

# Rules and \*Rules of Thumb for Duct Systems

For precise duct system design, follow the procedures in the ACCA Manuals: J, S, D and T, otherwise read on...

## Designing Heat Pump duct systems with correct velocity and low restriction

### Supply and Return Plenums - properly sized; minimize the System Effect, assure Static Regain and allow even airflow thru coils

- Size supply plenums to the flanged opening of the blower outlet, not to the extents of the AHU or fan/coil cabinet.
- Supply plenum length should be 2.5 times the blower outlets equivalent diameter minus the heater section, \*or 24"
- Extend return plenums out to a length \*at least as long, if not longer, than width of the AHU or fan/coil 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 for \*400 cfm per ton, convert round sizes to their rectangle equivalent as necessary.
- \*Use long and radiused duct fittings instead of short or mitered fittings wherever possible.
  - 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 & Registers – properly sized with adjustable dampers; allow quiet draftless airflow that can be balanced

- Use a flex ductulator at a friction rate of \*0.1"wc or less (or a metal ductulator at \*0.05"wc or less) to size flexible duct.
- \*Assume 75 cfm per 6" flex branch with a 4x10 floor or a 6x10 ceiling register. Example; a 2 ton system should have 10 or 11 outlets. Use straight boots instead of 90° wherever possible. Avoid using ceiling diffusers with ceiling returns.
- \*Assume 25 cfm per 4" flex branch run. Use in average size closets and bathrooms etc. 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 take offs within \*18" downstream of elbows, transitions or other fittings with uneven pressure in the duct.
- Use branch take off dampers to control the amount of airflow. Adjusting at the register may cause air noise.
- 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 duct calculator at a friction rate of \*0.1"wc or less (or a metal ductulator at \*0.05"wc or less) to size flex duct.
- Use the duct calculator to find the velocity of the air at the size determined by the friction rate and increase the size if the velocity is greater than 700 fpm. 600 fpm is recommended for low restriction and noise. Size for \*400 cfm per ton.
  - 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 quiet, allow the rated airflow, and allow air filters to perform as designed

- Size Filter Grilles to a face velocity no greater than 400 fpm. Standard filters lose effectiveness over 400 fpm.
- Use equation;  $CFM \div FPM = Ak$  to find the required effective area and match it to the Ak of the grille.
  - 10x6 (Ak 0.28<sup>†</sup>) up to 111 cfm      • 14x18 (Ak 1.14<sup>†</sup>) up to 457 cfm      • 16x25 (Ak 1.80<sup>†</sup>) up to 720 cfm
  - 12x12 (Ak 0.66<sup>†</sup>) up to 263 cfm      • 14x20 (Ak 1.27<sup>†</sup>) up to 507 cfm      • 20x20 (Ak 1.80<sup>†</sup>) up to 720 cfm
  - 14x14 (Ak 0.89<sup>†</sup>) up to 357 cfm      • 18x18 (Ak 1.46<sup>†</sup>) up to 585 cfm      • 14x30 (Ak 1.89<sup>†</sup>) up to 756 cfm
  - 12x18 (Ak 0.98<sup>†</sup>) up to 392 cfm      • 20x16 (Ak 1.46<sup>†</sup>) up to 585 cfm      • 24x20 (Ak 2.16<sup>†</sup>) up to 862 cfm
  - 14x16 (Ak 1.02<sup>†</sup>) up to 407 cfm      • 24x14 (Ak 1.52<sup>†</sup>) up to 607 cfm      • 25x20 (Ak 2.24<sup>†</sup>) up to 898 cfm
  - 20x12 (Ak 1.10<sup>†</sup>) up to 440 cfm      • 16x24 (Ak 1.73<sup>†</sup>) up to 692 cfm      • 20x30 (Ak 2.96<sup>†</sup>) up to 1074 cfm

### Flat Grilles - properly sized flat grilles are quiet, 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<sup>†</sup>) up to 139 cfm      • 14x14 (Ak 0.89<sup>†</sup>) up to 446 cfm      • 24x14 (Ak 1.52<sup>†</sup>) up to 758 cfm
  - 8x8 (Ak 0.30<sup>†</sup>) up to 148 cfm      • 12x20 (Ak 1.09<sup>†</sup>) up to 544 cfm      • 20x20 (Ak 1.80<sup>†</sup>) up to 900 cfm
  - 12x8 (Ak 0.44<sup>†</sup>) up to 221 cfm      • 14x18 (Ak 1.14<sup>†</sup>) up to 571 cfm      • 30x14 (Ak 1.89<sup>†</sup>) up to 945 cfm
  - 10x10 (Ak 0.46<sup>†</sup>) up to 230 cfm      • 16x16 (Ak 1.16<sup>†</sup>) up to 580 cfm      • 20x24 (Ak 2.16<sup>†</sup>) up to 1078 cfm
  - 12x12 (Ak 0.66<sup>†</sup>) up to 329 cfm      • 18x18 (Ak 1.46<sup>†</sup>) up to 732 cfm      • 16x30 (Ak 2.18<sup>†</sup>) up to 1088 cfm

<sup>†</sup> Effective Area data for Hart & Cooley model 673 Return Air Filter Grille and 672 Flat Return Air Grille. Supply registers are model 682.