Room Air Distribution - 2021

Proper indoor air distribution is required to maintain human comfort within the building. Florida buildings require a room-by-room heat load demand calculation to determine room airflow amounts and a manual T air device selection procedure performed for each conditioned room of the building. Cooling season is dominant in our region (8 months per year), so the airflow amounts should be based on the cooling season required cfm's (cubic feet of air flow per minute) with adequate exposure diversity calculations considered, a seasonal test and balance may be required in rooms with large heating/cooling cfm variations. The heat load demand calculation should be based on the room's true compass orientation to assure correct airflow amounts, the same room with a different compass orientation requires different amounts of airflow and in some cases an alternate cooling calculation procedure.

Once the room demand cfm's are known; an air device can be selected. Consider how the room will be used, what air sound level is acceptable, the location and quantity of air device(s), and a style to match the architecture. Rooms that require a very quiet atmosphere (less than 38 db) should base the air device selection on outlet velocities less than 400 fpm (feet per minute). For residential or office spaces; 400-650 fpm (38 to 42 db) are acceptable, for factories or buildings where sound is not a consideration use 1500 fpm (42 to 61 db). Knowing the required cfm and velocity forms the most common air equation cfm=a*v (a = area in decimal feet, v = velocity I feet per minute). The next step, and probably the most critical, is selecting and locating an air device that will condition the room properly. Consult the air device manufacturers engineering guide for style, size, and air flow performance. The best location for the air device(s) in any Florida room is at the ceiling or high sidewall, directly across from the worst-case exterior wall. The worst case exterior wall in a Florida room is an exterior wall containing glass. If the room contains glass facing more than one compass orientation, the worst-case exterior wall is the one that has the most glass exposure (most heat gain). The highest energy transfer due to glass exposure in Florida is west / east followed in order by southeast / southwest, northeast / northwest, south, and north has the least heat gain.

A peak hour heat load demand calculation indicates a 12' by 14' bedroom requires 170 cfm's of cooling airflow to maintain a comfortable indoor temperature. The heat load demand calculation also recommends an 8" round branch duct based on 600 fpm. Consulting the air device engineering guide; we find that a 12" wide by 8" long white ceiling register will throw the air 10 to 13' and spread the air adequately to condition the room properly. The air device should contain adjustable air fins to adjust throw and adjustable air volume control damper to adjust airflow cfm amount. Adjust the air fins to throw the cool air directly below the ceiling surface of the room. The airflow should never be directed towards occupants or objects within the space, it best to adjust supply airflow directly at the worst exposure within the room. Be sure the air device does not discharge the cold air directly onto any furnishings or building envelope component (wall, door, floor, widows, etc). The goal is to direct the primary air stream (air greater than terminal velocity, 50 fpm) about ¾ the rooms length creating air mixture in the room without overcooling the building envelope.

Supply air device selection as shown above is only part of proper room air distribution; also consider the air outflow (relief air) from the room. Supply air devices provide fresh conditioned air into the room (which pressurizes the room); the air must circulate within the room then be relieved (depressurize). Relief air is required in rooms containing a closable door that would isolate the room

from the main return air device. Relief air can be accomplished with a transfer air duct and transfer air devices, a direct transfer air device, or with ACCA reference standard ducted return air device as shown below. A 30" wide 1" undercut door allows only 30 cfm to transfer when closed, so only a small bathroom or closet should use the undercut doors for relief air. Properly sized room supply air systems will only work if the room also has a properly sized return or relief air system. Habitable rooms without relief or return air duct systems will be uncomfortable when the required airflow circulation is not meet. The supply air device must be selected to create all of the room air circulation and room air mixing, return air devices affect only the air motion within its immediate vicinity (less than 3 feet) and the return air device location has little effect on room air motion. The sketch below is a bedroom with the proper air devices located at the ceiling for the cooling mode. The supply air device has an airflow pattern directed towards the worst-case exposure (west window) and a ducted return air device located in the stagnant zone @ ceiling relieves the room air pressure.