

Step By Step for Kwik Model 3D KESTREL

Introduction

KM3D KESTREL is a professional grade residential **HVAC duct design tool** that allows you to take the room by room load calculations and equipment selection from **any other load calculation software** and design flex duct and rigid duct systems to ensure excellent airflow and balanced comfort. It is basically an “abbreviated” version of KM3D EAGLE, our full HVAC design application that does load calculations, equipment selection and duct design (Manuals J, S and D). There are so many software apps out there that only do load calculations we felt that a duct design tool was very important that can be used with those. In a ducted HVAC system, airflow is everything. What good is a heart and pair of lungs without good blood flow? Also, “Good airflow forgives a lot of sins.” By “sins” we mean certain “less than optimal” design features, such as where supplies and returns are located, slightly off balancing, etc. Even the impacts of oversized or undersized equipment can be greatly mitigated by good duct design.

We sincerely hope you will eventually upgrade to KM3D EAGLE, but whatever load calculation software you use, we hope you took the time to do a good, accurate load calc without unnecessary “padding”. One of the biggest mistakes people make is to play it “safe” by making the loads bigger. Oversized equipment will cause more comfort problems than undersized equipment. Even so, good airflow resulting from good duct design is the best way to limit these potential problems.

Note that in KM3D KESTREL, the 3D house model is just a foundation to draw the ducts on, whereas in KM3D EAGLE the house model is the basis of the areas used in the load calculations and precision is much more important. In KESTREL, you don’t even have to draw windows if you don’t want to – the basic shape of the house is all that is needed.

IMPORTANT: Save your project frequently. There is nothing worse than losing work because your computer crashed or something like that. The “save file” icon is in the upper left corner. KM3D does frequently and automatically save back up files, but better safe than sorry.

Step by Step Instructions:

- Start Kwik Model
 - Read and accept EULA (first time, only)
- A. Project Tab
 1. Enter Project Name.
 2. Enter other information, as needed. This is just informational data.
 3. “Cond Floor Plans Area (in sqft)” in the bottom left corner is what you expect the floor area to be, based on the architectural plans or other information. “From Drawing” shows the conditioned floor area of the Kwik Model 3D house. When you are done building the house. These two numbers should be reasonably close to each other.
- B. Libraries Tab

1. This is mostly a remnant of KM3D EAGLE. This is where you would define all of your surface types (walls, floors, ceilings, windows, etc.) The only thing we left is the ability to define a custom duct type, which should be super rare. You can basically ignore this tab.

C. Floor Plan Tab

1. Elevations
 - a. Start with first floor. Avoid changing these values after you have placed rooms. It can cause rooms not to align properly. Room ceiling heights can be changed individually on each room by dragging the green handle up or down.
 - b. Set default floor thicknesses (default = 0.5')
 1. Slab on grade, use 0.5' (6")
 2. Floor over crawlspace, use height of crawlspace plus height of floor framing (typically 1') or just use height of floor framing.
 3. 2nd and 3rd level floors, use height of floor framing
 - c. Set default room height, aka plate height (default = 8')
 - d. Set default roof truss heal height (default = 0') Note: raised heal trusses are not common.
2. Import Floor Plan – select a file. You can import any image file or a pdf.
3. Scale Floor Plan. Setting the scale of the floor plan allows the software to accurately determine the lengths of ducts. We recommend using 2D mode and Top view for this step.
 - a. Scale left to right by aligning the ends of the red arrow with some known dimension on the floor plan, then click “scale” below where you enter the length on the left. (Doing this with longer dimensions will make the scaling more accurate)
 - b. Repeating the previous step with blue arrow to scale the floorplan back to front.
 - c. Double-check any dimensions with yellow ruler arrows, which will show the lengths between them on the left side of the screen when selected. Adjust as necessary.
4. Move Floor Plan – line up a main reference corner of house with grid
5. Set orientation by dragging/rotating the North arrow to correct position. In KESTREL, this is purely for reference. It no impact on anything.

D. Rooms Tab

1. Start on lowest story (turn off other stories using view controls in bottom right corner of screen)
2. Place boxes to cover all rooms, vaulted ceilings, etc. If you plan to have high sidewall registers, you will need to build your rooms with vaulted ceilings, otherwise they are purely visual.
3. Group boxes into rooms (each room will need at least one register, spaces without a register such as closets and hallways will need to be grouped with a room).
 - a. To select multiple rooms, hold the shift or ctrl key while selecting them
 - b. To group selected rooms, press ctrl+G or click the group button on the left side of the screen.

4. Every room you create must have at least one register. Spaces such as hallways and closets that will not have a register should be grouped with a room that does have a register. This will make more sense when you assign loads to each room.
 5. Indicate any **unconditioned** rooms (e.g., garage) by selecting the rooms you wish to designate, then using the dropdown menu on the left to select from conditioned/ unconditioned/ unconditioned garage etc.
 6. For below grade rooms, create “Earth” boxes adjacent to them using the same dropdown menu as the previous step. This is purely visual. It has no impact on anything.
 7. “Check Alignment” will check for boxes that are very close, but not touching. Adjust as necessary.
- E. Windows Tab (windows are optional, they just make the house look more finished)
1. Place all windows, skylights and exterior doors by holding the alt key and clicking on a room.
 2. After placing them, you can change the width and height of the window or door using the panel at the bottom left. Or drag them around with your mouse.

<<Repeat steps C – E for additional stories (floors)>>

F. HVAC Draw Tab

1. Place your air handlers (furnace or fan-coil unit). Notice that there are choices for upflow, downflow, horizontal, etc. and that the sizes of each component can be changed. We will draw ducts later.

G. Roof Tab

1. Place roofs as needed. This is **Optional**. Currently roofs are only visual and do not affect any calculations. Drawing a roof can help you determine how much room you have for ducts in the attic.

H. Data Tab

1. Go to “Rooms” Table first.
 - a. Name all rooms, which can consist of one or more grouped boxes.
 - b. Double check that all boxes are associated with a named room. (Unconditioned rooms do not show in table unless the “unconditioned” box is checked at bottom of table.)
 - c. If more that one air handler was placed, assign rooms to air handlers in “System/Block” column (air handler names can be changed in the “Systems/Block” table)
 - d. Enter the heating load calculation for each room. You may need to group/ungroup rooms to make them match your load calculations.
 - e. Enter your cooling load calculations for each room. Only sensible loads are needed, but if your load calculation software gives total cooling load by room that works too.
 - f. Once these numbers are entered you will see how the table allocates airflow based on each room's share of the load. E.g., if a room has a heating fraction of 0.154 (15.4% of total heating load) it will be allocated 0.154 of the heating airflow.
 - g. The table takes the higher of the two flows, heating and cooling, and puts that in the last column. This is what the ducts will be sized to.

2. Boxes Table – you can ignore this table
3. Walls Table
 - a. This table is purely informational. It wouldn't hurt to put in the walls based on the plans and compare them to your load calculation window areas.
4. Ceilings Table
 - a. This table is purely informational. It wouldn't hurt to put in the walls based on the plans and compare them to your load calculation window areas
5. Floors Table
 - a. Floors names can be changed, if desired.
 - b. Assign Floors Types, as needed. New types can be created in "Library" mode.
 - c. Double check Floors against plans.
6. Windows Table
 - a. Windows are optional. This table is purely informational. It would hurt to put in the windows based on the plans and compare them to your load calculation window areas.
7. Doors Table
 - a. Doors are totally optional.
8. Air handlers Table
 - a. The air handlers you placed in step F1 will show up here.
 - b. You can name them as you please.
 - c. These will show in the dropdown list in the "System/Block/Air handler" column of the Rooms Table in the Data Tab.
 - d. Enter your heating cfm and cooling cfm from you air handler OEM airflow tables, along with the corresponding external static pressure (ESP).
- I. HVAC Draw Mode
 1. Place at least one register in every room (alt+left click). If more than one in a room, airflow will be split evenly. Change register size, if desired. (has no effect on calculations, but will show up in duct table)
 - a. On the left side of the screen, you can choose whether the register will be placed on ceiling/walls/floors, it will default to place on ceilings, and will only place on sides of a room box that you click on that are facing you.
 2. Place at least one return grille per system. If more that one return in system, supply registers will need to be assigned to a return grille in duct table. Change size, if desired. (has no effect on calculations)
 3. Draw ducts.
 - a. Flex ducts require a start and end point to be selected, then press enter, if only a start point is selected when you press enter, it will add a fitting based on the dropdown on the left to act as end point.
 1. The most simple pair of these is a start collar to a register. Fittings will generally contain both start and end points.
 2. If you have a duct selected and press enter, the yellow/orange handle will turn into the fitting type selected on the left dropdown.
 - b. Use the fitting tool to move around the floating fittings connecting the ducts as needed with the fitting tool selected on the left panel.
 - c. For flex ducts, with the flex duct tool selected, you can drag the center or start/ end handles with the duct selected to shape it.

- d. Press the R key to straighten any ducts/fittings
- e. (come back to this step at the end)
 - 1. At the bottom of the screen, there is a 'change labels' button to show what information is on each duct. Duct labels will be disabled until you go into the data table with your ducts already created.
 - 2. If a branch/trunk has elbows and you want to move the label to the other side of the label, click on the duct you want the label to show up on and click the 'show' button on the left of the screen.
 - 3. You can drag the label like you would drag the center handle, slide the 'distance label along duct' slider to move where on the duct the label is pointing.
 - 4. If you hold shift and press R, it will reset the label position.

J. Friction Rate Tab

- 1. KESTREL will automatically build the TEL table based on how you drew the ducts. It is only a "best guess". You need to edit it for accuracy. Any of the values can be changed.
 - a. There are separate tables for supply and return runs.
Runs are Columns, while fittings are Rows. Select a cell to highlight the run, and change the effective length of the fitting for that run.
 - b. You can also enter additional miscellaneous equivalent lengths in the rows called "Extra Effective Length". To add one of these rows, select one of the add buttons at the bottom of the table.
- 2. Use Friction rate table to calculate friction rate.
 - a. The ESP and CFM you entered in the Data Tab, Air Handler Table shows up here.
 - b. In Step 2: enter all of the static pressure drops
 - c. The friction rate will be automatically calculated. Manual D allows a max friction rate of 0.18 and a minimum of 0.06. I recommend keeping them between 0.08 and 0.12 for most projects.
 - d. You can check the box to use the worst case TEL for all runs (not recommended)
 - e. You can look at the friction rate calculation for each run by selecting it in the drop down menu.

K. Data Tab

- 1. Go to Duct table
 - a. If more than one return was drawn, assign supply branches to returns.
 - b. Assign duct types. New types can be created in "Library" mode.
 - c. If there is more than one system, other systems can be viewed by selecting system in drop down menu at bottom of table.
 - d. Click "Auto Size Ducts". Duct sizes will change in table. Ducts will be drawn to scale in drawing.
 - e. If you get an error about the friction rate being too high or too low, you will have to adjust the static pressure drops or the equivalent lengths.

Review everything!