

## Project Information

For: Amarillo, Tx

Notes:

## Design Information

**A** Weather: Amarillo Rick Husband Intl, TX, US

| <b>B Winter Design Conditions</b> |       |
|-----------------------------------|-------|
| Outside db                        | 16 °F |
| Inside db                         | 70 °F |
| Design TD                         | 54 °F |

| <b>C Summer Design Conditions</b> |              |
|-----------------------------------|--------------|
| Outside db                        | <b>98</b> °F |
| Inside db                         | 75 °F        |
| Design TD                         | 23 °F        |
| Daily range                       | M            |
| Relative humidity                 | 50 %         |
| Moisture difference               | -17 gr/lb    |

| <b>D Heating Summary</b> |            |
|--------------------------|------------|
| Structure                | 21056 Btuh |
| Ducts                    | 8763 Btuh  |
| Central vent (36 cfm)    | 1890 Btuh  |
| Outside air              |            |
| Humidification           | 0 Btuh     |
| Piping                   | 0 Btuh     |
| Equipment load           | 31709 Btuh |

| <b>E Sensible Cooling Equipment Load Sizing</b> |            |
|---|------------|
| 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 |

| <b>G Infiltration</b>     |                |                |
|---------------------------|----------------|----------------|
| Method                    | Simplified     |                |
| Construction quality      | Average        |                |
| Fireplaces                | 0              |                |
|                           | <b>Heating</b> | <b>Cooling</b> |
| Area (ft <sup>2</sup> )   | 1808           | 1808           |
| Volume (ft <sup>3</sup> ) | 14464          | 14464          |
| Air changes/hour          | 0.38           | 0.20           |
| Equiv. AVF (cfm)          | 92             | 48             |

| <b>F Latent Cooling Equipment Load Sizing</b> |                   |
|---|-------------------|
| Structure                                     | 119 Btuh          |
| Ducts   | 48 Btuh           |
| Central vent (36 cfm)                         | -361 Btuh         |
| Outside air                                   |                   |
| Equipment latent load                         | 0 Btuh            |
| <b>Equipment Total Load (Sen+Lat)</b>         | <b>23396 Btuh</b> |
| Req. total capacity at 0.85 SHR               | 2.3 ton           |

| <b>H Heating Equipment Summary</b>          |                   |
|---|-------------------|
| 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 |                   |

| <b>I Cooling Equipment Summary</b> |                   |
|------------------------------------|-------------------|
| 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

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 (December 2021) 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.

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**. Perfectly acceptable if the jurisdiction has amended

### A. Weather: Amarillo Rick Husband Intl, TX, US

All approved manual J software has built in weather database. 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 16 °F:

The outside design dry bulb for winter is 16 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 54 °F:

The Temperature Differential between the outdoor design and indoor design is 54 degrees

## Building Codes Support Program

### C. Summer Design Conditions

Outside db 98 °F:

The outside design dry bulb for summer is 98 degrees.

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 23 °F:

The temperature differential between the outside design dry bulb and inside design dry bulb. In this case is 23 degrees.

Daily range M:

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 -17 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. Amarillo has a relatively dry climate and as such this will generally be a negative number. If we were in Iowa or Florida this would be a positive number as those environments are very humid.

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

## Building Codes Support Program

### D. Heating Summary

|   |  |
|---|--|
| <u>Structure 21,056 Btuh:</u>           | This indicates the heat loss for the structures thermal envelope   |
| <u>Ducts 8763 Btuh:</u>                 | 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 in a vented attic and therefore a substantial duct heat loss. |
| <u>Central vent (36 cfm) 1890 Btuh:</u> | 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 36 CFM of unconditioned air is being introduced into the return air system.                                    |
| <u>Humidification 0 Btuh:</u>           | This will indicate any heat losses based on any type of humidification system that's installed. Design at 30% RH for heating   |
| <u>Piping 0 Btuh:</u>                   | This would indicate any heat losses based on any piping such as in radiant systems. No radiant systems in this design  |
| <u>Equipment load 31709 Btuh:</u>       | This simply indicates the total load for the heating appliance.  |

### E. Sensible Cooling Equipment Load Sizing

|                               |  |
|-------------------------------|--|
| <u>Structure 13,315 Btuh:</u> | <p>This indicates the sensible heat gain for the building thermal envelope.</p> <p>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.</p> |
| <u>Ducts 9279 Btuh:</u>       | 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 in a vented attic and therefore a substantial duct heat gain   |

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

## Building Codes Support Program

### Central vent (36 cfm) 802 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 36 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 would be from the manufacturers data

### 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 selects no (n) the software comes up with some magical number.

### Rate/swing multiplier 1.00:

If the rate swing multiplier is 1.00 the designer has selected to use the manufacturers performance data. If a number higher or lower than 1 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 23,396 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 119 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 48 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 in a vented attic and therefore a latent load.

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

## Building Codes Support Program

Central vent (36 cfm) -361 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 36 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)  
23,396 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  
2.6 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 2.6 tons. Just do the math. 12,000 Btuh is one ton.  $26,601/12,000 = 2.2$  tons...not 2.6

### 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 airtight 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 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.

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

## Building Codes Support Program

|                                | Heating | Cooling  |
|--------------------------------|---------|--|
| <u>Area (ft<sup>2</sup>)</u>   | 1808    | 1808 Indicates the conditioned floor area  |
| <u>Volume (ft<sup>3</sup>)</u> | 14,464  | 14,464 Indicates the above grade volume  |
| <u>Air changes/hour</u>        | 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. |
| <u>Equiv. AVF (cfm)</u>        | 92      | 48 The cfm of filtration. Air coming through the unintended holes in the thermal envelope  |