DUCTLESS AND DUCTED MINI SPLIT SYSTEMS

Recently mini split systems have become popular due to television advertising – the TV ad's claim that no ducts are needed! There are two main types of mini split systems with very different uses – when sized properly both ductless and ducted mini split units are the best equipment selection for low demand conditioned spaces. Some confusion about proper equipment sizing and meeting the rooms required air flow exists among the hvac industry.

DUCTLESS **mini split air handlers are room mounted, high wall or ceiling, and can serve just a single room. Most of these mini split units have variable capacity, typically from 50 to 100%. Example: 1 ton ductless mini split – this unit has a .53 ton minimum capacity and is variable up to 1 ton capacity. On low speed this variable capacity mini split has about 6,360 btuh capacity and on high speed 12,000 btuh capacity. The goal of every equipment selection procedure is to select your equipment to very closely match the manual j 8th edition heat load calculation. MJ8 calculations are a worst-case heat load (about 15% of the cooling season) calculation that determines the amount of demand that must be met on an hourly basis, so if you have a .50-to-.99-ton MJ8 demand – the one-ton variable capacity mini split is the ideal equipment. During part load conditions (85% of the cooling season) the equipment varies the cooling capacity to better match the milder hourly outdoor conditions. Part load conditions (like night time, spring, fall) are about ½ the total MJ8 heat load @ peak load conditions. This ductless mini split equipment can only serve a single room because it's ductless, providing a separate ventilation air system is used to induce fresh out door air as this ductless air handler can't induce ventilation air, must be correctly sized for the rooms heat load demand, and must meet the room's air flow requirements (air handler air flow discharge with respect to air throw and air mixture within the single room the air handler serves). I use a one-ton ductless mini split in my single room 16x14 wood shop that has a heat load demand of .85 tons – this unit is correctly sized for heating, cooling, dehumidification, and the wood shop has a separate ventilation air system to provide fresh outdoor air for the health of the occupants. This split system equipment type locates the noisy compressor outdoors, and replaces wall and window a/c package units from the past (1970's, aka wall or window "shaker").**

DUCTED **mini split air handlers typically mount above the ceiling or in an interior closet, this type of mini split can be ducted to one or more rooms to provide air flow in each area as required by Manual J heat load calculation + Manual D duct Design + Manual S equipment selection procedure + Manual T room air device selection procedure + Manual ZR thermal zone selection procedure. Properly sized ducts (using Manual D duct design) will divide the total equipment capacity into the exact capacity amounts required to each room - ensuring all rooms receive conditioned air at the CFM rate that matches the heat load demand – each room about the same temperature (3-degree temp swing). Ducted mini splits also can provide ventilation air by using a ventilation air duct with motorized damper.**

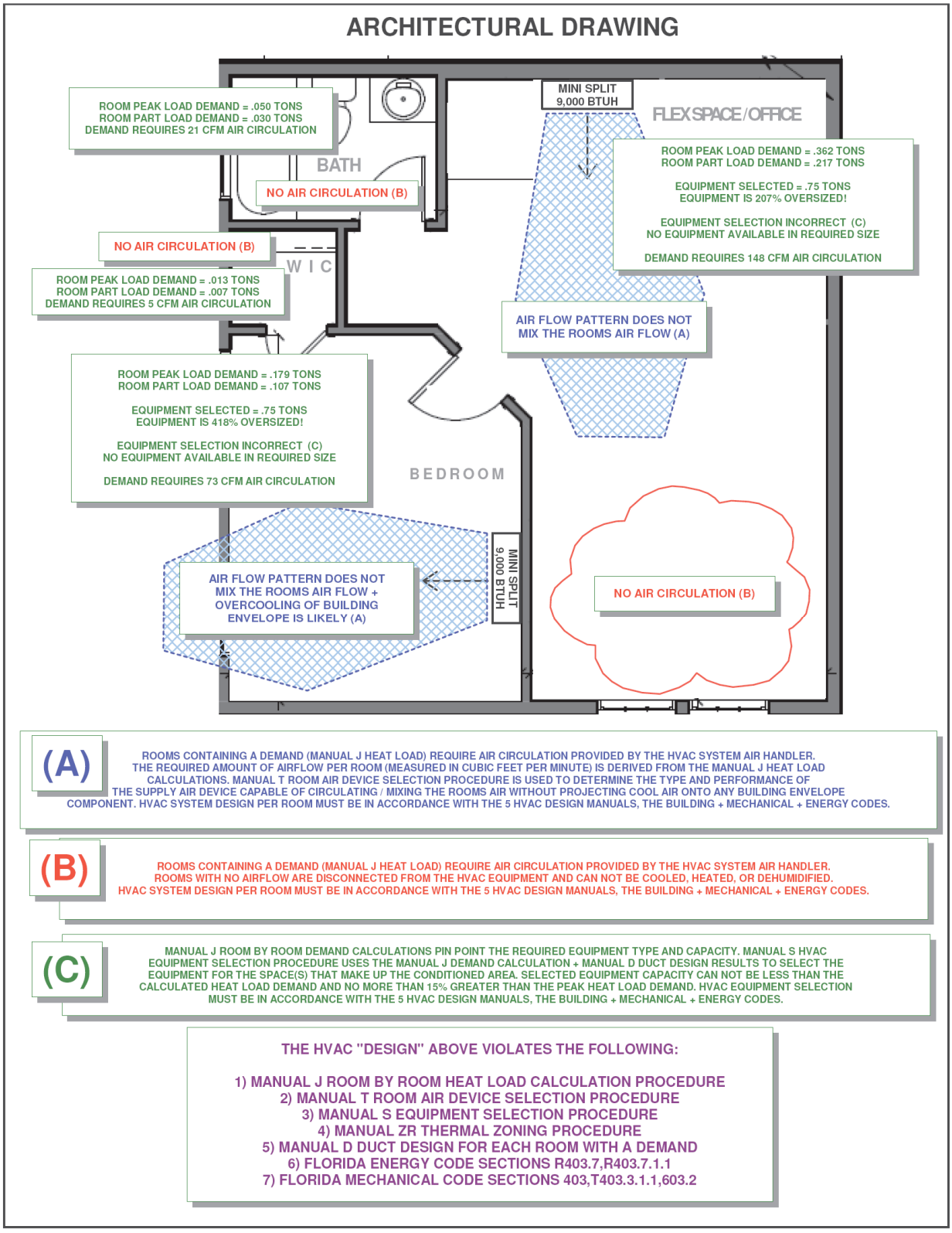
Today our customers expect each room of the home to be conditioned – this includes baths, walk in closets, laundry rooms, etc. and recently codes have adopted ACCA manuals that require each conditioned room be provided with forced air flow provided by the air handler including ventilation air.

Ductless mini split systems can only serve a single room, a separate ventilation air system is required because ductless air handlers can't induce ventilation air. Use this system type to condition spaces that don't contain occupants.

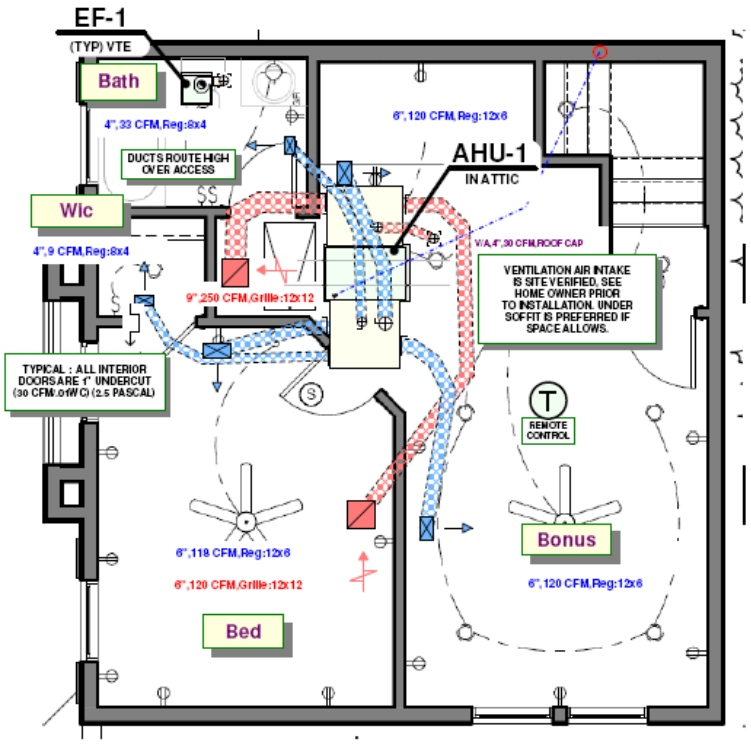
Ducted mini split systems serve one or more rooms and provide ventilation air (required by ACCA) for occupants.

Use standard forced air hvac equipment for conditioned spaces that have a 1.05 ton or larger demand. Standard single stage hvac equipment sizes are 1.5-ton,2 ton,2.5-ton,3 ton,3.5-ton,4-ton,5 ton. Variable sizes = 2,3,4,5.

Below is a typical common floor plan of a conditioned space, the (2) ductless mini splits reflect an incorrectly designed hvac system for this 4-room conditioned space. Each room has a unique demand that must be neutralized by the hvac system, in this case the demands for the bathroom, walk in closet, and ½ of the bonus room are not met by the hvac equipment selection – I have added color lines and notes to the architects black and white drawing detailing why this Hvac design approach is not compliant with the various hvac ACCA design manual's + building codes.



The hvac industry "ACCA" hvac design approach shown below is correct for this project. The design uses every ACCA design manual (manual's J,S,D,T,ZR) to establish the one and only demand that is used for equipment selection. A single one-ton variable capacity ducted mini split system was the correct equipment type to meet the total heat load demand of .69 tons. The variable capacity equipment can operate as low as 50% of the total capacity, making this equipment size correct for peak load conditions. The ducts shown break up the total equipment capacity into the correct capacities for each room – this can only be done with ductwork – ducts ensure each room is conditioned to about the same temperature. Ventilation air duct is provided (purple) for the health of the occupants.



References / Florida building code required = Manual J 8thedition + Manual S required: R403. / Manual D required:FECC403.2.7.5+FMC603.2/FECC103.2+FECR103.2/FBC101.4.2+FBC101.4.6+FBC105.3.1.2+FBC107.3.5/FECCR403.6.1.1

References / HVAC Manuals J,D,S,T,ZR required = special thanks to Hank Rutkowski P.E. the genius author of the Manual J 8th edition load calculation procedure(first printing, April 2002)// Introduction: how hvac works, 8th edition is room by room calculations, continuous equipment operation is normal at design conditions, 7-10 minutes to reach dew point conditions at the cooling coil, part load and full load description, sensible heat ratio of building and sensible heat ratio at equipment differences ,no benefit to oversizing equipment, "An HVAC design involves much more than a heat load estimate – producing a heat load estimate is not equivalent to designing a comfort system"/ Section one: cooling and heating loads room by room, peak heat load and average heat load procedure, adequate exposure diversity and thermal zone grouping, thermal zoning and zone control per level minimum, evaluating zoning requirements/ Section five: indoor design conditions authority (DOE) determined by Manual J with a warning about oversizing equipment for unlikely scenarios like "I like it cold at night = bigger hvac equipment", educating home owners about the disadvantages of oversized equipment, solar heat load reduction at night/ Section ten: Manual D software for modeling hvac duct systems, default duct heat load, CAD HVAC design tools that tie together all 5 of the HVAC designs manuals produces the most accurate results/ Survey section appendix one: thermal zone identification, north arrow super critical, indoor design conditions, building envelope component make up/ Fenestration appendix 4: solar heat gain is the major heat load, thermal storage absorption at peak conditions extends the cooling cycle, cooling dominate climates and low e coatings / Appendix section seven: duct system efficiency and the environment that surrounds the duct, whimsical guidelines and unreliable rules of thumb (ducts not based on graphic manual D)/ Table 1A: climatic conditions for USA.

Home Energy Modeling for this study courtesy of ⇨ HVAC Designs Inc. ⇨ "Precise, Calculating, and Cool"