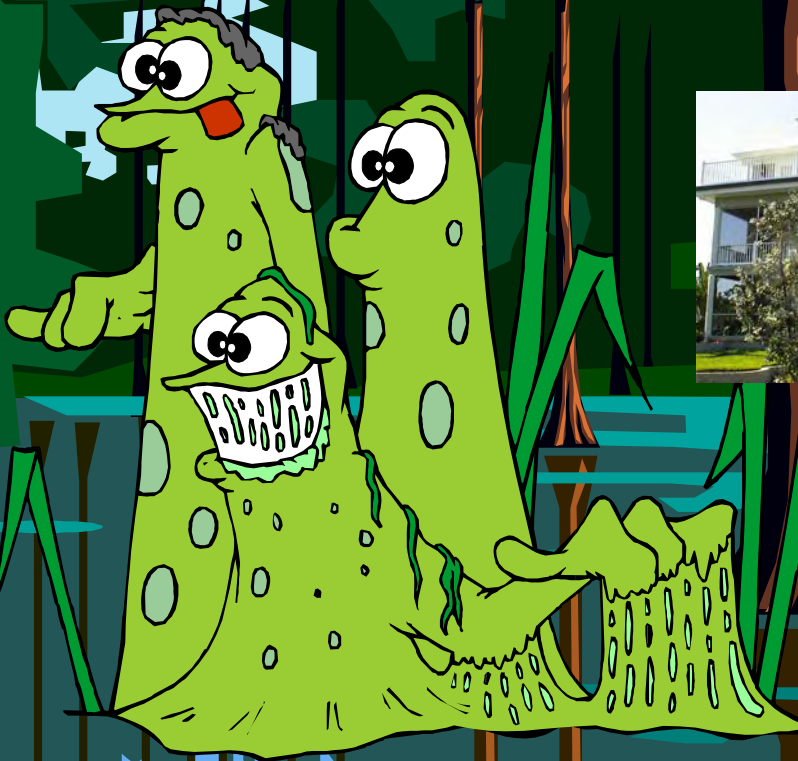


Oversized Equipment Causes

- ◆ increases the installed cost
- ◆ increases the operating cost
- ◆ increases the demand on our utilities
- ◆ adds unnecessary stress on equipment



Humidity Control

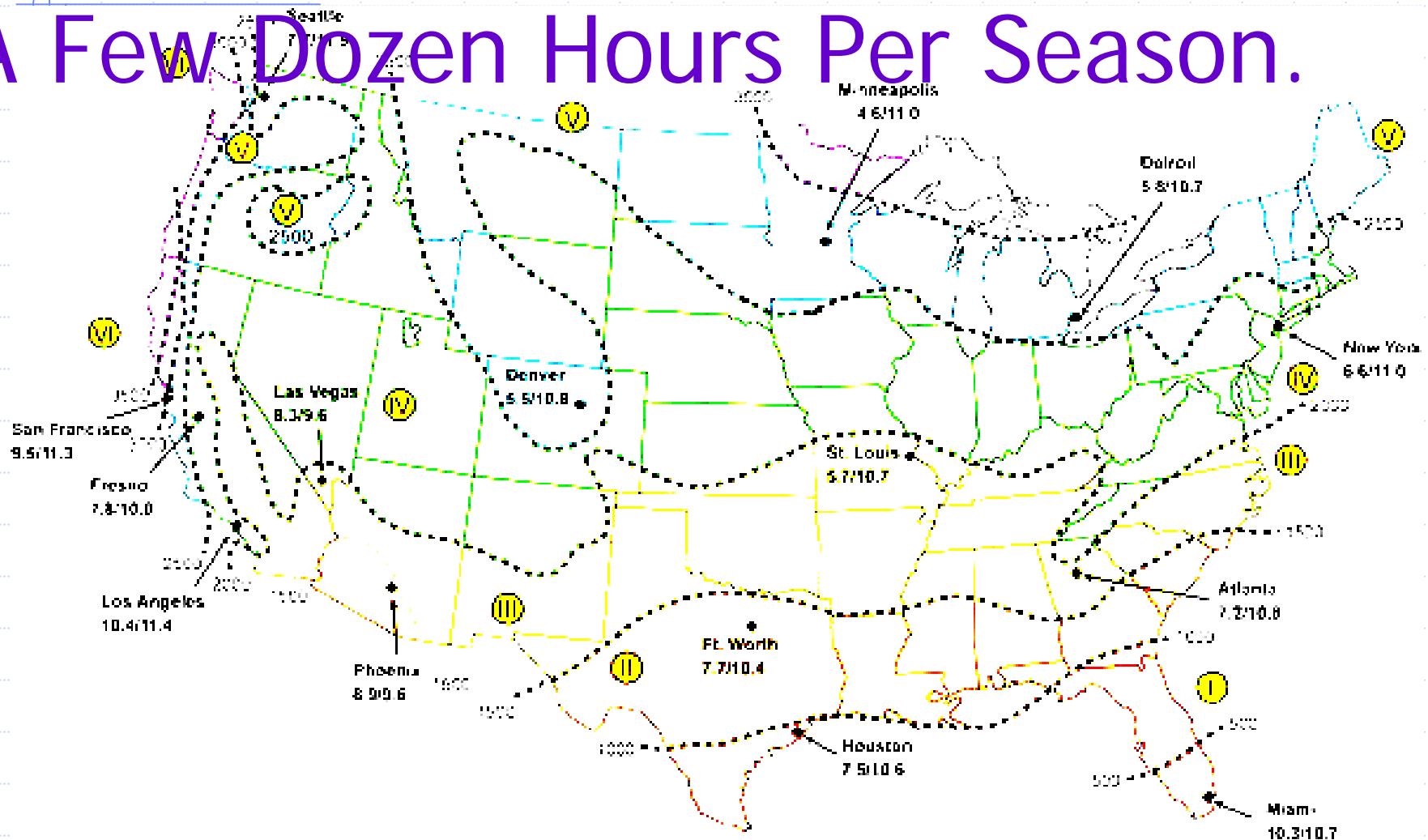


The next subdivision

Humidity Control During The Cooling Season

- ◆ Sensible and latent cooling loads are imposed on buildings located in hot humid climates. When the summer design condition occurs, properly sized equipment will operate continuously or almost continuously, both loads will be neutralized, and the occupants will be comfortable.

BUT,
Design Conditions Only Occur For
A Few Dozen Hours Per Season.



Design Conditions

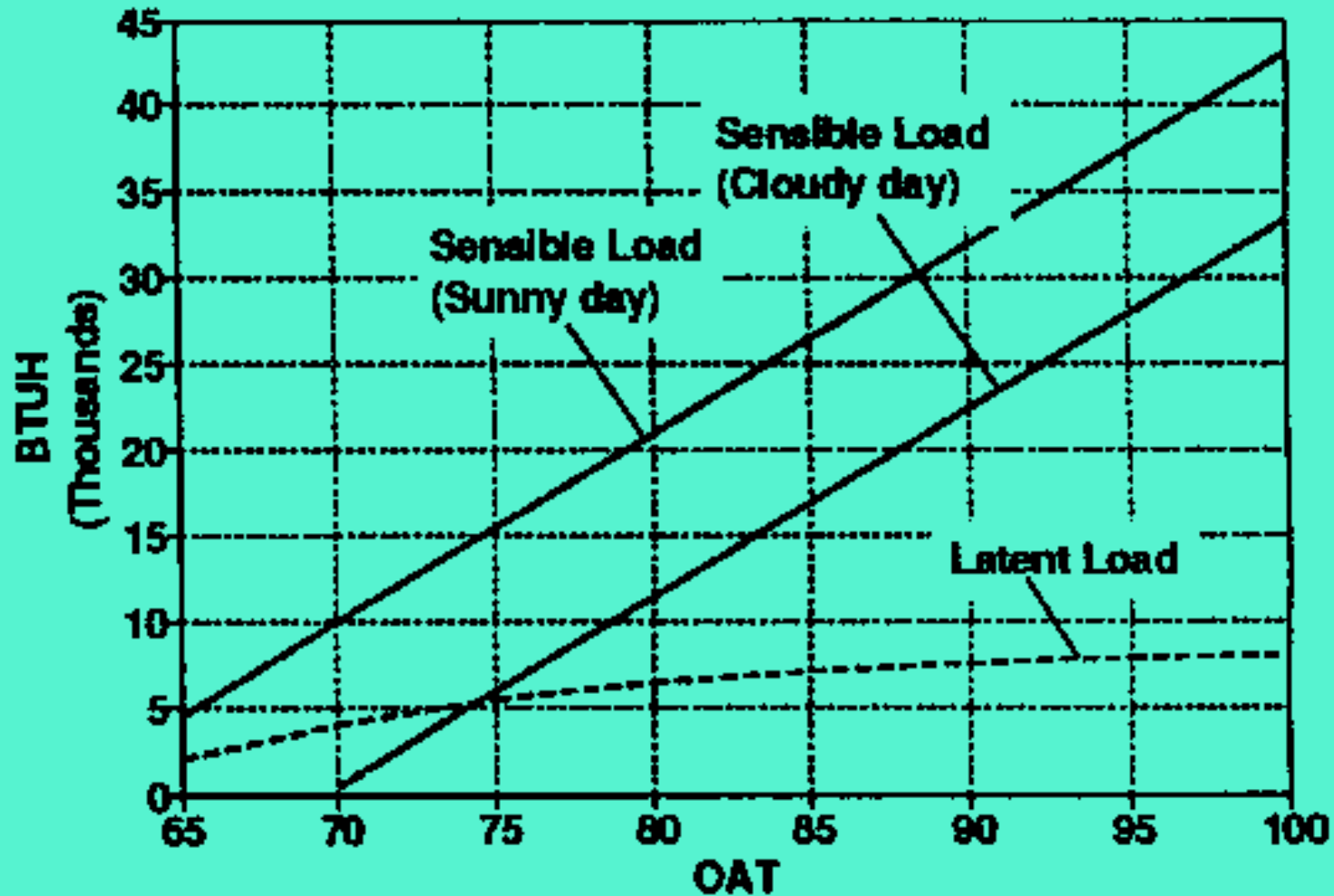
Table 1A

Outdoor Design Conditions For the United States and Canada

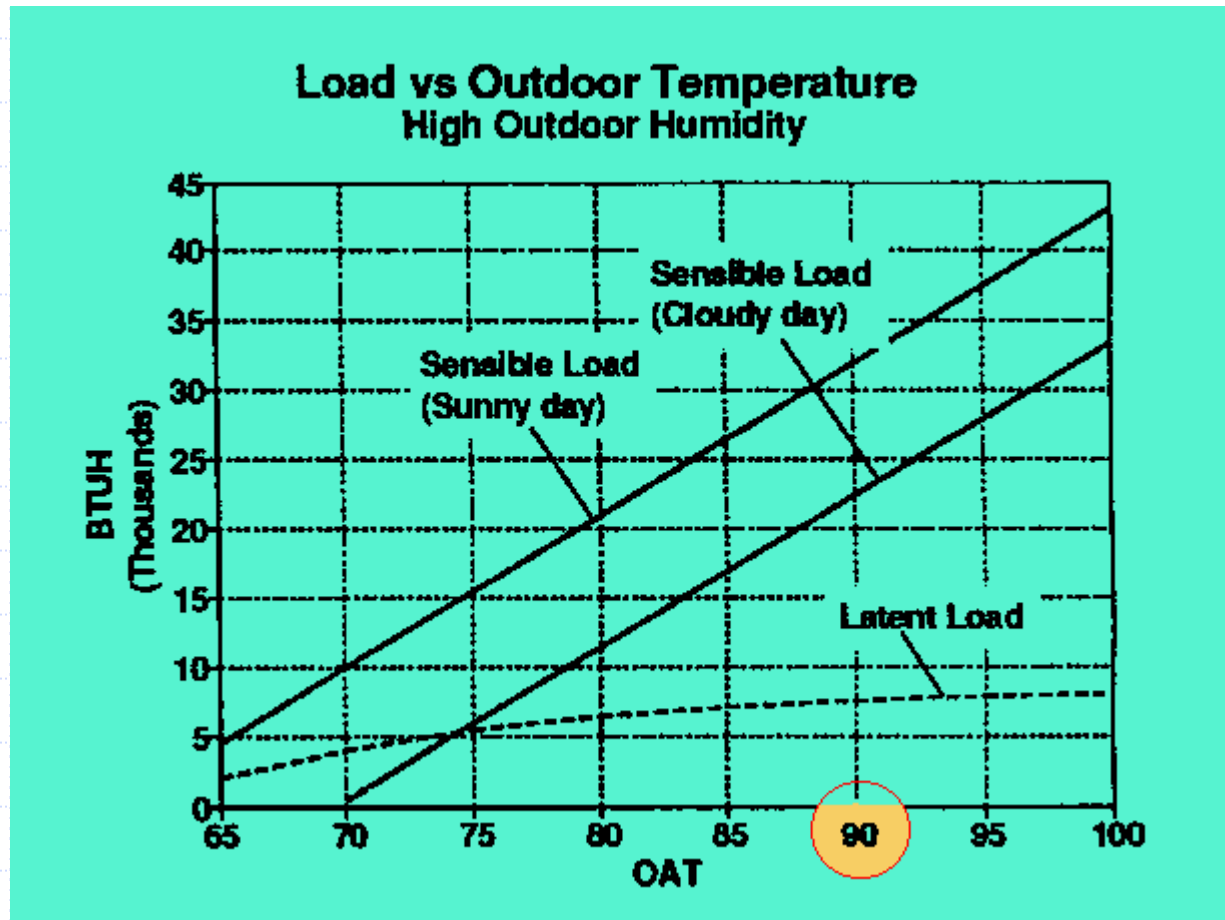
Location	Elevation	Latitude	Winter	Summer					
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
St. Augustine	10	29	35	89	78	59	66	72	M
St. Petersburg	11	28	47	93	79	59	66	72	M
Sanford	55	28	38	93	76	39	46	52	M
Sarasota/Bradenton	30	27	43	92	79	61	68	74	M
Tallahassee AP	55	30	28	93	76	39	46	52	M
Tampa AP	19	28	40	91	77	49	56	62	M
Valpariso, Eglin AFB	85	30	33	90	78	57	64	70	M
Vero Beach	13	27	43	90	78	57	64	70	M
West Palm Beach AP	15	26	47	90	78	57	64	70	M

Load vs Outdoor Temperature

Load vs Outdoor Temperature
High Outdoor Humidity

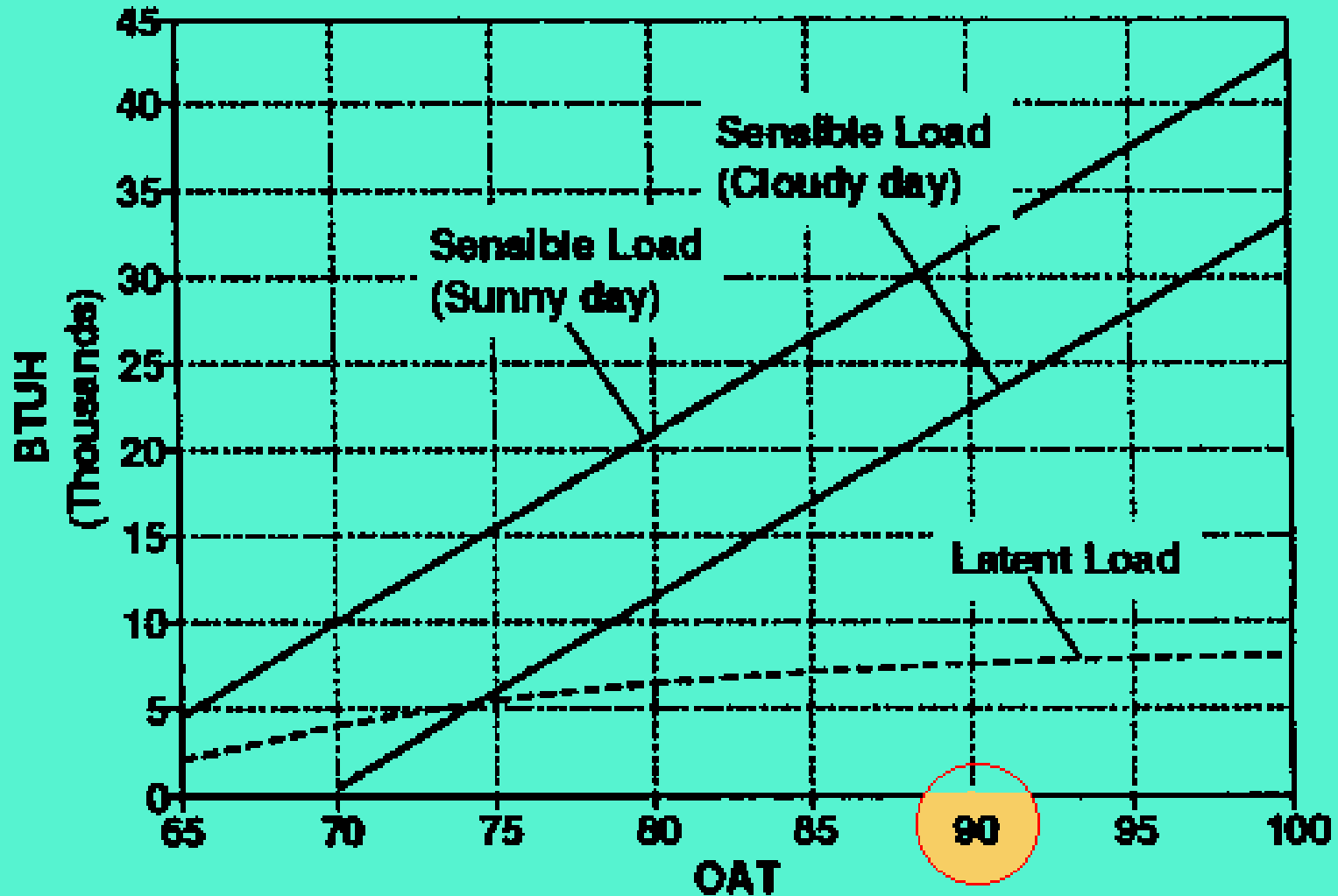


Using table 1 from ACCA Manual J for West Palm Beach the summer outdoor dry bulb temperature is 90°

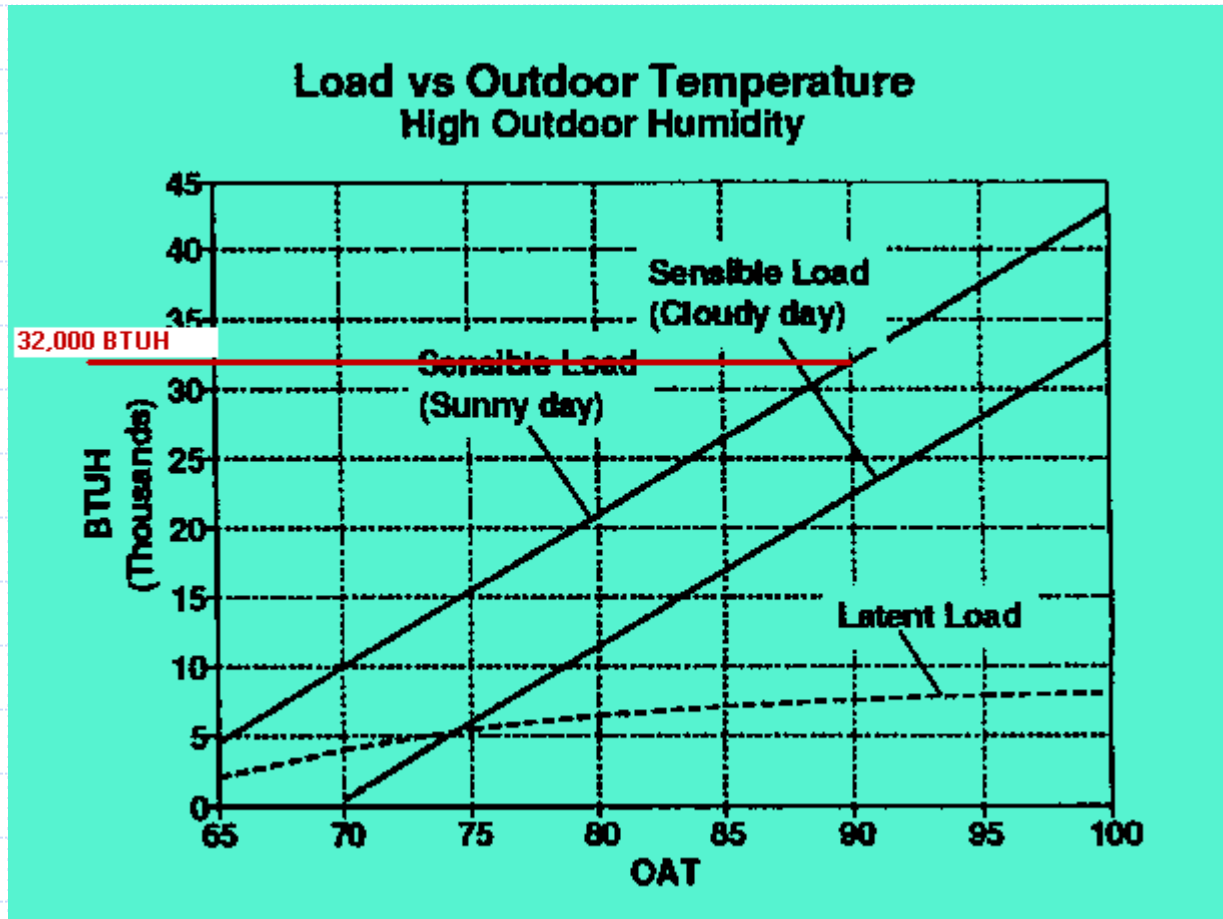


90° Outdoor Air Temperature on a Sunny Day

Load vs Outdoor Temperature High Outdoor Humidity

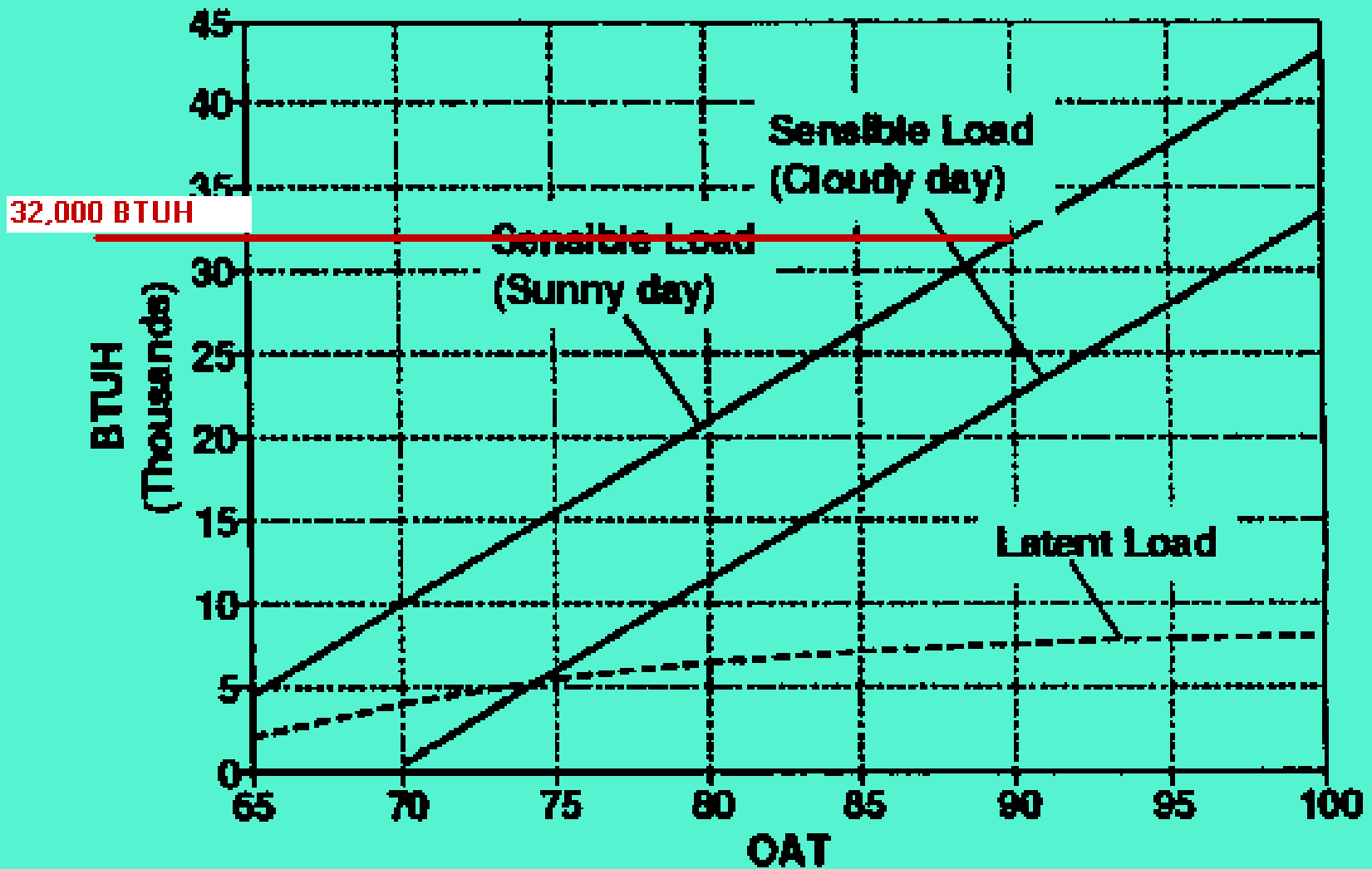


At peak load conditions the building demand is about 32,000 BTUH total

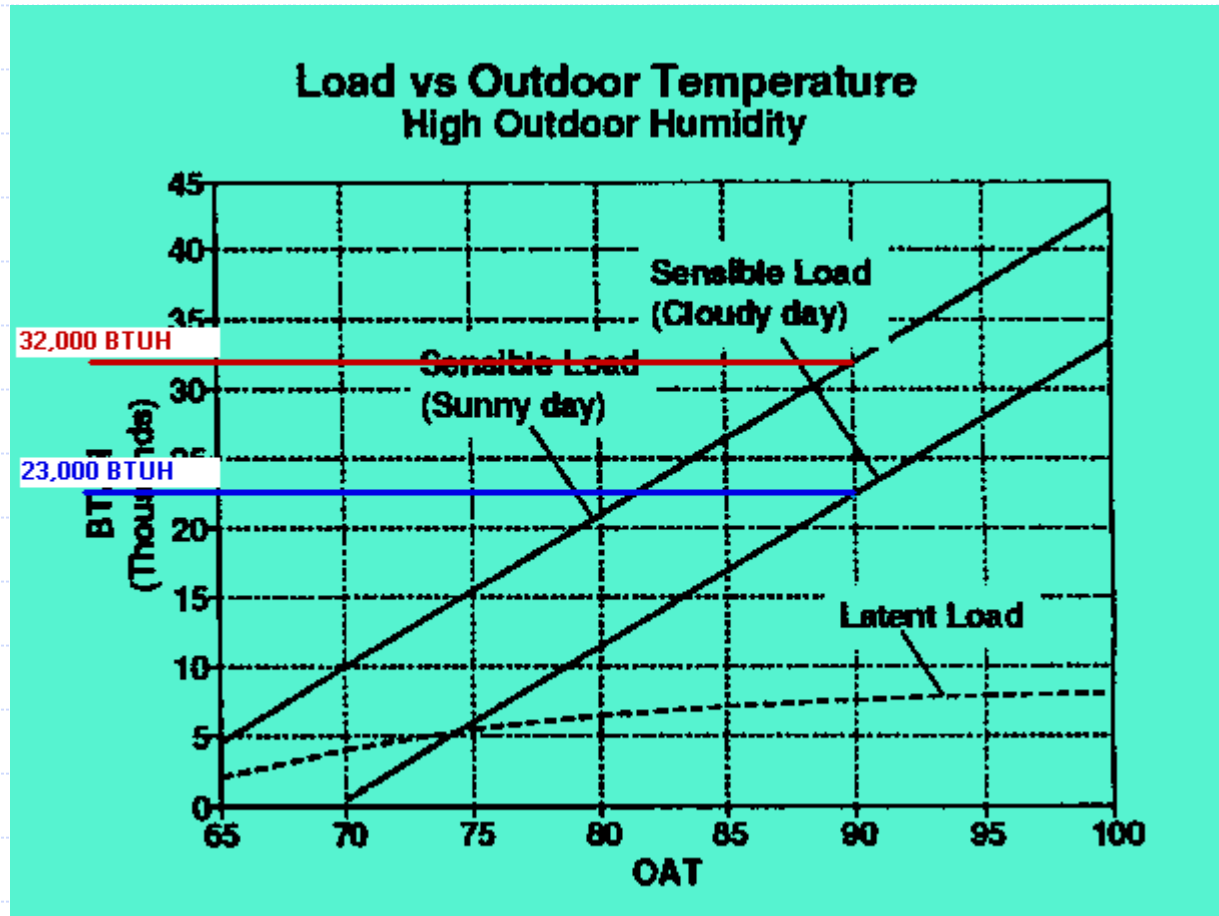


Load vs Outdoor Temperature

High Outdoor Humidity

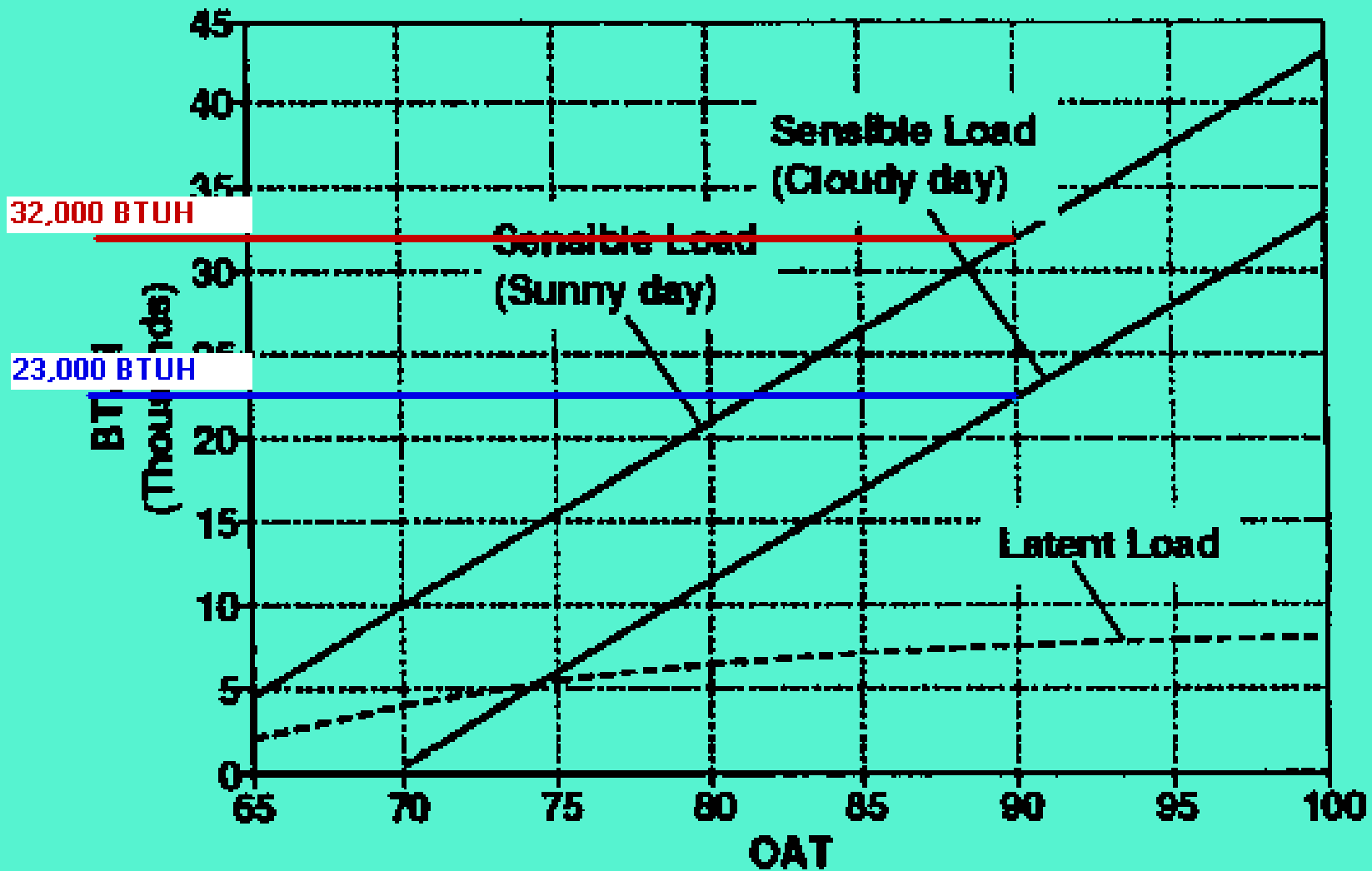


50% of the time our temperatures range in the moderate temperature zone

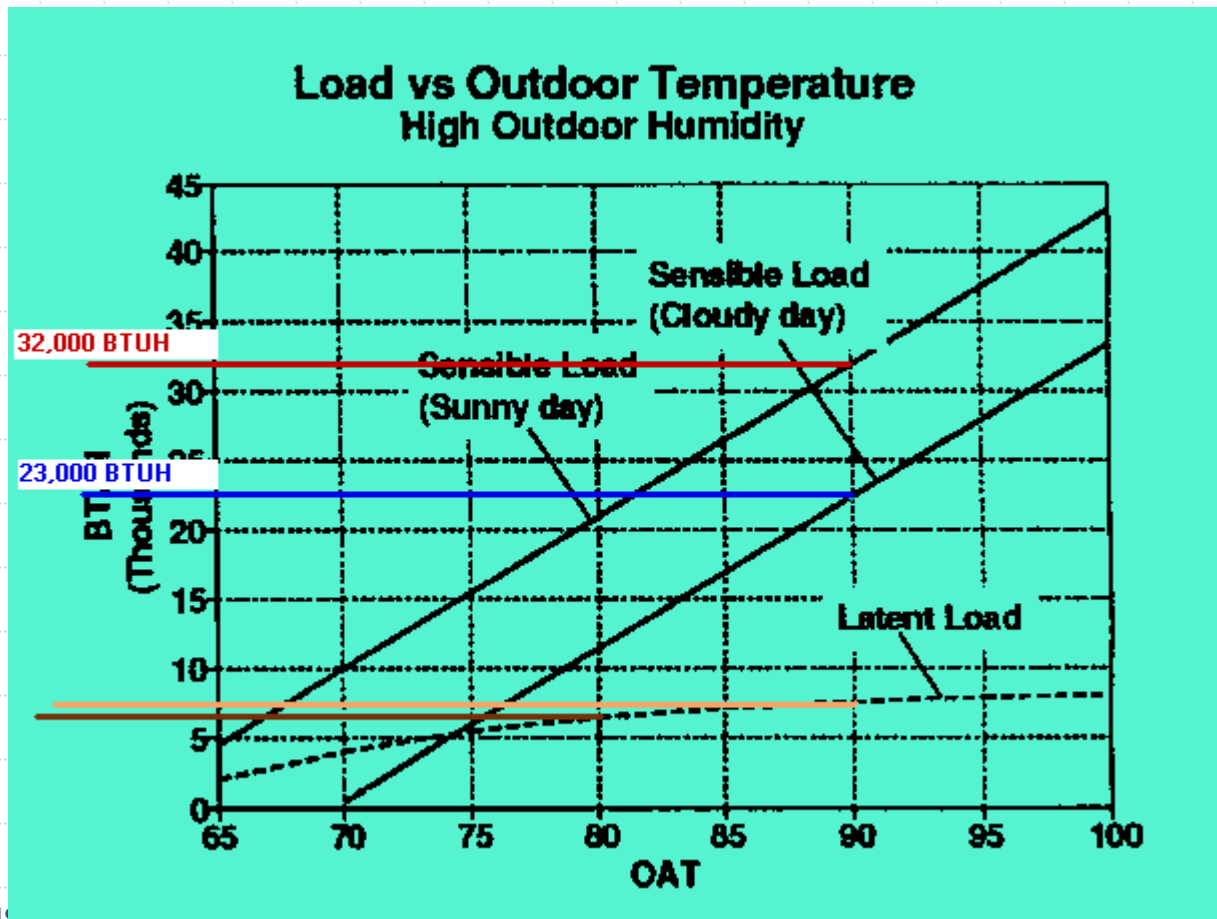


Load vs Outdoor Temperature

High Outdoor Humidity

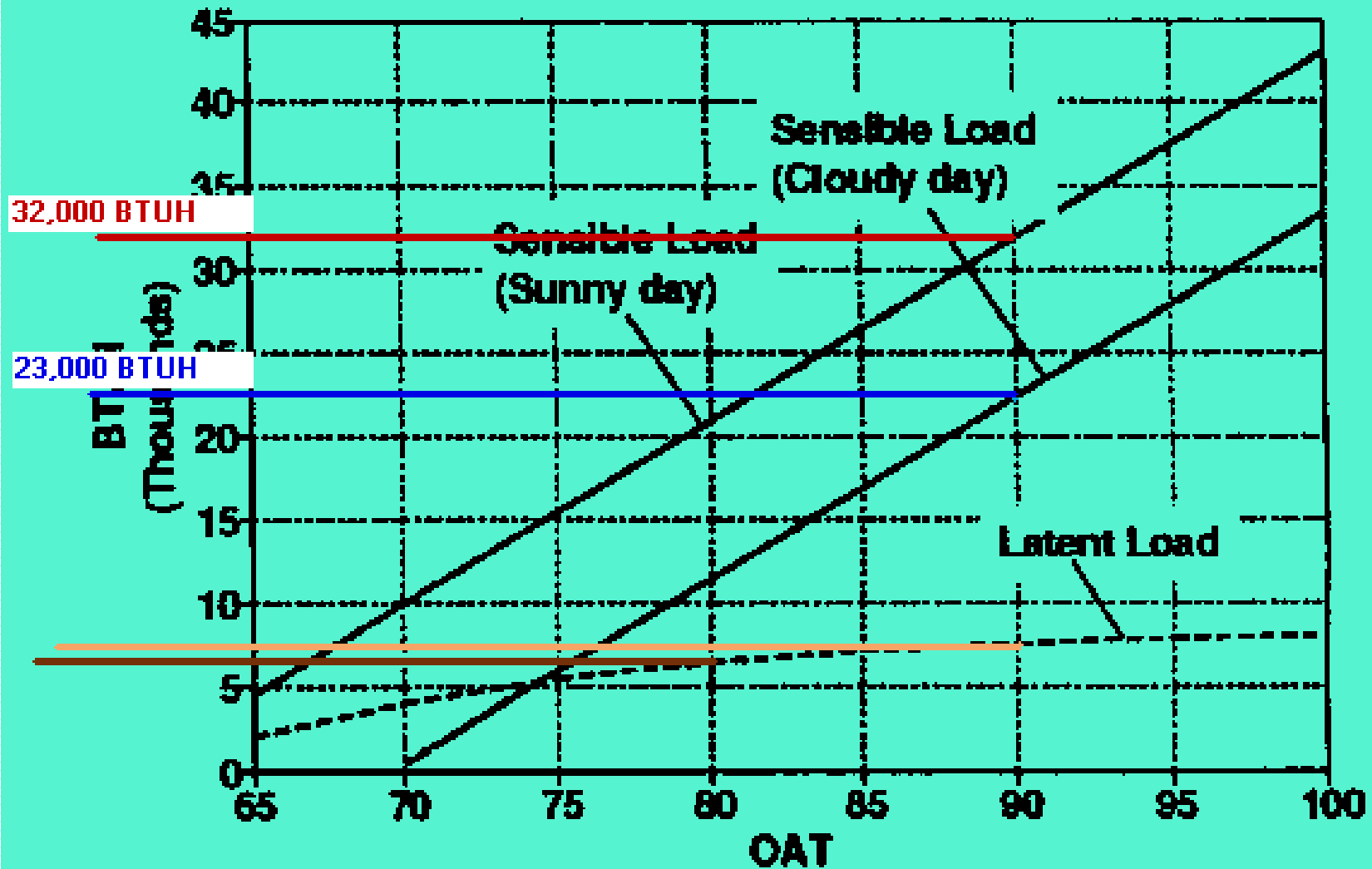


Sensible load variation shows a difference of 9000 BTUH while our latent difference is barely 500 BTUH



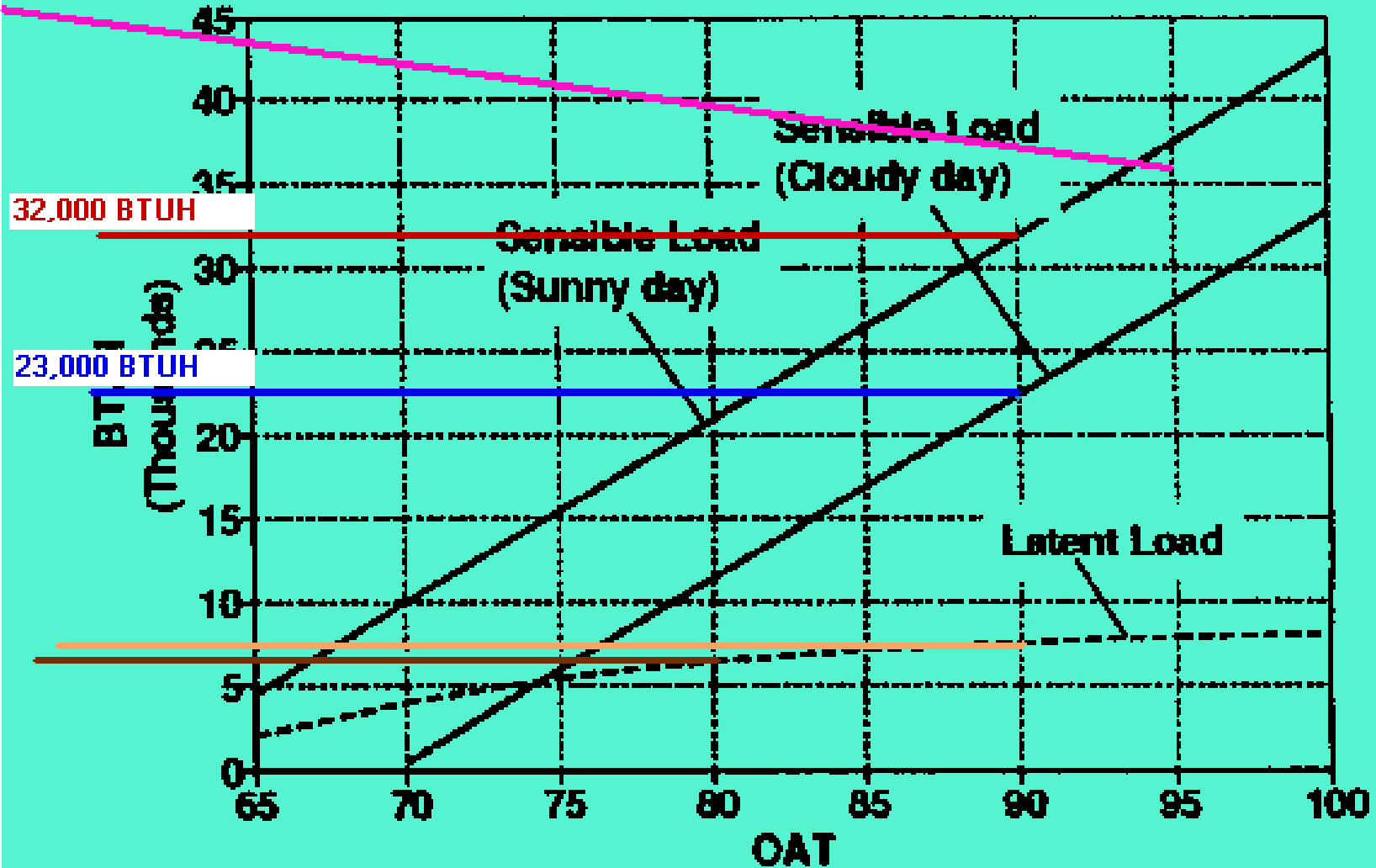
Load vs Outdoor Temperature

High Outdoor Humidity



36,000 BTUH System at
ARI conditions of 95 F
can be as much as 50%
oversized during
moderate temperature
conditions

Load vs Outdoor Temperature High Outdoor Humidity



MJ8 Sensitivities

Design conditions

Building tightness

Fenestration

Air system design & installation

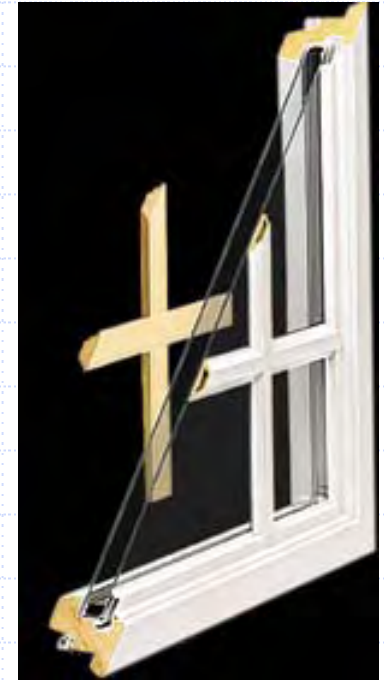
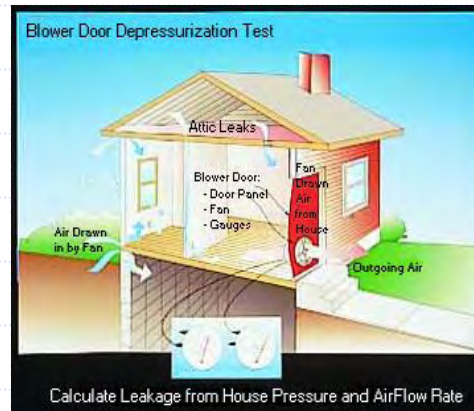


Table 1A

Outdoor Design Conditions For the United States and Canada

Location	Elevation Feet	Latitude Degrees North	Winter		Summer				Daily Range (DR)
			Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	
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St. Petersburg	11	28	47	93	79	59	66	72	M
Sanford	55	28	38	93	76	39	46	52	M
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Tampa AP	19	28	40	91	77	49	56	62	M
Valpariso, Eglin AFB	85	30	33	90	78	57	64	70	M
Vero Beach	13	27	43	90	78	57	64	70	M
West Palm Beach AP	15	26	47	90	78	57	64	70	M



Guidelines

- ◆ Use outdoor design conditions recommended by Table 1 Manual J.
- ◆ Use the default indoor design conditions recommended by Manual J.
- ◆ Take full credit for all internal shading devices and external overhangs.
- ◆ Use internal shading devices that are compatible with the type of room.

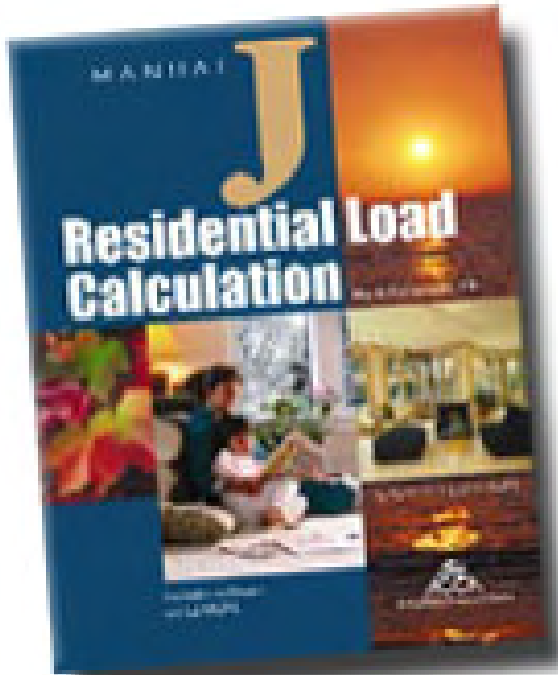
Guidelines

- ◆ Do not use internal shade if the room is specifically used for day lighting.
- ◆ Use the tested performance coefficients when known.
- ◆ Take full credit for all insulation & sealing efforts.
- ◆ Take full credit for insulated & sealed duct runs located in unconditioned space.

Guidelines

- ◆ Take full credit for load factors and diversity when estimating internal loads.
- ◆ Take full credit for diversity when estimating the cooling load on central equipment.

ACCA Manual J v8



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A Computer Only Procedure

From "Addendum B" from ACCA Manual J®

Addendum B to

ACCA Manual J®
**Residential Load
Calculation**
Eighth Edition

ANSI/ACCA Man J 2-2004

ISBN# 1-892765-27-6

*This addendum updates Version 1.10 of Manual J
Eighth Edition (MJ8[™]) and addresses AED
Protocol Revisions to the MJ8[™] procedures.*

Executive Summary

Now that the industry and software houses have had time to work with the Eighth Edition of *Manual J*®, ACCA has determined that AED simplifications would ease implementation by third-party software vendors and improve the understanding and use of MJ8 by practitioners. This addendum revises the adequate exposure diversity (AED) approach on window/glass exposures in the following manners:

- a) MJ8 shall become a computer-only procedure. (Note: A shorter, abridged version of MJ8 is under development that supports a hand calculation procedure aimed at single-family, detached dwellings with single-zone, constant-volume systems).
- b) A computer-only, hourly fenestration gain (HFG) procedure shall be used for all application scenarios.
- c) Calculations shall be made for midsummer, unless southerly-facing fenestration causes a peak gain in the fall.
- d) Hand calculation procedures for applications other than single family detached dwellings served by a single zone, constant volume system shall be abandoned in favor of computerized solutions.

Forms & Worksheets

1 Name of Room												Entire House											
2 Running Feet of Exposed Wall																							
3 Ceiling Height At Walls (Ft) and Gross Wall Area (SqFt)																							
4 Room Dimensions LxW (Ft) and Floor Plan Area (SqFt)																							
5 Ceiling Slope (Degrees) and Gross Ceiling Area (SqFt)																							
Type of Exposure	Const. Number	Panel Faces	HTM Hfg. Clg.		Area or Length	Btuh Heating Sensible Latent			Area or Length	Btuh Heating Sensible Latent													
6a Windows and Glass Doors	a																						
	b																						
	c																						
	d																						
	e																						
	f																						
	g																						
	h																						
	i																						
	j																						
6b Skylights	a																						
	b																						
	c																						
7 Wood and Metal Doors	a																						
	b																						
	c																						
8 Above Grade Walls and Partitions	a																						
	b																						
	c																						
	d																						
9 Below Grade Walls	a																						
	b																						
	c																						
10 Ceilings	a																						
	b																						
11a Passive Floors	a																						
	b																						
11b Radiant Floors	a																						
	b																						
12 Infiltration	Heat Loss					Btuh		WPR															
	Sensible Gain					Btuh																	
	Latent Gain					Btuh																	
13 Internal	a Occupants at 230 and 200 Btuh					#		#															
	b Scenario Number																						
	c Default Adjustments																						
	d Individual Appliances																						
	e Plants																						
14 Subtotals	Sum lines 6 through 11a + line 12 + line 13																						
15 Duct Loads	ELF-Loss and ELF-Gain																						
	Latent Gain																						
16 Ventilation Loads	Vent CPM		Exh																				
17 Winter Humidification load	Gal / Day																						
18 Piping Load																							
19 Blower Heat																							
20 Total Load	Sum line 11b + lines 14 through 19																						

Form J1
Residential Heat Loss and Heat Gain Estimation
Manual J, Eighth Edition

**Average Load Procedure, Single Zone System
Generic Fenestration**

Project Name: _____
Address: _____
Phone: _____

State: _____
Intr: _____
Tr: _____

Worksheet E
Average Load Procedure, Multi Zone System
Generic Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Project Name: _____
Address: _____
Phone: _____

Worksheet A
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet B
Average HTM For Windows and Glass Doors

Generic Fenestration

Worksheet C
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet D
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet F
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet G
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet H
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet I
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet J
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet K
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet L
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet M
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet N
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet O
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet P
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet Q
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet R
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet S
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet T
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet U
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet V
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet W
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet X
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Worksheet Y
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

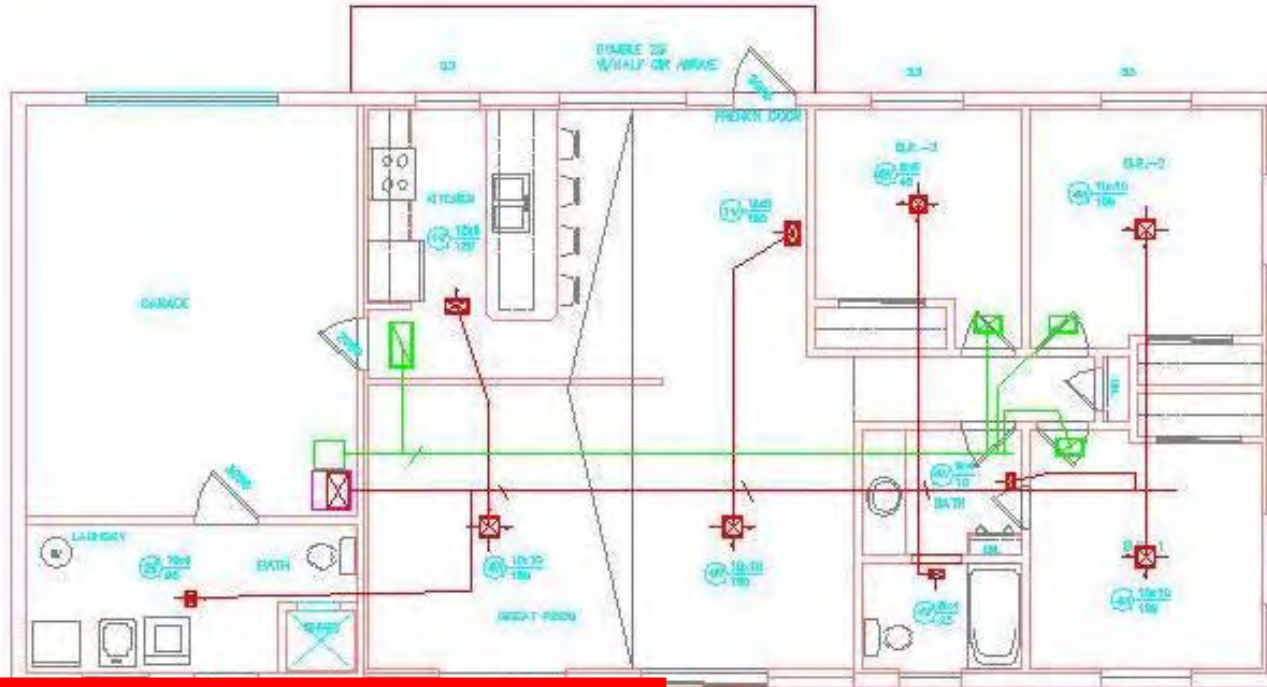
Job ID: _____ Date: _____

Worksheet Z
Average Load Procedure, Multi Zone System
NFRC Rated Fenestration

Supporting Detail For The Average Load Procedure

Job ID: _____ Date: _____

Floor Plan Required.



PORCH ————— 88 SQ. FT.
 UTILITY ————— 133 SQ. FT.
 PORCH ————— 317 SQ. FT.
 LANAI ————— 283 SQ. FT.
 LIVING AREA — 1235 SQ. FT.

TOTAL AREA — 2059 SQ. FT.

1 Name of Room										Entire House			
2 Running Feet of Exposed Wall													
3 Ceiling Height At Walls (Ft) and Gross Wall Area (SqFt)													
4 Room Dimensions LxW (Ft) and Floor Plan Area (SqFt)													
5 Ceiling Slope (Degrees) and Gross Ceiling Area (SqFt)													
Type of Exposure	Const. Number	Panel Faces	HTM		Area or Length	Btuh			Area or Length	Btuh			
			Hg.	Cig.		Heating	Sensible	Latent		Heating	Sensible		
6a Windows and Glass Doors	a												
	b												
	c												
	d												
	e												

TOTAL AREA — 2059 SQ. FT.

SCALE 3/16" = 1'

M-1

DATE

64002700 / 91-100 / HFC-000 / NSI-0700

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INDOOR ENVIRONMENTAL CONSULTANTS

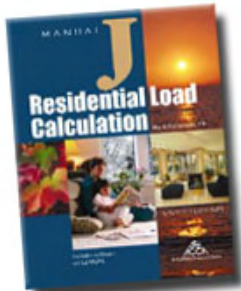
280 Duckworth Rd., Fenton, MI 48430 / 941-930-0912 / info@calcs.com

Room x Room Entry

1 Name of Room		Entire House																			
2 Running Feet of Exposed Wall																					
3 Ceiling Height At Walls (Ft) and Gross Wall Area (SqFt)																					
4 Room Dimensions LxW (Ft) and Floor Plan Area (SqFt)																					
5 Ceiling Slope (Degrees) and Gross Ceiling Area (SqFt)																					
Type of Exposure	Const. Number	Panel Faces	HTM		Area or Length	Btuh			Area or Length	Btuh		Area or Length	Btuh		Area or Length	Btuh		Area or Length	Btuh		
			Htg.	Cig.		Heating	Sensible	Latent		Heating	S-Cig.		Heating	S-Cig.		Heating	S-Cig.		Heating	S-Cig.	
6a Windows and Glass Doors	a																				
	b																				
	c																				
	d																				
	e																				
	f																				
	g																				
	h																				
	i																				
6b Skylights	a																				
	b																				
	c																				
7 Wood and Metal Doors	a																				
	b																				
	c																				
8 Above Grade Walls and Partitions	a																				
	b																				
	c																				
	d																				
	e																				
9 Below Grade Walls	a																				
	b																				
	c																				
10 Ceilings	a																				
	b																				
11a Passive Floors	a																				
	b																				
11b Radiant Floors	a																				
	b																				
12 Infiltration	Heat Loss																				
	Sensible Gain																				
	Latent Gain																				
13 Internal	a Occupants at 230 and 200 Btuh																				
	b Scenario Number																				
	c Default Adjustments																				
	d Individual Appliances																				
	e Plants																				
14 Subtotals	Sum lines 6 through 11a + line 12 + line 13																				
16 Duct Loads	ELF-Loss and ELF-Gain																				
	Latent Gain																				
16 Ventilation Loads	Vent CPM																				
17 Winter Humidification load	Gal / Day																				
18 Piping Load																					
19 Blower Heat																					
20 Total Load	Sum line 11b + lines 14 through 19																				

From Part of Section 1-16 ACCA Manual J 8th Edition

- ◆ Computerized method calculates load by month of year and time of day associated with each room load and with the equipment sizing load.
- ◆ Computer can generate solutions for 288 scenarios (12 month year and 24 hour day)



+



General Information

Help

General Project Data

Project Client Company Design Duct

Project Title:

Designed By:

Date:

Units: ▼

Comment:

Include this comment on reports.

The Design Tab

The Data that is automatically filled in comes from Table 1A in ACCA Manual J 8th edition.

Outdoor Design Conditions For the United States and Canada.

The screenshot shows a software window titled "General Project Data" with a blue title bar and standard Windows window controls. Below the title bar is a tabbed interface with five tabs: "Project", "Client", "Company", "Design", and "Duct". The "Design" tab is currently selected. The main area of the dialog contains several input fields and dropdown menus for configuring outdoor design conditions. The "Reference City" is set to "West Palm Beach, Florida". "Daily Range" is set to "Medium". "Latitude" is set to "26" and "Elevation" is set to "15". Under "Elev. Derating", there are three dropdown menus for "Sensible", "Total", and "Heating", all of which are currently empty. "Dry Bulb Temperature" is set to "45" for "Winter" and "91" for "Summer". "Wet Bulb Temperature" is set to "78". Under "People Loads", there are two dropdown menus for "Sensible" and "Latent", both of which are currently empty.

Field	Value
Reference City:	West Palm Beach, Florida
Daily Range:	Medium
Latitude:	26
Elevation:	15
Elev. Derating:	Sensible: [Empty], Total: [Empty], Heating: [Empty]
Dry Bulb Temperature:	Winter: 45, Summer: 91
Wet Bulb Temperature:	78
People Loads:	Sensible: [Empty], Latent: [Empty]

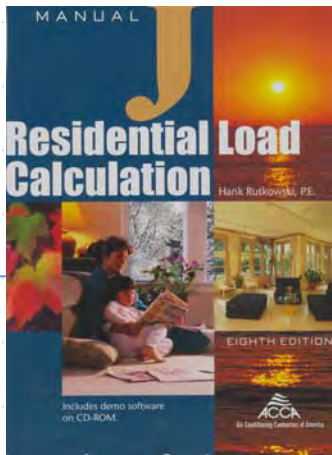


Table 1A

RHVAC weather data base comes directly from ACCA Manual J version 8 Table 1A & 1B(micro climates).

Table 1A
Outdoor Design Conditions For the United States and Canada

Location	Elevation Feet	Latitude Degrees North	Winter	Summer					
			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)
St. Augustine	10	29	35	89	78	59	66	72	M
St. Petersburg	11	28	47	93	79	59	66	72	M
Sanford	55	28	38	93	76	39	46	52	M
Sarasota/Bradenton	30	27	43	92	79	61	68	74	M
Tallahassee AP	55	30	28	93	76	39	46	52	M
Tampa AP	19	28	40	91	77	49	56	62	M
Valpariso, Eglin AFB	85	30	33	90	78	57	64	70	M
Vero Beach	13	27	43	90	78	57	64	70	M
West Palm Beach AP	15	26	47	90	78	57	64	70	M

Default Room Data

No.	Name	System	Zone	Width	Length	Height	Check Errors
n/a	Default Room	1	1	0	0	8	n/a

Floor Material	U-Value	Width	Length	Perimeter
1 19A-11p	0.073	0	0	0

Over enclosed unconditioned crawl space, No insulation on exposed walls, sealed or vented space, passive, R-11 blanket, carpet covering

Roof Material	U-Value	Width	Length	Direction
1 16B-19	0.049	0	0	UP

Under attic or knee wall, Vented Attic, No Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane, R-19 insulation

Wall Material	U-Value	Length	Height	Dir	STD	WTD
1 13A-5ocs	0.125	0	8	N	0	0

Block, board insulation only, R-5 board insulation, open core, siding finish

Glass Material	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off
1 1A-cb-o	1.08	0.75	0	0	1	1	0	0

Single pane, operable window, clear, metal frame with break, outdoor insect screen with 50% coverage, white or reflective color drapes with tight weave with 50% coverage

Door Material	U-Value	Width	Height	Ref
1 11P	0.29	0	0	0

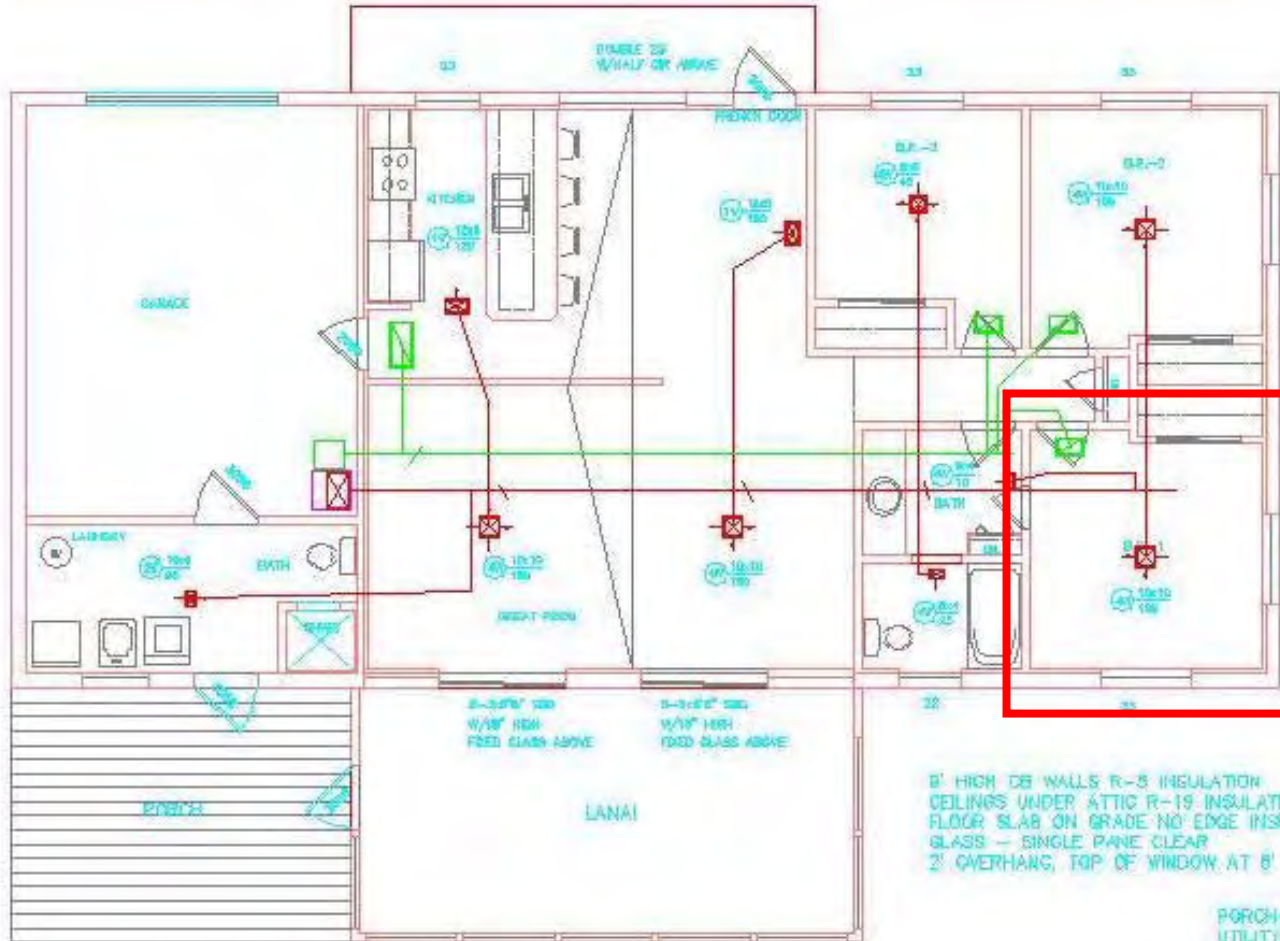
Polyurethane Core

People & Equip.
Ppl: 0
S.Eq: 0
L.Eq: 0

Other
Regs: 0
Infil: 0
Vent: 0
Light: 0
Occ: 1
Mode: Both
Rad.F: 0

Set up default data so you don't have to do repetitive inputs.

From the Floor Plan



8" HIGH DB WALLS R-5 INSULATION
 CEILING UNDER ATTIC R-19 INSULATION
 FLOOR SLAB ON GRADE NO EDGE INSULATION
 GLASS - SINGLE PANE CLEAR
 2' OVERHANG, TOP OF WINDOW AT 8'

PORCH	88 SQ. FT.
UTILITY	133 SQ. FT.
GARAGE	317 SQ. FT.
LANAI	293 SQ. FT.
IVING AREA	1235 SQ. FT.
TOTAL AREA	2056 SQ. FT.

SCALE 3/16" = 1'

M-1

DATE

60422708 / 91-108 / 180-008 / 181-4070
CALCS-PLUS
 INDOOR ENVIRONMENTAL CONSULTANTS
 280 Duckworth Rd., Fenton, MI 48430 / 941-433-0912 / info@calcs-plus.com

Room Entry Data

Room Data - Room 1 of 1

No.	Name	System Zone	Width
1	Bedroom 1	1	11.5

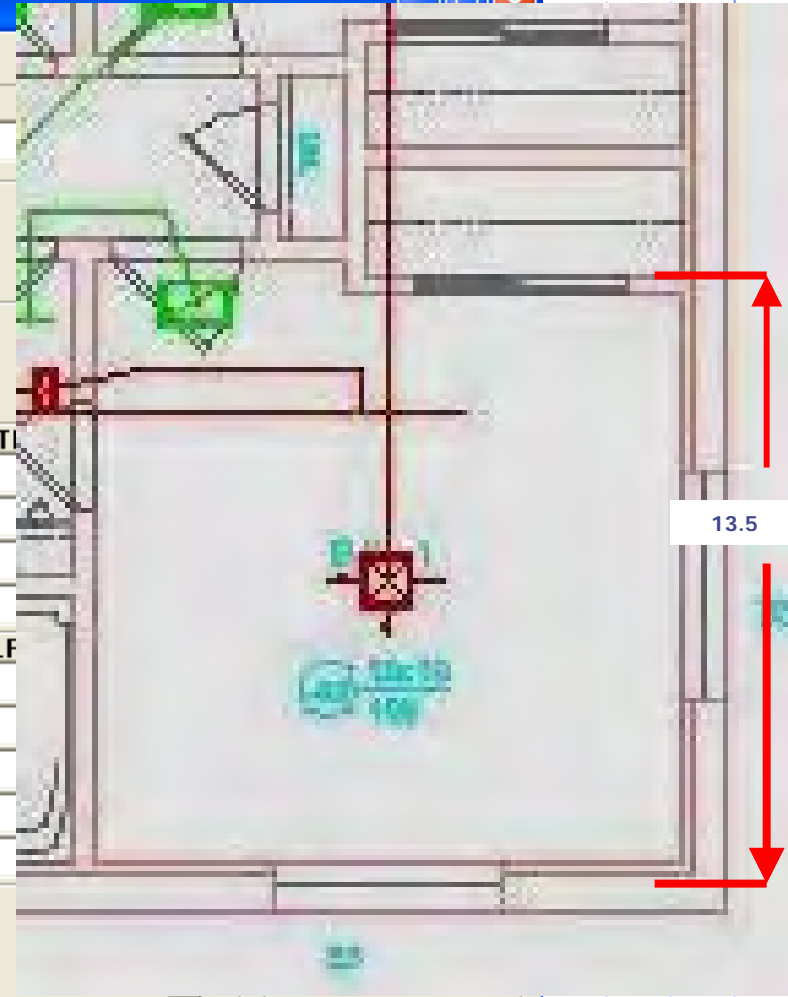
Floor Material		U-Value	Width	Length	Perimeter
1	22A-ph	1.358	11.5	13.5	25
2		0	0	0	0

Roof Material		U-Value	Width	Length	Direction
1	16B-19	0.049	11.5	13.5	UP
2		0	0	0	UP

Wall Material		U-Value	Length	Height	Dir	STD	WT
1	13A-5ocs	0.125	11.5	9	S	0	0
2	13A-5ocs	0.125	13.5	9	E	0	0
3		0	0	0	N	0	0
4		0	0	0	N	0	0

Glass Material		U-Value	SHGC	Width	Height	Ref	Occ.	O.F
1	1A-cb-o	1.08	0.75	4.4	3.2	1	1	2
2	1A-cb-o	1.08	0.75	4.4	3.2	1	1	2
3		0	0	0	0	0	1	0
4		0	0	0	0	0	1	0
5		0	0	0	0	0	1	0

Door Material		U-Value	Width	Height	Ref
1		0	0	0	0
2		0	0	0	0



System Information

System Data - System 1 of 1

No: 1 Name: System 1

Design | Equipment

System Design Conditions

	Winter	Summer		
Indoor Temperature:	70	75	Do Winter Humid.:	No
Relative Humidity:	50	50	System Air Type:	Fixed
Lvg. Coil-Rm DT:	70	20	System CFM:	675
Infiltration:	0	0	Pct. Sens. Capacity:	75
Ventilation:	42.46	42.46	Radiator Btuh/ft.:	0
Exhaust:	0	0	Radiator Text Option:	Foot
Do Heat Recovery:	No	No	Duct Load Factors:	(None)
Heat Recovery SER:	60	60		
Blower Power:		0		
Hot Water Piping:	0			

- ◆ Design Conditions
- ◆ Infiltration
- ◆ Ventilation
- ◆ Airflow

MJ8 & Infiltration For Winter

Winter Infiltration

3 or 4 Exposures (free standing structure) | 1 or 2 Exposures

Select the number of exposures that this system has by clicking the appropriate changes per hour option based on the quality of the envelope and the appropriate fireplace option based on the construction quality and number of fireplaces. To read descriptions of exactly what is required, click the link for the "Construction Quality" help window and click the link for the "Construction Quality" help window.

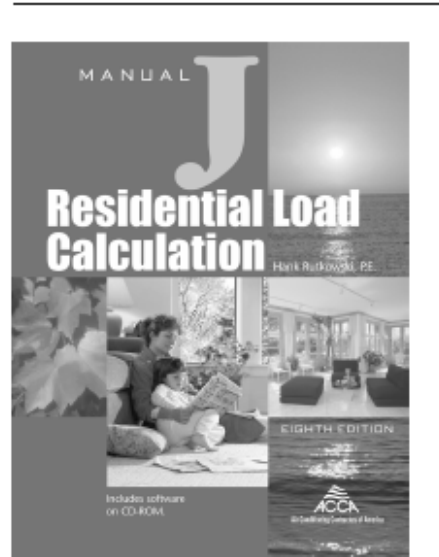
Conditioned Space (Square feet)

Construction	900 or Less	901 to 1500	1501 to 2000	2001 to 2500	2501 to 3000	3001 to 3500	3501 to 4000	4001 to 4500	4501 to 5000	5001 to 5500	5501 to 6000	6001 to 6500	6501 to 7000	7001 to 7500	7501 to 8000	8001 to 8500	8501 to 9000	9001 to 9500	9501 to 10000
Tight	<input type="radio"/> 0.21	<input type="radio"/> 0.16	<input type="radio"/> 0.1	<input type="radio"/> 0.08	<input type="radio"/> 0.07	<input type="radio"/> 0.06	<input type="radio"/> 0.05	<input type="radio"/> 0.04	<input type="radio"/> 0.03	<input type="radio"/> 0.02	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01
Semi-Tight	<input type="radio"/> 0.41	<input type="radio"/> 0.31	<input type="radio"/> 0.2	<input type="radio"/> 0.15	<input type="radio"/> 0.12	<input type="radio"/> 0.1	<input type="radio"/> 0.09	<input type="radio"/> 0.08	<input type="radio"/> 0.07	<input type="radio"/> 0.06	<input type="radio"/> 0.05	<input type="radio"/> 0.04	<input type="radio"/> 0.03	<input type="radio"/> 0.02	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01
Average	<input type="radio"/> 0.61	<input type="radio"/> 0.45	<input type="radio"/> 0.3	<input type="radio"/> 0.22	<input type="radio"/> 0.18	<input type="radio"/> 0.15	<input type="radio"/> 0.13	<input type="radio"/> 0.11	<input type="radio"/> 0.1	<input type="radio"/> 0.09	<input type="radio"/> 0.08	<input type="radio"/> 0.07	<input type="radio"/> 0.06	<input type="radio"/> 0.05	<input type="radio"/> 0.04	<input type="radio"/> 0.03	<input type="radio"/> 0.02	<input type="radio"/> 0.01	<input type="radio"/> 0.01
Semi-Loose	<input type="radio"/> 0.95	<input type="radio"/> 0.70	<input type="radio"/> 0.59	<input type="radio"/> 0.49	<input type="radio"/> 0.43	<input type="radio"/> 0.37	<input type="radio"/> 0.31	<input type="radio"/> 0.25	<input type="radio"/> 0.2	<input type="radio"/> 0.15	<input type="radio"/> 0.1	<input type="radio"/> 0.07	<input type="radio"/> 0.05	<input type="radio"/> 0.03	<input type="radio"/> 0.02	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01	<input type="radio"/> 0.01
Loose	<input type="radio"/> 1.29	<input checked="" type="radio"/> 0.94	<input type="radio"/> 0.80	<input type="radio"/> 0.66	<input type="radio"/> 0.58	<input type="radio"/> 0.5	<input type="radio"/> 0.43	<input type="radio"/> 0.37	<input type="radio"/> 0.31	<input type="radio"/> 0.25	<input type="radio"/> 0.2	<input type="radio"/> 0.15	<input type="radio"/> 0.1	<input type="radio"/> 0.07	<input type="radio"/> 0.05	<input type="radio"/> 0.03	<input type="radio"/> 0.02	<input type="radio"/> 0.01	<input type="radio"/> 0.01

Number of Fireplaces: Fireplace CFM (added to AC/hr):

Infiltration Air Changes per Hour:

OK Cancel



Addendum D to

ACCA Manual J® Residential Load Calculation Eighth Edition

ANSI/ACCA Man J 2-2004

ISBN# 1-892765-27-6

This addendum updates Version 1.10 of Manual J Eighth Edition (MJ8™) and addresses *Infiltration Gain / Loss Revisions* to the MJ8 procedures.

MJ8 & Infiltration For Summer Loose Construction

Summer Infiltration

3 or 4 Exposures (free standing structure) | 1 or 2 Exposures (townhome, condo, apartment)

Select the number of exposures that this system has by clicking the appropriate tab above. Then select the the air changes per hour option based on the quality of the envelope construction and the area of the building. To read descriptions of exactly what is meant by "Tight," "Semi-Tight," etc., press F1 to open the Rhvac Help window and click the link for the "Construction Tightness" topic.

**Conditioned Floor Area
(Square feet) of Building**

<u>Construction</u>	<u>900 or Less</u>	<u>901 to 1500</u>	<u>1501 to 2000</u>	<u>2001 to 3000</u>	<u>More than 3000</u>
Tight	<input type="radio"/> 0.11	<input type="radio"/> 0.08	<input type="radio"/> 0.07	<input type="radio"/> 0.06	<input type="radio"/> 0.05
Semi-Tight	<input type="radio"/> 0.22	<input type="radio"/> 0.16	<input type="radio"/> 0.14	<input type="radio"/> 0.11	<input type="radio"/> 0.10
Average	<input type="radio"/> 0.32	<input type="radio"/> 0.23	<input type="radio"/> 0.20	<input type="radio"/> 0.16	<input type="radio"/> 0.15
Semi-Loose	<input type="radio"/> 0.50	<input type="radio"/> 0.36	<input type="radio"/> 0.31	<input type="radio"/> 0.25	<input type="radio"/> 0.23
Loose	<input type="radio"/> 0.67	<input checked="" type="radio"/> 0.49	<input type="radio"/> 0.42	<input type="radio"/> 0.34	<input type="radio"/> 0.30

Infiltration Air Changes per Hour:

OK Cancel

MJ8 & Infiltration

5,739 BTUH gain from a loosely built building by today's standards

System Design Conditions

	Winter	Summer		
Indoor Temperature:	70	75	Do Winter Humid.:	No
Relative Humidity:	50	50	System Air Type:	Fixed
Evg. Coil Rm DT:	78	28	System CFM:	940
Infiltration:	0.94	0.49	Fct. Sens. Capacity:	75
Ventilation:	0	0	Radiator Btuh/ft.:	0
Exhaust:	0	0	Radiator Text Option:	Foot
Do Heat Recovery:	No	No	Duct Load Factors:	[Data]
Heat Recovery SER:	60	60		
Blower Power:		0		
Hot Water Piping:	0			

Subtotals for structure:		17,491	0	11,924	11,924
People:	4		800	920	1,720
Equipment:			800	1,600	2,400
Lighting:	0			0	0
Ductwork:		5,660	999	5,162	6,161
Infiltration: Winter CFM: 190, Summer CFM: 99		5,222	3,998	1,741	5,739
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		28,373	6,597	21,347	27,944

Check Figures			
Total Building Supply CFM:	940	CFM Per Square ft.:	0.754
Square ft. of Room Area:	1,246	Square ft. Per Ton:	525
Volume (ft ³) of Cond. Space:	12,124	Air Turnover Rate (per hour):	4.7

MJ8 & Infiltration For Summer Tight Construction

Summer Infiltration

3 or 4 Exposures (free standing structure) | 1 or 2 Exposures (townhome, condo, apartment)

Select the number of exposures that this system has by clicking the appropriate tab above. Then select the the air changes per hour option based on the quality of the envelope construction and the area of the building. To read descriptions of exactly what is meant by "Tight," "Semi-Tight," etc., press F1 to open the Rhvac Help window and click the link for the "Construction Tightness" topic.

**Conditioned Floor Area
(Square feet) of Building**

<u>Construction</u>	900 or Less	901 to 1500	1501 to 2000	2001 to 3000	More than 3000
Tight	<input type="radio"/> 0.11	<input checked="" type="radio"/> 0.08	<input type="radio"/> 0.07	<input type="radio"/> 0.06	<input type="radio"/> 0.05
Semi-Tight	<input type="radio"/> 0.22	<input type="radio"/> 0.18	<input type="radio"/> 0.14	<input type="radio"/> 0.11	<input type="radio"/> 0.10
Average	<input type="radio"/> 0.32	<input type="radio"/> 0.23	<input type="radio"/> 0.20	<input type="radio"/> 0.16	<input type="radio"/> 0.15
Semi-Loose	<input type="radio"/> 0.50	<input type="radio"/> 0.36	<input type="radio"/> 0.31	<input type="radio"/> 0.25	<input type="radio"/> 0.23
Loose	<input type="radio"/> 0.67	<input type="radio"/> 0.49	<input type="radio"/> 0.42	<input type="radio"/> 0.34	<input type="radio"/> 0.30

Infiltration Air Changes per Hour:

OK Cancel

MJ8 & Infiltration

939 BTUH gain from a loosely built building by today's standards

System Data - System 1 of 1

No: 1 Name: System 1

Design | Equipment

System Design Conditions

Indoor Temperature:	70	75	Do Winter Humid.:	No
Relative Humidity:	50	50	System Air Type:	Fixed
Lvg. Coil-Bm DT-:	70	20	System CFM:	940
Infiltration:	0.16	0.08	Pct. Sens. Capacity:	75
Ventilation:	0	0	Radiator Btuh/ft.:	0
Exhaust:	0	0	Radiator Text Option:	Foot
Do Heat Recovery:	No	No	Duct Load Factors:	(Data)
Heat Recovery SER:	60	60		
Blower Power:		0		
Hot Water Piping:	0			

People:	4	17,491	0	11,924	11,924
Equipment:			800	920	1,720
Lighting:	0		800	1,600	2,400
Ductwork:		5,682	1,223	5,234	6,457
Infiltration: Winter CFM: 32, Summer CFM: 16		888	654	285	939
Ventilation: Winter CFM: 0, Summer CFM: 0		0	0	0	0
Total Building Load Totals:		24,061	3,477	19,963	23,440

Check Figures

Infiltration Sensitivity

- 901 to 1500**
- 0.08**
- 0.16**
- 0.23**
- 0.36**
- 0.49**

TIGHT

LOOSE

Summer Infiltration

3 or 4 Exposures (free standing structure) | 1 or 2 Exposures (townhome, condo, apartment)

Select the number of exposures that this system has by clicking the appropriate tab above. Then select the air changes per hour option based on the quality of the envelope construction and the area of the building. To read descriptions of exactly what is meant by "Tight," "Semi-Tight," etc., press F1 to open the Rhvac Help window and click the link for the "Construction Tightness" topic.

Conditioned Floor Area (Square feet) of Building

Construction	900 or Less	901 to 1500	1501 to 2000	2001 to 3000	More than 3000
Tight	<input type="radio"/> 0.11	<input checked="" type="radio"/> 0.08	<input type="radio"/> 0.07	<input type="radio"/> 0.06	<input type="radio"/> 0.05
Semi-Tight	<input type="radio"/> 0.22	<input type="radio"/> 0.16	<input type="radio"/> 0.14	<input type="radio"/> 0.11	<input type="radio"/> 0.10
Average	<input type="radio"/> 0.32	<input type="radio"/> 0.23	<input type="radio"/> 0.20	<input type="radio"/> 0.16	<input type="radio"/> 0.15
Semi-Loose	<input type="radio"/> 0.50	<input type="radio"/> 0.36	<input type="radio"/> 0.31	<input type="radio"/> 0.25	<input type="radio"/> 0.23
Loose	<input type="radio"/> 0.67	<input type="radio"/> 0.49	<input type="radio"/> 0.42	<input type="radio"/> 0.34	<input type="radio"/> 0.30

Infiltration Air Changes per Hour:

OK Cancel

Loose Construction

Infiltration: Winter CFM: 190, Summer CFM: 99	5,222	3,998	1,741	5,739
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Tight Construction

Infiltration: Winter CFM: 32, Summer CFM: 16	888	654	285	939
--	-----	-----	-----	------------

MJ8 & Duct Leakage



MJ8 & Duct Design

The screenshot shows a software window titled "Load Preview" with a table of HVAC load data. The table has 14 columns: Scope, AED, Net.Ton, Rec.Ton, f²/Ton, Area, S.Gain, L.Gain, Net.Gain, S.Loss, W.CFM, S.CFM, Sys.CFM, and D. Size. The data is organized into sections: Building, System 1, Zone 1, and individual rooms. A red box highlights the "Sys.CFM" and "D. Size" columns.

Scope	AED	Net.Ton	Rec.Ton	f ² /Ton	Area	S.Gain	L.Gain	Net.Gain	S.Loss	W.CFM	S.CFM	Sys.CFM	D. Size
Building		2.11	2.28	546	1,246	20,534	4,794	25,327	24,566	227	900	940	
System 1	Yes	2.11	2.28	546	1,246	20,534	4,794	25,327	24,566	227	900	940	0*
Ventilation						747	1,715	2,462	1,167				
Duct Loads						5,343	1,479	6,822	5,908				
Zone 1					1,246	14,444	1,600	16,044	17,491	227	900	940	
1-Bedroom 1					155	1,392	0	1,392	2,414	31	87	91	1-6
2-Bedroom 2					155	1,392	0	1,392	2,414	31	87	91	1-6
3-Bedroom 3					120	783	0	783	1,213	16	49	51	1-4
4-Bathroom Powder A...					48	121	0	121	59	1	8	8	1-4
5-Bathroom Tub Area					43	378	0	378	702	9	24	25	1-4
6-Great Room					329	4,838	400	5,238	4,196	55	301	315	1-10
7-Kitchen / Dining					276	3,240	1,200	4,440	3,462	45	202	211	1-9
8-Laundry					120	2,300	0	2,300	3,031	39	143	150	1-7

Design room CFM (airflow)

Duct Loads

Addendum C to

ACCA Manual J[®] Residential Load Calculation Eighth Edition

ANSI/ACCA Man J 2-2004

ISBN# 1-892765-27-6

This addendum updates Version 1.10 of Manual J Eighth Edition (MJ8™) and addresses *Duct Gain / Loss Revisions* to the MJ8 procedures.

Ducts located in the unconditioned space also have a heat gain that adds to the cooling load of the building.

Duct Load Factors - Location Scenario 1 of 5

Duct Properties

	Supply	Return
Duct Location:	Attic	Attic
Attic Ceiling Type:	16B	16B
Duct Leakage Rate:	0.12	0.24
Duct Insulation R-Value:	6	6
Duct Surface Area:	0	0

Results

Calculate

	System 1 Duct Load	Percent of Total Load
Sensible Loss:	0	0%
Sensible Gain:	0	0%
Latent Gain:	0	0%

Multiple Duct Scenarios (Optional)

If the ducts in this system are in more than one location or have other properties that differ, you can change the Duct Scenario Number below and enter "Duct Properties" data for additional scenarios (up to 5 total).

Duct Scenario No.: 1 Desc.: Main

<< >> [Icons]

	Supply	Return
Total Duct Surface Area for System 1:	0	0
Scenario 1 Percentage:	0%	0%

OK Cancel

Calculate Duct Loads

Duct Load Factors - Location Scenario 1 of 5

Duct Properties

	Supply	Return
Duct Location:	Attic	Attic
Attic Ceiling Type:	16B	16B
Duct Leakage Rate:	0.06	0.06
Duct Insulation R-Value:	6	6
Duct Surface Area:	336	249

Results

	System 1 Duct Load	Percent of Total Load
Sensible Loss:	4,350	18%
Sensible Gain:	4,700	24%
Latent Gain:	629	18%

Multiple Duct Scenarios (Optional)

If the ducts in this system are in more than one location or have other properties that differ, you can change the Duct Scenario Number below and enter "Duct Properties" data for additional scenarios (up to 5 total).

Duct Scenario No.: 1 Desc.: Main

	Supply	Return
Total Duct Surface Area for System 1:	336	249
Scenario 1 Percentage:	100%	100%

The Sensible Loss, Sensible Gain, and the Latent Gain are calculated for the duct system.

What If?

Duct Load Factors - Location Scenario 1 of 5

Duct Properties

	Supply	Return
Duct Location:	Attic	Attic
Attic Soiling Type:	1CB	1CB
Duct Leakage Rate:	0.06	0.06
Duct Insulation R-Value:	6	6
Duct Surface Area:	336	249

Results

	System 1 Duct Load	Percent of Total Load
Sensible Loss:	4,350	18%
Sensible Gain:	4,700	24%
Latent Gain:	629	18%

Multiple Duct Scenarios (Optional)

Duct Scenario No.	Desc.	Main
1		

Total Duct Surface Area for System 1: Supply 336, Return 249

Scenario 1 Percentage: Supply 100%, Return 100%

OK Cancel

Extremely sealed (seal shall be verified by leakage test)

Duct Load Factors - Location Scenario 1 of 5

Duct Properties

	Supply	Return
Duct Location:	Attic	Attic
Attic Soiling Type:	1CB	1CB
Duct Leakage Rate:	0.12	0.06
Duct Insulation R-Value:	6	6
Duct Surface Area:	336	249

Results

	System 1 Duct Load	Percent of Total Load
Sensible Loss:	5,624	23%
Sensible Gain:	5,195	26%
Latent Gain:	1,117	28%

Multiple Duct Scenarios (Optional)

If the ducts in properties that below and enter (5 total).

Duct Scenario No.	Desc.	Main
1		

Total Duct Surface Area for System 1: Supply 336, Return 249

Scenario 1 Percentage: Supply 100%, Return 100%

OK Cancel

Average sealed system (MJ8 default)

MJ8 & the Energy Rater

The information you gather to do a energy rating is the same as required for an HVAC Load Calculation.

Do it to set yourself apart from your competition.

Do it to become a better Energy Rater.

Do it to provide another avenue for income.

Larger Customer Base

AC Contractors know or at least had to have learned load calculations if they carry a license or certification.

AC contractors are busy running a company and don't have time to do room x room calculations.

If they were provided room x room calculations they would use them as a design tool.

Diagnostic Tool

Start every diagnostic investigation with a room x room HVAC load calculation.

You will understand the construction of the building much better.

You will have a better understanding of the results of all the data gathered.

A Plug for MJ8

The possibility for experiencing comfort problems at part load conditions can be minimized by observing the guidelines set forth in Manual J.

The Manual J calculation should take full advantage of legitimate opportunities to minimize the size of the estimated loads.



Thank You

Questions?