

MODEL HOMES – MULTIPLE ORIENTATION - 2021

The Model Home: builder model homes are identical homes constructed many times but on different lots. 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 orientations required different amounts of air conditioning, room airflow amounts, and duct sizes, and in some cases required variable capacity cooling systems. Contractors should be aware of this variance due to building orientation and should know 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 orientation, but the same calculations and HVAC duct design should not be used 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 very reason why square feet per ton can not be used. 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 (<4 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 branch duct volume control dampers are located within the floor trusses and are 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.

The report below shows the various room airflow cfm values for all orientations and the graph shows the total cooling equipment tons for each orientation. This model home required 3 different size air conditioners depending on the direction the front door faces, these results quantify why square feet per ton can not be used.

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.

