Manual J
Breakdown Series for
Manual J, S, & D
Building Codes 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 (December2021)

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

Explanations for the Wrightsoft “Project Summary” report.

A. Weather: Denver, CO, US

All approved manual J software has built in weather data base. As every jurisdiction may not be listed in the weather database. Using a location near your location also works.

B. Winter Design Conditions

When a weather location is selected the winter and summer design conditions are automatically provided.

Outside db -3 °F: The outside design dry bulb for winter is negative 3 degrees.

Inside db 70 °F: The inside design dry bulb for winter is 70 degrees. Code allows anywhere from 68 degrees to 72 degrees. ACCA recommends 70 degrees.

Design TD 73 °F: The Temperature Differential between the outdoor design an indie design is 73 degrees.

C. Summer Design Conditions

Outside db **90** °F:	The outside design dry bulb for summer is 90 degrees. Notice that in this case 90 degrees is in bold text. 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. Perfectly acceptable if the jurisdiction has amended
Inside db 75 °F:	The inside design dry bulb for summer is 75 degrees. 75 degrees is also the code allowed minimum for indoor cooling design.
Design TD 15 °F:	The temperature differential between the outside design dry bulb and inside design dry bulb. In this case is 15 degrees.
Daily range H:	Daily Range is the average difference between the daily high and low dry bulb temperatures at a particular weather location. Low (L) = swing less than 16° F Medium (M) = swing between 16° F and 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. So for design purposes we will set indoor relative humidity at 50%
Moisture difference -36 gr/lb:	Moisture Difference is the absolute humidity differential between the outdoor air and the indoor air, expressed in grains of water per pound of air. Colorado has a very dry climate and as such this will always be a negative number. If we were in Iowa or Florida this would be a positive number as those environments are very humid.

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D. Heating Summary

Structure 26,468 Btuh:	This indicates the heat loss for the structures thermal envelope 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.
Ducts 0 Btuh:	This indicates any heat losses for ductwork. Ductwork located in a vented attic assembly would be an example of where duct heat loss would be expected. in this design all ducts are inside the thermal envelope and therefore no duct losses.
Central vent (64 cfm) 4213 Btuh:	If the design is introducing outside air into the return air system this will show up as a load in the central vent. In this design 64 CFM of unconditioned air is being introduced into the return air system.
Humidification 0 Btuh:	This will indicate any heat losses based on any type of humidification system that's installed. No humidifier in this design
Piping 0 Btuh:	This would indicate any heat losses based on any piping such as in radiant systems. No radiant systems in this design
Equipment load 30,680 Btuh:	This just simply indicates the total load for the heating appliance.

E. Sensible Cooling Equipment Load Sizing:

Structure 14,878 Btuh:	This indicates the sensible heat gain for the building thermal envelope.
Ducts 0 Btuh:	This indicates any heat gains for ductwork. Ductwork located in a vented attic assembly would be an example of where duct heat gain would be expected. In this design all ducts are inside the thermal envelope and therefore no duct gains.
Central vent (64 cfm) 877 Btuh:	If the design is introducing outside air into the return air system this will show up as a load in the central vent. In this design 64 CFM of unconditioned air is being introduced into the return air system.
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 design did not include any blower heat.
Use manufacturer's data y:	This is where we can start to say there is no software that does a Manual S. Manual S is a procedure by which the heating and cooling appliances are selected to meet the calculated heat loss and heat gain. When the designer selects a yes (y) the rate swing multiplier is 1. If the designer select no (n) the software comes up with some magical number.
Rate/swing multiplier 1.00:	If the rate swing multiplier is 1 the designer has selected to use the manufacturers performance data. If a number higher or lower than one is shown then simply ignore. You will know the actual sensible load by simply adding the structure, duct, central vent, and blower loads.

Equipment sensible load 15,756 Btuh: If the designer has used the manufacturers data this number is correct. Otherwise simply add the structure ducts, central vent and any blower loads to calculate the actual sensible load.

F. Latent Cooling Equipment Load Sizing:

Structure 274 Btuh: This indicates the latent heat gain for the building thermal envelope.

Latent gain is the net amount of moisture added to the inside by people, plants, cooking, infiltration and any other moisture sources.

Ducts 0 Btuh: This indicates any latent heat gains for ductwork. Ductwork located in a vented attic assembly would be an example of where duct heat gain would be expected. In this design all ducts are inside the thermal envelope and therefore no duct latent gains.

Central vent (64 cfm) -1,281 Btuh: If the design is introducing outside air into the return air system this will show up as a load in the central vent. In this design 64 CFM of unconditioned air is being introduced into the return air system. Notice that this is a negative number. Remember the negative number in the Moisture difference in grains per pound of air earlier? Clearly the dry air that's entering the system will not add any moisture in fact it will dry the air out.

Equipment latent load 0 Btuh: This indicates the total latent heat load for the building. Notice that it is zero.

Equipment Total Load (Sen+Lat) 15,756 Btuh: This indicates the total cooling load for the building sensible plus latent. Note that the negative latent load does not reduce the sensible load.

Req. total capacity at 0.85 SHR 1.5 ton: SHR is sensible heat ratio. This is the sensible load divided by the total load. But wait did you notice that the total load and the sensible load in this design are the same number. So, the SHR is 1.00. 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 1.5 tons. Just do the math. 12,000 Btuh is one ton.
15,756/12,000 = 1.3 tons…not 1.5.

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 are four choices on how air tight the building is. Tight, Semi-Tight, Average, Semi- Loose, Loose. With the blower door and airtightness requirements in today's code many houses can be designed using the Tight choice. Semi-Tight and Average are acceptable.

Fireplaces 0: This is actually intended for loose fireplaces. Like a masonry fireplace. Although designers will include natural gas fireplaces, these fireplaces should be indicated as semi-tight or tight.

	Heating	Cooling	
Area (ft^2)	3600	3600	Indicates the conditioned floor area
Volume (ft^3)	14,464	14,464	Indicates the above grade volume
Air changes/hour	0.28	0.15	Is the infiltration when the Average construction quality is chosen. Why the two different rates. ACCA and ASHRAE use a 15 mph wind for winter design and a 7.5 mph wind for summer design.
Equiv. AVF (cfm)	67	36	The cfm of filtration. Air coming through the unintended holes in the thermal envelope

Project Summary
Entire House
ACME Design

Job: 1006
Date:
By:

Project Information

For: New House, Good Builder

Notes:

Design Information

A Weather: Denver, CO, US

B Winter Design Conditions

Outside db	-3 °F
Inside db	70 °F
Design TD	73 °F

C Summer Design Conditions

Outside db	***90*** °F
Inside db	75 °F
Design TD	15 °F
Daily range	H
Relative humidity	50 %
Moisture difference	-36 gr/lb

D Heating Summary

Structure	26468 Btuh
Ducts	0 Btuh
Central vent (64 cfm)	4213 Btuh
Outside air	
Humidification	0 Btuh
Piping	0 Btuh
Equipment load	30680 Btuh

E Sensible Cooling Equipment Load Sizing

Structure	14878 Btuh
Ducts	0 Btuh
Central vent (64 cfm)	877 Btuh
Outside air	
Blower	0 Btuh
Use manufacturer's data	y
Rate/swing multiplier	1.00
Equipment sensible load	15756 Btuh

F Latent Cooling Equipment Load Sizing

Structure	274 Btuh
Ducts	0 Btuh
Central vent (64 cfm)	-1281 Btuh
Outside air	
Equipment latent load	0 Btuh
Equipment Total Load (Sen+Lat)	15756 Btuh
Req. total capacity at 0.85 SHR	1.5 ton

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)	67	36

H Heating Equipment Summary

Make	Carrier
Trade	Carrier
Model	58MCB040-12x
AHRI ref	144278
Efficiency	92.1 AFUE
Heating input	40000 Btuh
Heating output	33156 Btuh
Temperature rise	44 °F
Actual air flow	830 cfm
Air flow factor	0.031 cfm/Btuh
Static pressure	0.70 in H2O
Space thermostat	

I Cooling Equipment Summary

Make	Carrier
Trade	BASE 13 PURONAC
Cond	24ABB324(A,W)31
Coil	CAP**2414A**++TDR
AHRI ref	3250356
Efficiency	11.0 EER, 13 SEER
Sensible cooling	18835 Btuh
Latent cooling	2765 Btuh
Total cooling	21600 Btuh
Actual air flow	995 cfm
Air flow factor	0.067 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.