Manual J Breakdown
Series for Manual J, S, & D
Minnesota Energy Code Support Program

A Manual J calculation is the first step in the residential HVAC design process. Manual J calculates the total heat loss (heating system) and total heat gain (air conditioning) for the building.

Current ACCA approved Manual J Software (August 2024)

- *Wrightsoft Right-J8,*
- *Elite HVAC,*
- *Adtek Acculoads,*
- *Florida Solar Energy Center's EnergyGauge,*
- *Carmelsoft HVAC ResLoad-J,*
- *Avenir MJ8 Editions of HeatCAD LoopCAD*
- *Cool Calc Manual J*
- *Conduit Tech*
- *Amply Energy*

The following pages contain the Wrightsoft “Project Summary” report for reference and explanations. The Project Summary report has been placed into red boxes with a letter attached for reference, which each section corresponding to the appropriate lettered box

When you see bold text in Manual J:

There are times when the jurisdiction has amended the design temperatures from what may be in the weather database. The designer can then override the design temperature and that is why it shows up in bold. It is perfectly acceptable if the jurisdiction has amended these.

wrightsoft

Project Summary
Entire House

Job:
Date: Jan 2019
By:

Project Information

For: St. Cloud, MN

Notes:

Design Information

A Weather: St Cloud Regional, MN, US

B Winter Design Conditions

Outside db	-17	°F
Inside db	70	°F
Design TD	87	°F

C Summer Design Conditions

Outside db	86	°F
Inside db	75	°F
Design TD	11	°F
Daily range	M	
Relative humidity	50	%
Moisture difference	25	gr/lb

D Heating Summary

Structure	35164	Btuh
Ducts	0	Btuh
Central vent (0 cfm)	0	Btuh
(none)		
Humidification	0	Btuh
Piping	0	Btuh
Equipment load	35164	Btuh

E Sensible Cooling Equipment Load Sizing

Structure	14405	Btuh
Ducts	0	Btuh
Central vent (0 cfm)	0	Btuh
(none)		
Blower	0	Btuh
Use manufacturer's data	y	
Rate/swing multiplier	1.00	
Equipment sensible load	14405	Btuh

G Infiltration

Method	Simplified
Construction quality	Average
Fireplaces	0

	Heating	Cooling
Area (ft²)	3600	3600
Volume (ft³)	14464	14464
Air changes/hour	0.28	0.15
Equiv. AVF (cfm)	107	83

F Latent Cooling Equipment Load Sizing

Structure	2363	Btuh
Ducts	0	Btuh
Central vent (0 cfm)	0	Btuh
(none)		
Equipment latent load	2363	Btuh
Equipment Total Load (Sen+Lat)	16768	Btuh
Req. total capacity at 0.85 SHR	1.4	ton

H Heating Equipment Summary

Make	Carrier
Trade	Carrier Performance 95 Single-...
Model	59SP5A060E17--14
AHRI ref	4702805

Efficiency	96.5	AFUE
Heating input	60000	Btuh
Heating output	52110	Btuh
Temperature rise	68	°F
Actual air flow	725	cfm
Air flow factor	0.021	cfm/Btuh
Static pressure	0.70	in H2O
Space thermostat		

I Cooling Equipment Summary

Make	Carrier
Trade	BASE 13 PURON AC
Cond	24ABB324(A,W)31
Coil	CAP**2414A**++TDR
AHRI ref	3250356

Efficiency	11.0 EER, 13 SEER	
Sensible cooling	18360	Btuh
Latent cooling	3240	Btuh
Total cooling	21600	Btuh
Actual air flow	995	cfm
Air flow factor	0.069	cfm/Btuh
Static pressure	0.70	in H2O
Load sensible heat ratio	0.86	

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

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Box Breakdowns

A. Weather: St. Cloud Regional, MN, US

All approved manual J software has a built in weather database. As every jurisdiction may not be listed in the weather base one would use a location that is near the location where the project will be built.

B. Winter Design Conditions

Outside db(Drybulb) -17°F:	*The outside design dry bulb for winter is –17 degrees. This is not the coldest temperature that can be reached, but during a standard weather year it will be warmer 99% of the time.*
Inside db 70°F:	*The inside design dry bulb for winter is 70 degrees. The code allows anywhere from 68 degrees to 72 degrees. ACCA recommends designing for 70 degrees.*
Design TD 87°F :	*TD is the Temperature Differential between the outdoor design and the indoor design. In this design, that is 87 degrees. This is an equation.* *TD = Outside Dry Bulb - Inside Dry Bulb*

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C. Summer Design Conditions

Outside db 86°F:	*The outside design dry bulb for summer is 86 degrees. During a standard weather year it will only be warmer 1% of the time.*
Inside db 75°F:	*The inside design dry bulb for summer is 75 degrees.*
Design TD 11°F :	*TD is the Temperature Differential between the outdoor design and the indoor design. For this design it is 11 degree. 86 - 75 = 11*
Daily Range M:	*The daily range is the average difference between the daily high and low dry bulb temperatures for the location.* *LOW (L) = swing less than 16°F* *Medium (M) = swing between 16°F & 25°F* *High (H) = swing exceeds 25°F*
Relative humidity 50%:	*ACCA and ASHRAE define "Comfort" for air conditioning at 75 degrees and 50% relative humidity. For design purposes this is set at 50% relative humidity.*
Moisture difference 25gr/lb:	*Moisture Difference is the absolute humidity difference between the outdoor air and the indoor air. This is expressed in grains of water per pound of air. Minnesota is humid climate and would result in a positive number shown here. If it was a dry climate the number would be negative.*

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D. Heating Summary

Structure 35,164 Btuh:	*This indicates the heat loss for the structure from the thermal envelope.*
Ducts 0:	*This indicates any heat losses for the ductwork. Ductwork located in the outside the thermal envelope with have a number listed here. Ductwork located inside the thermal envelope will be 0 as shown here.*
Contral vent (0cfm) 0 Btuh :	*If the design is introducing outside air into the return system, or using hrv/erv, or outside combustion air it will show up as a load in the central vent. In this design an exhaust only whole house mechanical system was used. (See infiltration explanation for added load)*
Humidification 0 Btuh:	*This will indicate any heat losses based on the humidification system that is installed.*
Piping 0 Btuh:	*This would indicate any heat losses based on any piping such as in radiant systems. No radiant systems are installed for this design so the number is 0.*
Equipment load 35,164 Btuh:	*This the total load for the heating appliance.* *Structure + Ducts =+ Central vent + Humidification + Piping = Equipment Load*

E. Sensible Cooling Equipment Load Sizing

The Sensible Load is the heat gain of the home due to conduction, solar radiation, infiltration, appliances, people and pets. Burning a light bulb, for example, adds only sensible load to the house. The sensible load raises the dry-bulb temperature.

Structure Btuh:	*This indicates the heat gain for the, structure from the thermal envelope.*
Ducts 0:	*This indicates any heat losses for the ductwork. Similar to what is found for heating loss in box D.*
Contral vent (0cfm) 0 Btuh :	*If the design is introducing outside air into the return system it will show up as a load in the central vent.* In this design an exhaust only whole house mechanical system was used. (See infiltration explanation for added load)
Blower 0 Btuh:	*The blower motors of most forced air furnaces are within the airstream. Many designers will add the heat load of the motor. This would be from the manufacturers data.*

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F. Latent Cooling Equipment Load Sizing

Structure Btuh:	*This indicates the heat gain for the, structure from the thermal envelope.*
Ducts 0:	*This indicates any heat losses for the ductwork. Similar to what is found for heating loss in box D.*
Contral vent (0cfm) 0 Btuh :	*If the design is introducing outside air into the return system it will show up as a load in the central vent.*
Equipment latent load:	*This indicates the total latent load for the building. Humidity has an affect on the cooling systems capacity to remove or add humidity to maintain comfort. The report shows a load of 2,363 Btuh. This would be correct to have a number indicated here since it is a humid climate.*
Equipment Total Load:	*The Equipment Total Load indicates the total cooling loads for the building. This is calculated by adding the sensible load to the latent load. This project has a total cooling load of 16,768 Btuh*

F. Latent Cooling Equipment Load Sizing (cont.)

Req. total capacity at 0.85 SHR: *SHR is Sensible Heat Ratio. This is the sensible load divided by the total load. In this case the SHR is: 14,405 / 16,768 = 0.86 Then why does it say 0.85? This again is the software's magical attempt to try to do Manual S. In this case it's trying to calculate the CFM needed for air conditioning. Ignore the 1.4 tons. Just do the math. 12,000 Btuh is one ton. 16,768/12,000 = 1.3 tons*

G. Infiltration

Method Simplified: *The designer has three choices here. Simplified, blower door, or detailed. Most will use the simplified method.*

Construction quality Average: *When the simplified method is used there five choices on how tight the building is. Tight, Semi-tight, Average, Semi-loose, and Loose. With the blower door and airtightness requirements in today's code many houses can be designed to Tight, but Semi-tight or Average is also acceptable.*

G. Infiltration (cont.)

Fireplaces 0:

This is for the number of fireplaces that would be considered leaky such as a masonry fireplace. Designers can include natural gas fireplaces, but they should indicate the project as Tight or Semi-tight.

Area (ft^2):

Indicates the square footage of floor area that is being conditioned. Not the total square footage of the building.

Heating	***Cooling***
3,600	*3,600*

Volume (ft^3):

Indicates the above grade volume

Heating	***Cooling***
14,464	*14,464*

Air Changes/hour:

This is the infiltration when the Average construction quality is chosen. The reason for the two different rates is ACCA and ASHRAE use a 15 mph wind for winter design and 7.5 mph wind for summer design.

Heating	***Cooling***
0.28	*0.15*

Equiv. AVF (cfm):

The cfm of infiltration. Air coming through unintended holes in the thermal envelope.

Heating	***Cooling***
107	*83*

G. Infiltration (cont.)

Equiv. AVF (cfm):

The cfm of infiltration. Air coming through unintended holes in the thermal envelope.

Heating	***Cooling***
107	*83*

As noted the central vent was 0 cfm. With an exhaust only whole house ventilation system the "make up air" is coming through the unintended holes in the thermal envelope. To verify if the designer has added to the infiltration rate we do some math. We will use heating for the example.

Above Grade Volume * infiltration rate/60 = cfm infiltration

14,464 x 0.28 / 60 = 68 cfm.

Volume (ft^3) | Air changes/hour

The equation above shows 68 cfm of infilatration and what was Listed in the Equiv. AVF (cfm) line is 107. Looks like the designer added at least 39 cfm for the exhaust only system.