



BLD #	Received by
Date	Valuation

Residential HVAC Worksheet

Manual J / S Summary

NOTE: The load calculation must be calculated on a room basis. Room loads are a mandatory requirement for making Manual D duct sizing calculations. This sheet has been developed for homes built in Utah's dry climates- do not use for other climate conditions.

Design Information

Project	Location
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Design Conditions

Htg	Clg	Altitude	ft	
Outside db	°f	°f	Entering wb	°f
Inside db	°f	°f	Assume no higher than 63 °f unless there is ventilation air or significant duct leakage or heat gain	
Design TD	°f	°f	If design conditions used are not those listed in Table 1 / 1A Manual 3, please justify.	

Infiltration

Method	Construction quality	# of fireplaces
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Summary

Manual J heat loss	btuh	Heating fan	CFM	Htg design TD	°f	
Temp rise range	to	°f	Latent gain	btuh	Total gain	btuh
Manual J sensible gain	btuh	Cooling fan	CFM			
Calculated SHR	Use SHR to determine cooling CFM / ton					

Heating Equipment

Furnace manufacturer	Model #	AFUE	
Sea level: input	btuh	Output	Altitude adjusted output

Multistage If yes, provide Altitude adjusted lowest output

If "adjusted output" is greater than 1.4 times the "total heating load", please justify

Cooling Equipment

AC manufacturer	Model #	SEER			
Total capacity	btuh	Sensible capacity	btuh	Latent capacity	btuh
Evaporator coil manufacturer	Model #				

Metering Multistage TXV Actual SEER rating w/ selection coil, furnace, & metering

Attach manufacturer's data showing actual cooling capacity and actual SEER using these components

If "cooling capacity" is greater than 1.15 times the "total heating load", please justify

Manual J / S Summary Instructions

The load information asked for on the summary must be taken from the actual load calculation completed on the project.

Project

Identify project name, lot number- information that matches the plan submitted.

Location

The city or town must be reasonably close to actual location. Software used may not have the specific location in the database.

Outside Dry Bulb, Inside Dry Bulb

Temperature data should be from Table 1 or Table 1A of ACCA Manual J. It is understood that there may be situations where a slight adjustment to this values is necessary. For example; there may be areas in the Salt Lake Valley where the low temperature is historically lower than the airport temperature. If values are adjusted- please justify the adjustment. Provide both heating (htg) and cooling (clg) design temperatures. If inside or outside design conditions listed are not the same values listed in Manual J, explain why the different values were used.

Entering WB

The entering wet-bulb represents the default value wet-bulb temperature across the evaporator coil. This will typically be 63 °f (75 °f dry bulb) relative humidity). A higher wb temperature will result from duct leakage, un-insulated duct or ventilation air- any condition that raises the return air temperature. Use this wb temperature when selecting cooling condenser from manufacturer's comprehensive data.

Design TD

TD: the temperature difference between inside and outside design temperatures.

Infiltration

Infiltration calculations are based on the Construction Quality. Version 7 of Manual J uses Best, Average or Poor to evaluate Infiltration. Version 8AE uses Tight, Semi-Tight, Average, Semi-Loose and Loose to evaluate. Version 8 goes into very specific detail for a more accurate number. Note method used on summary. Open firebox fireplaces that draw air from inside the home must be included, even if there is a 4" 'combustion air' flex bring air into the fireplace. Sealed, direct vent type fireplaces should not be counted. Methods include: Simplified / Default Method- taken from Table 5A; Component Leakage Area Method- calculating infiltration based on individual leakage points taken from Table 5C of Manual J8; or Blower Door Method, where the actual leakage is based on a blower door test on the home.

Manual J Heat Loss

This is the whole house winter heat loss taken directly from the completed attached Load Calculation. Load must account for all factors such as loss building components as well as loss through infiltration, ventilation, and duct losses.

Heating Fan

Heating airflow typically may be lower than cooling cfm. Adjusted to insure the temperature rise across the heat exchanger falls within the range specified by the manufacturer. Software will often do this calculation and provide a correct heating cfm. See Manual S Section 2-6 - Rise (°f) = Output Capacity ÷ (1.1 x heating cfm)

Manufacturer's Temperature Rise Range

Range taken from manufacturer's performance data. Various manufacturers may certify ranges from 20 - 70 °f.

Manual J — Sensible Gain

The whole house summer heat gain taken directly from the completed attached Load Calculation. Load must account for all factors including gain through building components, solar gain, infiltration, ventilation and ducts. Also includes the sensible internal gains from appliances and people.

Manual 3 — Latent Gain

The gains due to moisture in the air. Large latent load are typically from moisture migration into the home from outside in humid climates. People, cooking, plants, bathing and laundry washing can all add to the latent load in a home.

Total Gain

The combined total of the sensible and latent gain. May be referred to as Total Cooling Load.

SHR- Sensible Heat Ratio

Use to determine Cooling cfm per ton. The ratio of sensible heat gain to total heat gain. $SHR = \text{Sensible Heat Gain} \div \text{Total Heat Gain}$. Recommended air flows: If SHR is below 0.80 select 350 cfm / ton; if SHR is between 0.80 & 0.85 select 400 cfm; if SHR is greater than 0.85, select 450 cfm / ton. Note: This cfm is not the final cfm; additional adjustment may be required for Altitude. See next item- Cooling Fan.

Cooling Fan

Software used to perform the calculation will typically provide a minimum cfm based on the minimum required size of the equipment. This number may be adjusted to meet specific requirements of the home. Heating and Cooling CFM may or may not be the same. The cooling CFM should be around 450 CFM per ton of cooling in Utah's dry climates. For higher altitudes, CFM must be adjust up as detailed in ACCA / ANSI Manual S. Mountain location should expect Cooling CFM at 500 CFM per ton and higher.

HEATING

Equipment

List specific equipment to be used. This information is not required on the Load Calculation documents, however it must be provided here to verify equipment sizing against calculated loads.

AFUE

The AFUE (Annual Fuel Utilization Efficiency) listed here will be compared to that listed on plans and on energy compliance documents (RES check or other). It must also match the equipment actually installed in the home.

Sea Level Input

The listed input on the furnace label and in manufacturers' documentation. Input represents the total amount of heat in the gas at sea level.

Output

The amount a heat available for discharge into the conditioned space. The input less any vent or stack losses, or heat that is carried out with the products of combustion. May be taken from manufacturer's performance data or calculated using input and furnace efficiency.

Altitude Adjusted Output

This number is the actual output that will be attained after the furnace has been adjusted for efficiency and de-rated for altitude (typically 4% for every 1000' above sea-level, however 2% /1000' for many 90+ efficient furnaces). Some manufacturers may have different requirements- adjustments should be made per their requirements. Calculations should be attached. Example: 80,000 input 91% efficient furnace in Salt Lake, with manufacturers' installation instructions specifying 4% / 1000'. $80,000 \times .91 \times .83 = 60,424$ btuh.

Multi-Stage Furnace

Multi-stage and modulating equipment is now available. When comparing to heating load calculated, use the maximum adjusted output to verify the furnace is large enough and the lowest output to insure it is not too large.

Size Justification

Example: If the Total Heating Load = 29954 btuh. A furnace with an adjusted output larger than 45,000 btuh ($29954 \times 1.5 = 44931$) would require an explanation justifying the size.

COOLING

Equipment

List specific equipment to be used. Provide manufacturers comprehensive data for furnace, furnace blower and condenser, with capacities at design conditions highlighted.

Condenser SEER

This SEER (Seasonal Energy Efficiency Ratio) is the listed SEER for this model series, not the exact SEER with components used this system.

Total Capacity

Manufacturers base data is based on ARI Standard 210 / 240 ratings; 95 °f outdoor air temperature, 80 °f db / 67 °f wb entering evaporator. As the Design Conditions are different than this standard, refer to manufacturers expanded ratings for capacities at actual design conditions. Total capacity is the latent and sensible capacity at design conditions

Sensible Capacity

The sensible only capacity from the manufacturer's expanded data at design conditions.

Latent Capacity

The latent only capacity from the manufacturer's expanded data at design conditions. NOTE: One half of the excess latent capacity may be added to the sensible capacity.

Evaporator Coil Make and Model

List the exact model number for the evaporator coil used this system. If coil is from a different manufacturer than the condenser is used, provide data from both manufacturers verifying actual performance.

Expansion / Metering

Provide the specific metering used-orifice or TXV (thermostat expansion valve). If the manufacturer has several options, list the option used.

Actual SEER Rating

Attach manufacturers' documentation or ARI report showing actual cooling capacity, and actual SEER using the components used this system. Indoor air handler / furnace blower must be included in this documentation. Do not use ARI (ARHI) data for actual sizing.

Size Justification

If cooling capacity is 15% greater than the calculated Cooling load explain. High latent (moisture) loads can be listed here. Special requirements particular to the customer may also be noted here.

Manual D Calculations & Summary

Project

Friction Rate Worksheet & Steps

1 Manufacturer's Blower Data

External static pressure (ESP) IWC CFM

2 Device Pressure Losses

Evaporator	Supply register	.03	Other device
Air filter	Return grill	.03	Total device losses (DPL) IWC

3 Available Static Pressure (ASP)

ASP = (ESP - DPL) IWC

4 Total Effective Length (TEL)

Supply side TEL	ft	Return side TEL	ft
Total effective length (TEL) = supply side TEL + return side TEL			ft

5 Friction Rate Design Value (FR)

FR = ((100 x ASP) / TEL) IWx / 100'

This friction rate (FR) calculated in Step 5 is the rate to be used with a duct calculator or a friction chart for the duct design on this project.

Attach at a minimum, a one line diagram showing the duct system with fittings, sizes, equivalent lengths through fitting and duct lengths.

Mechanical Sizing

Name of contractor / designer

Phone Fax

Address

Permit # Lot #

Vent height (base of duct to roof exit) ft

Boiler or furnace input rating	btu
De-rated input rating (use .83)	btu
Connector rise	ft
Connector run	ft
Connector size	in
Orifice size	in

Boiler or furnace #2 input rating	btu
De-rated input rating (use .83)	btu
Connector rise	ft
Connector run	ft
Connector size	in
Orifice size	in

Water heater input rating	btu
De-rated input rating (.83 minimum)	btu
Connector rise	ft
Connector run	ft
Connector size	in
Orifice size	in

Water heater #2 input rating	btu
De-rated input rating (.83 minimum)	btu
Connector rise	ft
Connector run	ft
Connector size	in
Orifice size	in

Total heat input of all appliances	btu
Vent size for the system	in
Combustion air size	in ²

Attach a complete gas pipe layout & sizing detail to the plan or permit application.

If a manifold is used to connect the appliances on the horizontal, it shall be the same size as the vent.

To the best of my knowledge, I certify that the information contained within this document is true, correct, and meets the requirements of the 2009 International Mechanical Code and International Fuel Gas Code.

Signature

Date

Mechanical Sizing Worksheet How-To

Materials needed to fill out this form are the International fuel gas Code and the [Questar Recommended Good Practices Book](#).

VENT SIZING

- 1 Vent height is measured from the draft diverter or appliance vent outlet to the top of the vent cap.
- 2 Connector rise is the height of the vent connector from the appliance outlet to the center of the tee in the vent at the point of connection to the vent.
- 3 Connector run is the horizontal distance from the appliance vent outlet to the vent.
- 4 Go to the International Fuel Gas Code Chapter 5. Sizing is done to the appropriate gamma table .
- 5 The gamma tables are in Btu and not ft³

DE-RATING

- 1 See Questar handbook for a step-by-step formula and the required conversion numbers. To complete this form:
 - a Input is de-rated at 4% per 1000' in elevation.

- b Example: SLC has a 17% de-ration factor. On a 100,000 Btu furnace you multiply 100,000 x .83 = 83,000 Btu's
- c On the vent sizing this becomes the fan min. The fan max is the listed input rate example fan min = 83 and fan max = 100
- d *The Btu to ft³ conversion number for SLC is 890 and the specific gravity of the gas is .60. Divide the new input rating by 890, 83,000 = 93.258 ft³. 890*
- e Take the ft³ of input and divide it by the number of burners on the appliance, this will give you the ft³ / burner. Then use the orifice tables in the Questar handbook to determine the orifice size. Example if you have 4 burners: 93.258 ft³ / 4 burners = 23.315 ft³ / 1 burner. Match as close as possible to the Orifice table in the handbook. In this sample the orifice size would be (49)

- 2 Use the International Fuel Gas Code and the International Mechanical Code to complete the vent sizing and the combustion air sizing. See Chapter 5 IFC for the rules and the tables to fill out this portion of the form. ICBO also has available a commentary on the mechanical code that contains a step-by-step examples of how to size the vents.

- 3 The International Mechanical Code commentary also contains examples to size the gas pipe. You must show the pipe lengths, the Btus and the volume of each appliance and show the size of each length of pipe. All tables necessary to size gas pipe are also contained in the International Fuel Gas Code, and in the Questar handbook.
- 4 For Salt Lake City use:
 - a 890 Btu per ft³
 - b A multiplier of .83
 - c Specific gravity of .60
 - d Combustion air is computed at 1 in² per 3,000 Btu of input of all fuel burning appliances in the room. One duct upper 12" of the room.
- E [Questar](#) gas has a training program available to all persons and contractors.