wrightsoft

Project Summary
Entire House
Worlds Best

Job:
Date:
By:

Project Information

For: Amarillo, Tx

Notes:

Design Information

A Weather: Amarillo Rick Husband Intl, TX, US

B Winter Design Conditions

Outside db	16	°F
Inside db	70	°F
Design TD	54	°F

C Summer Design Conditions

Outside db	***98***	°F
Inside db	75	°F
Design TD	23	°F
Daily range	M	
Relative humidity	50	%
Moisture difference	-17	gr/lb

D Heating Summary

Structure	21056	Btuh
Ducts	8763	Btuh
Central vent (36 cfm)	1890	Btuh
Outside air		
Humidification	0	Btuh
Piping	0	Btuh
Equipment load	31709	Btuh

E Sensible Cooling Equipment Load Sizing

Structure	13315	Btuh
Ducts	9279	Btuh
Central vent (36 cfm)	802	Btuh
Outside air		
Blower	0	Btuh
Use manufacturer's data	y	
Rate/swing multiplier	1.00	
Equipment sensible load	23396	Btuh

G Infiltration

Method	Simplified
Construction quality	Average
Fireplaces	0

	Heating	Cooling
Area (ft²)	1808	1808
Volume (ft³)	14464	14464
Air changes/hour	0.38	0.20
Equiv. AVF (cfm)	92	48

F Latent Cooling Equipment Load Sizing

Structure	119	Btuh
Ducts	48	Btuh
Central vent (36 cfm)	-361	Btuh
Outside air		
Equipment latent load	0	Btuh
Equipment Total Load (Sen+Lat)	23396	Btuh
Req. total capacity at 0.85 SHR	2.3	ton

H Heating Equipment Summary

Make	Carrier
Trade	CARRIER
Model	25HBC536A00300
AHRI ref	10508651

Efficiency	8.2 HSPF	
Heating input		
Heating output	34200	Btuh @ 47°F
Temperature rise	32	°F
Actual air flow	1120	cfm
Air flow factor	0.038	cfm/Btuh
Static pressure	0.70	in H2O

Space thermostat
Capacity balance point = 43 °F

Backup: Carrier
Input = 9 kW, Output = 29840 Btuh, 100 AFUE

I Cooling Equipment Summary

Make	Carrier
Trade	CARRIER
Cond	25HBC536A00300
Coil	CNPVP3621ALA
AHRI ref	10508651

Efficiency	11.5 EER, 14 SEER	
Sensible cooling	30375	Btuh
Latent cooling	2605	Btuh
Total cooling	32980	Btuh
Actual air flow	1120	cfm
Air flow factor	0.050	cfm/Btuh
Static pressure	0.70	in H2O
Load sensible heat ratio	1.00	

Bold/italic values have been manually overridden

Calculations approved by ACCA to meet all requirements of Manual J 8th Ed.

Manual J Breakdown Series for Manual J, S, & D

Building Codes Support Program

Manual S is the second step in the residential HVAC design process. The designer is responsible for following the procedures for selection and sizing residential heating and cooling appliances as there are no approved manual S software systems available.

Submittal documents must include the performance data for all proposed heating and cooling appliances. This includes the expanded performance data for the air conditioner.

Explanations for the Wrightsoft report

H. Heating Equipment Summary

Make Carrier:	Manufacturer
Trade Carrier:	Trade if different from the manufacturer
Model 25HBC536A00300:	Model number
AHRI ref 10508651:	Has been tested, listed, and will provide the stated capacities. All units should have an AHRI number
Efficiency 8.2 HSPF:	The efficiency of the proposed unit
Heating input:	No input heating for heat pumps. This would be used for gas fired appliances

Heating output 34090 Btuh @ 47°F: The heating output with an outdoor temperature of 47°

Temperature rise 32° F: The software will calculate the temperature rise. This is a calculation of the output capacity and the heat CFM. The temperature rise range will be part of the manufacturer's performance data.

Actual air flow 1120 cfm: Air flow for heating. The designer will choose the proper speed from the manufacturer's performance data for the required airflow based on the temperature rise. The higher the CFM the lower the temperature rise. The lower the CFM the higher the temperature rise.

Air flow factor 0.038 cfm/Btuh: The software will calculate this factor. Based on actual airflow (cfm) and needed heating Btu's for each room.

Static pressure 0.70 in H2O: Total external pressure used by the designer. Please refer to the duct design technical paper for more information.

Space thermostat: The designer can add some specifications for a space thermostat.

Capacity balance point = 43° The software will calculate at what point the heating appliance will have the capacity to heat the home. In this case the heat pump will not have the capacity to heat the home when the outdoor temperature is less than 43°. This is why most heat pumps will require some type of supplementary and/or back up heat. Many times, this is electric heat strips inside the air handler. This could also be a gas fired furnace

Manual J Breakdown Series for Manual J, S, & D

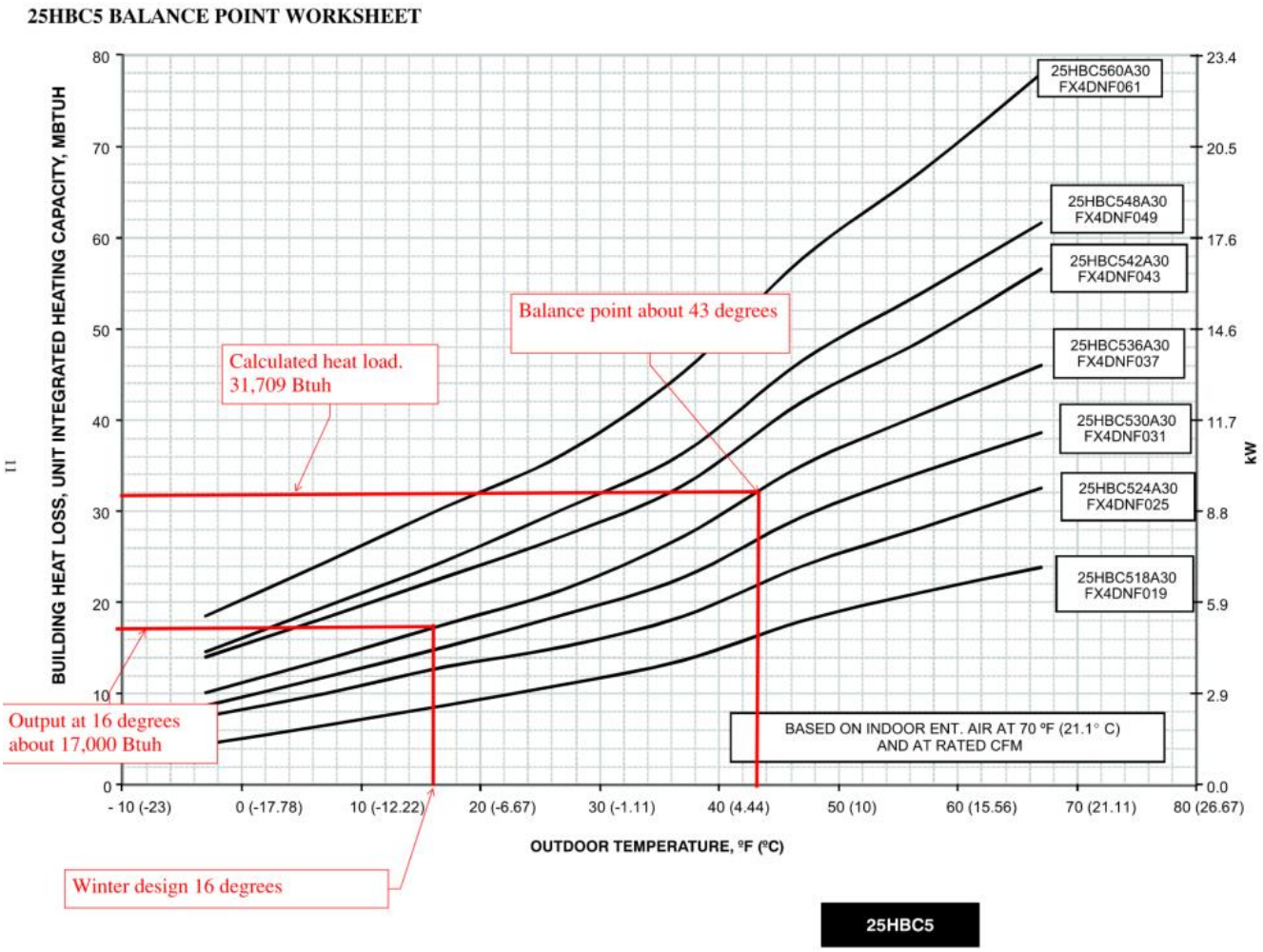
Building Codes Support Program

Backup: Carrier

Input = 9 kW,

Output = 29840 Btuh, 100 AFUE

The software will estimate the needed backup heat. Generally, this will be close to the calculated load. The designer will typically have a set of coils that will provide supplementary heat in a stepped manner. Three steps are not unusual.



SHUMS CODA ASSOCIATES

Manual J Breakdown Series for Manual J, S, & D

Building Codes Support Program

I. Cooling Equipment Summary

Make Carrier:	The manufacturer
Trade COMFORT 15 SEER2 HP:	Trade if different from the manufacturer
Cond 25HBC536A00300:	The systems outside unit model number
Coil CNPVP3621ALA:	The indoor coil model number
AHRI ref 10508651:	The listing number that verifies the indoor and outdoor units are compatible.
Efficiency 11.5 EER, 14 SEER:	The systems efficiency
Sensible cooling 25954 Btuh:	The sensible cooling capacity of the proposed unit from the manufacturers expanded performance data
Latent cooling 5316 Btuh:	The latent cooling capacity of the proposed unit from the manufacturers expanded performance data
Total cooling 31270 Btuh:	The total cooling capacity of the proposed unit
Actual air flow 1120 cfm:	Airflow from the manufacturer's performance data
Air flow factor 0.050 cfm/Btuh:	Airflow factor is calculated by the software based on the CFM and the cooling load per room.
Static pressure in 0.70 H2O:	Total external pressure used by the designer. Please refer to the duct design technical paper for more information.

Load sensible heat ratio 1.0: As discussed on the Manual J technical paper this is where the software calculates the actual sensible heat ratio.

The selection of air conditioning equipment in Texas is more complicated than in other areas of the country. First there is no calculated latent load and second is the altitude.
Below is the expanded performance data for the air conditioning equipment selected for this project. Keep in mind all the performance data we will look at are the capacities at **sea level**.

The calculated total cooling load for our example is 23,396 Btuh.

We will be using the 1350 CFM row at a 63 degree entering wet bulb. (EWB)

The 95 degree column as this is within 5 degrees of our outside summer design dry bulb.

Total capacity is 32,980 Btuh with 27,760 Btuh of that being the sensible capacity.

Total capacity of 32,980 less the Sensible capacity of 27,760 = 5,220 Latent capacity

Per Manual S one half of the excess latent capacity can be converted to sensible capacity as this is self-correcting.

5,220 / 2 = 2,610 New sensible capacity

27,760 + 2,610 = 30,370 new sensible capacity

Per Manual S we can be 15,000 Btuh oversized for air source heat pumps:

Target total load of 23,396 + 15,000 = 38,396 Btuh < 32,980

Loos like this unit will work!

DETAILED COOLING CAPACITIES# CONTINUED

EVAPORATOR AIR		CONDENSER ENTERING AIR TEMPERATURES °F (°C)											
		75 (23.9)			85 (29.4)			95 (35)			105 (40.6)		
CFM	EWB °F (°C)	Capacity MBtuh		Total System KW**	Capacity MBtuh		Total System KW**	Capacity MBtuh		Total System KW**	Capacity MBtuh		Total System KW**
		Total	Sens‡		Total	Sens‡		Total	Sens‡		Total	Sens‡	
25HBC536A**30 Outdoor Section With FX4DNF037 Indoor Section													
1050	72 (22.2)	41.59	22.07	2.25	39.75	21.35	2.51	37.77	20.58	2.79	35.67	19.78	3.11
	67 (19.4)	37.90	27.12	2.23	36.20	26.38	2.48	34.37	25.60	2.77	32.42	24.78	3.09
	63 (17.2)††	35.22	26.13	2.22	33.62	25.39	2.47	31.90	24.60	2.75	30.07	23.77	3.07
	62 (16.7)	34.53	32.04	2.21	32.97	31.27	2.47	31.31	30.44	2.75	29.55	29.53	3.07
	57 (13.9)	33.22	33.22	2.21	32.01	32.01	2.46	30.68	30.68	2.74	29.25	29.25	3.06
1200	72 (22.2)	42.40	23.16	2.28	40.49	22.43	2.54	38.44	21.66	2.83	36.24	20.84	3.15
	67 (19.4)	38.68	28.89	2.26	36.90	28.13	2.52	35.00	27.34	2.80	32.97	26.50	3.12
	63 (17.2)††	35.97	27.78	2.25	34.30	27.02	2.50	32.52	26.22	2.78	30.61	25.37	3.10
	62 (16.7)	35.34	34.38	2.24	33.74	33.54	2.50	32.07	31.86	2.78	30.45	30.45	3.10
	57 (13.9)	34.65	34.65	2.24	33.35	33.35	2.50	31.93	31.93	2.78	30.41	30.41	3.10
1350	72 (22.2)	43.03	24.20	2.31	41.06	23.46	2.58	38.93	22.68	2.86	36.68	21.85	3.18
	67 (19.4)	39.27	30.57	2.29	37.43	29.81	2.55	35.47	29.00	2.83	33.38	28.14	3.15
	63 (17.2)††	36.55	29.35	2.28	34.82	28.58	2.53	32.98	27.76	2.81	31.02	26.89	3.13
	62 (16.7)	36.05	36.44	2.28	34.51	34.51	2.53	33.01	33.01	2.81	31.41	31.41	3.14
	57 (13.9)	35.84	35.84	2.28	34.46	34.46	2.53	32.97	32.97	2.81	31.37	31.37	3.14

*If your altitude is less than or equal to 2000’ above sea level, then no adjustment is needed.

Now what about the effects of altitude. Unfortunately, very few if any manufacturers provide guidance for altitude adjustment for air conditioners. Fortunately, Manual S does provide two options.

One option is to derate the capacity based on your location above sea level. Please refer to appendix 5 of the Manual S 2nd edition that provides the tables and calculation necessary for deration.

The other is to increase the CFM to maintain sea level capacity and can be found in appendix 6 manual S first edition. Air is less dense at altitude than it is at sea level, so we need to move more air to maintain the same capacity. Many designers use this method.

The formula for air density correction: CFM at Altitude = Sea-Level Flow Rate / Density Ratio

Altitude Correction factors: 5000’= 0.832, 6000’ = 0.801, 7000’ = 0.772, 8000’ = 0.743

1350 cfm/ 0.832 = 1,622 cfm. In our example we would need to move a minimum of 1,622 CFM to maintain same capacity of our air conditioner at 5000’ above sea level.