

Right Sizing AC Systems for Profit and Energy Star Certification Part I

RESNET 2007

Dennis J Stroer

CALCS-PLUS

Venice Florida

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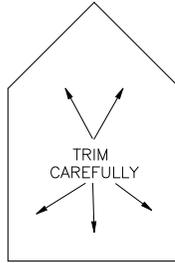
BUBBA'S PROFESSIONAL HVAC LOAD CALCULATION

SIZING CHART AIR CONDITIONING OR HEAT PUMP

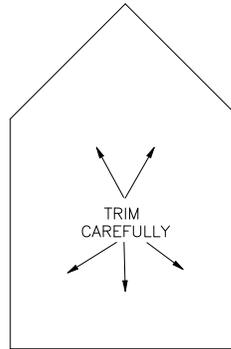
TRIM OUT VERY CAREFULLY ON BLACK LINES, THEN FOLLOW INSTRUCTIONS BELOW



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.

◆ HVAC Load Calculations

- Why should an Energy Rater perform these calculations?
- Whole-House or room x room?
 - ◆ What are the benefits
- Why use ACCA MJ8
- MJ8 Sensitivities

◆ MJ8 take off

- Design Conditions
- What constitutes the envelope (air barriers and the thermal barriers)

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Why Should an Energy Rater Perform HVAC Load Calculations?



ENERGY STAR Qualified Homes National Performance Path Notes

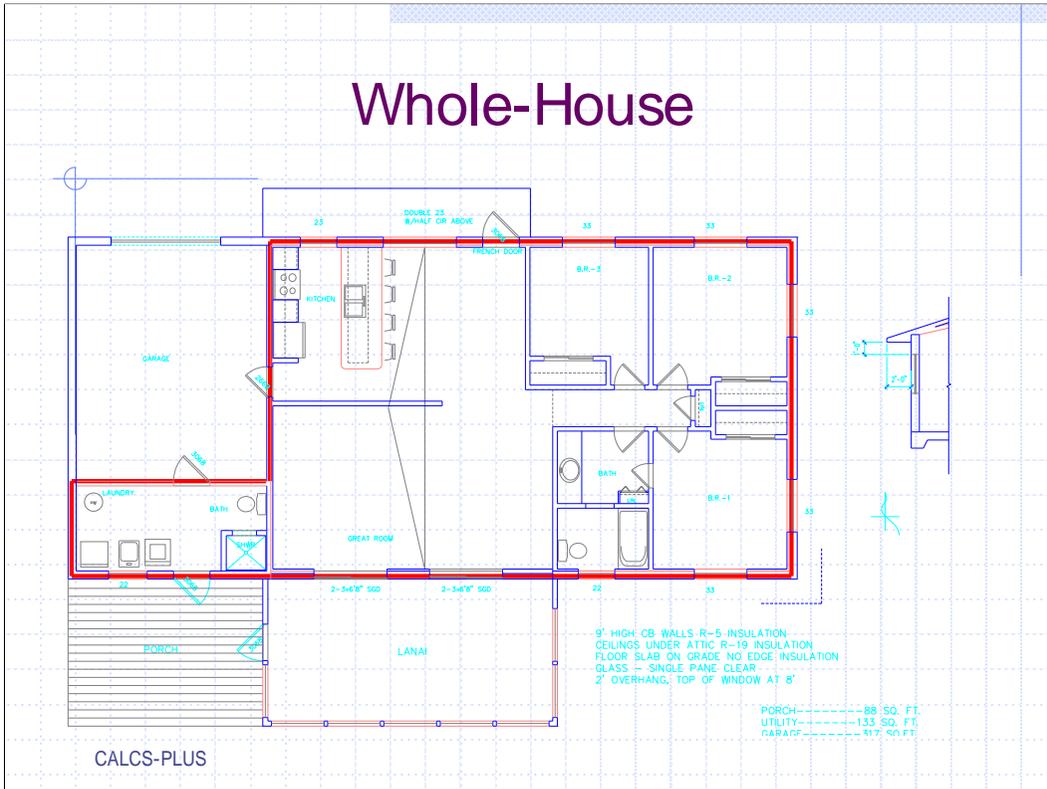
7. All cooling equipment, regardless of whether it is used to satisfy the ENERGY STAR products requirement, must be sized according to the latest editions of ACCA Manuals J and S, ASHRAE 2001 Handbook of Fundamentals, or an equivalent computation procedure. Maximum over sizing limit for air conditioners and heat pumps is 15% (with the exception of heat pumps in Climate Zones 5 - 8, where the maximum over sizing limit is 25%). This can be accomplished either by the rater performing the calculations or reviewing documentation provided by the professional contractor or engineer who calculated the sizing (e.g., HVAC contractor).

\$\$\$ Additional Profit Center \$\$\$

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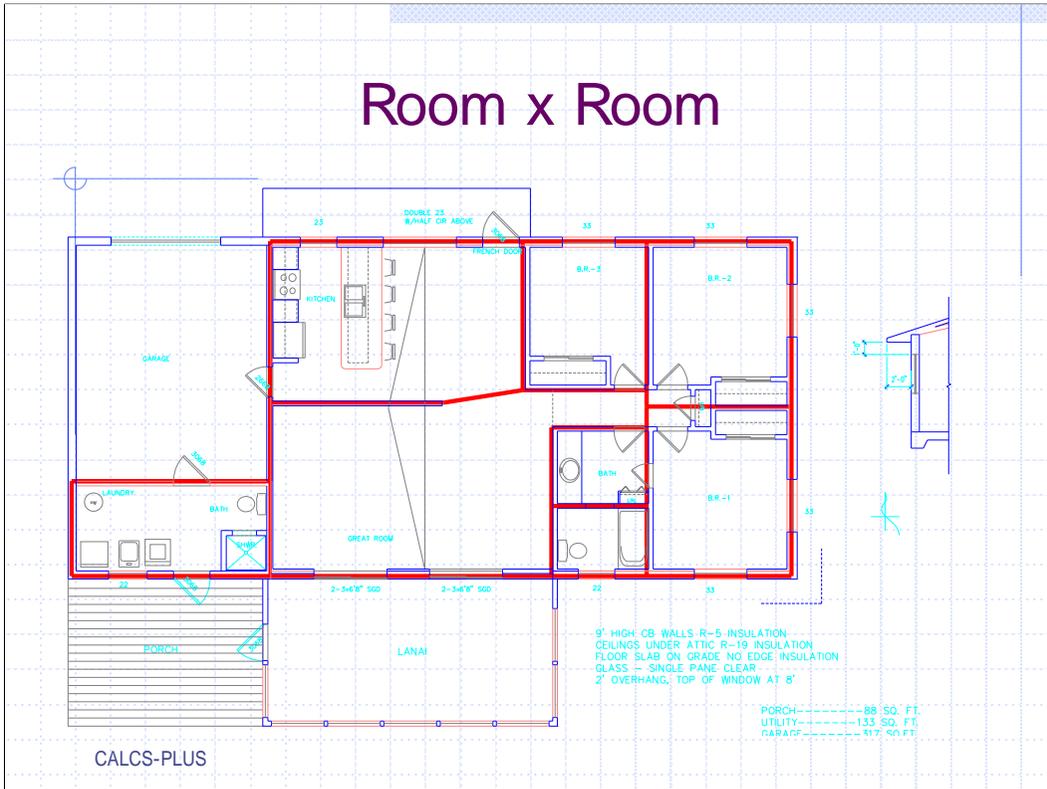
From Number 7 of the National Performance Path Notes.

Whole-House



The Whole-House approach calculates the heat gain and loss for the envelope. It is a quicker way to accurately calculate the building's heating and cooling loads to verify overall equipment sizing. But this method is no help when trying to satisfy an individual room's requirement.

Room x Room



By breaking the house up into rooms we can get a better idea of each rooms unique requirements.

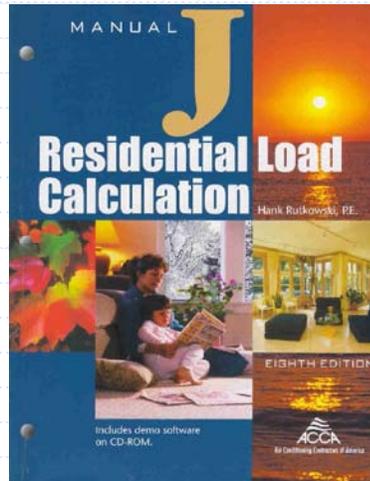
Room x Room Loads

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

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ACCA Manual J v8



Why use it?

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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

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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-cycling, minimal runtime
- ◆ marginalized temperature control
- ◆ pockets of stagnate air
- ◆ degrades humidity control during the cooling season
- ◆ requires larger duct runs



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Oversized Equipment Causes

- ◆ increased installed cost
- ◆ increased operating cost
- ◆ increased demand on our utilities
- ◆ adds unnecessary stress to equipment



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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

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MJ8 Sensitivities

Design conditions

Building tightness

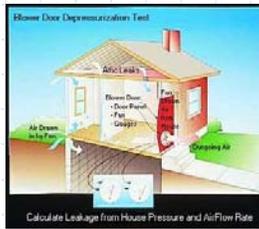
Fenestration

Air duct system design & installation



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

Location	Elevation		Winter			Summer			
	Feet	Design Degree Month	Heating 99% Dry Bulb	Cooling 95% Dry Bulb	Condensed Wet Bulb	Design Dry Bulb (95% RH)	Design Wet Bulb (95% RH)	Design Globe Globe (95% RH)	Daily Range (95%)
St. Augustine	41	33	38	80	76	86	86	72	14
St. Petersburg	11	33	47	82	78	88	88	72	16
Seattle	35	39	38	52	78	78	78	45	32
San Francisco	39	31	42	52	75	81	88	74	14
Tulsa	98	31	38	62	76	88	88	62	26
Tampa, FL	18	38	47	81	77	85	85	62	23
Vancouver, B.C.	66	30	38	58	78	81	81	73	18
West Beach	12	31	42	80	78	87	87	73	14
West Palm Beach, FL	4	38	47	80	78	87	87	73	14



MJ8 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.

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MJ8 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.

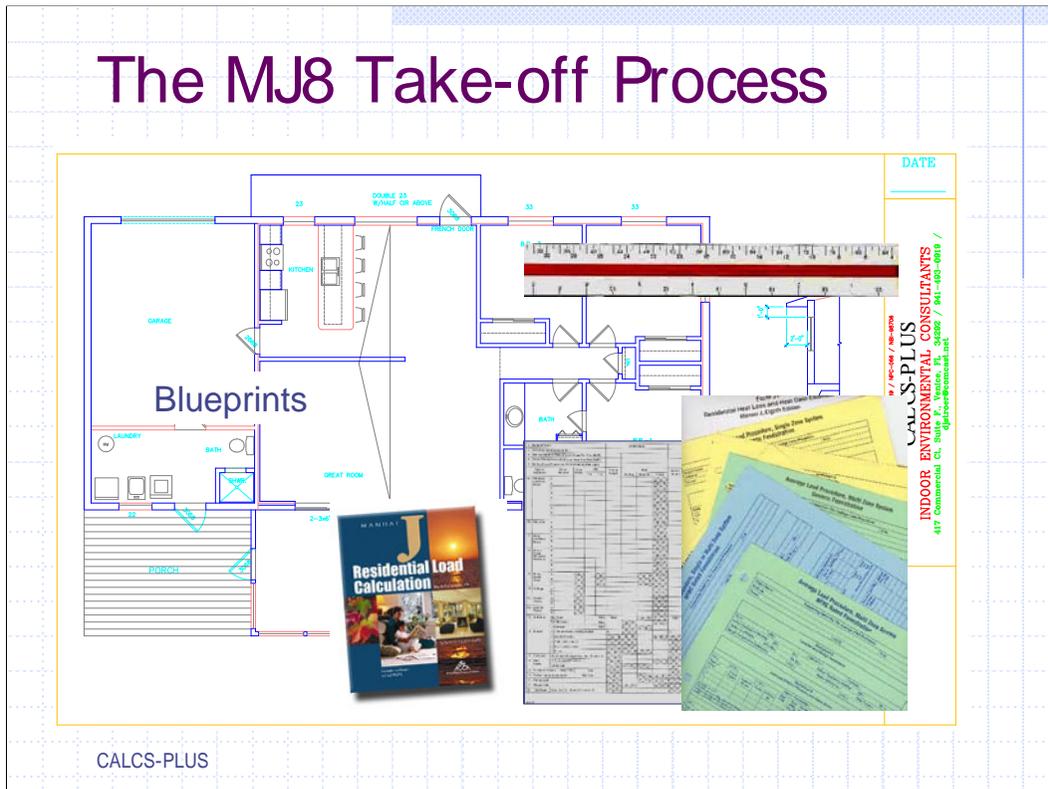
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MJ8 Guidelines

- ◆ 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.

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The MJ8 Take-off Process

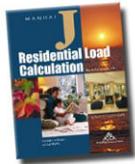


In order to perform an accurate HVAC load calculation you will need scalable blueprints, a scale, MJ8 forms, and of course Manual Jv8 to obtain all the heat transfer factors.

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)

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+



A Computer Only Procedure

From "Addendum B" from ACCA Manual J®

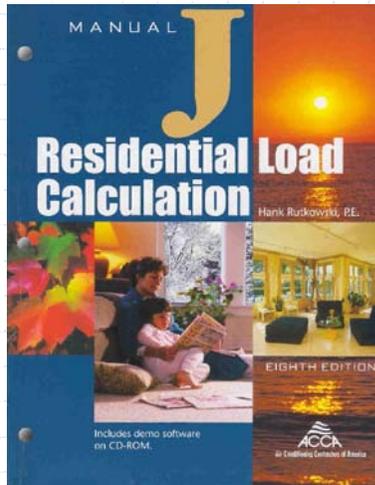
Addendum B to
ACCA Manual J,
**Residential Load
Calculation**
Eighth Edition
ANSI/ACCA Man J-2004
ISBN# 1-89765-27-6
This addendum updates Version 1.10 of Manual J
Eighth Edition (MJ8) and addresses AED
Protocol Revisions to the MJ8 procedures.

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.

This is from the Executive Summary in Addendum B to ACCA Manual J. Version 8 is a very complex calculation which was designed to be performed by a computer.



Only three software programs are recognized by ACCA as meeting the standards of Manual J residential load calculations.



Elite Software

RHVAC

WrightSoft

Right-J

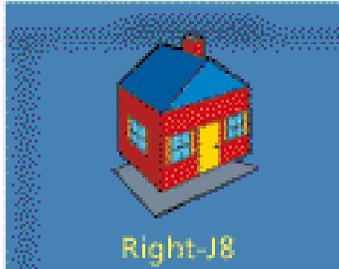
Nitek

HVAC Wizard



From the ACCA website which is www.ACCA.org.

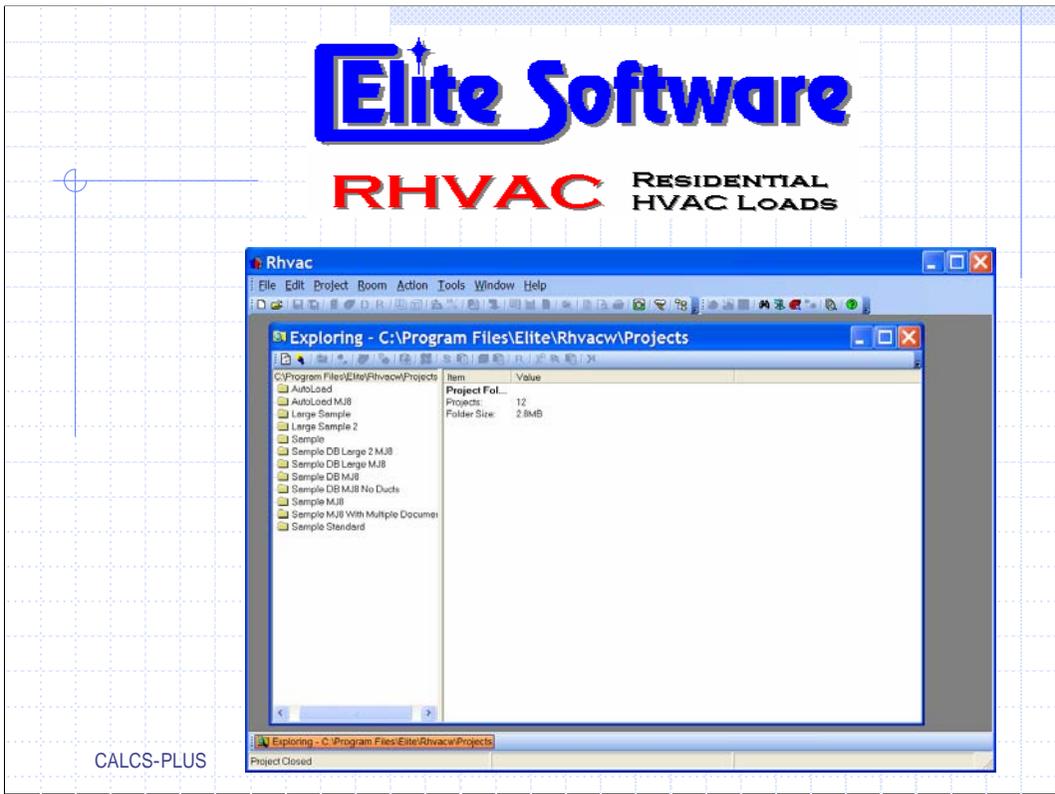
ACCA Approved MJ8 Programs



Elite Software

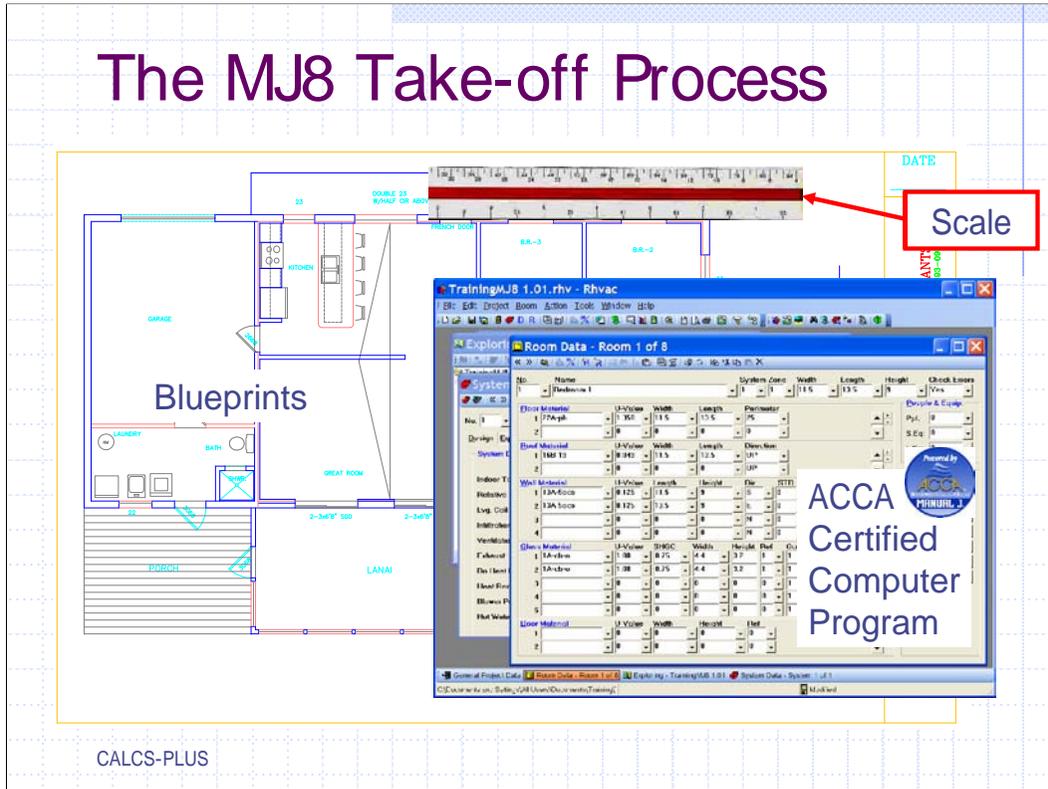
RHVAC RESIDENTIAL HVAC LOADS

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The software we will be using for this program will be Elite Software. Not to say that Elite Software is better than Wright Soft or HVAC Wizard, we started using Elite back in 1987. At that time, and even now the basis of our business is HVAC load calculations. After researching both Elite and Write Soft we chose Elite because we thought it appeared more user friendly. We have learned it well and are very satisfied with our selection and have found the Elite Software company to be sensitive to our needs.

The MJ8 Take-off Process



In order to perform an accurate HVAC load calculation only three things are required: a blue print, a scale, and a certified ACCA MJ8 computer program. Most of the certified programs have a computer aided drawing program that, if set up correctly will do the loads in the background while you draw the floor plan. For the purposes of satisfying the intent of this session we will do the take-off the old fashioned way; understanding the construction documents which includes scaling the plans.

Design Conditions

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.

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General Project Data

Project | Client | Company | Design | Duct

City Name

Select a city from the list

City

Tallahessee, Florida
Tampa, Florida
Valparaiso, Florida
Vero Beach, Florida
West Palm Beach, Florida
Albany, Georgia
Americus, Georgia
Athens, Georgia
Atlanta, Georgia
Augusta, Georgia
Brunswick, Georgia
Columbus, Georgia
Dalton, Georgia
Dublin, Georgia
Gainesville, Georgia
Griffin, Georgia
La Grange, Georgia
Macon, Georgia
Marietta, Georgia

Reference City: West Palm Beach

Daily Range: Medium

Latitude: 26

Elevation: 15

Elev. Derating: Sensible

Dry Bulb Temperature: 45

Wet Bulb Temperature: Sensible

People Loads: Sensible

The certified programs have “Table 1-A” database from Manual J already built into them. This table shows outdoor design conditions for the United States and Canada. Selection of the climate area for the location of the building is very important. For this example we will be using West Palm Beach, Florida.

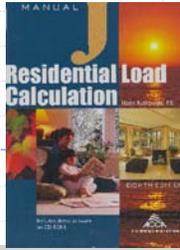


Table 1A

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

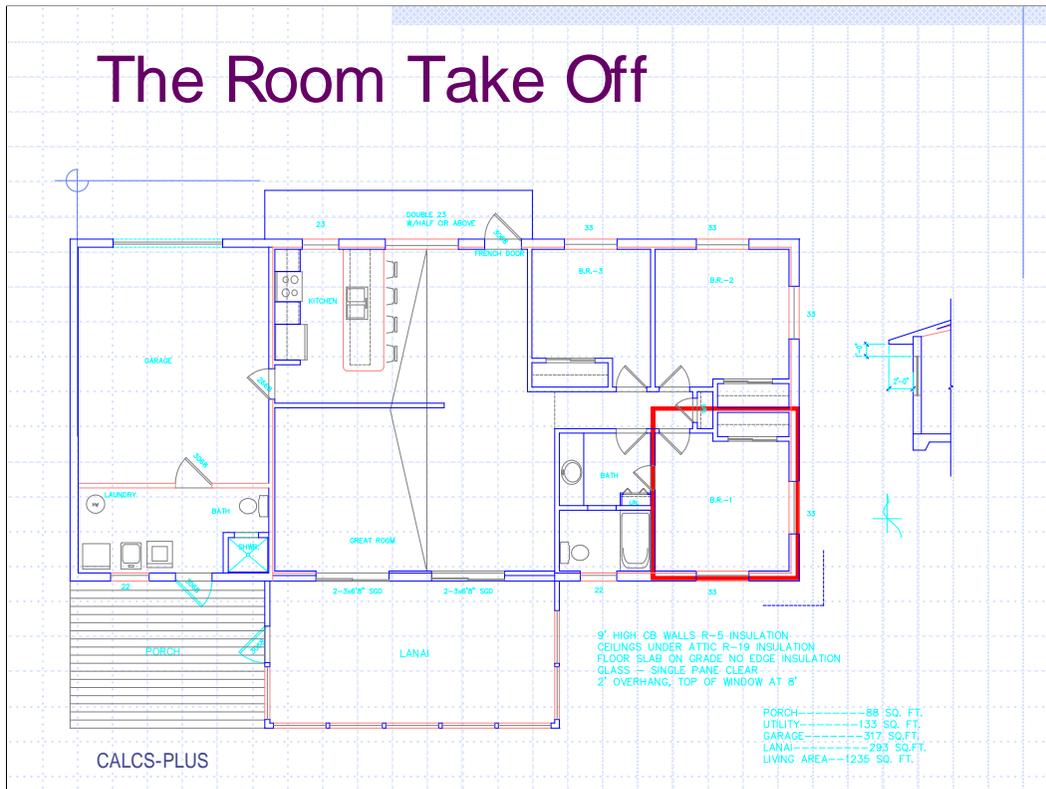
Table 1A
Outdoor Design Conditions For the United States and Canada

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

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Setting up the correct design conditions for the area the building is very important when it comes to satisfying one of MJ8's sensitivities.

The Room Take Off



We are going to be using a simple 3 bedroom 2 bath floor plan. The home has 9' CB (cement block) walls with R-5 board insulation on the inside of the wall; 100% coverage, furred and dry walled. The ceiling has a vented attic above with R-19 insulation, floor is slab on grade, all of the glass is single pane clear, and the top of the window as at 8' with an average overhang of 2'.

Default Room Data

Set Up:

- Floor Material
- Roof Material
- Wall Material
- Glass Material
- Door Material

Room Height

No.	Name	System Zone	Width	Length	Height	Check Errors
1	Default Room	1	1	1	9	7/a

Material	J-Value	Width	Length	Perimeter
1 22A-ph	1.358	0	0	0

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

Material	J-Value	Length	Height	Dir	STD	WTD
1 13A-5occs	0.125	0	9	N	0	0

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

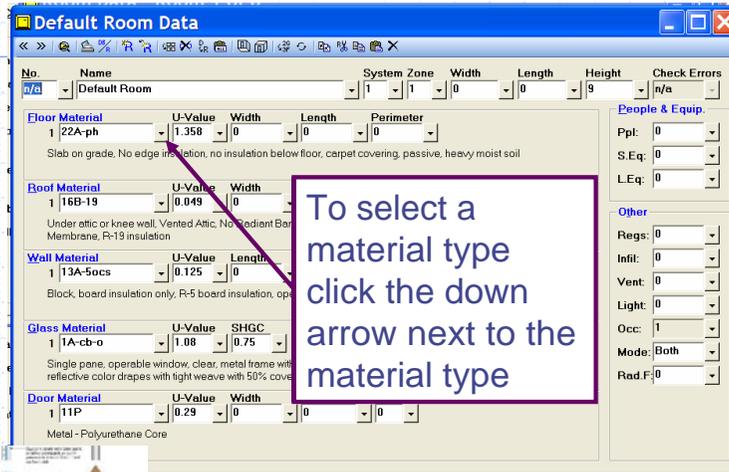
Material	J-Value	Width	Height	Ref
1 11P	0.29	0	0	0

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

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Set up a default room. The materials in the Default Room Data are those materials that make up the air and thermal barrier of the building. This room will be used as a template and it will include the most common building materials used in the home we will be sizing. All of the ACCA MJ8 materials are stored in the program's database. Some boxes will be left at 0 or unfilled but at minimum the floor to ceiling height should be entered, the floor material, roof material, wall material, glass material, and door material. This will save a lot of time later.

Floor Materials



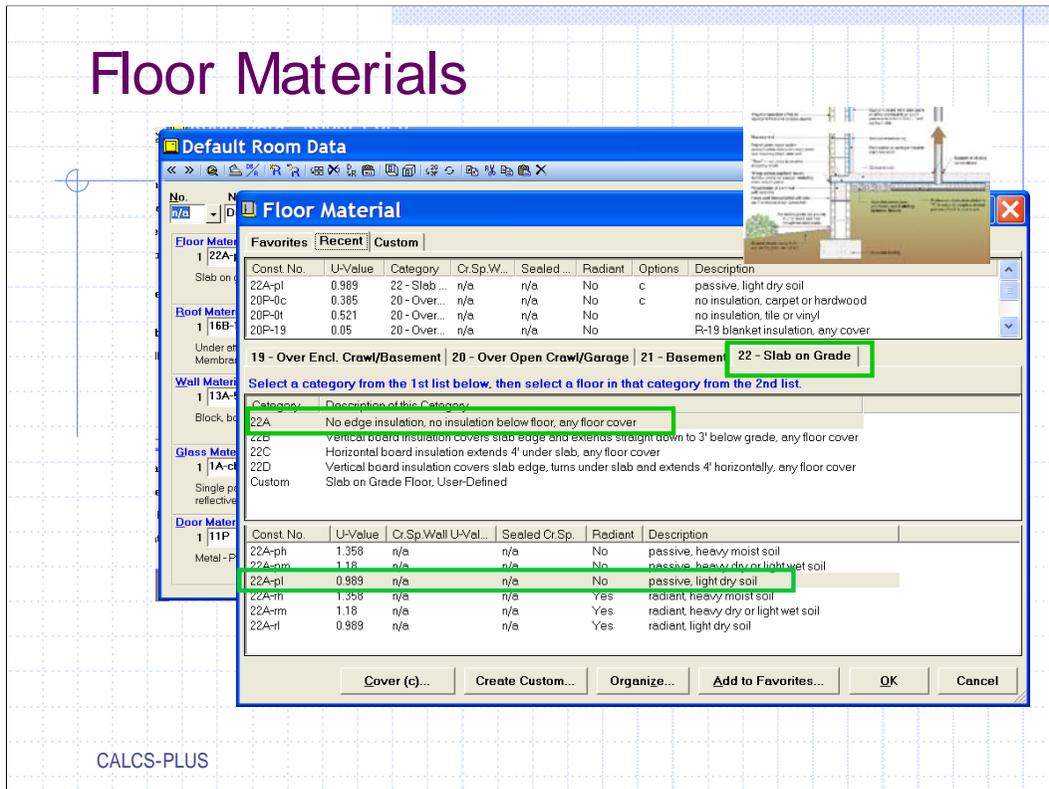
We will be using the wall section at the right (ripped off from Joe Lstiburek, Ph.D., P.Eng, Builders Guide, Hot Humid Climate, Figure 7.15).

The floor will be slab on grade with no edge insulation.

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To set the floor “material type” click the down arrow

Floor Materials



Here we click on the Floor Material and the Floor Material database window pops up. For this home we will choose “Slab on Grade”, “No edge insulation, no insulation below floor, any floor cover”, “passive, light dry soil”.

Roof Materials

The screenshot shows the 'Default Room Data' window with the following material settings:

No.	Name	System	Zone	Width	Length	Height	Check Errors
n/a	Default Room	1	1	0	0	9	n/a

Floor Material					
No.	Material	U-Value	Width	Length	Perimeter
1	22A-pl	0.989	0	0	0

Slab on grade. No edge insulation, no insulation below floor, carpet covering, passive, light dry soil

Roof Material					
No.	Material	U-Value	Width	Length	Direction
1	16B-19	0.049	0	0	UP

Under attic or knee wall. Vented Attic. No Radon Barrier. Dark Asphalt Shingles or Dark Membrane. R-19 insulation

Wall Material						
No.	Material	U-Value	Length	Height	Dir	STL
1	13A-5occs	0.125	0	9	N	0

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

Glass Material									
No.	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				
No.	Material	U-Value	Height	Ref
1	11P	0.29	0	0

Metal - Polyurethane Core

People & Equip.

Ppl: 0
S.Eq: 0
L.Eq: 0

Other

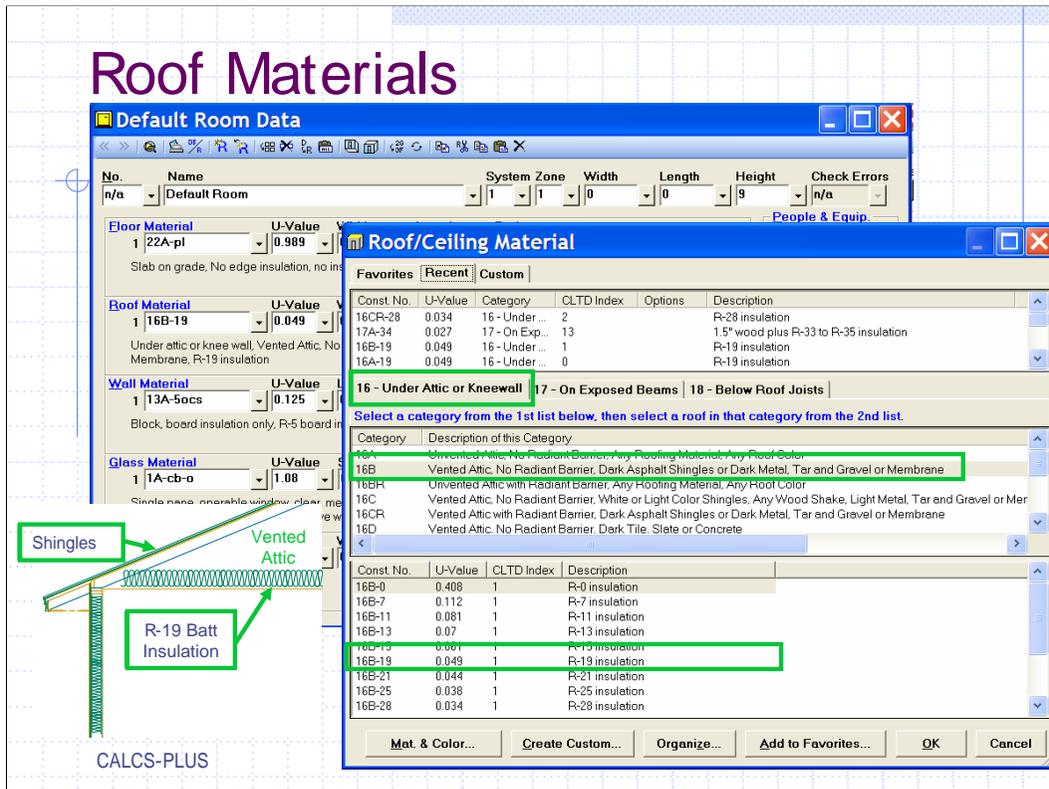
Light: 0
Occ: 1
Mode: Both
Rad.F: 0

Select the Roof Material Type

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To set the roof “material type” click the down arrow.

Roof Materials



For this home we will be using a vented attic; choose “16-Under attic or Kneewall”, under category choose “16B Vented attic, No Radiant Barrier, Dark asphalt Shingles or Dark Metal, Tar and Gravel or Membrane”, and under construction number choose “16B-19” for R-19 insulation. If you know the roof will be tile, or white metal select the proper vented attic description.

Wall Materials

Default Room Data

No.	Name	System Zone	Width	Length	Height	Check Errors
n/a	Default Room	1	1	0	9	n/a
Floor Material						
1	22A-pl		0	0	0	
Slab on grade, No edge insulation, no insulation below floor, carpet covering, passive, light dry soil						
Roof Material						
1	16B-19		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						
1	13A-5occs		0	9	N	0
Block, board insulation only, R-5 board insulation, open core, siding finish						
Glass Material						
1	1A-cb-o		0.75	0	1	
Single pane, operable window, clear, metal frame with break, outdoor insect reflective color drapes with tight weave with 50% coverage						
Door Material						
1	11P		0	0	0	
Metal - Polyurethane Core						

People & Equip.

Ppl: 0
S.Eq: 0
L.Eq: 0

Other

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

Select the Wall Material Type

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To set the wall “material type” click the down arrow.

Wall Material

Favorites | Recent | Custom

Const. No.	U-Value	Group	Description	Abv. Grd. U-Value
12B-0sw	0.097	B	12 - Frame no board insulation, siding finish, wood studs	0
14B-4.5s	0.072	G	14 - Altern... stucco or wood siding, interior finish, 4.5 inc...	0
13AB-0ocs	0.258	E	13 - Block open core, siding finish	0
12E-0sw	0.068	E	12 - Frame no board insulation, siding finish, wood studs	0
13AB-0fcs	0.183	E	13 - Block filled core, siding finish	0
CustomWall2	0.069	I	13 - Block My second example custom wall	0

12 - Frame | **13 - Block** | 14 - Alternative | 15 - Basement

Select a category from the 1st list below, then select a wall in that category from the 2nd list.

Category	Description of this Category
13AA	No Blanket or Board Insulation, No Exterior Finish, Open or Filled Core, No Interior Finish
13AB	No Blanket or Board Insulation, Stucco, Siding or Brick Veneer, Open or Filled Core, Plus Interior Finish
13A	Board Insulation Only, Stucco, Siding or Brick Veneer, Open or Filled Core, Plus Interior Finish
13B	Framing With R-11 In 2 x 4 Stud Cavity, No Board Insulation, No Exterior Finish, Open or Filled Core, Plus Interior Finish
13BB	Framing with R-11 In 2 x 4 Stud Cavity, No Board Insulation, Any Exterior Finish, Open or Filled Core, Plus Interior Finish
13B	Framing With R-11 In 2 x 4 Stud Cavity Plus Board Insulation, Any Exterior Finish, Open or Filled Core, Plus Interior Finish
13CA	Framing With R-13 In 2 x 4 Stud Cavity, No Board Insulation, No Exterior Finish, Open or Filled Core, Plus Interior Finish
13CB	Framing With R-13 In 2 x 4 Stud Cavity, No Board Insulation, Any Exterior Finish, Open or Filled Core, Plus Interior Finish
13C	Framing With R-13 In 2 x 4 Stud Cavity Plus Board Insulation, Any Exterior Finish, Open or Filled Core, Plus Interior Finish

Const. No.	U-Value	Group	Description
13A-3ocs	0.167	F	R-3 board insulation, open core, siding finish
13A-3ocb	0.174	F	R-3 board insulation, open core, brick finish
13A-3fcs	0.132	F	R-3 board insulation, filled core, siding finish
13A-3fcb	0.136	F	R-3 board insulation, filled core, brick finish
13A-4ocs	0.143	F	R-4 board insulation, open core, siding finish
13A-4ocb	0.148	F	R-4 board insulation, open core, brick finish
13A-4fcs	0.117	F	R-4 board insulation, filled core, siding finish
13A-4fcb	0.12	F	R-4 board insulation, filled core, brick finish
13A-5ocs	0.125	F	R-5 board insulation, open core, siding finish

Membrane strip covering wood frame/masonry intersection under weep screed flashing
Weep screed flashing tucked under "Tysol" GoucoWrap®
Polymer modified (PM) or standard Portland cement stucco
Masonry wall
Polyethylene vapor barrier extends under slab and turned down over masonry block stem wall
"Seal" in concrete to receive masonry block

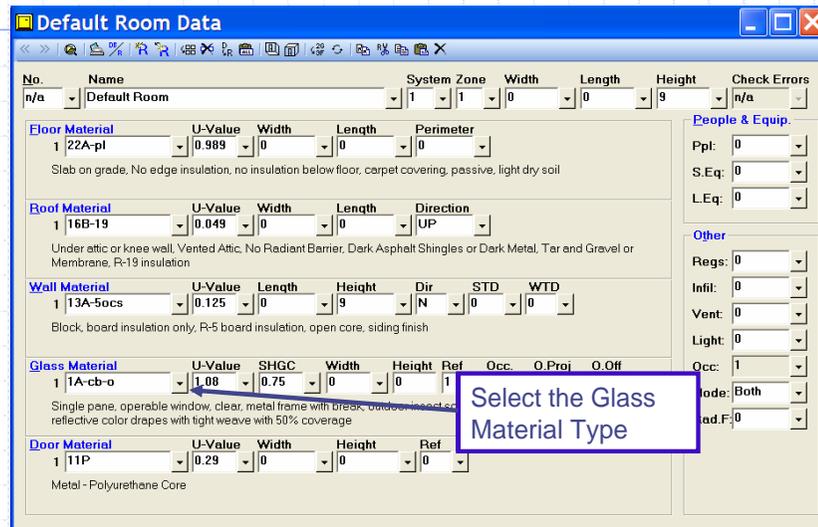
Horizontal fire stop
Gypsum board with latex paint or other permeable or semi-permeable interior finish, held up from slab
Vertical wood lurring
Permeable or semi-permeable rigid insulation
Concrete slab

Create Custom... Organize... Add to Favorites... OK Cancel

We will be using the wall section at the right (ripped off from Joe Lstiburek, Ph.D., P.Eng, Builders Guide, Hot Humid Climate, Figure 7.15).
The wall is concrete block, open core with stucco on the exterior and R-5 board insulation on the interior, firing, and drywall finish.

The Wall Material dialog box is the ACCA Manual J wall type database found in the tables of the manual. The construction numbers and properties come directly out of Manual-J. The wall type we will be using is “13-Block”, “13A Board Insulation Only, Stucco, Siding or Brick Veneer, Open or Filled Core, Plus Interior Finish”, and “13A-5ocs, R-5 board insulation, open core, siding finish.

Glass Materials



Fenestration is one of MJ8's sensitivities.

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Fenestration Notes

In general, take full credit for the rated (or tested) performance of glazing assemblies, construction materials and construction features.

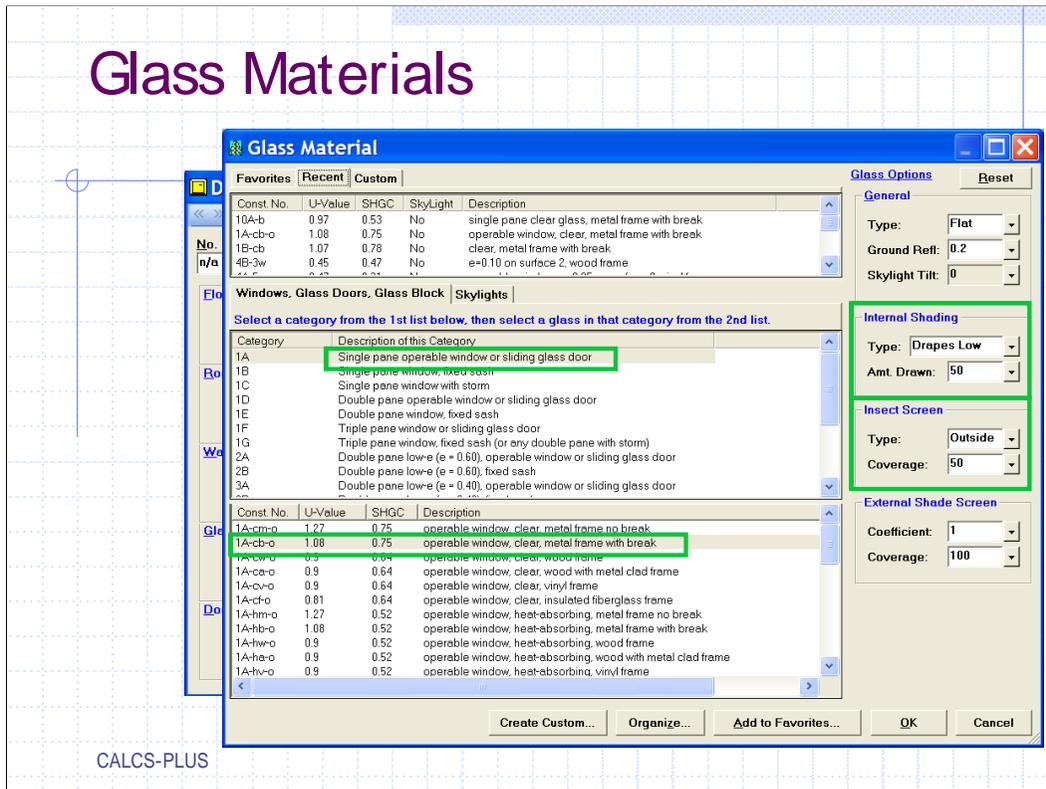
Take full credit for documented window, glass door and skylight U-values and SHGC values. For generic fenestration, use the Appendix 10 data provided by MJ8. For NFRC fenestration, use the Table 3D-1 procedures provided by MJ8.

Take credit for bug screens when such devices are installed or specified.

Take credit for internal shade (per MJ8 defaults and protocols, and Table 3D-4). Windows and glass doors shall be shaded by a medium blind. However, internal shades are not applicable for purpose-built day-lighting windows.

Take credit for overhangs (per MJ8 defaults and protocols, and Table 3E-1). The overhang adjustment shall be applied to all windows and glass doors, including purpose-built day-lighting windows.

Glass Materials



The Glass Material dialog box contains the complete Manual-J fenestration database. Glass is one of the building's major contributors to heat loss and heat gain. So it is very important to include only the most accurate glass data in the calculation. Things like internal shading, insect screens, and external shading screens must be considered. For unoccupied (or "spec") homes, system designers almost always assume the worst case for window shading (none) and site shading (none) during sizing. This assumption can unnecessarily add one-half ton of installed cooling capacity to a 2,500 sq ft home. MJ8 stipulates that drapes and blinds be assumed unless there is specific information to the contrary.

For this home we will be using "1A, Single pane operable window or sliding glass door", "1A-cb-o, operable window, clear metal frame with break".

Door Materials

Default Room Data

No.	Name	System	Zone	Width	Length	Height	Check Errors
n/a	Default Room	1	1	0	0	9	n/a

Floor Material

U-Value	Width	Length	Perimeter
1 22A-pl 0.989	0	0	0

Slab on grade, No edge insulation, no insulation below floor, carpet covering, passive, light dry soil

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-5occs 0.125	0	9	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			

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

Door Material

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

Metal - Polyurethane Core

People & Equip.

Ppl: 0
S.Eq: 0
L.Eq: 0

Other

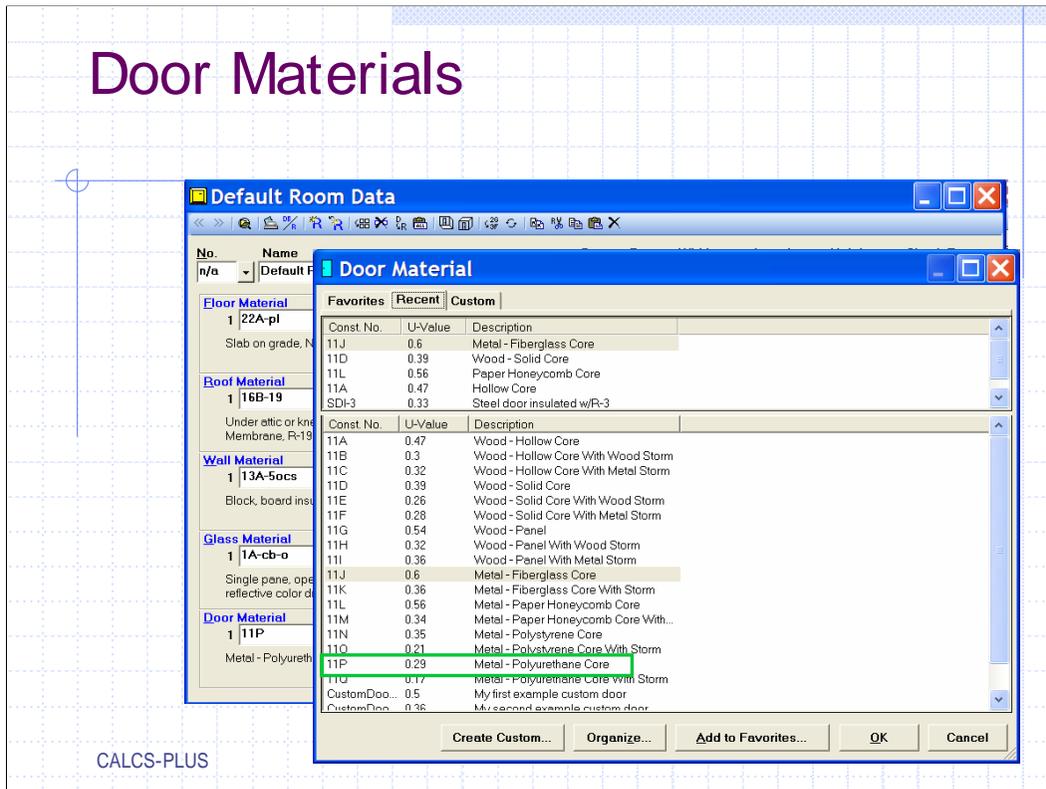
Regs: 0
Infil: 0
Vent: 0
Light: 0
Occ: 1
Code: Both
Rad.F: 0

Select the Door Material Type

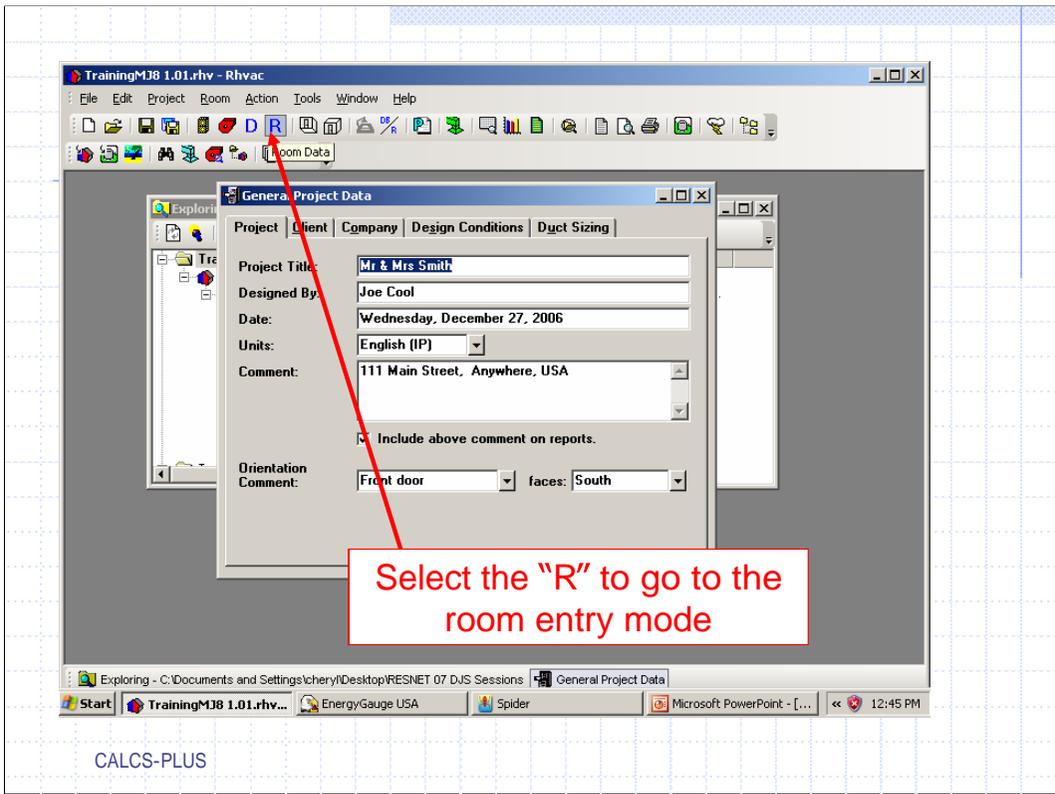
CALCS-PLUS

Select a door material.

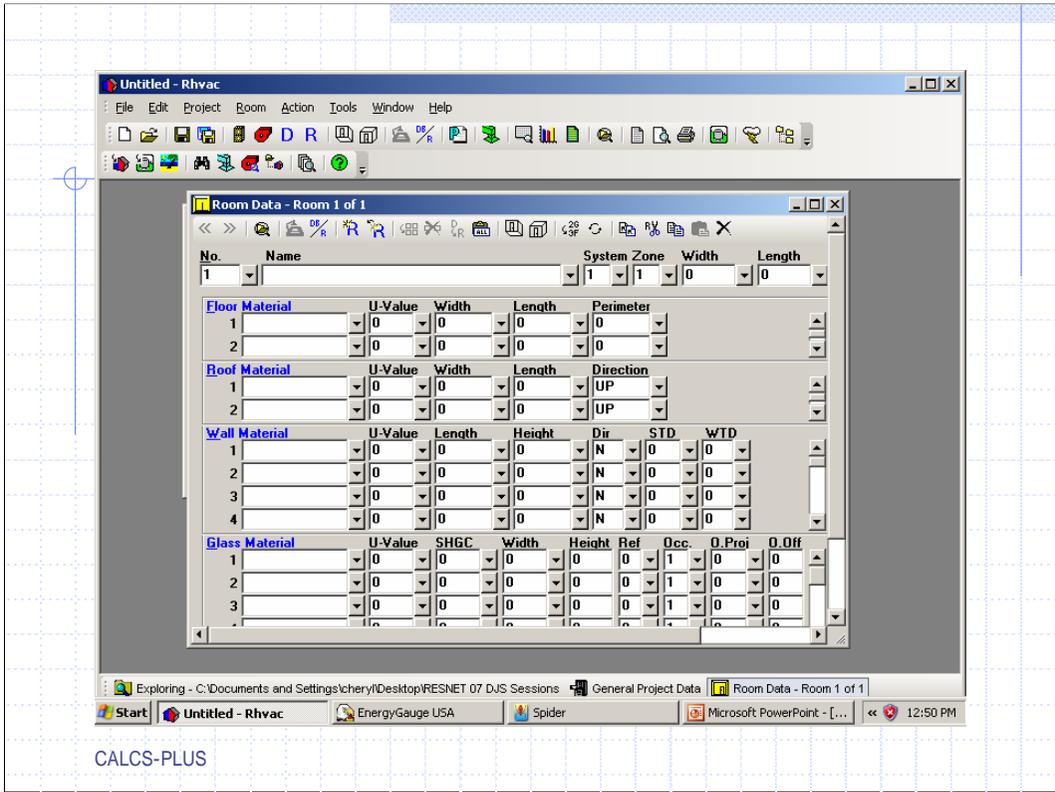
Door Materials



Select a door material.

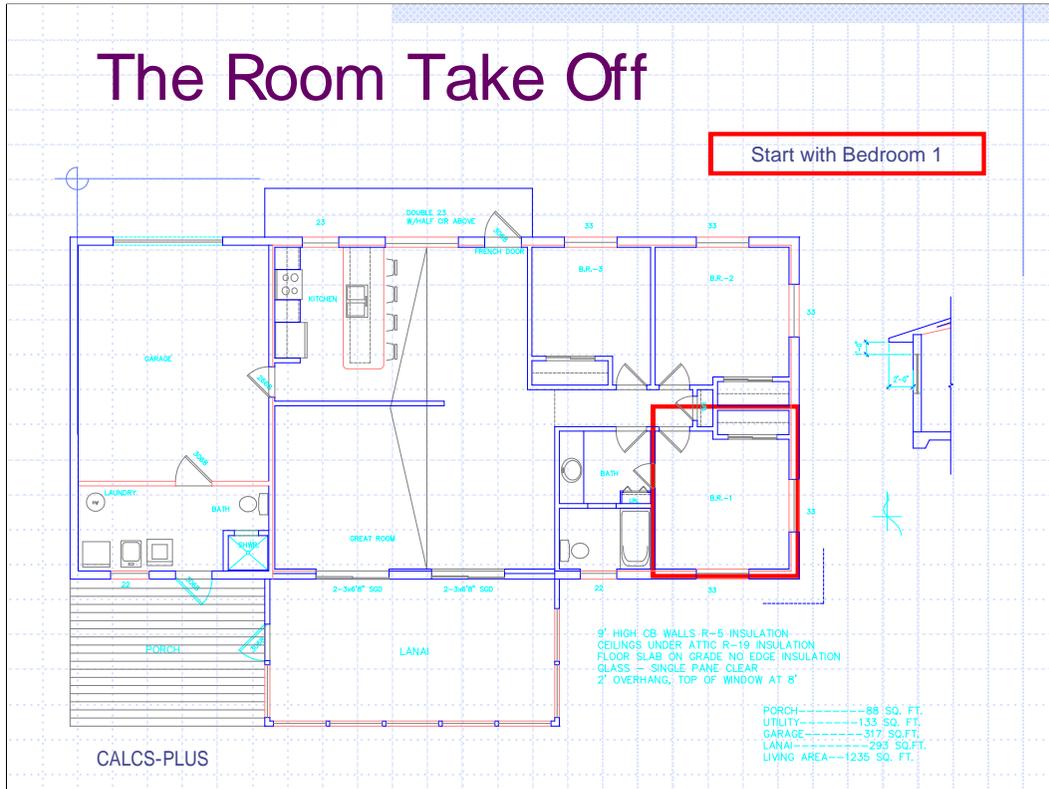


CALCS-PLUS



The Room Take Off

Start with Bedroom 1



Starting with Bedroom 1

Room Data Entry

Room Data - Room 1 of 1

No.	Name	System Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	0	9	Yes

Floor Material				People & Equip	
	U-Value	Width	Length	Perimeter	
1	0	0	0	0	
2	0	0	0	0	

Roof Material				Direction
	U-Value	Width	Length	
1	0	0	0	UP
2	0	0	0	UP

Wall Material				Dir	STD	WTD
	U-Value	Length	Height			
1	0	0	0	N	0	0
2	0	0	0	N	0	0
3	0	0	0	N	0	0
4	0	0	0	N	0	0

Glass Material				Ref	Occ.	O.Proj	O
	U-Value	SHGC	Width	Height			
1	0	0	0	0	0	1	0
2	0	0	0	0	0	1	0
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				Ref
	U-Value	Width	Height	
1	0	0	0	0
2	0	0	0	0

Room Dimensions: 11.5' x 13.5'

Room Label: B.R.-1

Software: CALCS-PLUS

Any good room x room ACCA approved program will allow the designer to look at the individual room in it's entirety. When filling out the "Room Data" window it forces the designer to look at every heat transferable building material in that room; you begin to understand how the building will be put together.

Room Area Dimensions

Room Data - Room 1 of 1

No.	Name	System Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	11.5	13.5	9	Yes

Floor Material

	U-Value	Width	Length	Perimeter
1	0	0	0	0
2	0	0	0	0

Roof Material

	U-Value	Width	Length	Direction
1	0	0	0	UP
2	0	0	0	UP

Wall Material

	U-Value	Length	Height	Dir	STD	WTD
1	0	0	0	N	0	0
2	0	0	0	N	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.Proj	O.Off
1	0	0	0	0	0	1	0	0
2	0	0	0	0	0	1	0	0
3	0	0	0	0	0	1	0	0
4	0	0	0	0	0	1	0	0
5	0	0	0	0	0	1	0	0

Door Material

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

People & Equip.

Ppl: 0
S.Eq: 0
L.Eq: 0

Other

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

CALCS-PLUS

Enter the width and length of the room. The height was set up in the default screen so it appears on this screen. Move to the “Floor Material” box

Floor Material

Room Data - Room 1 of 1

No.	Name	System Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	11.5	13.5	9	Yes

Floor Material					
No.	Name	U-Value	Width	Length	Perimeter
1	22A-pl	0.989	11.5	13.5	0
2		0	0	0	0

Roof Material						
No.	Name	U-Value	Width	Length	Direction	
1		0	0	0	UP	
2		0	0	0	UP	

Wall Material							
No.	Name	U-Value	Length	Height	Dir	STD	WTD
1		0	0	0	N	0	0
2		0	0	0	N	0	0
3		0	0	0	N	0	0
4		0	0	0	N	0	0

Glass Material									
No.	Name	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off
1		0	0	0	0	0	1	0	0
2		0	0	0	0	0	1	0	0
3		0	0	0	0	0	1	0	0
4		0	0	0	0	0	1	0	0
5		0	0	0	0	0	1	0	0

Door Material					
No.	Name	U-Value	Width	Height	Ref
1		0	0	0	0
2		0	0	0	0

Diagram Dimensions:
 Width: 11.5'
 Length: 13.5'
 Height: 9'

Other Settings:
 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

CALCS-PLUS

In this software program hitting the F5 key with the cursor in the “Floor Material” box will enter the floor material that was set up in the default screen. The floor area dimensions are also copied to the width and length screen. But since our floor is slab on grade with no edge insulation no load will be calculated until the length is entered into the “Perimeter” box. This program tracks the perimeter as you enter walls. We will now move to the “Roof Material” box.

Roof Material

Room Data - Room 1 of 1

No.	Name	System	Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	11.5	13.5	9	Yes

Floor Material						People & Equip.	
	U-Value	Width	Length	Perimeter			
1	22A-pl	0.989	11.5	13.5	0	Ppl:	0
2		0	0	0	0	S.Eq:	0
						L.Eq:	0

Roof Material						Other	
	U-Value	Width	Length	Direction			
1	16B-19	0.049	11.5	UP		Regs:	0
2		0	0	UP		Infil:	0

Wall Material							
	U-Value	Length	Height	Dir	STD	WTD	
1		0	0	N	0	0	
2		0	0	N	0	0	
3		0	0	N	0	0	
4		0	0	N	0	0	

Glass Material								
	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off
1		0	0	0	0	1	0	0
2		0	0	0	0	1	0	0
3		0	0	0	0	1	0	0
4		0	0	0	0	1	0	0
5		0	0	0	0	1	0	0

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

Other:

Rad.F: 0

Mode: Both

Occ: 1

Vent: 0

Infil: 0

Regs: 0

Light: 0

L.Eq: 0

S.Eq: 0

Ppl: 0

Check Errors: Yes

CALCS-PLUS

In the “Roof Material” box again hit the F5 key and the roof material we set up in the default room will appear, so will the width and length which is copied from the room width and length. If the room has a flat ceiling and no kneewalls the “Roof Material” section is completed and we can move on to the “Wall Material” section.

Wall Material

Room Data - Room 1 of 1

No.	Name	System	Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	11.5	13.5	9	Yes

Floor Material						People & Equip.		
No.	U-Value	Width	Length	Perimeter		Ppl:	S.Eq:	L.Eq:
1	22A-pl	0.989	11.5	13.5	0	0	0	0
2		0	0	0	0			

Roof Material					
No.	U-Value	Width	Length	Direction	
1	16B-19	0.049	11.5	13.5	UP
2		0	0	0	UP

Wall Material							
No.	U-Value	Length	Height	Dir	STD	WTD	
1	13A-5ocs	11.5	9	N	0	0	
2		0	0	N	0	0	
3		0	0	N	0	0	
4		0	0	N	0	0	

Glass Material									
No.	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off	
1		0	0	0	0	1	0	0	
2		0	0	0	0	1	0	0	
3		0	0	0	0	1	0	0	
4		0	0	0	0	1	0	0	
5		0	0	0	0	1	0	0	

Door Material				
No.	U-Value	Width	Height	Ref
1		0	0	0
2		0	0	0

Other

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

CALCS-PLUS

In the “Wall Material” box hit the F5 key and the wall material previously set up in the default room appears. The room height is copied but the length is set to zero, direction is North and there is something called STD and WTD. Enter the length of the front facing wall for Bedroom 1 and move to the “Dir” box.

Wall Material

Room Data - Room 1 of 1

No.	Name	System Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	11.5	13.5	9	Yes

Floor Material						
	U-Value	Width	Length	Perimeter		
1	0.989	11.5	13.5	11.5		
2	0	0	0	0		

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

Wall Material							
	U-Value	Length	Height	Dir	STD	WT	
1	0.125	11.5	9	S	0	0	
2	0	0	0	N	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.
1	0	0	0	0	0	1	0
2	0	0	0	0	0	1	0
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

CALCS-PLUS

The orientation arrow on the plan shows that the back of the home is to the North, so the front is south, enter a S in this box for “South”.

Wall Material

Room Data - Room 1 of 1

No.	Name	System	Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	11.5	13.5	9	Yes

Floor Material							People & Equip.		
	U-Value	Width	Length	Perimeter			Ppt:	S.Eq:	L.Eq:
1	0.989	11.5	13.5	11.5			0	0	0
2	0	0	0	0					

Roof Material							Other		
	U-Value	Width	Length	Direction			Regs:	Infil:	Vent:
1	0.049	11.5	13.5	UP			0	0	0
2	0	0	0	UP					

Wall Material									
	U-Value	Length	Height	Dir	STD	WTD			
1	0.125	11.5	9	S	0	0			
2	0	0	0	N	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.Proj	O.Off	
1	0	0	0	0	0	1	0	0	
2	0	0	0	0	0	1	0	0	
3	0	0	0	0	0	1	0	0	
4	0	0	0	0	0	1	0	0	
5	0	0	0	0	0	1	0	0	

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

Other

Rad.F: 0

CALCS-PLUS

STD (summer temperature difference) and WTD (winter temperature difference) are used when the wall is adjacent to an un-conditioned space such as a garage. Move to the first empty box under “Wall Material” to enter in the East wall for Bedroom 1.

Wall Material

Room Data - Room 1 of 1

No.	Name	System	Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	11.5	13.5	9	Yes

Floor Material							
No.	U-Value	Width	Length	Perimeter			
1	22A-pl	0.989	11.5	13.5	23		
2		0	0	0			

Roof Material							
No.	U-Value	Width	Length	Direction			
1	16B-19	0.049	11.5	13.5	UP		
2		0	0	UP			

Wall Material										
No.	U-Value	Length	Height	Dir	STD	WTD				
1	13A-5ocs	0.125	11.5	9	S	0	0			
2	13A-5ocs	0.125	11.5	9	S	0	0			
3		0	0	0	N	0	0			
4		0	0	0	N	0	0			

Glass Material										
No.	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off		
1		0	0	0	0	1	0	0		
2		0	0	0	0	0	1	0		
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				
No.	U-Value	Width	Height	Ref
1	0	0	0	0
2	0	0	0	0

People & Equip.

Ppt: 0
S.Eq: 0
L.Eq: 0

Other

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

CALCS-PLUS

In this software program hitting the F5 key will copy Wall 1 into Wall 2 which is OK, all we will need to do is edit the Length and Direction

Wall Material

Room Data - Room 1 of 1

No.	Name	System	Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	11.5	13.5	9	Yes

Floor Material				U-Value	Width	Length	Perimeter
1	22A-pl	0.989	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	WTD
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.Proj	O.Off
1		0	0	0	0	0	0	1	0	0	0
2		0	0	0	0	0	0	0	1	0	0
3		0	0	0	0	0	0	0	1	0	0
4		0	0	0	0	0	0	0	1	0	0
5		0	0	0	0	0	0	0	1	0	0

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

People & Equip.

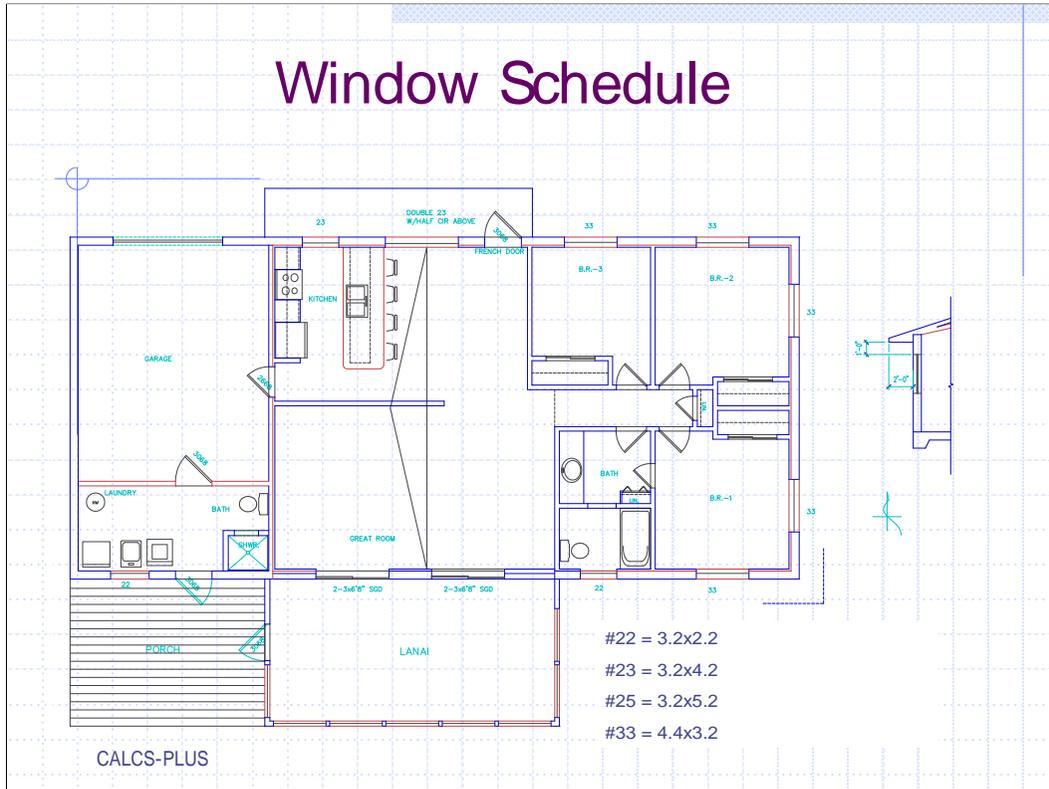
Ppt: 0
S.Eq: 0
L.Eq: 0

Other

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

Once this has been done and we have accounted for all of the exterior walls we can move to the box under Glass Material.

Window Schedule



Hopefully some place on the plans there will be a window schedule. It is always important to use the correct window size and just as important to know the U-values and SHGC (solar heat gain coefficient). If this information is not on the plans it may take a few telephone calls to get it but as glass is one of the major transmittance factors of heat gain and loss it is worth the effort.

Glass Material

Room Data - Room 1 of 1

No.	Name	System	Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	1	11.5	13.5	9	Yes

Floor Material							
No.	Material	U-Value	Width	Length	Perimeter		
1	22A-pl	0.989	11.5	13.5	25		
2		0	0	0	0		

Roof Material							
No.	Material	U-Value	Width	Length	Direction		
1	16B-19	0.049	11.5	13.5	UP		
2		0	0	0	UP		

Wall Material									
No.	Material	U-Value	Length	Height	Dir	STD	WTD		
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										
No.	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	
2		0	0	0	0	0	1	0	0	
3		0	0	0	0	0	1	0	0	
4		0	0	0	0	0	1	0	0	
5		0	0	0	0	0	1	0	0	

Door Material					
No.	Material	U-Value	Width	Height	Ref
1		0	0	0	0
2		0	0	0	0

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

33

CALCS-PLUS

Again hitting the F5 key will enter the glass material that was set up in the default room data we originally set up. This is a bedroom so we can safely assume that there will be some kind of window covering. Enter in the width and the height of the glass. Opening the glass material window will allow you to add drapes to this window.

Glass Material

The screenshot shows the 'Room Data - Room 1 of 1' window. The 'Glass Material' section is expanded, showing two rows of input fields. A red box highlights a text box with the following text:

The overhang projection represents the maximum horizontal distance in feet that the overhang projects out from the glass. The overhang offset represents the distance that the overhang is above the top of the glass. If the overhang is directly above the window, the offset should be zero.

Note that these inputs will be grayed out and unavailable if a skylight material code (one starting with 8 or 9) has been entered in the Glass Material input.

The diagram on the right shows a window with an overhang. The window is represented by a blue line, and the overhang is represented by a red dashed line. The number '33' is visible in the diagram.

After we enter the width and height the next box is the “Ref “ (reference) box. This is where you tell this software what wall the window is attached to. “Occ” is the number of (occurrences) windows of this same size and type are in this wall; in this case 1. “O.Proj” and “O.Off” is the overhang projection and overhang offset.

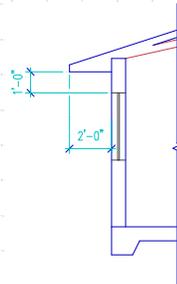
Overhang Projection and Offset

Table 3E-1 from ACCA MJ8 (to the right) is a calculation for HTM adjustment factor.

All of the ACCA approved MJ8 software will do these calculations in the background

The sample house has a 2' overhang and the top of the window is 1' from the bottom of the overhang.

O.Prog = 2'
O.Off = 1'



CALCS-PLUS

Heat Gain Adjustment For Generic and NFRC Rated Fenestration HTM Adjustments for Overhang, Foreground Reflectance, Latitude and Internal Shade Color Average Load and Peak Load Procedure

Table 3E applies to the average and the peak load procedures. The adjustment procedures for shade by an overhang and foreground reflectance apply to generic and rated fenestration. The HTM adjustment procedures for latitude and internal shade color only apply to generic fenestration (the rated fenestration HTM equations are sensitive to latitude and shade color). Table 3E-5 is used to estimate the shading coefficient for an untested or undocumented sun screen. Table note 2 (page T31-4) specifies the order of application of the HTM adjustment procedures.

HTM Adjustment For Shade By An Overhang				
Shaded Glass Area Calculation	Operation	Window		
		#1	#2	#3
A) Direction glass faces				
B) Overhang distance	X (Ft)			
C) SLM value at latitude =				
D) S-line to overhang (Z Ft)	Z = X ± SLM			
E) Top of opening to overhang	Y (Ft)			
F) Shaded glass height (S Ft)	S = Z - Y			
G) Height of opening	H (Ft)			
H) Unshaded glass height (U Ft)	U = H - S			
I) Width of opening	W (Ft)			
J) Shaded area (SqFt)	S x W			
K) Unshaded area (SqFt)	U x W			
L) Adjusted HTMN (From Worksheet J, U, B or BB)				
M) Adjusted HTMD (From Worksheet J, U, B or BB)				
N) Bluh gain for shaded area	Lines: J x L			
O) Bluh gain for area in sun	Lines: K x M			
P) Bluh gain for entire assembly	Lines: N + O			
Q) Total assembly area (SqFt)	H x W			
R) HTM _{GH} for entire assembly	Lines: P / Q			

Direction of Exposure	Midsummer Shade Line Multiplier Values (SLM)					
	Degree North Latitude					
	25	30	35	40	45	50
East and West	0.83	0.83	0.82	0.81	0.80	0.79
South-East and South-West	1.89	1.83	1.41	1.25	1.13	1.01
South	10.1	5.40	3.53	2.80	2.05	1.70

1) Use this table to determine the shaded and sunlit areas of a generic or NFRC rated window or glass door shaded by an overhang. Refer to Section 6-14 for discussion and examples pertaining to its use.
2) Shade line multiplier values are for August— East at 8 to 9 am; West at 3 to 4 pm; South-East at 9 to 10 am; South-West at 2 to 3 pm and South at 3 to 4 pm.

Table 3E-1

T3E-1

Table 3E-1 from ACCA MJ8 (to the right) is a calculation for the HTM adjustment factor. The adjustment procedures for shade by an overhang or foreground reflectance apply to generic and rated fenestration. All of the ACCA approved MJ8 software will do these calculations in the background.

Glass Material Data Entry

Room Data - Room 1 of 1

No.	Name	System Zone	Width	Length	Height	Check Errors
1	Bedroom 1	1	11.5	13.5	9	No

Floor Material						People & Equip.		
	U-Value	Width	Length	Perimeter		Ppl:	S.Eq:	L.Eq:
1	0.989	11.5	13.5	25		0	0	0
2	0	0	0	0		0	0	0

Roof Material						Other		
	U-Value	Width	Length	Direction		Regs:	Infil:	Vent:
1	0.049	11.5	13.5	UP		0	0	0
2	0	0	0	UP		0	0	0

Wall Material								Light	
	U-Value	Length	Height	Dir	STD	WTD		Occ:	Mode:
1	0.125	11.5	9	S	0	0		1	Both
2	0.125	13.5	9	E	0	0		0	0
3	0	0	0	N	0	0		0	0
4	0	0	0	N	0	0		0	0

Glass Material										
	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off		
1	1.08	0.75	4.4	3.2	1	1	2	1		
2	1.08	0.75	4.4	3.2	2	1	2	1		
3	0	0	0	0	0	1	0	0		
4	0	0	0	0	0	1	0	0		
5	0	0	0	0	0	1	0	0		

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

Change the reference wall to wall 2

Enter 2 in O.Proj and 1 in O.Off. Hitting the enter key will bring us to the Glass Material 2 box. Hitting the F5 key will copy the glass from 1 to 2.

Change the reference wall (Ref) to wall 2 which is the East wall.

Move to the Next Room

Room Data - Room 2 of 2

No.	Name	System	Zone	Width	Length	Height	Check Error
2		1	1	0	0	9	No

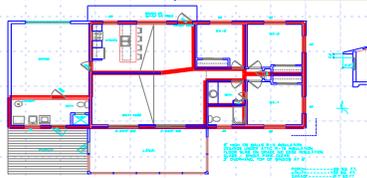
Floor Material					Perimeter	People & Equip.	
U-Value	Width	Length	Parameter	Ppt.		S.Eq.	
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0

Roof Material					Direction	Other
U-Value	Width	Length	Direction	Regis.		
1	0	0	0	UP	0	
2	0	0	0	TIP	0	

Wall Material					Dir	STD	WTD	Infil.	Vent.	Light
U-Value	Length	Height	Dir	STD						
1	0	0	0	NI	0	0	0	0	0	0
2	0	0	0	NI	0	0	0	0	0	0
3	0	0	0	NI	0	0	0	0	0	0
4	0	0	0	NI	0	0	0	0	0	0

Glass Material					Ref	Occ.	O.Proj	O.Off	Occ.	Mudu.	Rad.F
U-Value	SHGC	Width	Height	Ref							
1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0

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



CALCS-PLUS

Complete the other two bedrooms and bathroom as blocked out. Your room number 6 should be the Great Room; meet you there.

We have entered all the information relating to this bedroom and now we can move on to the next room. In this software package you can hit the F2 key which will bring up the second room. Move to Bedroom 2 and repeat the same procedures as in Bedroom 1. Following the schematic, also complete Bedroom 3, Bathroom Powder Area, Bathroom Tub Area, and I will meet you in the great room.

Room 6, Great Room

Room Data - Room 6 of 6

No.	Name	System	Zone	Width	Length	Height	Check Errors
6	Great Room	1	1	0	0	9	Yes

Calculate the floor area of the Great Room. Divide the area by the average width and enter the width and length.

CALCS-PLUS

The Great Room has several different features to it that make it unique to other rooms such as bedrooms and bathrooms. Not only is the occupant type different but this room also has a cathedral ceiling that incorporates pre-manufactured trusses which makes the space above the cathedral a vented space. The room also has two kneewall areas that we must include in the calculation. We also have a different glass type instead of windows they are sliding glass doors.

Room 6, Great Room

The screenshot displays the 'Room Data - Room 6 of 6' window. The main data fields are:

No.	Name	System	Zone	Width	Length	Height	Check Errors
6	Great Room	1	1	26.3	14	10.5	Yes

Below these are sections for Floor Material, Roof Material, Wall Material, Glass Material, and Door Material, each with sub-tables for U-Value, Width, Length, and Height. A red box highlights the text 'Calculate the average room height.' in the upper right area of the software window.

The floor plan diagram on the right shows the 'Great Room' with a cathedral ceiling. A red line traces the perimeter of the room, and a blue line indicates the height of the ceiling. The diagram also shows adjacent rooms labeled 'BATH' and 'B.R.-1'. The software interface includes a toolbar at the top and the text 'CALCS-PLUS' at the bottom left.

The Great Room has a cathedral ceiling so the average room height is higher than 9' as set up in the default room. The draftsman has drawn a section of the cathedral on the floor plan which makes it easier to figure the average room height.

Room 6, Great Room

Room Data - Room 6 of 6

No.	Name	System Zone	Width	Length	Height	Check Errors
6	Great Room	1	26.3	14	10.5	Yes

Floor Material					
	U-Value	Width	Length	Perimeter	
1	0.989	26.3	14	0	
2	0	0	0	0	

Roof Material					
	U-Value	Width	Length	Direction	
1	0.049	26.3	14	UP	
2	0	0	0	UP	

Wall Material					
	U-Value	Length	Height	Dir	STD
1	0	0	0		
2	0	0	0		
3	0	0	0		
4	0	0	0		

Glass Material			
	U-Value	SHGC	W
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0

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

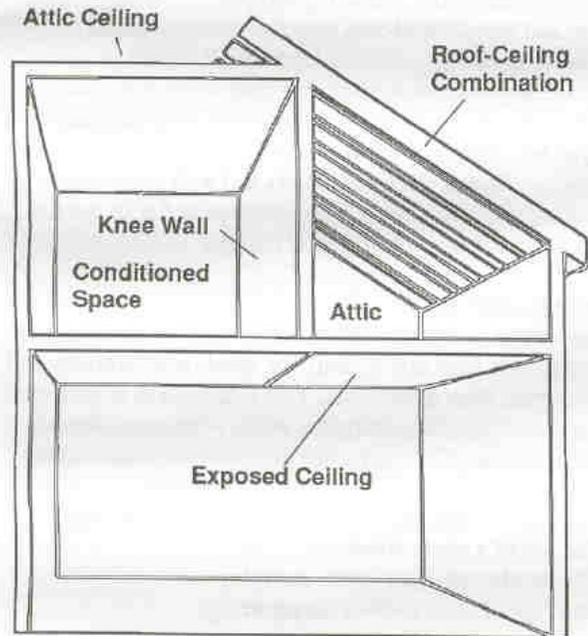
Roof Material 2 will be the first kneewall.

CALCS-PLUS

Enter the floor material and the roof material. This room has two kneewalls, one to the east and the other to the west. MJ8 considers any wall that is adjacent to a vented attic as a kneewall

Knee Wall

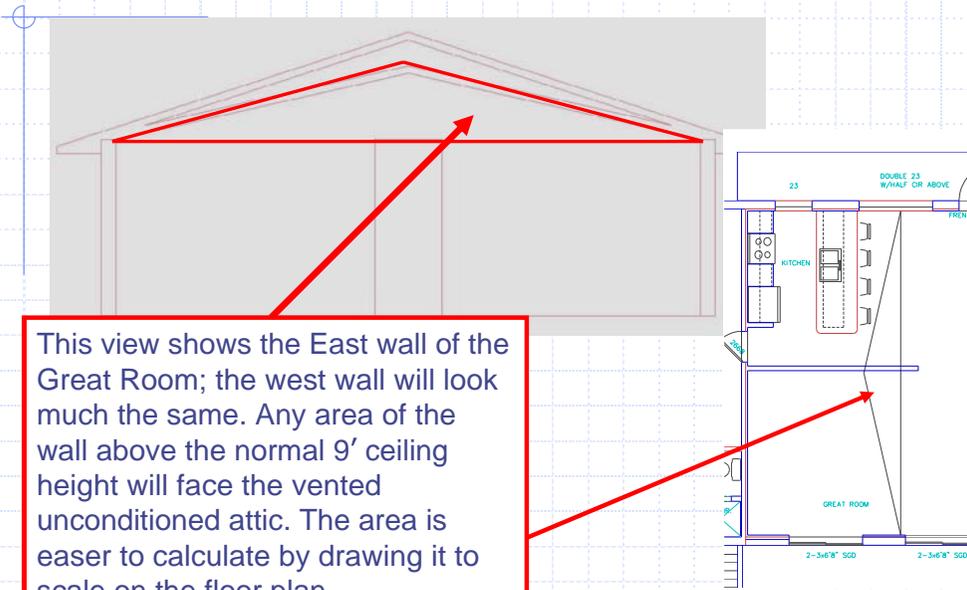
Figure A1-8 in the Appendix of ACCA MJ8 pretty well defines a knee wall as any wall that is adjacent to the attic.



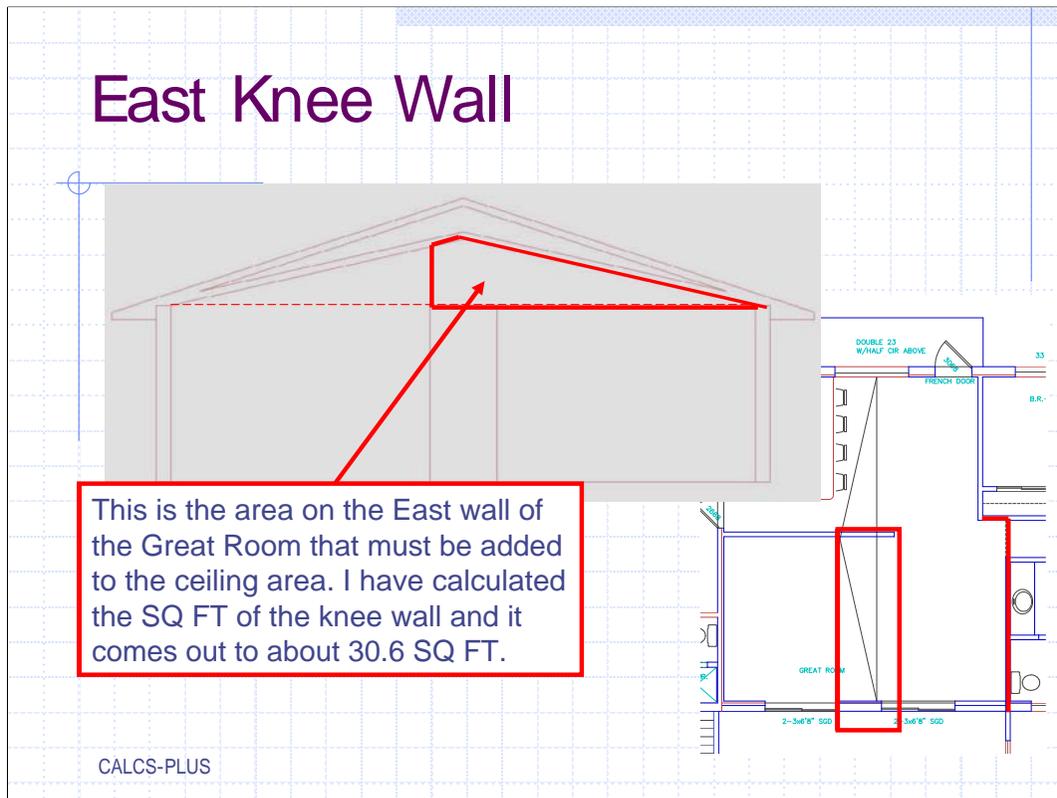
A1-8

When it comes to HVAC load calculations the building envelope is the air barrier (in contact with the thermal barrier) that separates the conditioned space from the unconditioned space. Basically all we are doing is calculating the heat transfer across the building materials that make up the building envelope. But sometimes it's hard to decide if a certain part of the envelope is a wall or part of the ceiling.

Knee Walls



East Knee Wall



Calculate the area of the east kneewall and enter it as Roof Material #2.

East Knee Wall

Room Data - Room 6 of 6

No.	Name	System	Zone	Width	Length	Height	Check Errors
6	Great Room	1	1	26.3	14	10.5	Yes

Floor Material							
	U-Value	Width	Length	Perimeter			
1	22A-pl	0.989	26.3	14	0		
2		0	0	0	0		

Roof Material							
	U-Value	Width	Length	Direction			
1	16B-19	0.049	26.3	14	UP		
2	16B-19	0.049	1	30.6	E		

Wall Material										
	U-Value	Length	Height	Dir	STD	WTD				
1		0	0	N	0	0				
2		0	0	N	0	0				
3		0	0	N	0	0				
4		0	0	N	0	0				

Glass Material										
	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off		
1		0	0	0	0	0	0	0		
2		0	0	0	0	0	0	0		
3		0	0	0	0	0	0	0		
4		0	0	0	0	0	0	0		
5		0	0	0	0	0	0	0		

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

To enter the 30.6 square foot kneewall enter 1 for the width, 30.6 for the length and the direction from "UP" to "E" for east.

CALCS-PLUS

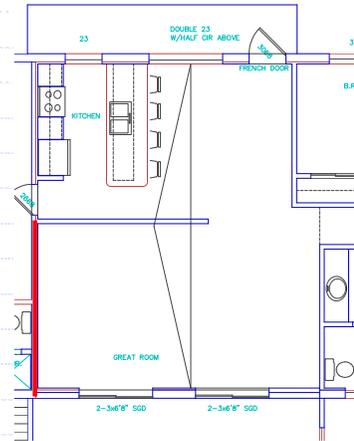
In this program hitting the F5 key will return a copy of Roof Material 1. You would normally have to just edit the width and length. The area of the east kneewall is 30.6 SQ FT. This can be entered as a Width of 1 and a length of 30.6. Change the direction from UP to E for east. Typically we assume that kneewalls are insulated with the same R value but that's not always true, Some times kneewalls will be insulated with a slightly lower R values. So the "Roof Material may have to be edited.

If your software is capable of exporting data as an ENB file into EnergyGauge USA® it helps to give all kneewalls a "Roof Material" number slightly different than the one we used in the default setup. This will help to identify the kneewalls after file transfer to insure that the kneewalls were labeled properly in EnergyGauge USA® (more on this later).

West Knee Walls



This is the area on the West wall of the Great Room that must be added to the ceiling area.



CALCS-PLUS

The area of this kneewall is about 20.5 SQ FT.

West Knee Wall

Room Data - Room 6 of 6

No.	Name	System Zone	Width	Length	Height	Check Errors
6	Great Room	1	26.3	14	10.5	Yes

Floor Material					
	U-Value	Width	Length	Perimeter	
1	22A-pl	0.989	26.3	14	0
2		0	0	0	0

Roof Material					
	U-Value	Width	Length	Direction	
1	16B-19	0.049	26.3	14	UP
2	16B-19	0.049	1	30.6	E
3	16B-19	0.049	1	20.5	W

Wall Material							
	U-Value	Length	Height	Dir	STD	WTD	
1	0	0	0	N	0	0	
2	0	0	0	N	0	0	
3	0	0	0	N	0	0	
4	0	0	0	N	0	0	

Glass Material			
	U-Value	Area	
1	0	0	
2	0	0	
3	0	0	
4	0	0	
5	0	0	

Door Material	
	U-Value
1	0
2	0

People & Equip.

Ppl: 2
S.Eq: 400
L.Eq: 0

Other

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

Annotations:

- Red arrows point from the 'Length' column of the 'Wall Material' table (row 3) to the text box.
- Red arrows point from the 'Length' column of the 'Roof Material' table (row 2) to the text box.
- Red arrows point from the 'Direction' column of the 'Roof Material' table (row 2) to the text box.

Text Box: The area of the West kneewall calculates out to about 20.5 SQ FT. Enter 1 for the width, 30.6 for the length and change the direction from "UP" to "E" for West.

CALCS-PLUS

The West kneewall can be entered and edited the same way.

Changing Roof Material

The screenshot shows the 'Room Data - Room 6 of 6' window with the 'Roof/Ceiling Material' dialog box open. The dialog box has a 'Favorites Recent Custom' tab and a table of material options. A red box highlights the '16B-15' material in the list, with a text box explaining its use for identifying kneewalls.

Const. No.	U-Value	Category	CLTD Index	Options	Description
17A-34	0.027	17 - On Exp...	13		1.5" wood plus R-33 to R-35 insulation
16B-19	0.049	16 - Under...	1		R-19 insulation
16A-19	0.049	16 - Under...	0		R-19 insulation
BU-R10	0.1	18 - Below...	31		Built up roof, tar and gravel W/R-10 (avg) board insulation

16 - Under Attic or Kneewall | 17 - On Exposed Beams | 18 - Below Roof Joists

Select a category from the 1st list below, then select a roof in that category from the 2nd list.

Category	Description of this Category
16A	Unvented Attic, No Radiant Barrier, Any Roofing Material, Any Roof Color
16B	Vented Attic, No Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane
16BR	Unvented Attic with Radiant Barrier, Any Roofing Material, Any Roof Color
16C	Vented Attic, No Radiant Barrier, White or Light Color Shingles, Any Wood Shake, Light Metal, Tar and Gravel or Mer
16CR	Vented Attic with Radiant Barrier, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane
16D	Vented Attic, No Radiant Barrier, Dark Tile, Slate or Concrete

Const. No.	U-Value	CLTD Index	Description
16B-0	0.408	1	R-0 insulation
16B-7	0.112	1	R-7 insulation
16B-11	0.081	1	R-11 insulation
16B-13	0.07	1	R-13 insulation
16B-15	0.061	1	R-15 insulation
16B-19	0.049	1	R-19 insulation
16B-21	0.044	1	R-21 insulation
16B-25	0.036	1	R-25 insulation
16B-28	0.034	1	R-28 insulation

Let's identify all kneewalls by using the "16B-15" which changes the R-value to 15.

Let's identify all kneewalls by using the "16B-15" which changes the R-value to 15.

Real World Kneewalls



CALCS-PLUS

This is typically what we find in the field a few years after the home is built. So what do you think the average R-value of the insulation on this knee wall is?

Walls

Room Data - Room 6 of 6

No.	Name	System	Zone	Width	Length	Height	Check Errors
6	Great Room	1	1	26.3	14	10.5	No

Floor Material					People & Equip.	
	U-Value	Width	Length	Perimeter	Ppt:	S.Eq:
1	0.989	26.3	14	0	0	0
2	0	0	0	0		

Roof Material				
	U-Value	Width	Length	Direction
1	0.049	26.3	14	UP
2	0.061	1	30.6	E
3	0.061	1	20.5	W

Wall Material					Dir	STD	WTD
	U-Value	Length	Height				
1	0.125	0	9	N	0	0	
2	0	0	0	N	0	0	
3	0	0	0	N	0	0	
4	0	0	0	N	0	0	

Glass Material					Ref	Occ.	O.Proj	O.Off
	U-Value	SHGC	Width	Height				
1	0	0	0	0	0	1	0	0
2	0	0	0	0	0	1	0	0
3	0	0	0	0	0	1	0	0
4	0	0	0	0	0	1	0	0
5	0	0	0	0	0	1	0	0

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

Now that the roof & knee walls for this room are completed we can move on to walls. In this program hitting the F5 key while in the “Wall Material” box will enter the default wall. All we have to do is enter the length of the wall and the direction (Dir). Enter in the length of the South wall.

Adjacent Wall

Room Data - Room 6 of 6

No.	Name	System Zone	Width	Length	Height	Check Errors
6	Great Room	1	26.3	14	10.5	No

Floor Material						
	U-Value	Width	Length	Perimeter		
1	22A-pl	0.989	26.3	14	12	
2		0	0	0	0	

Roof Material						
	U-Value	Width	Length	Direction		
1	16B-19	0.049	26.3	14	UP	
2	16B-15	0.061	1	30.6	E	
3	16B-15	0.061	1	20.5	W	

Wall Material							
	U-Value	Length	Height	Dir	STD	WTD	
1	13A-5occs	0.125	12	9	S	0	0
2		0	0	0	N	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.Proj		
1	0	0	0	0	0	1	0	0	0
2	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0

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

Diagram Labels: GARAGE, KITCHEN, LAUNDRY, BATH, GREAT ROOM, 22, 23, 2-3/4" x 8" SID

Annotation: To enter the adjacent wall click on the down arrow next to the box under "Wall Material" for wall 2.

CALCS-PLUS

Adjacent walls are those walls that are adjacent to unconditioned spaces. Those unconditioned spaces could very well be at a different temperature than outdoor conditions. In this case the Great Room has an adjacent wall that separates it from the garage. The adjacent wall is a wood frame wall with R-11 batt insulation.

Adjacent Wall

Wall Material

Const. No. | U-Value | Group | Category | Description | Abv.Grd.U-Value

Const. No.	U-Value	Group	Category	Description	Abv.Grd.U-Value
12B-0sw	0.097	B	12 - Frame	no board insulation, siding finish, wood studs	0
13BA-0rcw	0.080	H	13 - Block	filled core, wood studs	0
15D16-4	0.041	K	15 - Base...	foam-concrete matrix ASTM certified R-15 t...	0.052
12D-6bw	0.058	K	12 - Frame	R-6 board insulation, brick finish, wood studs	0

12 - Frame | 13 - Block | 14 - Alternative | 15 - Basement

Select a category from the 1st list below, then select a wall in that category from the 2nd list below.

Category	Description of this Category
12A	No insulation in Stud Cavity
12B	R-11 Insulation in 2 x 4 Stud Cavity
12C	R-13 Insulation in 2 x 4 Stud Cavity
12D	R-15 Insulation in 2 x 4 Stud Cavity
12E	R-19 Insulation in 2 x 6 Stud Cavity
12F	R-21 Insulation in 2 x 6 Stud Cavity
Custom	Frame Wall, User-Defined

Const. No.	U-Value	Group	Description
12B-0bw	0.097	H	no board insulation, brick finish, wood studs
12B-0bm	0.112	H	no board insulation, brick finish, metal studs
12B-0sw	0.097	B	no board insulation, siding finish, wood studs
12B-0sm	0.112	B	no board insulation, siding finish, metal studs
12B-2bw	0.086	I	R-2 board insulation, brick finish, wood studs
12B-2bm	0.106	I	R-2 board insulation, brick finish, metal studs
12B-2sw	0.086	C	R-2 board insulation, siding finish, wood studs
12B-2sm	0.106	C	R-2 board insulation, siding finish, metal studs
12B-3bw	0.079	J	R-3 board insulation, brick finish, wood studs

Create Custom... | Organize... | Add to Favorites... | OK | Cancel

CALCS-PLUS

Click the down arrow to enter the wall material box and select the wall that will match the great room's adjacent wall.

Adjacent Wall

Room Data - Room 6 of 6

No.	Name	System Zone	Width	Length	Height	Check Errors
6	Great Room	1	1	26.3	14	No

Floor Material						
	U-Value	Width	Length	Perimeter		
1	22A-pl	0.989	26.3	14	12	
2		0	0	0		

Roof Material						
	U-Value	Width	Length	Direction		
1	16B-19	0.049	26.3	14	UP	
2	16B-15	0.061	1	30.6	E	
3	16B-15	0.061	1	20.5	W	

Wall Material							
	U-Value	Length	Height	Dir	STD	WTD	
1	13A-5occs	0.125	12	9	S	0	0
2	12B-0aw	0.097	0	10.5	N	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.Proj	O.Off	
1		0	0	0	0	1	0	0	
2		0	0	0	0	1	0	0	
3		0	0	0	0	1	0	0	
4		0	0	0	0	1	0	0	
5		0	0	0	0	1	0	0	

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

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

Edit the "Length", "Height", "Direction", "STD" and "WTD" for wall 2; the adjacent wall.

CALCS-PLUS

After the wall material type has been selected we will need to enter the length of the wall, the wall height (the software program automatically copied the average room height as the wall height), the direction, the "STD" and the "WTD". It is the "STD" and the "WTD" that makes this an adjacent wall. The "STD" is the summer temperature difference and the "WTD" is the winter temperature difference.

Fenestration

Room Data - Room 6 of 6

No.	Name	System Zone	Width	Length	Height	Check Errors
6	Great Room	1	26.3	14	10.5	No

Floor Material			
	U-Value	Width	Length
1	0.989	26.3	14
2	0	0	0

Roof Material			
	U-Value	Width	Length
1	0.049	26.3	14
2	0.061	1	30.6
3	0.061	1	20.5

Wall Material			
	U-Value	Length	Height
1	0.125	12	9
2	0.097	6.4	9
3	0	0	0
4	0	0	0

Glass Material							
	U-Value	SHGC	Width	Height	Ref	Occ	O.Proj
1	0	0	0	0	0	1	0
2	0	0	0	0	0	1	0
3	0	0	0	0	0	1	0
4	0	0	0	0	0	1	0
5	0	0	0	0	0	1	0

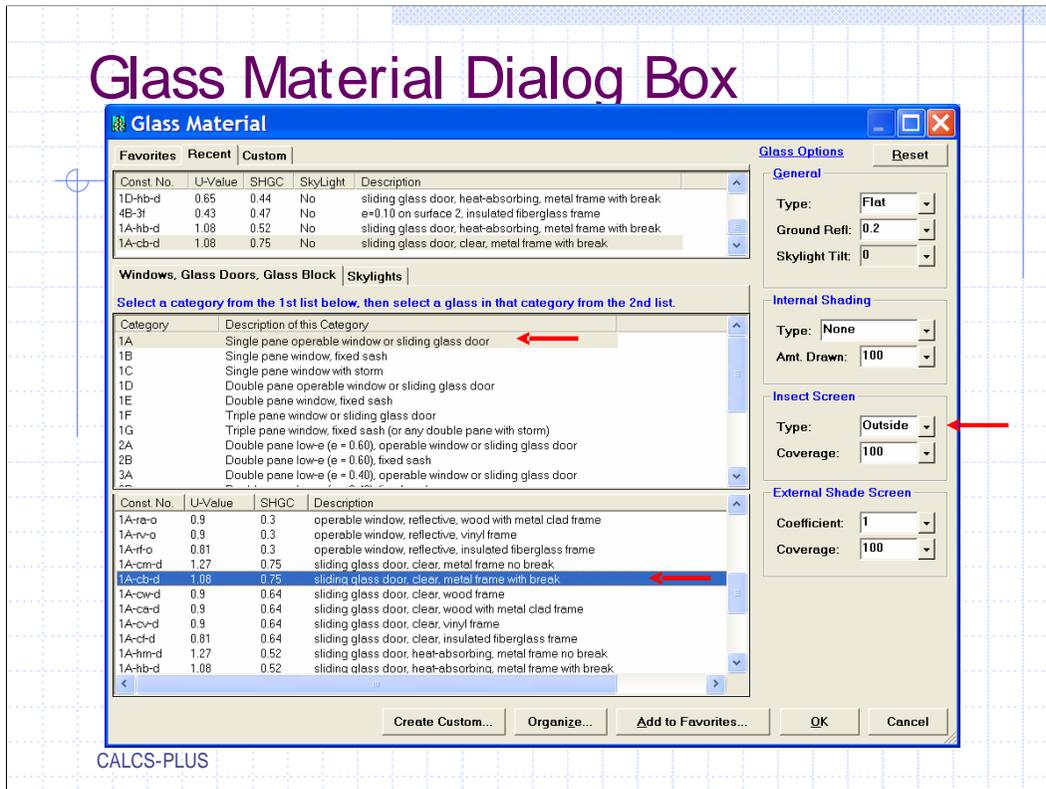
Door Material			
	U-Value	Width	Height
1	0	0	0
2	0	0	0

Click the down arrow button in the first box under "Glass Material".

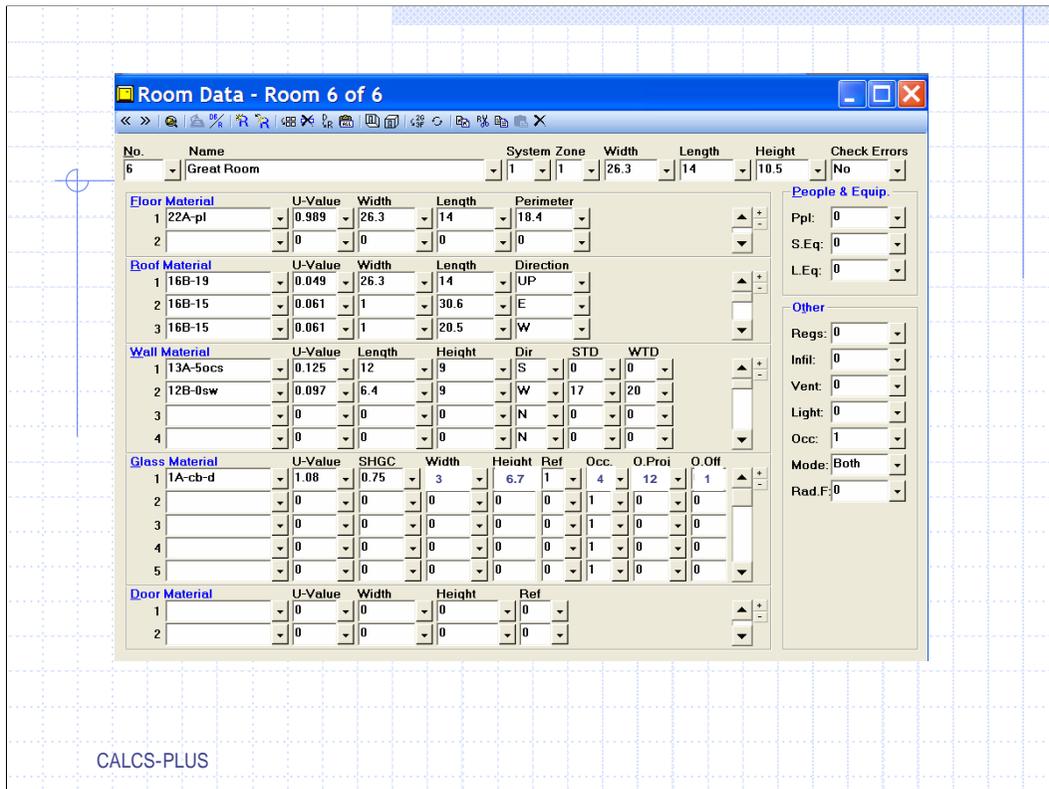
CALCS-PLUS

Enter the fenestration for the Great Room. Notice that the glass area consists of sliding glass doors which is a little different than operable windows.

Glass Material Dialog Box



In the glass material dialog box we will choose “1A” for “Single pane operable window or sliding glass door” then “1A-cd-d” for “sliding glass door, clear, metal frame with break”. Since this glass is in the great room we will assume no internal shading, because the glass is surrounded by a lanai with an insect screen we can take 100% “Insect Screen” shading.



There are two sets of sliding glass doors or four doors total; each is 3' wide by 6'8" high. Enter 3 for the "Width", 6.7 for the "Height", leave the "Ref" (reference wall) to 1, enter 4 in "Occ" (occurrences, the number of times this piece of glass is in the wall). The lanai goes out 12' so the "O.Proj" is 12 and the top of the glass is 1' under the lanai ceiling so use 1 for the "O.Off"

People and Equipment

Room Data - Room 6 of 6

No.	Name	System	Zone	Width	Length	Height	Check Errors
6	Great Room	1	1	26.3	14	10.5	No

Floor Material							
	U-Value	Width	Length	Perimeter			
1	22A-pl	0.989	26.3	14	18.4		
2		0	0	0	0		

Roof Material							
	U-Value	Width	Length	Direction			
1	16B-19	0.049	26.3	14	UP		
2	16B-15	0.061	1	30.6	E		
3	16B-15	0.061	1	20.5	W		

Wall Material									
	U-Value	Length	Height	Dir	STD	WTD			
1	13A-5occs	0.125	12	9	S	0	0		
2	12B-0sw	0.097	6.4	9	W	17	20		
3		0	0	0	N	0	0		
4		0	0	0	N	0	0		

Glass Material									
	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off	
1	1A-cb-d	1.08	0.75	3	6.7	1	4	12	1
2		0	0	0	0	0	1	0	0
3		0	0	0	0	0	1	0	0
4		0	0	0	0	0	1	0	0
5		0	0	0	0	0	1	0	0

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

People & Equip.
Ppt: 2
S.Eq: 400
L.Eq: 0

Other
Rad.F: 0

CALCS-PLUS

Before we move on to the next room we should add some internal heat gain to this room. Internal heat gain loads consist of people and appliances. The number of people is based on the number of bedrooms in the home plus 1. People are never put in bedrooms, they are put in the rooms that will be occupied around 5 PM. We will put 2 people in the “Ppl:” box. We will also enter 400 BTUH in “S.Eq:” (sensible heat of equipment) to cover an appliance such as a television.

Room 7-Kitchen/Dining

Room Data - Room 7 of 8

No.	Name	System	Zone	Width	Length	Height	Check Errors
7	Kitchen / Dining	1	1	13	21.2	10.5	No

Floor Material	U-Value	Width	Length	Perimeter
1 22A-ph	1.358	13	21.2	34
2	0	0	0	0

Glass Material	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off
1 1A-cb-o	1.08	0.75	3	3.2	1	1	2	1
2 1A-cb-o	1.08	0.75	3	3.2	1	1	2	1
3 10A-b	0.97	0.53	3	6.7	1	1	2	1
4	0	0	0	0	0	1	0	0
5	0	0	0	0	0	1	0	0

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

People & Equip.

Ppl: 2
 S.Eq: 400
 L.Eq: 800

Other

Regs: 0
 Infit: 0

Add 2 people in the Kitchen and one person for the Dining area.
 Normally a value of 1200 BTUH is used in the kitchen so enter 400 "S.Eq" and 800 in "L.Eq"

The Kitchen/Dining Room has most of the same characteristics as the great room relating to kneewalls and adjacent walls

CALCS-PLUS

The Kitchen/Dining Room has most of the same characteristics as the great room relating to kneewalls and adjacent walls. It will also have 2 people and both sensible and latent heat added for appliances and cooking.

Last Room

Room Data - Room 8 of 8

No. 8 Name Laundry System Zone 1 Width 16 Length 7.5 Height 9 Check Errors No

Floor Material					
No.	U-Value	Width	Length	Perimeter	
1	22A-ph	1.358	16	7.5	39.5
2		0	0	0	

Roof Material					
No.	U-Value	Width	Length	Direction	
1	16B-19	0.049	16	7.5	UP
2		0	0	0	UP
3		0	0	0	UP

Wall Material							
No.	U-Value	Length	Height	Dir	STD	WTD	
1	13A-5ocs	0.125	16	9	S	0	0
2	13A-5ocs	0.125	7.5	9	W	0	0
3	12B-0sw	0.097	16	9	N	15	20
4		0	0	0	N	0	0

Glass Material									
No.	U-Value	SHGC	Width	Height	Ref	Occ.	O.Proj	O.Off	
1	1A-cb-o	1.08	0.75	3	3.2	1	1	2	1
2		0	0	0	0	0	1	0	0
3		0	0	0	0	0	1	0	0
4		0	0	0	0	0	1	0	0
5		0	0	0	0	0	1	0	0

Door Material				
No.	U-Value	Width	Height	Ref
1	11J	0.6	3	6.7
2	11D	0.39	3	6.7

People & Equip.
 Ppl: 0
 S.Eq: 400
 L.Eq: 400

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

CALCS-PLUS

The laundry is the last room, enter in all the pertinent data including some sensible and latent for cloths washing equipment.

System Information

The screenshot shows a software window titled "System Data - System 1 of 1". It has a "Design" tab selected. Under "System Design Conditions", there are two columns: "Winter" and "Summer". The fields are as follows:

	Winter	Summer		
Indoor Temperature:	70	75	Do Winter Humid.:	No
Relative Humidity:	50	50	System Air Type:	Auto
Lvg. Coil-Rm DT:	70	20	System CFM:	
Infiltration:	0	0	Pct. Sens. Capacity:	75
Ventilation:	0	0	Radiator Bluh/Rt.:	0
Exhaust:	0	0	Radiator Text Option:	Foot
Do Heat Recovery:	No	No	Duct Load Factors:	(Data)
Heat Recovery SER:	60	60	Heating Duct Loads:	Yes
Blower Power:	0	0	Use CV if Multizone:	No
Hot Water Piping:	0			

Below the window, the text "CALCS-PLUS" is visible.

- ◆ Design Conditions
- ◆ Infiltration
- ◆ Ventilation
- ◆ Airflow
- ◆ Duct load factors

System information can be inputted before you start the take-off or after. In this software package “Duct Load Factors” is part of the system information along with indoor conditions, infiltration/ventilation, system airflow, etc. “Duct load Factors” cannot be completed until all of the room data has been completed because duct loads are a calculation in itself and is based on duct surface area.

Design conditions are easy, just use MJ8 suggested conditions, 70° for indoor winter temperature, 75° for indoor summer temperature. Use 50% for the design relative humidity.

The “Lvg. Coil-Rm DT” stands for the temperature difference between the conditioned room ambient temperature and the leaving coil temperature. This value represents the difference in degrees Fahrenheit between the air entering the rooms which are in the system and the inside design temperature of the system. For example, if 140 degree air (winter heating) enters the room which is in a system with a 70° indoor temperature, the leaving coil-room ΔT would be 70°. For summer a typical ΔT would be 20°; 75° room temperature and 55° leaving coil temperature.

Infiltration or Ventilation

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:	Auto
Lvs. Coil-Rm DT:	70	20	System CFM:	
Infiltration:	0	0	Pct. Sens. Capacity:	75
Ventilation:	0	0	Radiator Bluh/Rt.:	0
Exhaust:	0	0	Radiator Text Option:	Foot
Do Heat Recovery:	No	No	Duct Load Factors:	(Delta)
Heat Recovery SER:	60	60	Heating Duct Loads:	Yes
Blower Power:	0	0	Use CV if Multizone:	No
Hot Water Piping:	0			

MANUAL J
Residential Load Calculation
Eighth Edition
ANSI/ACCA Man J 2-2004
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Addendum D to
ACCA Manual J₈
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 (MJB⁸) and addresses *Infiltration Gain / Loss* Revisions to the MJB procedures.

Infiltration rates can be guessed at by using the information in Addendum D to ACCA Manual J.

To do so, click the down arrow button.

CALCS-PLUS

There has been a lot of talk on which to use, we don't want to use both. As energy raters we can test the building and enter the actual tested natural infiltration rate for winter and summer. The results of a Blower Door Test can be entered into the boxes to the right of "Infiltration". But typically in new construction HVAC load calculations are performed from plans before the home is built.

If we want to use the suggested infiltration rates in Addendum D then click the down arrows in the two infiltration boxes.

Instead of using infiltration we can input ventilation, if doing so we should use the criteria in ASHRAE Standard 62-2; 7.5 CFM per person + .01 CFM/SQ FT.

Infiltration Rates from Addendum D

Click on the tab that best describes the building.

Winter Infiltration

1 or 4 Exposures - Single Story | 3 or 4 Exposures - Two Story | 1 or 2 Exposures (townhouse, condo)

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. Next, select the appropriate fireplace option based on the construction quality of the fireplace construction. Then enter the number of fireplaces. To read descriptions of exactly what is meant by "Tight," "Semi-Tight," etc., press F1 to open the Phivec Help window and click the link for the "Construction Tightness" topic.

Construction	Conditioned Floor Area (Square feet) of Building					Fireplace Construction
	301 or Less	301 to 1500	1501 to 2000	2001 to 3000	More than 3000	
Tight	<input type="radio"/> 0.21	<input type="radio"/> 0.16	<input type="radio"/> 0.14	<input type="radio"/> 0.11	<input type="radio"/> 0.10	<input type="radio"/> 0
Semi-Tight	<input type="radio"/> 0.41	<input type="radio"/> 0.31	<input type="radio"/> 0.26	<input type="radio"/> 0.22	<input type="radio"/> 0.19	<input type="radio"/> 13
Average	<input type="radio"/> 0.81	<input type="radio"/> 0.45	<input type="radio"/> 0.38	<input type="radio"/> 0.32	<input type="radio"/> 0.28	<input type="radio"/> 20
Semi-Loose	<input type="radio"/> 0.95	<input type="radio"/> 0.70	<input type="radio"/> 0.58	<input type="radio"/> 0.49	<input type="radio"/> 0.43	<input type="radio"/> 27
Loose	<input type="radio"/> 1.29	<input type="radio"/> 0.94	<input type="radio"/> 0.80	<input type="radio"/> 0.66	<input type="radio"/> 0.58	<input type="radio"/> 33

Number of Fireplaces: Fireplace CFM (added to ACH):

Infiltration Air Changes per Hour:

OK Cancel

Summer Infiltration

1 or 4 Exposures - Single Story | 3 or 4 Exposures - Two Story | 1 or 2 Exposures (townhouse, condo)

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 Phivec Help window and click the link for the "Construction Tightness" topic.

Construction	Conditioned Floor Area (Square feet) of Building				
	301 or Less	301 to 1500	1501 to 2000	2001 to 3000	More than 3000
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"/> 0.58	<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

Click the radio button that best describes the infiltration rate of the home you are performing the calculation on. This home falls between 901 and 1500 SQ FT and if we feel the builder will make the building tight we could use .16 for winter and .08 for summer.

CALCS-PLUS

Addendum D gives suggested infiltration rates. But remember this is a leap of faith; if you know the builders construction practices then you can make an educated guess.

The effects of Infiltration

"What if" the home was very loose? Use .94 for winter and .49 for summer.

Winter Infiltration

1 or 4 Exposures - Single Story | 3 or 4 Exposures - Two Story | 1 or 2 Exposures (townhouse, condo)

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. Next, select the appropriate fireplace option based on the construction quality of the fireplace construction. Then enter the number of fireplaces. To read descriptions of exactly what is meant by "Tight," "Semi-Tight," etc., press F1 to open the Phivec Help window and click the link for the "Construction Tightness" topic.

Construction	Conditioned Floor Area (Square feet) of Building					Fireplace Construction
	300 or Less	301 to 1500	1501 to 2000	2001 to 3000	More than 3000	
Tight	<input type="radio"/> 0.21	<input type="radio"/> 0.16	<input type="radio"/> 0.14	<input type="radio"/> 0.11	<input type="radio"/> 0.10	<input type="radio"/> 0
Semi-Tight	<input type="radio"/> 0.41	<input type="radio"/> 0.31	<input type="radio"/> 0.26	<input type="radio"/> 0.22	<input type="radio"/> 0.19	<input type="radio"/> 13
Average	<input type="radio"/> 0.81	<input type="radio"/> 0.45	<input type="radio"/> 0.38	<input type="radio"/> 0.32	<input type="radio"/> 0.28	<input type="radio"/> 20
Semi-Loose	<input type="radio"/> 0.95	<input type="radio"/> 0.70	<input type="radio"/> 0.58	<input type="radio"/> 0.49	<input type="radio"/> 0.43	<input type="radio"/> 27
Loose	<input type="radio"/> 1.29	<input checked="" type="radio"/> 0.94	<input type="radio"/> 0.80	<input type="radio"/> 0.56	<input type="radio"/> 0.50	<input type="radio"/> 33

Number of Fireplaces: Fireplace CFM (added to ACH):

Infiltration Air Changes per Hour:

OK Cancel

Summer Infiltration

1 or 4 Exposures - Single Story | 3 or 4 Exposures - Two Story | 1 or 2 Exposures (townhouse, condo)

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 Phivec Help window and click the link for the "Construction Tightness" topic.

Construction	Conditioned Floor Area (Square feet) of Building				
	300 or Less	301 to 1500	1501 to 2000	2001 to 3000	More than 3000
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"/> 0.58	<input checked="" type="radio"/> 0.49	<input type="radio"/> 0.31	<input type="radio"/> 0.25	<input type="radio"/> 0.23
Loose	<input type="radio"/> 0.67	<input type="radio"/> 0.42	<input type="radio"/> 0.34	<input type="radio"/> 0.30	<input type="radio"/> 0.28

Infiltration Air Changes per Hour:

OK Cancel

Infiltration: Winter CFM: 190, Summer CFM: 99
 Ventilation: Winter CFM: 0, Summer CFM: 0

5,222	3,998	1,741	5,739
0	0	0	0

The winter heat loss is 5,222 BTUH and the summer heat gain is 5,739 BTUH

CALCS-PLUS

One of the nice things about computer programs is the ability to do "what if" calculations. If we used the "Loose" construction, .94 ACH for winter and .49 for summer we can see the results. The winter heat loss from 190 CFM of natural infiltration will be 5,222 BTUH; the summer heat gain will be 3,998 BTUH sensible and 1,741 BTUH latent, totaling out to 5,739 BTUH heat gain.

The effects of Infiltration

But if we consider the same home very tight and use .16 for winter and .08 for summer.

Winter Infiltration

1 or 4 Exposures - Single Story | 3 or 4 Exposures - Two Story | 1 or 2 Exposures (townhouse, condo)

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. Next, select the appropriate fireplace option based on the construction quality of the fireplace construction. Then enter the number of fireplaces. To read descriptions of exactly what is meant by "Tight," "Semi-Tight," etc., press F1 to open the Phoveo Help window and click the link for the "Construction Tightness" topic.

Construction	Conditioned Floor Area (Square feet) of Building					Fireplace Construction
	300 or Less	301 to 1500	1501 to 2000	2001 to 3000	More than 3000	
Tight	<input type="radio"/> 0.21	<input checked="" type="radio"/> 0.16	<input type="radio"/> 0.14	<input type="radio"/> 0.11	<input type="radio"/> 0.10	<input type="radio"/> 0
Semi-Tight	<input type="radio"/> 0.41	<input type="radio"/> 0.31	<input type="radio"/> 0.26	<input type="radio"/> 0.22	<input type="radio"/> 0.19	<input type="radio"/> 13
Average	<input type="radio"/> 0.81	<input type="radio"/> 0.45	<input type="radio"/> 0.38	<input type="radio"/> 0.32	<input type="radio"/> 0.28	<input type="radio"/> 20
Semi-Loose	<input type="radio"/> 0.95	<input type="radio"/> 0.70	<input type="radio"/> 0.58	<input type="radio"/> 0.49	<input type="radio"/> 0.43	<input type="radio"/> 27
Loose	<input type="radio"/> 1.29	<input type="radio"/> 0.94	<input type="radio"/> 0.80	<input type="radio"/> 0.66	<input type="radio"/> 0.58	<input type="radio"/> 33

Number of Fireplaces: Fireplace CFM (added to ACH):

Infiltration Air Changes per Hour:

OK Cancel

Summer Infiltration

1 or 4 Exposures - Single Story | 3 or 4 Exposures - Two Story | 1 or 2 Exposures (townhouse, condo)

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 Phoveo Help window and click the link for the "Construction Tightness" topic.

Construction	Conditioned Floor Area (Square feet) of Building				
	300 or Less	301 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"/> 0.58	<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

Infiltration: Winter CFM: 32, Summer CFM: 16	888	654	285	939
Ventilation: Winter CFM: 0, Summer CFM: 0	0	0	0	0

The winter heat loss is 888 BTUH and the summer heat gain is 939 BTUH

CALCS-PLUS

If we use a "Tight" construction scenario the winter heat loss reduces to only 888 BTUH and the summer heat gain reduces to 939 BTUH

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 Rthvac 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: 0.08

OK Cancel

Loose Construction

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

Tight Construction

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

CALCS-PLUS

Ventilation

The screenshot shows a software window titled "System Data - System 1 of 1". It has a "Design" tab selected. Under "System Design Conditions", there are two columns for "Winter" and "Summer". The "Ventilation" field is set to 43 for both. Other fields include Indoor Temperature (70/75), Relative Humidity (50/50), Lvg. Coil-Rm DT (70/20), Infiltration (0/0), Exhaust (0/0), Do Heat Recovery (No/No), Heat Recovery SER (60/60), Blower Power (0/0), Hot Water Piping (0/0), Do Winter Humid. (No), System Air Type (Auto), System CFM (empty), Pct. Sens. Capacity (75), Radiator Btuh/ft. (0), Radiator Text Option (Foot), Duct Load Factors ((Data)), Heating Duct Loads (Yes), and Use CV if Multizone (No).

If ventilation is used instead of infiltration, follow the guide lines in ASHRAE 62-2 which basically the Standard says 7.5 CFM per person plus .01 CFM per SQ FT.

$$(4 \text{ people} \times 7.5 \text{ CFM}) + (.01 \times 1285) = 30 + 12.85 = 42.85 \text{ or round up to } 43 \text{ CFM}$$

CALCS-PLUS

Typically we never use both infiltration and ventilation together. If you decide to use ventilation then follow the guide lines in ASHRAE Standard 62-2, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. Basically the Standard says 7.5 CFM per person plus .01 CFM per SQ FT.

If you are going to export data into EnergyGauge USA® then you will want to use only infiltration otherwise USA will get confused and not run properly. For this calculation we will use infiltration and select the “Semi Tight” construction Scenario.

The "Semi Tight" scenario gives us a winter infiltration rate of 65 CFM and a summer infiltration of 33 CFM.

Infiltration: Winter CFM: 65, Summer CFM: 33	1,780	1,350	588	1,938
Ventilation: Winter CFM: 0, Summer CFM: 0	0	0	0	0

CALCS-PLUS

The "Semi Tight" scenario gives us a winter infiltration rate of 65 CFM and a summer infiltration of 33 CFM.

MJ8 & Duct Leakage



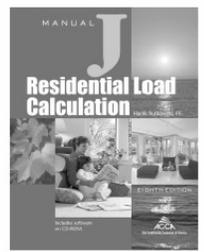
Now that all of the rooms have been entered and the system design conditions are completed we can calculate the duct loads associated with duct systems located in unconditioned spaces.

Duct Loads



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

CALCS-PLUS



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.

ACCA publications are subject to periodic review and are updated accordingly. Refer to the ACCA website (www.acca.org) for the status of the underlying publication and subsequent addendums and/or erratas. The latest copy of the publication can be ordered from ACCA via the website or by telephone at 888/290-2220.

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This Addendum is currently undergoing the ANSI Standards Review Process.

The author and his committees recognized the need to more accurately calculate the gain and loss due to duct leakage.

Addendum C to

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

Executive Summary

152. The Version 1.10 procedure is implemented by application of the hard-copy data provided by Table 7 of MJ8. Now that the industry and software houses have had time to work with this procedure, ACCA has ascertained that a calculation engine specification (rather than a look-up table approach) will enhance implementation by third party software vendors; increase procedure capability, sensitivity and accuracy; improve practitioner understanding and increase solution accuracy. This addendum undertakes the following actions in updating the MJ8 Version 1.10 duct-load procedure:

- Replace the Table 7 database look-up approach with an improved version of the calculation engine that originally produced the Table 7 data.
- Expand the capability and sensitivity of the procedure (more location scenarios, more system geometry options and more construction detail options).
- MJ8 shall become a computer-only procedure. (Note: A shorter, abridged version of MJ8 will be crafted in the future that supports a hand calculation procedure aimed at single -family, detached dwellings that have simple types of single -zone, constant-volume duct systems).
- A new set of hard copy tables shall be produced for an abridged version of MJ8.
 - a) To provide hard copy solutions for industry-requested location and surface area scenarios.
 - b) To provide hard copy solutions for two leakage classes that are tighter than MJ8, Table 7 "sealed."
 - c) To provide a leakage class that falls between MJ8, Table 7 "sealed" and "unsealed."
 - d) To be used for training exercises and hand calculations.
- The new set of hard copy tables shall be added to MJ8 V-1.10.

CALCS-PLUS

The engine the author developed to do the calculation is very comprehensive and it must be used by all ACCA certified software.

Duct Heat Loss/Gain Calculation

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:	Auto
Lvg. Coil-Rm DT:	70	20	System CFM:	
Infiltration:	0.31	0.16	Pct. Sens. Capacity:	75
Ventilation:	0	0	Radiator Bluh/ft.:	0
Exhaust:	0	0	Radiator Text Option:	Foot
Do Heat Recovery:	No	No	Duct Load Factors:	(Data)
Heat Recovery SER:	60	60	Heating Duct Loads:	Yes
Blower Power:		0	Use CV if Multizone:	No
Hot Water Piping:	0			

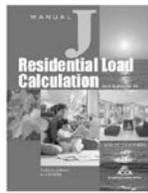
Click the down arrow button next to the box labeled "Duct Load Factors".

CALCS-PLUS

To start the duct heat gain/loss calculation in this software program click the down arrow button next to the box labeled "Duct Load Factors".

Duct Loads

Ducts located in the unconditioned space also have a heat loss/gain that adds to the heating/cooling loads of the building.



**Addendum C to
ACCA Manual J₈
Residential Load
Calculation
Eighth Edition**

ANSI/ACCA Man. J.7-2004

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This addendum updates Version 1.1C of Manual J Eighth Edition (ME⁸) and addresses *Duct Gain/Loss* revisions to the MB9 procedures.

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This Addendum is currently undergoing an ASHRAE 90.1-2005 Energy Review.

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System 1 Duct Load Factors - Scenario 1 of 5 ✖

System 1 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	
Update SA from MDD:	No	No	

Results	System 1 Duct Load	Percent of Total Load	Manual Override
Calculate			
Sensible Loss:	0	0	<input type="checkbox"/>
Sensible Gain:	0	0	<input type="checkbox"/>
Latent Gain:	0	0	<input type="checkbox"/>

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

Navigation: << >> [Refresh] [Print]

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

OK Cancel

In the "Duct Load Factors" dialog box, the "Duct Location", "Attic Ceiling Type", "Duct Leakage Rate", "Duct System R-Value", and "Duct Surface Area" must be filled in for Supply and Return to calculate duct loads for ducts in un-conditioned spaces. Duct load calculations are based on Addendum C to ACCA Manual J version 8, the procedure is compatible with ASHRAE Standard 152.

Duct Load Properties

System 1 Duct Load Factors - Scenario 1 of 5

System 1 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	
Update SA from MDD:	No	No	

Results

	System 1 Duct Load	Percent of Total Load	Manual Override
Sensible Loss:	0	0	<input type="checkbox"/>
Sensible Gain:	0	0	<input type="checkbox"/>
Latent Gain:	0	0	<input type="checkbox"/>

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

Total Duct Surface Area for System 1: 0 (Supply) 0 (Return)

Scenario 1 Percentage: 0% (Supply) 0% (Return)

OK Cancel

To calculate the sensible loss/gain and latent gain you must first enter in the "Duct Load Properties.

Note: before doing this calculation all of the room data must be entered. The SQ FT of duct surface area is based on the SQ FT of conditioned space.

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In this particular software the down arrow key for each item will give us the information we need to complete the input; this would be typical of most ACCA approved programs. But the duct load calculation cannot be completed until all the rooms of the building have been entered into the program

Duct Load Properties

System 1 Duct Load Factors - Scenario 1 of 5

System 1 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
Update SA from MDD:	No	No

Results

Calculate

	System 1 Duct Load	Percent of Total Load	Manual Override
Sensible Loss:	0	0	<input type="checkbox"/>
Sensible Gain:	0	0	<input type="checkbox"/>
Latent Gain:	0	0	<input type="checkbox"/>

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

Total Duct Surface Area for System 1: 0 Supply 0 Return

Scenario 1 Percentage: 0% Supply 0% Return

OK Cancel

Duct Location

Select a duct location from the list below.

Option	Description
Attic	Also select Attic Ceiling Type
Open Crawl	Open crawl space or garage
Closed Crawl A	Closed crawl space below insulated floor, no wall insulation
Closed Crawl B	Closed crawl space, no wall or ceiling insulation, or wall insulation only, or wall and ceiling insulation
Basement	Unconditioned basement, no wall or ceiling insulation, or wall insulation only, or wall and ceiling insulation*
Under Slab	Duct runs underneath slab floor
Outside Wall	Riser or drop in exterior wall
Cond. Space	Duct located in conditioned space

Attic Ceiling Type

If the ducts are located in an attic, select the attic ceiling type.

Type	Description
16A	Unvented Attic, No Radiant Barrier, Any Roofing Material, Any Roof Color
16B	Vented Attic, Dark Asphalt Shingles or Dark Metal, Tar and Gravel or Membrane
16C	Vented Attic, White or Light Color Shingles, Any Wood Shake, Light Metal, Tar and Gravel or Membrane
16D	Vented Attic, Dark Tile, Slate or Concrete
16E	Vented Attic, Light Tile, Slate or Concrete
16F	Vented Attic, White Tile, Slate or Concrete, White Metal or White Membrane

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Pick out the location of the duct system; “Attic”, “Open Crawl A”, “Open Crawl B”, “Basement”, “Under Slab”, “Outside Wall”, “Cond Space”.

If the duct system is located in the attic pick out the type of attic; vented, un-vented roof color type, roof cover and material, etc. Remember in this case that whether the attic is vented or unvented the thermal barrier is located on the ceiling.

Duct Load Properties

System 1 Duct Load Factors - Scenario 1 of 5

System 1 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:	0	0
Update SA from MDD:	No	No

Results

Calculate

	System 1 Duct Load	Percent of Total Load	Manual Override
Sensible Loss:	0	0	<input type="checkbox"/>
Sensible Gain:	0	0	<input type="checkbox"/>
Latent Gain:	0	0	<input type="checkbox"/>

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

Total Duct Surface Area for System 1: 0 (Supply) 0 (Return)

Scenario 1 Percentage: 0% (Supply) 0% (Return)

OK Cancel

Leakage Rate

Select the leakage rate in CFM/sq.ft. of duct surface area from the list below, or enter your own. This rate will be multiplied times the duct surface area to give a leakage CFM.

Supply	Return	Description
0.03	0.03	Duct below slab (some surface area above grade)
0.06	0.06	Extremely sealed (seal shall be verified by leakage test)
0.09	0.15	Notably sealed (verification by leakage test recommended)
0.12	0.24	Average sealed system (MJB default)
0.24	0.47	Partially sealed (fabrication conforms to standards)
0.35	0.70	Unsealed system

Duct Surface Area Calculator - System 1

Reference Information

ASHRAE Standard 152 provides the following method of determining duct surface areas. If you know the surface areas or want to use a different method, enter your own values for SA and RA.

Surface area of supply runs: $SA = 0.27 \times \text{Floor Area}$
 Surface area for return runs: $RA = 0.05 \times \text{Number of Returns} \times \text{Floor Area}$

Note: The value for the number of returns defaults to 5 when there are more than five returns.

Supply Duct Surface Area (SA)

Floor Area x 0.27 = SA
 1285 x 0.27 = 347

Return Duct Surface Area (RA)

Floor Area x 0.05 x No. Returns = RA
 1285 x 0.05 x 4 = 257

OK Cancel

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Choose the duct sealing category. If the calculation is done from plans before construction has been started assume that the duct system is going to be tight to prevent over sizing. If the building has been completed duct test results can be entered here.

Calculate the duct surface area, this program calculates a duct surface area based on the SQ FT of the building which may or may not be correct. Typically I find that the actual duct area calculates out to less than ASHRAE 152

Calculate the Sensible Loss/Gain and Latent Gain

System 1 Duct Load Factors - Scenario 1 of 5

System 1 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:	347	257
Update SA from MDD:	No	No

Results

	System 1 Duct Load	Percent of Total Load	Manual Override
Sensible Loss:	4.747	18	<input type="checkbox"/>
Sensible Gain:	4.912	25	<input type="checkbox"/>
Latent Gain:	571	15	<input type="checkbox"/>

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

Total Duct Surface Area for System 1:

	Supply	Return
Total Duct Surface Area for System 1:	347	257
Scenario 1 Percentage:	100%	100%



After you choose or change any of the "Duct Properties" inputs above, the "Calculate" button performs a recalculation and shows the results in the boxes to the right.

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When all of the proper information has been filled in for the "Duct location", "Attic Ceiling Type" (if applicable), "Duct Leakage Rate", "Duct Insulation R-Value", "Duct Surface Area", clicking the "Calculate" button in this program will calculate the sensible loss, sensible gain, and latent gain that is associated with the environment where the duct system is located and the anticipated or measured duct leakage.

What If?

System 1 Duct Load Factors - Scenario 1 of 5

Property	Supply	Return
Duct Location	Attic	Attic
Attic Ceiling Type	T&B	T&B
Duct Leakage Rate	0.06	0.06
Duct Insulation R-Value	6	6
Duct Surface Area	347	257
Update SA from MDD	No	No

Results

	System 1 Duct Load	Percent of Total Load	Manual Override
Sensible Loss	4,747	18	<input type="checkbox"/>
Sensible Gain	4,912	25	<input type="checkbox"/>
Latent Gain	571	18	<input type="checkbox"/>

Extremely sealed (seal shall be verified by leakage test)

System 1 Duct Load Factors - Scenario 1 of 5

Property	Supply	Return
Duct Location	Attic	Attic
Attic Ceiling Type	T&B	T&B
Duct Leakage Rate	0.12	0.24
Duct Insulation R-Value	6	6
Duct Surface Area	347	257
Update SA from MDD	No	No

Results

	System 1 Duct Load	Percent of Total Load	Manual Override
Sensible Loss	5,931	23	<input type="checkbox"/>
Sensible Gain	7,018	33	<input type="checkbox"/>
Latent Gain	1,075	36	<input type="checkbox"/>

Average sealed system (MJ8 default)

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One of the benefits of computer based HVAC load calculation programs is the ability to play “what if” scenarios with quick results.

The duct leakage rate has a huge impact on the calculation. As can be seen by this slide