Rules and *Rules of Thumb for Duct Systems

(for a system that performs as rated and per design, follow the procedures in the ACCA Manuals: J, S, D and T)

Designing heat pump duct systems for correct velocity and low restriction

Supply and Return Plenums - *properly sized; minimize the System Effect and assure Static Regain*

- Size supply plenums to the flanged opening of the blower outlet, not to the extents of the AHU cabinet.
- Extend supply plenums to a length of 2.5 times the outlets equivalent diameter, *or at least 24".
- Extend return plenums out to a length at least as long, if not longer, than the widest side of its base.

Metal Supply Trunks - *properly sized supply trunks allow the rated airflow and reduce the power consumed by the blower*

- Use a sheet metal duct calculator at a friction rate of *0.1"wc or less to size each metal trunk duct.
- Check the velocity of the air and increase duct size if the velocity is greater than 900 fpm. 700 fpm is recommended for low restriction and noise. Size to *400 cfm per ton, convert round sizes to the rectangle equivalent as necessary
- Use radiused instead of mitered fittings wherever possible. Consider using turning vanes in rectangle duct.

• 8" up to 245 cfm	• 1.5 ton - 12" *or* 10" and an 8"	• 4 ton - 18" *or* two 14" *or* two 12" and one 10"
• 10" up to 440 cfm	• 2 ton - 14" *or* two 10"	• 5 ton - 20" *or* two 16" *or* two 12" and one 14"
• 12" up to 715 cfm	• 2.5 ton - 16" *or* 12" and 10"	
• 14" up to 975 cfm	• 3 ton - 16" *or* two 12" *or* three 10"	
• 16" up to 1270 cfm	• 3.5 ton - 18" *or* 12" and 14" *or* two 10" and one 12"	

Flex Supply Branches and Registers - *properly sized; allow for quite and unnoticeable airflow and even room temperatures*

- Use a flex ductulator at a friction rate of *0.1"wc or less (or a metal ductulator at .05"wc or less) to size flex duct.
- *Assume 75 cfm per 6" flex branch run with a 6" x 10" ceiling register. Example; a 2 ton system should have 10 or more branch runs. Some floor registers allow more air at the desired velocity, than the same size ceiling register.
- *Assume 25 cfm per 4" flex branch run. Use in average size closets and bathrooms that have an outside wall.
- *Distribute one for each exterior opening or outside wall. One or two per room unless very large or more than 3 exposures. Sunrooms and rooms over garages should have 3 or more. Educated guesses and past experience with trial and error apply when using rules of thumb. Stretch the flex duct tight, avoid crimping and sharp turns.
- Avoid attaching branches within *18" of elbows, transitions or other areas of turbulent airflow in the duct.
- Use branch take off dampers to control the amount of air without causing noise at the register.
- Use manufactures engineering data to size registers for an unobtrusive throw without stratification. 700 fpm max.

Flex Return Runs - *properly sized air returns allow the rated airflow and reduce the power consumed by the blower*

- Use a flex ductulator at a friction rate of *0.1"wc or less (or a metal ductulator at .05"wc or less) to size flex duct.
- Check the velocity of the air and increase duct size if the velocity is greater than 700 fpm. 600 fpm is recommended for low restriction and noise.

• 8" up to 170 cfm	• 1.5 ton - 14" *or* two 10"	• 4 ton - 16" and a 14" *or* two 14" and one 8"
• 10" up to 315 cfm	• 2 ton - 16" *or* 12" and a 10"	• 5 ton - two 16" and one 8" *or* three 14"
• 12" up to 510 cfm	• 2.5 ton - 16" *or* 14" and a 10"	
• 14" up to 755 cfm	• 3 ton - 14" and a 12" *or* three 12"	
• 16" up to 990 cfm	• 3.5 ton - 16" and a 12" *or* two 14" *or* three 12"	

Filter Grilles - *properly sized filter grilles are very quite, allow the rated airflow and reduce the power consumed by the blower*

- Size Filter Grilles to a face velocity no greater than 400 fpm. Standard filters lose effectiveness over 400 fpm.
- Use the formula; CFM ÷ FPM = Effective Area in square feet (Ak)[†].

• 10x6 (Ak 0.28) up to 111 cfm	• 14x18 (Ak 1.14) up to 457 cfm	• 16x25 (Ak 1.80) up to 720 cfm
• 12x12 (Ak 0.66) up to 263 cfm	• 14x20 (Ak 1.27) up to 507 cfm	• 20x20 (Ak 1.80) up to 720 cfm
• 14x14 (Ak 0.89) up to 357 cfm	• 18x18 (Ak 1.46) up to 585 cfm	• 14x30 (Ak 1.89) up to 756 cfm
• 12x18 (Ak 0.98) up to 392 cfm	• 20x16 (Ak 1.46) up to 585 cfm	• 24x20 (Ak 2.16) up to 862 cfm
• 14x16 (Ak 1.02) up to 407 cfm	• 24x14 (Ak 1.52) up to 607 cfm	• 25x20 (Ak 2.24) up to 898 cfm
• 20x12 (Ak 1.10) up to 440 cfm	• 16x24 (Ak 1.73) up to 692 cfm	• 20x30 (Ak 2.96) up to 1074 cfm

Flat Grilles - *properly sized flat grilles are very quite, allow the rated airflow and reduce the power consumed by the blower*

- Size Flat Return Air Grilles to a face velocity no greater than 500 fpm.

• 10x6 (Ak 0.28) up to 139 cfm	• 14x14 (Ak 0.89) up to 446 cfm	• 24x14 (Ak 1.52) up to 758 cfm
• 8x8 (Ak 0.30) up to 148 cfm	• 12x20 (Ak 1.09) up to 544 cfm	• 20x20 (Ak 1.80) up to 900 cfm
• 12x8 (Ak 0.44) up to 221 cfm	• 14x18 (Ak 1.14) up to 571 cfm	• 30x14 (Ak 1.89) up to 945 cfm
• 10x10 (Ak 0.46) up to 230 cfm	• 16x16 (Ak 1.16) up to 580 cfm	• 20x24 (Ak 2.16) up to 1078 cfm
• 12x12 (Ak 0.66) up to 329 cfm	• 18x18 (Ak 1.46) up to 732 cfm	• 16x30 (Ak 2.18) up to 1088 cfm

[†] Effective Area (Ak) data for Hart & Cooley model 673 Return Air Filter Grille and 672 Flat Return Air Grille. Supply registers are 682.