



Air flow

- Supply air plenum should be 7x length of barrel fan diameter before first spigot to avoid turbulence
- Return air plenum should be 2x length of fan barrel diameter before first spigot to avoid turbulence
- Large duct = high volume, low velocity, low static pressure, short throw, low noise
- Small duct = low volume, high velocity, high static pressure, long throw, high noise
- Surface area of return air filter should be no less than the surface area of the indoor coil ideally filter should be no less than 1.8x indoor coil surface area
- Return air flex duct cross sectional area should be the same size as the indoor coil surface area or larger
- Air speed across indoor coil should be no lower than 1.3m/s and no higher than 2.8m/s
- The colder the air the higher the relative humidity (supply air can be close to 100% RH)
- For maximum throw on side blow diffusers angle all blades horizontally except for the bottom blade. Turn the front edge of bottom blade up on a 45° angle
- To overcome stratification on heating increase air velocity
- Decrease noise by changing duct direction 3 times (this can be flex or hard duct)
- Toilet exhausts require 10L/s of exhaust per stall

Electrical

- Running amps of a motor are generally 7x less than locked rotor amps
- Star connection = low speed, high torque
- Delta connection = high speed low torque
- Capacitors connected in series decrease capacitance ($C1 \times C2 / (C1 + C2)$)
- Capacitors connected in parallel increase capacitance ($C1 + C2$)
- Fan amp draw decreases due to a resistance in air flow (e.g., blocked filter) on centrifugal fans (unless speed controlled on air flow)
- Fan amp draw increases due to a resistance in air flow (e.g., blocked condenser coil) on propeller fans.

Piping

- Five changes in direction before between fixing points reduces vibration without the need for vibration eliminators
- Suction lines should tilt downhill towards the compressor 10mm for every horizontal meter of suction pipe
- The longer the suction line and the more bends the bigger the reduction in unit capacity
- Suction line must be trapped at the very first vertical rise after indoor unit regardless of total vertical height.
- Traps should be as short as possible horizontally as to only hold the minimum amount of oil before flushed out (prevention of oil logging)

Water

- Drain trap exit should be half the height of entry.
- Use a deeper drain trap to overcome large negative static on the return air chamber
- Drain lines should slope down a minimum of 10mm per 1m
- Water pressure increases 10pa with every 1m of vertical rise
- Pumps located on ground level are larger and more power consuming than pumps on roof level due to water level (gravity) not increasing the head required to create flow
- Ideal condensing water temperature supplied from cooling towers is 28-32 degrees
- Ideal condensing temperature on water cooled equipment is 32-34 degrees
- Swapping inlet and outlet hoses on water cooled equipment can clear condenser blockages, just remember to swap them back after its cleared!
- Wind thread tape in the opposite direction to thread

Heat Load estimation

- General home sizing is approximately 130 W/m
- 1 computer is approximately 100W
- Heat load of a passive person is 150 -200W
- Sensible load performs the change of air temperature
- Latent load removes humidity and does not change air temperature
- High humidity can make rooms 'feel' excessively hot. This is common in oversized air-conditioned spaces during low load
- Glass is an architect's best friend and the HVAC designer's enemy. Reduce impacts of sun on glass wherever possible

Economic lifespan of packages and split ducted units is 10 years full use (10 hrs day 5 days a week)