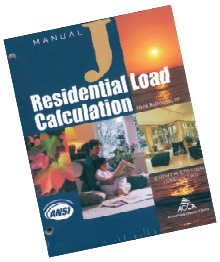
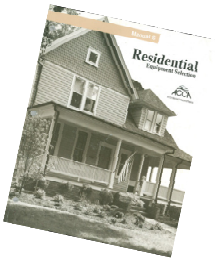




How to Verify Manual-J Accuracy & Properly Select Equipment

RESNET Conference - 2014

Isaac Savage, CEM
Training Development Director
Home Energy Partners

ABOUT US

Home Energy Partners develops and distributes training curriculum for the HVAC and Building Performance contracting industry.

Topic include:

- Manual-J, S, D, & T
- HVAC Design Software (Wrightsoft & Elite)
- RESNET HERS Training
- BPI Training
- Home Performance Contracting

WHAT WE'LL COVER…

- Design is required by…
- Common challenges
- The variables that matter
- Reports for Wrightsoft & Elite
- Manual-S basics
- Start-to-finish equipment selection example
- Demo of a Manual-S spreadsheet tool

WHO REQUIRES LOAD CALCULATIONS?

- Required by Programs
  - ENERGY STAR Version 3
  - LEED for Homes
  - Utility Rebates
- Required by Building Code!
  - 2006, 2009, 2012 IECC
- Many programs require 3rd party review.

COMMON CHALLENGES

- Tracking down the information in reports.

Elite Software wrightsoft®

- Some variables don't show up on the reports.
- Sometimes things just look funny on the reports. "What does that mean?"

VARIABLES THAT MATTER

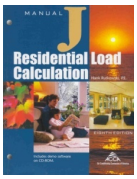
- Design conditions
- Envelope details
- Ductwork specifications
- Internal Loads
- Infiltration
- Ventilation

DESIGN CONDITIONS (OUTDOOR)

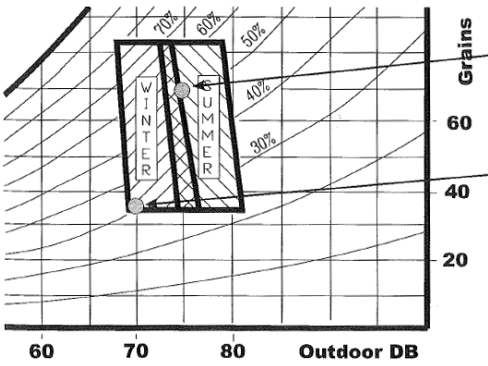
Table 1A
Outdoor Design Conditions for the United States

Location	Elevation	Latitude	Winter	Summer					
	Feet	Degrees North	Heating 99% Dry Bulb	Cooling 1% Dry Bulb	Coincident Wet Bulb	Design Grains 55% RH	Design Grains 50% RH	Design Grains 45% RH	Daily Range (DR)
Texas									
Abilene AP	1790	32	22	97	71	2	9	15	M
Alice AP	178	27	34	98	77	37	44	50	M
Amarillo AP	3604	35	12	94	66	-17	-10	-4	H
Austin AP	597	30	30	96	74	22	29	35	M
Bay City	45	29	33	94	77	59	66	72	M
Beaumont	16	30	32	92	79	61	68	74	M

Outdoor design conditions come from Table 1-A



DESIGN CONDITIONS (INDOOR)



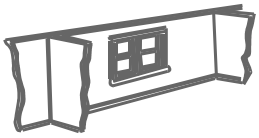
Manual J **bulls eye for cooling:**
- 75°F drybulb
- 50% relative humidity

Manual J **bulls eye for heating:**
- 70°F drybulb
- Relative humidity shall not cause visible or concealed condensation

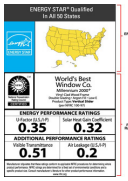
Figure 3-2

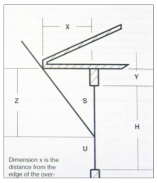
ENVELOPE DETAILS

- Walls/Doors
  - Sqft, U-value, # of Types

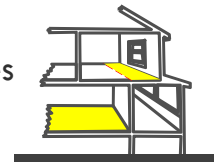


- Windows
  - Sqft, Orientation, Overhangs, U-value & SHGC





- Floors/Ceilings
  - Sqft, U-value, # of Types



- Orientation

DUCTWORK SPECIFICATIONS

- Inputs
  - Location (temperature of that space)
  - Sqft surface area (default values are commonly used)
  - Leakage (uses tables, not CFM@25pa)
  - Insulation levels
  - Supply discharge temp (heating)
- Unfortunately, these inputs **don't show up in the reports.** Reports only show the resulting duct loads.

EVALUATING DUCT LOADS

Summary of Default Duct Load Tables

Location	Supply System Geometry [1]	Return System Geometry [1]	Table Number
Unvented attic or attic knee wall space above 16A ceiling (150 °F attic when OAT = 95 °F).	Radial with outlets in center of rooms.	Radial, 400 CFM per return, returns close to air handler.	7A-R
	Trunk and branch with outlets in center of rooms.	Trunk and branch, 400 CFM per return, returns close to air handler.	7A-T
Vented attic or attic knee wall space above 16B ceiling (130 °F attic when OAT = 95 °F).	Radial with outlets in center of rooms.	Radial, 400 CFM per return, returns close to air handler.	7B-R
	Trunk and branch with outlets in center of rooms.	Trunk and branch, 400 CFM per return, returns close to air handler.	7B-T
	Radial with outlets in center of rooms.	Single ceiling return close to air handler.	7A-AE
	Radial with outlets in center of rooms.	Ceiling air handler, return in closet door.	7B-AE
	Trunk and branch with outlets in center of rooms.	Grille at floor of conditioned space, return riser to attic air handler.	7C-AE
Vented attic or attic knee wall space above 16C ceiling (120 °F attic when OAT = 95 °F).	Radial with outlets in center of rooms.	Radial, 400 CFM per return, returns close to air handler.	7C-R
	Trunk and branch with outlets in center of rooms.	Trunk and branch, 400 CFM per return, returns close to air handler.	7C-T
Vented attic or attic knee wall space above 16D ceiling (110 °F attic when OAT = 95 °F).	Radial with outlets in center of rooms.	Radial, 400 CFM per return, returns close to air handler.	7D-R
	Trunk and branch with outlets in center of rooms.	Trunk and branch, 400 CFM per return, returns close to air handler.	7D-T
Vented attic or attic knee wall space above 16E ceiling (105 °F attic when OAT = 95 °F).	Radial with outlets in center of rooms.	Radial, 400 CFM per return, returns close to air handler.	7E-R
	Trunk and branch with outlets in center of rooms.	Trunk and branch, 400 CFM per return, returns close to air handler.	7E-T

EVALUATING DUCT LOADS

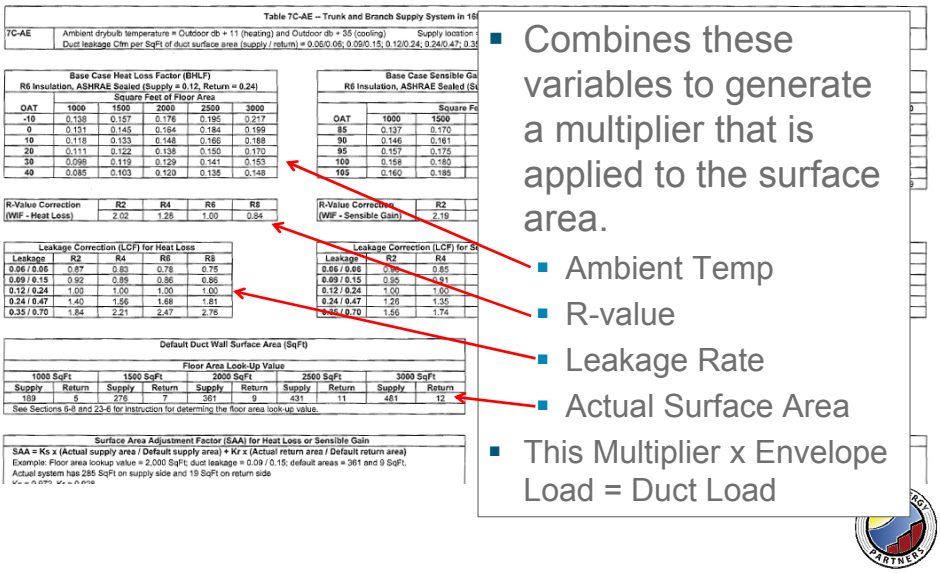


Table 7C-AE -- Trunk and Branch Supply System in 16

7C-AE — Ambient drybulb temperature = Outdoor db + 11 (heating) and Outdoor db + 35 (cooling) — Supply location

Duct leakage Cfm per SqFt of duct surface area (supply / return) = 0.06/0.06; 0.09/0.15; 0.12/0.24; 0.24/0.47; 0.35

Base Case Heat Loss Factor (BHLF)
R6 Insulation, ASHRAE Sealed (Supply = 0.12, Return = 0.24)

	Square Feet of Floor Area				
OAT	1000	1500	2000	2500	3000
-10	0.138	0.157	0.176	0.195	0.217
0	0.131	0.145	0.164	0.184	0.199
10	0.118	0.133	0.148	0.166	0.188
20	0.111	0.122	0.136	0.150	0.170
30	0.098	0.119	0.129	0.141	0.153
40	0.085	0.103	0.120	0.135	0.148

Base Case Sensible Ga
R6 Insulation, ASHRAE Sealed (Sc

	Square Fe	
OAT	1000	1500
85	0.137	0.170
90	0.146	0.161
95	0.157	0.175
100	0.158	0.180
105	0.160	0.185

R-Value Correction (WIF - Heat Loss)	R2	R4	R6	R8
	2.02	1.28	1.00	0.84

R-Value Correction (WIF - Sensible Gain)	R2
	2.19

Leakage Correction (LCF) for Heat Loss

Leakage	R2	R4	R6	R8
0.06 / 0.06	0.67	0.83	0.78	0.75
0.09 / 0.15	0.92	0.89	0.86	0.86
0.12 / 0.24	1.00	1.00	1.00	1.00
0.24 / 0.47	1.40	1.56	1.68	1.81
0.35 / 0.70	1.84	2.21	2.47	2.75

Leakage Correction (LCF) for St

Leakage	R2	R4
0.06 / 0.06	0.86	0.85
0.09 / 0.15	0.95	0.91
0.12 / 0.24	1.00	1.00
0.24 / 0.47	1.26	1.35
0.35 / 0.70	1.56	1.74

Default Duct Wall Surface Area (SqFt)

Floor Area Look-Up Value

1000 SqFt		1500 SqFt		2000 SqFt		2500 SqFt		3000 SqFt	
Supply	Return	Supply	Return	Supply	Return	Supply	Return	Supply	Return
189	5	276	7	361	9	431	11	461	12

See Sections 5-8 and 23-6 for instruction for determing the floor area look-up value.

Surface Area Adjustment Factor (SAA) for Heat Loss or Sensible Gain

SAA = Ks x (Actual supply area / Default supply area) + Kr x (Actual return area / Default return area)

Example: Floor area lookup value = 2,000 SqFt; duct leakage = 0.09 / 0.15; default areas = 361 and 9 SqFt.

Actual system has 285 SqFt on supply side and 19 SqFt on return side

- Combines these variables to generate a multiplier that is applied to the surface area.
  - Ambient Temp
  - R-value
  - Leakage Rate
  - Actual Surface Area
- This Multiplier x Envelope Load = Duct Load

DUCT LEAKAGE

- Here's how Manual-J terminology lines up with duct testing standard of cfm_{25}/100 sqft of conditioned floor area (based on trunk & branch system in attic – Table 7B-T)
  - Extreme = ~1.8%
  - Notable = ~3.3%
  - Average = ~4.7%
  - Partially = ~9.4%
  - Unsealed = ~13.8%

INTERNAL LOADS

- # of people (230 sensible / 200 latent)
- Appliances
  - Kitchens are a must. Others are optional.
  - Some code officals require laundry room loads.
- Other loads
  - Plants
  - Electronics
  - Etc.

INFILTRATION

Manual-J has ACH charts in 1000 sqft increments.
Example of Single Story Residence - 2001-3000 sqft

Construction Quality	ACH Heating	ACH Cooling
Tight	.11	.06
Semi-Tight	.22	.11
Average	.32	.16
Semi-Loose	.49	.25
Loose	.66	.34

The most accurate method is based on blower door testing.
Use target ACH50 from code to back into blower door #.

VENTILATION

- Type
  - None
  - Outdoor Air
  - HRV (efficiency)
  - ERV (efficiency)
  - Ventilating Dehumidifier
- CFM
  - Base on ASHRAE 62.2

WHERE TO FIND THE INFORMATION

Load Variable	Elite Load Reports	Wrightsoft Load Reports
Design Temps	Project Report Miscellaneous Report	Short Form Building Analysis Component Constructions Project Summary AED Assessment
Envelope Details	Total Building Summary Loads System Summary Loads	Component Constructions Right-J Worksheet
Orientation	Project Report – Frond Door Orientation Building Rotation General Overview Detailed Room Loads – Window Orientation	Multiple Orientations Report Component Constructions (Use window directions)
Ductwork Details Note that all duct characteristics do not show up on reports.	**Loads & duct location show in:** Miscellaneous Report	**Loads show in:** Building Analysis Project Summary Right-J Worksheet
Infiltration	Miscellaneous Report Total Building Summary Loads System Summary Loads	Building Analysis Component Constructions Project Summary
Ventilation Note that type & efficiency does not show up on reports.	Miscellaneous Report Total Building Summary Loads System Summary Loads	**Loads show in:** Load Short Form (“Other Equip. Loads”) Building Analysis Project Summary
Appliance Loads	Total Building Summary Loads System Summary Loads	Right-J Worksheet

WHERE TO FIND THE INFORMATION

	Elite Load Reports	Wrightsoft Load Reports
Reports to Request	Project Report Total Building Summary Loads Miscellaneous Report	Component Constructions Project Summary Right-J Worksheet

DESIGN TEMPS

Rhvac - Residential & Light Commercial HVAC Loads
Calcs-Plus
North Venice, FL 34275

Elite Software Development, Inc.
Mr & Mrs Smith
Page 2

Design Data

Reference City:		Sarasota, Florida
Building Orientation:		Front door faces South
Daily Temperature Range:		Medium
Latitude:	27	Degrees
Elevation:	26	ft.
Altitude Factor:	0.999	
Elevation Sensible Adj. Factor:	1.000	
Elevation Total Adj. Factor:	1.000	
Elevation Heating Adj. Factor:	1.000	
Elevation Heating Adj. Factor:	1.000	

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	42	39.4	80%	n/a	70	n/a
Summer:	92	77	51%	50%	75	51

Design Conditions

Location:
Example City, XX
Elevation: 77 ft
Latitude: 33°N

Outdoor:	**Heating**	**Cooling**
Dry bulb (°F)	-13	99
Daily range (°F)	-	16 (L)
Wet bulb (°F)	-	77
Wind speed (mph)	15.0	7.5

Indoor:	**Heating**	**Cooling**
Indoor temperature (°F)	70	75
Design TD (°F)	33	24
Relative humidity (%)	30	50
Moisture difference (gr/lb)	30.6	40.3

Infiltration:

Method	Simplified
Construction quality	Average
Fireplaces	1 (Tight)

ENVELOPE DETAILS

Component Description	Area Quan
1A-cb-o: Glazing-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, u-value 1.08, SHGC 0.75	115.4
1A-cb-d: Glazing-Single pane, sliding glass door, clear, metal frame with break, outdoor insect screen with 100% coverage, u-value 1.08, SHGC 0.75	80.4

Construction descriptions	**Or**	**Area** ft²	**U-value** Btuh/ft²-°F	**Insul R** ft²-°F/Btuh	**Htg HTM** Btuh/ft²	**Loss** Btuh	**Clg HTM** Btuh/ft²	**Gain** Btuh
Walls								
12E-0sw: Frm wall, wd ext, 1/2" wood shth, r-19 cav ins, 1/2" gypsum board int fnsh, 2"x6" wood frm	n	184	0.068	19.0	5.64	1038	2.14	393
	e	275	0.068	19.0	5.64	1550	2.14	586
	s	214	0.068	19.0	5.64	1208	2.14	457
	w	221	0.068	19.0	5.64	1245	2.14	471
	all	893	0.068	19.0	5.64	5042	2.14	1907

ORIENTATIONS

Design Data		
Reference City:		Sarasota, Florida
Building Orientation:		Front door faces Southwest
Daily Temperature Range:		Medium
Latitude:	27	Degrees
Elevation:	26	ft.
Altitude Factor:	0.999	

	Outdoor Dry Bulb	Outdoor Wet Bulb	Outdoor Rel.Hum	Indoor Rel.Hum	Indoor Dry Bulb	Grains Difference
Winter:	42	39.4	n/a	n/a	70	n/a
Summer:	92	77	51%	45%	75	58

	North	Northeast	East	Southeast	South	Southwest	West	Northwest
Sensible Load (Btuh)	12735	13206	11484	12846	11154	11581	11449	12964
Latent Load (Btuh)	2543	2591	2525	2543	2517	2525	2523	2586
Total Load (Btuh)	15278	15797	14009	15389	13671	14107	13972	15549
Heating AVF (cfm)	542	564	488	547	473	492	486	554
Cooling AVF (cfm)	542	564	488	547	473	492	486	554

DUCTWORK

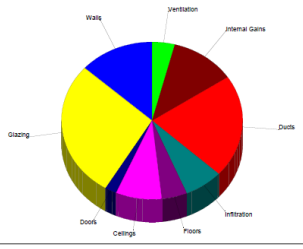
Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
Ductwork:		4,747	569	4,899	5,468

Duct Load Factor Scenarios for System 1

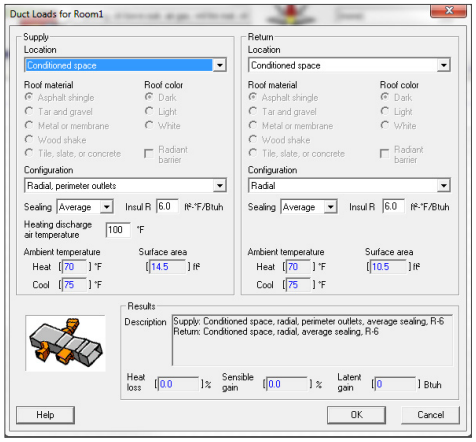
No.	Type	Description	Location	Attic Ceiling	Duct Leakage	Duct Insulation	Surface Area	From [T]MDD
1	Supply		Closed Crawl A	-	0.12	8	189	No
1	Return		Closed Crawl A	-	0.24	8	35	No

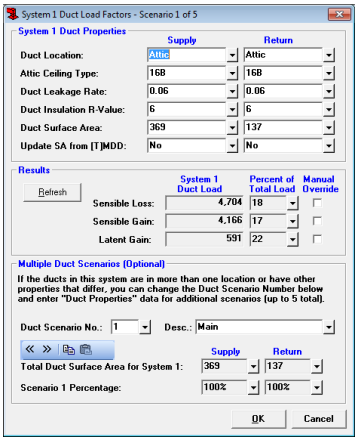
Cooling

Component	Btuh/ft²	Btuh	% of load
Walls	2.1	1907	13.4
Glazing	24.2	4009	28.1
Doors	14.2	298	2.1
Ceilings	1.7	1171	8.2
Floors	0.9	649	4.5
Infiltration	0.9	988	6.9
Ducts		3021	21.2
Ventilation		579	4.1
Internal gains		1660	11.6
Blower		0	0
Adjustments		0	
Total		**14283**	**100.0**



INPUTS FOR DUCTS (not all data is in reports)





INFILTRATION

	Winter		Summer	
Infiltration Specified:	0.310	AC/hr	0.160	AC/hr
	65	CFM	33	CFM
Infiltration Actual:	0.310	AC/hr	0.160	AC/hr
Above Grade Volume:	X 12,535	Cu.ft.	X 12,535	Cu.ft.
	3,886	Cu.ft./hr	2,006	Cu.ft./hr
	X 0.0167		X 0.0167	
Total Building Infiltration:	65	CFM	33	CFM

Design Conditions

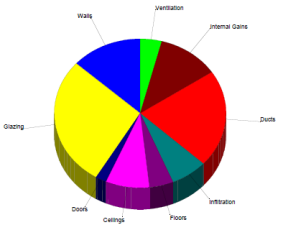
Location:			**Indoor:**	**Heating**	**Cooling**
Example City, XX			Indoor temperature (°F)	70	75
Elevation: 77 ft			Design TD (°F)	83	24
Latitude: 33°N			Relative humidity (%)	30	50
Outdoor:	**Heating**	**Cooling**	Moisture difference (gr/lb)	30.6	40.3
Dry bulb (°F)	-13	99	**Infiltration:**		
Daily range (°F)	-	10 (L)	Method	Simplified	
Wet bulb (°F)	-	77	Construction quality	Average	
Wind speed (mph)	15.0	7.5	Fireplaces	1 (Tight)	

VENTILATION

Infiltration: Winter CFM: 65, Summer CFM: 33	1,993	1,166	625	1,791
Ventilation: Winter CFM: 0, Summer CFM: 0	0	0	0	0

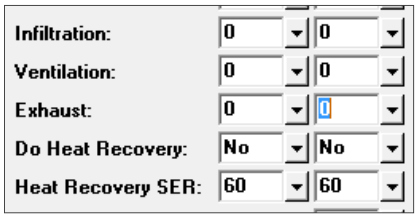
Cooling

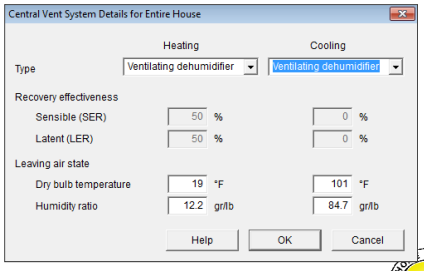
Component	Btuh/ft²	Btuh	% of load
Walls	2.1	1907	13.4
Glazing	24.2	4009	28.1
Doors	14.2	298	2.1
Ceilings	1.7	1171	8.2
Floors	0.9	649	4.5
Infiltration	0.9	988	6.9
Ducts		3021	21.2
Ventilation		579	4.1
Internal gains		1660	11.6
Blower		0	0
Adjustments		0	
Total		**14283**	**100.0**



INPUTS FOR VENTILATION (not in reports)

- Outdoor Air
  - Via Location
- HRV/ERV
  - Efficiency
- Dehumidifier
  - Dry bulb temp
  - Humidity Ratio





APPLIANCES & PEOPLE

Component Description	Area Quan	Sen Loss	Lat Gain	Sen Gain	Total Gain
People:	4		800	920	1,720
Equipment:			1,200	1,200	2,400
Lighting:	0			0	0

							Dining				Kitchen			
1	Room name													
2	Exposed wall						12.0 ft				23.5 ft			
3	Room height						10.0 ft		heat/cool		10.0 ft		heat/cool	
4	Room dimensions						12.0 x 13.5 ft				10.0 x 13.5 ft			
5	Room area						162.0 ft²				135.0 ft²			
	Ty	Construction number	U-value (Btuh/ft²-°F)	Or	HTM (Btuh/ft²)		Area (ft²) or perimeter (ft)		Load (Btuh)		Area (ft²) or perimeter (ft)		Load (Btuh)	
					Heat	Cool	Gross	N/P/S	Heat	Cool	Gross	N/P/S	Heat	Cool
13	Internal gains:		Occupants @		230		0			0	1			230
			Appliances/other							0				1200

BUILDING LOAD RESULTS

Building Loads			
Total Heating Required Including Ventilation Air:	26,307 Btuh	26.307 MBH	
Total Sensible Gain:	19,568 Btuh	84 %	
Total Latent Gain:	3,735 Btuh	16 %	
Total Cooling Required Including Ventilation Air:	23,303 Btuh	1.94 Tons (Based On Sensible + Latent)	

ROOM NAME	Area (ft²)	Htg load (Btuh)	Clg load (Btuh)	Htg AVF (cfm)	Clg AVF (cfm)
Entire House	704	25599	13704	587	587
Other equip loads		2003	579		
Equip. @ 1.04 RSM			14854		
Latent cooling			2596		
TOTALS	704	27602	17450	587	587

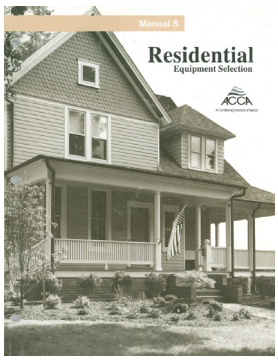
ENCAPSULATED ATTICS (Wrightsoft)

Construction descriptions	Or	Area ft²	U-value Btuh/ft²-°F	Insul R ft²-°F/Btuh	Htg HTM Btuh/ft²	Loss Btuh	Clg HTM Btuh/ft²	Gain Btuh
Ceilings								
16X19-0md: Attic ceiling, mtl roof mat, r-20 roof ins, 1/2" gypsum board int fnsh		704	0.408	19.0	4.70	3308	2.11	1488

- This is indicating the U-value of a ceiling below an encapsulated attic. The Clg HTM represents an attic temp of 85°.
- As the R-value of foam changes, the HTM's will change, but the U-value will not.

MANUAL-S

- Provides a process of properly selecting equipment
- Currently being re-written by ACCA



MANUAL-S SELECTION BASICS

- Heating Only Systems
  - Pick a unit that will meet the heating load.
  - 140% max for furnaces
- Air Conditioner or Heat Pump
  - Select based on cooling capacity
  - Max 115% (125% in cold climates)
  - **Both** the **sensible** and **latent** loads must be satisfied by the selected equipment.

PROCESS OVERVIEW

- Determine sensible & latent loads of house
- Divide total load by 12,000 to get you started
- Look up "detailed capacity chart" of condenser and find the size that you believe may satisfy the load.
- Interpolate capacity data based on your outdoor/indoor conditions and the altitude.
- Ensure it doesn't exceed the Manual-S sizing limits.

REQUIRED DATA SUMMARY

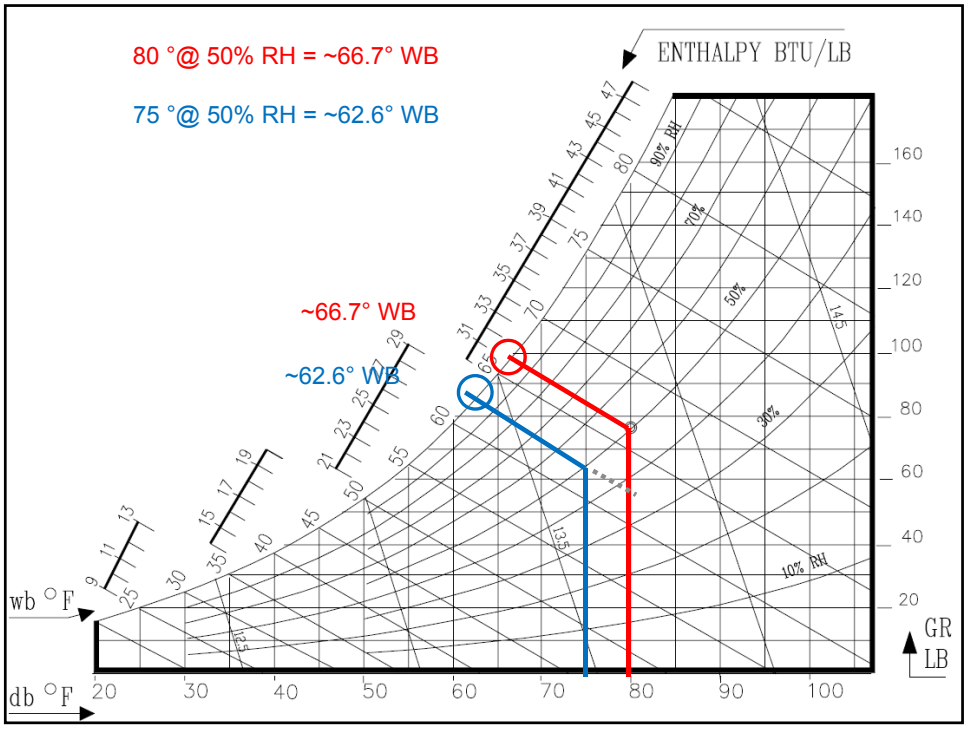
- Manual-J Loads (reports)
- Outdoor Design Conditions (City, State)
- Indoor Cooling Design Conditions (75/50)
- Estimated CFM for Cooling

DETAILED COOLING CAPACITIES

EVAPORATOR AIR		CONDENSER ENTERING AIR TEMPERATURES d										
		75			85			95			105	
CFM	EWB	Capacity MBtuh†		Total System KW* *	Capacity MBtuh†		Total System KW* *	Capacity MBtuh†		Total System KW* *	Capacity MBtuh†	
		Total	Sens ‡		Total	Sens ‡		Total	Sens ‡		Total	Sens ‡
25HPA524A30 Outdoor Section With FX4CNF030 Indoor Section												
700	72	28.21	14.49	1.47	26.92	13.99	1.65	25.57	13.46	1.85	24.13	12.92
	67	25.60	17.78	1.46	24.41	17.26	1.64	23.15	16.72	1.84	21.81	16.16
	63	23.74	17.18	1.46	22.61	16.65	1.64	21.42	16.11	1.84	20.16	15.53
	62	23.27	21.07	1.46	22.17	20.52	1.64	21.02	19.95	1.84	19.80	19.32
	57	22.41	22.41	1.46	21.53	21.53	1.64	20.61	20.61	1.83	19.62	19.62
800	72	28.81	15.19	1.49	27.47	14.68	1.67	26.06	14.14	1.87	24.57	13.59
	67	26.16	18.90	1.49	24.91	18.37	1.67	23.60	17.82	1.87	22.21	17.25
	63	24.26	18.23	1.48	23.08	17.69	1.66	21.84	17.14	1.86	20.53	16.55
	62	23.82	22.56	1.48	22.69	21.98	1.66	21.53	21.32	1.86	20.39	20.39
	57	23.35	23.35	1.48	22.42	22.42	1.66	21.44	21.44	1.86	20.39	20.39
												22
												28
												52
												05
												05

23.60 - 17.82 = 5.78 → Latent Capacity = 5,780 btu's

Remember to deduct sensible capacity if EDB < 80°
835 btu/1000cfm/degree in this case



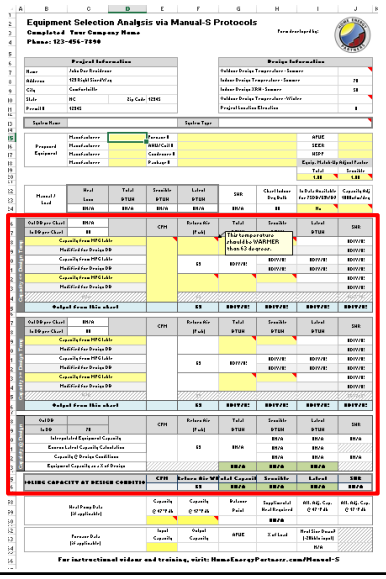
COOLING CAPACITY FOOTNOTES

- Often times, these charts are based on a fixed EDB temp. In the previous chart, for instance, it was 80°F.
- If your EDB temp is different, you need to adjust the capacities listed in these charts.
  - Sometimes, another chart will provide multipliers.
  - Sometimes, it will give you a BTU/degree adjustment figure (add or subtract as needed).
- READ THE FOOTNOTES !!!!!!!!!

EXAMPLE PROJECT

- One system down, Furnace with A/C
- One system up, Heat pump

INTRODUCTION TO THE SPEEDSHEET



INTRODUCTION TO THE SPEEDSHEET

Capacity <= Design Temp	Out DB per Chart	85	CFM	Return Air (F wb)	Total BTUH	Sensible BTUH	Latent BTUH	SHR
	In DB per Chart	80						
	Capacity from MFG table							#DIV/0!
	Modified for Design DB							#DIV/0!
	Capacity from MFG table			63	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Modified for Design DB					#DIV/0!	#DIV/0!	#DIV/0!
	Capacity from MFG table							#DIV/0!
	Modified for Design DB							#DIV/0!
	Output from this chart			**63**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Capacity >= Design Temp	Out DB per Chart	95	CFM	Return Air (F wb)	Total BTUH	Sensible BTUH	Latent BTUH	SHR
	In DB per Chart	80						
	Capacity from MFG table							#DIV/0!
	Modified for Design DB							#DIV/0!
	Capacity from MFG table			63	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Modified for Design DB					#DIV/0!	#DIV/0!	#DIV/0!
	Capacity from MFG table							#DIV/0!
	Modified for Design DB							#DIV/0!
	Output from this chart			**63**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**

Capacity @ Design	Out DB	86	CFM	Return Air (F wb)	Total BTUH	Sensible BTUH	Latent BTUH	SHR
	In DB	70						
	Interpolated Equipment Capacity					#DIV/0!	#DIV/0!	#DIV/0!
	Excess Latent Capacity Calculation			63	#DIV/0!	#DIV/0!	#DIV/0!	
	Capacity @ Design Conditions					#DIV/0!	#DIV/0!	#DIV/0!
	Equipment Capacity as a % of Design				#DIV/0!	#DIV/0!	#DIV/0!	

COOLING CAPACITY AT DESIGN CONDITIONS	CFM	Return Air WB	Total Capacity	Sensible	Latent	SHR
		63	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Questions & Answers

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