SOUTH JORDAN CITY'S BUILDING DEPARTMENT REQUIREMENTS TO SHOW COMPLIANCE WITH HEAT LOAD CALCULATIONS REQUIRED IN MANUAL J AND THE CALCULATIONS REQUIRED TO DEVELOP THE DUCT DESIGN REQUIRED BY THE MANUAL D AND BUILDING CODES

MANUAL J HEAT LOAD CALC'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 of ACCA Manual J. It is understood that there may be situations where a slight adjustment to this values is necessary. 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.*

Design TD: *TD-(temperature difference) 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.*

Total Heating and Cooling Load: *This is the whole house load information used for equipment sizing taken directly from the completed attached Load Calculation. Load must account for all factors such as infiltration, ventilation, appliances and people. Room by room information will be used in completing the duct design.*

Heating and 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 400 CFM per ton of cooling. If it is not, justify.*

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. Sea Level Input will be the listed input on the furnace label and in manufacturers' documentation.*

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

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). 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 X .91 X .83 = 60,424 BTUh.*

Size Justification: *Example: If the Total Heating Load = 29954 BTUh. A furnace with an adjusted output larger than 45,000 BTUh (29954 X 1.5 = 44931) would require an explanation justifying the size.*

Cooling Equipment: *List specific equipment to be used.*

Cooling 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. If the locations Design Conditions are different than this standard, refer to manufacturers expanded ratings for capacities at actual design conditions.*

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.*

Eva p. Coil M/N: *List the exact model number for the evaporator coil used this system.*

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.*

Size Justification: *If cooling capacity is 30% 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 **J** 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.

Design Information:

Project: _____

_____

Location: _____

_____

	Htg	**Clg**
Outside db (°F)	_____	_____
Inside db (°F)	_____	_____
Design TD (°F)	_____	_____

If design conditions used are not those listed in Table 1 or 1A Manual J please justify._____

_____

_____

Infiltration

Method: _____

Construction Quality:_____

Fireplaces (open fire box): _____

Summary

Total Heating Load: _____ (Btuh)

Heating Fan: _____ (CFM)

Total Cooling Load: _____ (Btuh)

(Total Cooling = Sensible load + Latent load)

Cooling Fan: _____ (CFM)

Heating Equipment

Furnace Manufacturer: _____

Furnace Model #: _____

Sea Level Input: _____(Btuh)

AFUE: _____ Multi-stage: Yes _ No_

Output Adjustment (adjust for efficiency, altitude de-ration:

Adjusted Output: _____ (Btuh)

Attach adjustment calculations- must be per manufacturers' instructions/requirements

If Adjusted Output is greater than 1.5 times the Total Heating Load, please justify: _____

_____

_____

Cooling Equipment:

A/C Manufacturer: _____

A/C model #: _____

Cooling Capacity: _____ (Btuh)

Condenser SEER :_____

Evap. Coil M/N: _____

Expansion/Metering: Orifice___ TXV

Actual SEER rating with selected coil, furnace and metering. SEER:_____

Attach manufacturer's data or ARI report showing actual cooling capacity and actual SEER using these components.

If Cooling Capacity is greater than 1.3 times the Total Cooling Load, please justify: _____

_____

HVAC Design Guidelines

- Proper airflow is most critical for cooling
- Figure 400 CFM per ton of cooling
- 1 ton of cooling = 12,000 BTU/h (3 ton = 36,000 BTU/h, 5 ton = 60,000 BTU/h)
- Approximate flow through smooth round pipe: (cross section area)

3" = 15 CFM	(7 sq. in.)
4" = 35 CFM	(12 sq. in.)
5" = 60 CFM	(20 sq. in.)
6" = 100 CFM	(28 sq. in.)
7" =150 CFM	(38 sq. in.)
8" = 200 CFM	(50 sq. in.)
10" = 400 CFM	(78 sq. in.)
12" = 600 CFM	(112 sq. in.)
14" = 900 CFM	(154 sq. in.)

- When counting supplies, if there are 6" round pipe branches ran to small rooms like powder baths, walk-in closets, interior baths, do not figure at 100 CFM. These outlets will be closed, at least partially when cooling.
- If a 5 ton, most manufacturers require 2 return air drops into sides, or air in through one side and the bottom. Some are ok with all air through the bottom.
- The registers and grills should be approximately 50% larger than the cross section of the duct. (Example: 6" Ø into 4" X 10" boot/register. 28 sq. in. X 1.5 = 42 sq. in)
- Return size is as critical as supply. You can't get 1600 CFM out through the supply outlets if you don't have 1600 CFM coming into the furnace/air handler blower from the return inlets.
- The return air drop (the duct down the side to the furnace blower compartment) must be sized for ALL the airflow of the system. A 4 ton drop must be able to move 1600 CFM.
- Typical return CFM (All based on a 2X4 wall):
  - 30" X 6"- 400 CFM
  - 24" X 6"- 300 CFM
  - 14" X 6"- 200 CFM
  - If walls are 2X6 AND grills are 8" tall, add about 20% to each.
- 1" thick pleated filters should not typically be used for cooling- they are too restrictive.

10 CRITICAL STEPS to Correct Duct Sizing

1. Size the load with the Manual J approach. For duct sizing purposes, you must calculate the Btuh for each room.
2. Size the equipment using Manual S techniques. You must determine the total airflow based on your equipment selection. Use the nominal medium speed cfm for your duct design.
3. Calculate the cfm per room based on the cooling sensible Btuh room load.
4. Determine the design type (trunk and branch, radial, etc.) and lay out the ductwork in the most effective manner.
5. Compute the total effective length of the duct system. Add the longest effective length of the supply and return to determine the longest critical path.
6. Determine available static pressure by deducting air side devices in the critical path from the design static pressure.
7. Calculate friction rate per 100 ft. by applying the available static pressure times 100 and dividing it by the total effective length.
8. Apply friction rate with the calculated room cfm to determine duct size (Use the appropriate duct calculator or friction chart for the chosen duct material).
9. Check chosen duct size for appropriate velocity.
10. Reduce friction rate to 0.04-in. wc or 0.05-in. wc for return sizing calculation to ensure adequate sizing and permissible velocity.

Manual **D** Calculations and Summary:

Project: _____

Friction Rate Worksheet

Step 1) **Manufacturer's Blower Data**

External static pressure (ESP)= _____IWC CFM =_____

Step 2) **Device Pressure Losses**

Evaporator Coil	_____
Air Filter	_____
Supply Register	0.03
Return Grill	0.03
Other Device	_____

Total device losses (DPL) _____ IWC

Step 3) **Available Static Pressure**

ASP = (ESP - DPL) _____ IWC

Step 4) **Total Effective Length (TEL)**

Supply-side TEL + Return-side TEL = (_____+ _____) = _____ Feet

Step 5) **Friction Rate Design Value (FR)**

FR = (ASP X 100) ÷ TEL = (_____ X 100) ÷ _____ = _____ (IWC/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 and lengths.