Load Calculator Field Definitions

Opening Screen after Login:

Street Address: The physical street name and house number of the residence

Zip Code: the 5-digit postal zip code for the residence

First section after entering street address and zip code:

House Information:

What direction of the house has the most glass?
Set the compass orientation for the side of the residence with the most glass.

Adjust square footage of window area: Enter the total square footage of glass for each side of the residence based on compass orientation.

% Shading: Enter the percentage of glass shading you observe due to trees, awnings, porches, and overhangs. An entry here will reduce the cooling heat gain btuhs from the glass.


: Inputs are unlocked. They will automatically update by adjusting the square footage of the house. Click the lock button to change this.


: **Inputs are locked.** They will not automatically update by adjusting the square footage of the house. Click the lock button to change this.

Click green arrow to enter House Information:

What is the conditioned square footage of your house?:
Square feet: Enter the square footage of conditioned living space or move the slider to adjust. Do not include garages and unconditioned basements even if finished. The default data is provided from available online real estate data. Please verify actual square to include all conditioned floors and any additions added to home that may not be accounted for in online data.

When was your house built?
Before 1990; 1990 – 2000; After 2000
Set the date range for the year the house was built to adjust the preset R-values for various construction components based on preset building codes for the selected timeframes.

How do you want insulation values displayed?

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R: R-values - the capacity of an insulating material to resist heat flow. The higher the R-value, the greater the insulating power. R-values for various construction components may be added together to get a total R-value. Multiply thickness of insulation by 3.14 to get approximate R-value. R-values for various construction materials are available through construction materials providers or online through a variety of sources.

U: U-values - a measure of the heat transmission through a building part (as a wall or window) or a given thickness of a material (as insulation) with lower numbers indicating better insulating properties — 1/Sum of R-Values. U-values for various construction materials are available through construction materials providers or online through a variety of sources. For windows, glass doors and glass block, this value is the effective u-value of the glazing assembly that includes the frame, panes, tint, the sash and the lites. For skylights this specifies the effective u-value of the skylight assembly, including the sash, curb, panes, tint, light shaft and lites.

Fuel Costs:
Winter Electricity Rate: price per kilowatt (kwh)
Summer Electricity Rate: price per kilowatt (kwh)
Natural Gas Rate: price per 100 cubic feet (ccf)
Propane Rate: price per gallon (gal)
Oil Rate: price per gallon (gal)

Summer Indoor Design Temperature: If not set by local codes, this is the inside temperature that the client wishes to maintain during the cooling season. A typical value is 75 degrees. Valid range for this input is 55 to 90 degrees Fahrenheit.

Summer Outdoor Design Temperature: This value represents the highest outdoor dry bulb ambient temperature that you expect the HVAC system to handle. The summer design temperature is used to determine the worst case cooling load.

Winter Indoor Temperature: If not set by local codes, this is the inside temperature that the client wishes to maintain during the heating season. A typical value is 72 degrees. Valid range for this input is 45 to 85 degrees Fahrenheit.

Winter Outdoor Temperature: This value represents the coldest outdoor dry bulb ambient temperature that you expect the HVAC system to handle. The winter design temperature is used to determine the worst case heating load.

Number of Residents: This value should be based on the number of bedrooms plus one to account for an occupant in each bedroom and two in the master bedroom regardless of the number of people living. Normally you should enter the maximum number of people you expect to occupy the residence during the cooling season (since people are only used when calculating the cooling load). If the number of people occupying a residence exceeds this value, you may want consider listing the actual number of occupants to account the added heat gain.

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SHR (Sensible Heating Ratio or Percent Sensible Capacity): This field allows you to input a decimal reflecting the percentage that describes what portion of the cooling system's cooling capacity is equivalent to sensible capacity to cover the sensible load, which varies by manufacturer and equipment selection. A recommended value of .75 or 75% is set by default. If the sensible load is not covered by the capacity, the system will struggle to achieve or maintain the Summer Indoor Design Temperature closer to the maximum Summer Outdoor Design Temperature. The software will use value to calculate the total cooling capacity required at the entered SHR with following formula:

(Sensible Load ÷ SHR = Total Required Capacity to cover Sensible Load)

12,000 Btuh/Ton

= Recommended Tonnage

Average Ceiling Height: Enter the average ceiling of the living space in feet.

Wall Square Feet: Enter the square footage of load bearing exterior walls less the square footage of window and door openings. The value is estimated by default, please verify actual.

Ceiling Square Feet: Enter the square footage of load bearing ceiling less the square footage of skylight openings. The value is estimated by default, please verify actual.

Wall R-Value: Enter the average R-value of the load bearing exterior wall construction including exterior finish, board insulation, wall cavity insulation, interior drywall or plaster. R-values for various construction materials are available through construction materials providers or online through a variety of sources.

Floor R-Value: Enter the average R-value of the load bearing floor construction over unconditioned space including floor cavity insulation, flooring board, and finish (carpet, tile, vinyl, wood, etc.). R-values for various construction materials are available through construction materials providers or online through a variety of sources.

Ceiling R-Value: Enter the average R-value of the load bearing ceiling below attic or exposed to outside conditions including ceiling cavity insulation, roofing deck, shingles, and interior drywall or plaster. R-values for various construction materials are available through construction materials providers or online through a variety of sources.

Window R-Value: Enter the average R-value of the windows in the home. The R-value is based on the number of sash, panes, air/gas gap between panes, gas type between panes, frame construction, etc. R-values for various construction materials are available through construction materials providers or online through a variety of sources. A few recommended settings are provided:

Single Pane = 1
Double Pane = .5
Triple Pane = .3

Load Calculator Field Definitions

Window SHGF [Solar Heat Gain Factor or Solar Heat Gain Coefficient (SHGC)]: Specifies the generic or NFRC-rated solar heat gain characteristic of the glass. Lower numbers mean that the glass produces less solar gain. The SHGF is the fraction of incident solar radiation admitted through an unshaded glass. Note that a shading coefficient (SC) value for a glass is approximately equal to 1.15 times the corresponding SHGC value. This value takes into consideration window tint and the gas type between window panes. A few recommended settings are provided:

Clear = 1-.85
Low-E = .6-.4

Grains of moisture difference: Grains of moisture is the amount of moisture or water vapor per pound of dry air at standard atmospheric pressure at relative humidity ranging *10 - 90%*. This value should take into consideration the difference between the grains of moisture for outdoor design temperature and the indoor design temperature. Specific values are available from ASHRAE weather data. Values for various temperatures are indicated in the table below:

Water Vapor in Air (*grains* water vapor per pound dry air*)								
Relative Humidity (%)	**Temperature**							
	°C							
	-1	**4**	**10**	**18**	**22**	**27**	**32**	**38**
	°F							
	30	**40**	**50**	**60**	**70**	**80**	**90**	**100**
10	3	4	6	8	11	16	21	29
20	5	7	10	16	21	30	42	58
30	7	11	14	22	34	46	65	87
40	9	14	20	30	44	62	85	116
50	12	18	26	39	55	78	108	147
60	14	22	32	48	66	92	128	176
70	17	26	38	54	78	108	152	208
80	19	29	42	62	88	125	173	-
90	21	33	48	70	100	140	190	-

* grains of water is commonly used in psychrometrics

- *1 grain = 0.000143 lb_m = 0.0648 g (7000 grains per lb_m)*

Duct Loss %: This input is based on duct system performance. Enter the percentage of Btus lost from thermal losses due to lack of duct insulation, airflow losses due to duct leakage, airflow restriction, a deficiently designed, improperly sized, and poorly installed underperforming duct system.

Duct Gain %: This input is based on duct system performance. Enter the percentage of Btus gained from thermal gains due to lack of duct insulation, Btus gained due to duct leakage, airflow restriction, a deficiently designed, improperly sized, and poorly installed underperforming duct system.

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Cooling Infiltration Rate (ACH): Infiltration is caused by air "leaking" into the building through gaps in the envelope to compensate for heat and humidity gain. All buildings have some infiltration. Set a rate of infiltration based on the construction tightness and floor area of the building. The program multiplies this value by the total volume of the residence and divides the result by 60 min./hr. to determine the total infiltration CFM. Reducing the air changes per hour value will reduce the load on the residence due to infiltration.

Heating Infiltration Rate (ACH): Infiltration is caused by air leaking into and out of the building through gaps in the envelope to compensate for heat loss. All buildings have some infiltration. Set a rate of infiltration based on the construction tightness and floor area of the building. The program multiplies this value by the total volume of the residence and divides the result by 60 min./hr. to determine the total infiltration CFM. Reducing the air changes per hour value will reduce the load on the residence due to infiltration.

Winter Ventilation: Specifies the amount of outside air that is mechanically introduced into the conditioned space by the HVAC equipment either through a duct with barometric or mechanical damper or Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV). This value can be entered either as CFM or as air changes per hour. If you enter a number of 10 or less it will be treated as an air changes per hour value while if you enter 10 or higher it will be treated as a CFM value. The addition of outside air to the HVAC equipment imposes a load that must be accounted for. The additional heating load is determined using the design temperature differences. Typically, less ventilation air is needed in the winter than in the summer.
The Ventilation Rate is the amount of ventilation that is necessary in order to provide enough outdoor air if the amount of infiltration in this system is insufficient (the cooling infiltration is used to determine the requirement). To determine the amount of ventilation air recommended refer to ACCA Manual J 8th edition for details.

Summer Ventilation: Specifies the amount of outside air that is mechanically introduced into the conditioned space by the HVAC equipment either through a duct with barometric or mechanical damper or Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV). This value can be entered either as CFM or as air changes per hour. If you enter a number of 10 or less it will be treated as an air changes per hour value while if you enter 10 or higher it will be treated as a CFM value.
The addition of outside air to the HVAC equipment imposes a load that must be accounted for. The additional sensible cooling loads are determined using the design temperature differences, while the latent cooling load is determined using the wet bulb temperature. Typically, more ventilation air is needed in the summer than in the winter.
The Ventilation Rate is the amount of ventilation that is necessary in order to provide enough outdoor air if the amount of infiltration in this system is insufficient (the cooling infiltration is used to determine the requirement). To determine the amount of ventilation air recommended refer to ACCA Manual J 8th edition for details.

Click green arrow to enter Floors:

Load Calculator Field Definitions

Floor over basement

Square feet: Enter the square footage of floor area that has an unconditioned basement space beneath it. Therefore, it is entirely possible for the floor area entered here to be substantially different from the square footage of living space since floor areas over conditioned spaces have no heat loss or heat gain.

Floor over unconditioned space

Square feet: Enter the square footage of floor area that has an unconditioned crawl space, garage, outdoors (in the case of floor overhangs) beneath it. Therefore, it is entirely possible for the floor area entered here to be substantially different from the square footage of living space since there may be floor areas over conditioned spaces, unconditioned spaces, or on slab.

U-Value: Enter the average U-value of the load bearing floor construction over unconditioned space including floor cavity insulation, flooring board, and finish (carpet, tile, vinyl, wood, etc.). U-Value=1/Sum of R-Values. R-values for various construction materials are available through construction materials providers or online through a variety of sources. U-values for various construction materials are available through construction materials providers or online through a variety of sources.

Temperature of space: Enter the coldest winter ambient temperature of the unconditioned space below the conditioned living space.

Slab

linear feet of perimeter: If the floor of a room is NOT concrete slab on grade, you should leave the perimeter as zero. The perimeter value is needed for concrete slab on grade type floors because such floors lose heat through the perimeter and not through the center. So the perimeter of the floor in feet will be used when determining the heating load due to the floor. Note that the heat gain (cooling load) through such a floor will always be zero.

r-value of perimeter insulation: Enter the average R-value of the perimeter insulation installed during house construction. R-values for various construction materials are available through construction materials providers or online through a variety of sources. Most older homes (built before 1990) do not have perimeter insulation for slabs. A range of recommended settings are provided:

values: 0–15

Basement below grade

square feet of basement: If the residence has a conditioned basement, enter the square footage of floor area for a conditioned basement. Therefore, it is entirely possible for the floor area entered here to be substantially different from the square footage of living space since there may be floor areas over conditioned spaces, unconditioned spaces, or on slab.

r-value of basement walls: If the residence has a conditioned basement, enter the average R-value of the load bearing basement walls exposed to outside conditions including block, frame and wall insulation, board insulation, and interior drywall. R-values for various

Load Calculator Field Definitions

construction materials are available through construction materials providers or online through a variety of sources.

percentage of wall below grade: If the residence has a conditioned basement, enter the percentage of the load bearing basement walls exposed to outside conditions below grade.

House Information:

Cooling Load: Represents the calculated total heat gain or total cooling load on the residence. Select equipment capable of delivering the required capacity. Review the report for the total cooling capacity required at the entered Sensible Heating Ratio (SHR).

Heating Load: Represents the calculated total heat loss or total heating load on the residence. Select equipment capable of delivering the required capacity.

Adequate Exposure Diversity (AED) Graph: The graph shows the Average Glass Load versus the Hourly Glass Load. A system has Adequate Exposure Diversity (AED) if the peak hour glass load for the entire conditioned space does not exceed the average glass load for the entire conditioned space by more than 30 percent. In other words, there is a proportionate amount of glass to impact the cooling load based on the compass orientation of the glass. If a house does not have AED, it may experience comfort issues based on the following criteria:

Hourly Glass Load below average glass load and up to 30% excursion
If the Hourly Glass Load is below the average glass load and up to 30%, the residence has Adequate Exposure Diversity (AED) and ***does not require*** variable air volume devices to overcome spikes in solar gain for one or more rooms. A zoned system is ***not required***, and ***does not require*** zone control (provided by individual, motorized, thermostatically controlled dampers) for problem areas. Constant airflow and Single speed/stage equipment ***may be adequate*** for the application. Customer ***may want to consider*** variable speed airflow and variable capacity heating and cooling equipment. Constant airflow and Single speed/stage equipment ***may be adequate*** for the application. Customer ***may want to consider*** variable speed airflow and variable capacity heating and cooling equipment or zoning equipment for enhanced comfort, efficiency, control and energy savings.

Hourly Glass Load excursion between 30-50%
If the house has glass areas that produce relatively large heat gains for part of the day with an excursion greater than (1.3 x baseline average) and less than (1.5 x baseline average), variable air volume devices ***may be required*** to overcome spikes in solar gain for one or more rooms. A zoned system ***may be required***, or some rooms ***may require*** zone control (provided by individual, motorized, thermostatically controlled dampers) for problem areas. Constant airflow and Single speed/stage equipment ***may not be suitable*** for the

Load Calculator Field Definitions

application. Customer ***may want to consider*** variable speed airflow and variable capacity heating and cooling equipment and zoning for enhanced comfort, efficiency, control and energy savings.

Note for this condition based on ACCA Manual J: A spike in the hourly fenestration (glass) gain has exceeded the acceptable limit for a single-zone constant volume system. This may cause several rooms to be more than 3 degrees warmer than the set point at the central thermostat, which is not acceptable (see ACCA Manual RS, Section 1).

This warning may indicate that there is an error in the heat gain estimate. Make sure the input for windows, glass doors and skylights is correct (verify inputs for fenestration areas, fenestration U-values and SHGF, overhangs, bug screens, sunscreens and credit for internal shading).

If the heat gain estimate inputs are correct, the warning indicates that the dwelling may have an above average fenestration (glass) gain on one or more exposures, which means that some type of zoning should be considered for these areas. (Thermostatically controlled dampers can be used to increase airflow to problem areas when solar gains peak.)

Note: If all the fenestration is concentrated on one or two critical exposures (a condominium facing West, for example), there will be significant swings in the cooling load during a 24-hour day, which means that single-speed equipment will short -cycle for much of an average day. Short cycling may cause an unacceptable humidity level within the conditioned space if the dwelling has a significant latent gain. (Humidity control is not a problem for dry-climate applications.) Such applications may require multi-speed or variable speed equipment that provides adequate latent capacity when operating at reduced speed. (Zoning may not be required if all rooms experience a peak gain at about the same time of day.)

Hourly Glass Load excursion greater than 50%
If the house has glass areas that produce relatively large heat gains for part of the day with an excursion that equals or exceeds (1.5 x baseline average), variable air volume devices ***are required*** to overcome large spikes in solar gain for one or more rooms. Install a zoned system or provide zone control (individual, motorized, thermostatically controlled dampers) for problem areas. Constant airflow and Single speed/stage equipment may not be suitable for the application. Customer ***should consider*** variable speed airflow and variable capacity heating and cooling equipment and zoning for enhanced comfort, efficiency, control and energy savings.

Note for this condition based on ACCA Manual J: A spike in the hourly fenestration (glass) gain is much larger than the acceptable limit for a single zone constant volume system. Use of a conventional constant volume system will

Load Calculator Field Definitions

cause several rooms to be more than 3 degrees warmer than the set point at the central thermostat, which is not acceptable (see ACCA Manual RS, Section 1).

This warning may indicate that there is an error in the heat gain estimate. Make sure the input for windows, glass doors and skylights is correct (verify inputs for fenestration areas, fenestration U-values and SHGF, overhangs, bug screens, sunscreens and credit for internal shading).

If the heat gain estimate is correct, the warning indicates that the dwelling has a large spike in the fenestration (glass) gain for one or more exposures, which means that some type of zoning is required for problem areas. (Thermostatically controlled dampers should be used to increase airflow to these areas when solar gains peak.)

Note: If all the fenestration is concentrated on one or two critical exposures (a condominium facing West, for example), there will be large swings in the cooling load during a 24-hour day, which means that single-speed equipment will short - cycle for much of an average day. Short cycling may cause an unacceptable humidity level within the conditioned space if the dwelling has a significant latent gain. (Humidity control is not a problem for dry-climate applications.) Such applications may require multi-speed or variable speed equipment that provides adequate latent capacity when operating at reduced speed. (Zoning may not be required if all rooms experience a peak gain at about the same time of day.)

Problem Resolving Considerations:

- Make sure load estimate is correct (verify inputs for fenestration areas, fenestration U-values and SHGF, overhangs, bug screens, sun screens and credit for internal shading)

- Ask the client to consider installing more internal external shading,

- If possible, have the client install sunscreens, drapes, blinds, awnings or window tinting.

- If possible, have the client reduce the size or amount of the fenestration that is causing the problem by reducing the size or amount of windows.

- If possible, have the client use high performance glass (low-e/low emitting or low SHGC) for the fenestration that is causing the problem.

- Ask the client for permission to install undersize single-speed equipment -- for better humidity control -- and accept the indoor temperature swing (at the thermostat) and when the local weather simulates the summer design condition.

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- Inform the client that a variable air volume and/or variable capacity system provides zone control for applications that have fenestration gains that peak at different times of day.

- Inform the client that variable speed or multi-speed equipment is recommended manufacturers and industry design trade associations for applications that have large temperature swings.

- For humid climates, variable speed or multi-speed equipment (variable airflow or variable capacity) shall have adequate latent capacity at part load conditions to provide enhanced comfort.

Loads Graph: The graph depicts the Heating, Cooling, Monthly Heating and Cooling Operating Loads Set the compass orientation for the side of the residence with the most glass.

Cooling Loads: The blue pie chart depicts the breakdown of the Cooling Load.

Heating Loads: The red pie chart depicts the breakdown of the Heating Load.

Customer Information:

Name: Customer's first and last name.

Email Address: The email where the customer wants to receive a PDF attached file of the load calculation report.

Phone Number: The phone number for the customer.