

MODEL HOMES – MULTIPLE ORIENTATION CALCULATIONS

The Model Home: A “model” home has multiple orientations (in reference to true north) and requires that a Manual “J” demand calculation be performed for each of the eight possible building orientation to ensure proper equipment sizing, room airflow amounts, and duct sizes. Also included are mirror demand calculations of any axis resulting in up to 32 possible Manual J demand results. HVAC equipment size, room airflow amounts, and duct sizes vary greatly when any model home is rotated to another orientation even though the building components remain exactly the same (unless of course your home is a perfect box with equal windows on each of the 4 walls!). In all study cases the exact same house placed on lots facing different orientation required different amounts of air conditioning, room airflow amounts, and duct sizes. Contractors should be aware of this variance due to building orientation and should be aware that designing an HVAC system based solely on the “worst” case orientation for a model home is the correct procedure **only if** the home actually faces the worst case, but the same calculations and HVAC duct design will not work for the home if it faces a different direction! The only correct way to design HVAC systems in Florida is to know the homes compass orientation. Using a worst case calculation and HVAC design for the “model” home that does not face worst case will certainly result in a home that has oversized equipment, improper room airflow, un-even temperatures, and if the home is multi-story – a duct system that is not accessible for airflow adjustments! The charts below are based on a study performed by HVAC Designs for a local home builder Model 2122. The charts represent what happens when you rotate the BASE model home to all eight orientations. The building rotation chart indicates the homes total air conditioning tonnage variance due to building orientation and more importantly the required air conditioning tons vary as the home is rotated to different orientations. The room airflow chart indicates how the airflow amounts required for each room vary, and indicates the proper size branch duct required to ensure an acceptable (<3 degrees) indoor temperature swing throughout the home. A designer basing his equipment selection and duct layout bases solely on “worst case” will certainly have airflow problems on a room by room basis, moisture removal problems for houses not facing “worst case” caused by equipment over sizing, and if the home is multi-story; problems adjusting airflow because the ductwork is located within the floor trusses and is not easily accessible for adjustments. So then why do some designers practice this improper procedure? Simply stated – time. The time required to perform 8 different Manual “J” demand calculations and 8 different HVAC system designs is nearly 3 days of work! Most HVAC contractors have only 15 minutes to spare for HVAC calculations and design, so most every HVAC contractor uses a “rule of thumb” to save time. (like square foot per ton) or they perform a “worst case” Manual “J” demand calculation and produce a single HVAC design for the home without considering building orientation.

Building Rotation Report

All rotation degree values in this report are clockwise with respect to the project's original orientation.
 Building orientation as entered (zero degrees rotation): Front Door faces North

Individual Rooms

| Rm No. | Room Name | 0° Rot. CFM | 45° Rot. CFM | 90° Rot. CFM | 135° Rot. CFM | 180° Rot. CFM | 225° Rot. CFM | 270° Rot. CFM | 315° Rot. CFM | High Duct Size |
|-----------|-----------------|-------------|--------------|--------------|---------------|---------------|---------------|---------------|---------------|----------------|
| System 1: | | | | | | | | | | |
| Zone 1: | | | | | | | | | | |
| 1 | Bed | 142 | 147 | 134 | 138 | 142 | 139 | 135 | *148 | 1--7 |
| 2 | Wic X | *15 | 12 | 10 | 11 | 15 | 11 | 10 | 12 | 1--4 |
| 3 | Wic I | *5 | 4 | 3 | 3 | 5 | 3 | 3 | 4 | 1--4 |
| 4 | M Bath | *66 | 55 | 45 | 48 | 66 | 47 | 45 | 54 | 1--6 |
| 5 | M Toilet | 13 | 16 | 16 | 13 | 13 | 13 | 16 | *16 | 1--4 |
| 6 | Kitchen / Great | 485 | 502 | 548 | 546 | 485 | 547 | *549 | 503 | 4--6 |
| 7 | Laundry | 49 | 50 | 48 | 43 | 49 | 43 | 48 | *51 | 1--4 |
| 8 | Bath 2 | *14 | 11 | 9 | 10 | 14 | 10 | 9 | 11 | 1--4 |
| 9 | Bonus | *210 | 203 | 186 | 188 | 210 | 188 | 185 | 202 | 2--6 |

* Indicates highest CFM of all rotations.

Whole Building

| Rotation Degrees | Front Door Faces | Supply CFM | Sensible Gain | Latent Gain | Recommended Tons |
|------------------|------------------|------------|---------------|-------------|------------------|
| 0° | North | *1,000 | 15,046 | *4,184 | 1.72 |
| 45° | Northeast | 1,000 | 21,555 | 4,179 | 2.46 |
| 90° | East | 1,000 | *23,986 | 4,174 | *2.74 |
| 135° | Southeast | 1,000 | 22,830 | 4,175 | 2.61 |
| 180° | South | 1,000 | 14,807 | 4,184 | 1.69 |
| 225° | Southwest | 1,000 | 20,534 | 4,176 | 2.34 |
| 270° | West | 1,000 | 21,204 | 4,178 | 2.42 |
| 315° | Northwest | 1,000 | 19,853 | 4,177 | 2.27 |

* Indicates highest value of all rotations.

