Effective and Efficient Heating and Cooling

Rebuild Green Expo

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A new SEER 14 EER 12 AC
Is it an AC appropriate for Santa Rosa?
Dry Climate vs. Wet Climate

- Official Measures of Performance:
  - SEER
  - EER

- Necessary Measure of Performance for Santa Rosa:
  - Sensible Efficiency
What Does an Air Conditioner DO?

Reduces the Temperature – Sensible Capacity

Removes Moisture – Latent Capacity
How to get a Santa Rosa Appropriate Air Conditioner

1. Keep the coil indoor warmer so little moisture is gathered on the coil
   – This produces high sensible capacity and high system sensible efficiency.
   – You do it with high airflow (CFM per ton)
   – Which takes SHORT DUCTS
   – Which takes a good duct system and fan motor

2. Evaporate the moisture off the coil at the end of the cycle
Warmer Coil = Higher Sens. Efficiency

- Warmer Coil comes from one thing: MORE AIRFLOW
- More Airflow is measured in CFM per TON
- CFM per Ton comes from two things: MORE CFM and
- LESS TONS
Historic AC and Heat Pump Sizing

• One ton per 400 Sq. Ft.
• Houses have changed
Back to More CFM

• More CFM comes from:
• LESS RESTRICTIVE DUCTS which are:
  – SHORT DUCTS
  – MINIMUM TURNS
  – PROPER DIAMETER
So What Makes a Santa Rosa Duct System?

• **SHORT DUCTS**

• Minimum Turns

• Proper Diameter

• Big Returns (include 2” or 4” filter)

  and

• Well Insulated (R ?) or

• Inside Conditioned Space
Case Study 1948 Stockton House
2x3 Walls
Start Here -- Ducts
Number 1 – Minimum Ducts
Buried Ducts
Some Numbers

- SHORT DUCTS insulated to attic R value
- Replacement ECM Motor
- Downsized FROM 2.5 to 1.25 Tons
- Went from 212 CFM/ton to 540 CFM/ton
- 0.12 Watts per CFM
- Went from 339 to 678 sq. ft. per ton
Why Are Ducts Number One?

• They generate LOSSES:
  – They are a really big heat exchanger
  – They are very effective at loosing the capacity of your AC, HP or furnace through conduction and leakage
Minimize Ducts

- Short
- Really Short
- Insulated
- Super Insulated
- Tight
- Leakless Tight
There are Two Ways to get a Dry Climate Air Conditioner

1. Keep the coil indoor warmer so little moisture is gathered on the coil
   – This produces high sensible capacity and (if done right) high system sensible efficiency.
   – You do it with high airflow (CFM per ton)
   – Which takes a good duct system

2. Evaporate the water off the coil at the end of the cycle
Water Builds up on Coil During Compressor on

• In hot and dry climates, when the typical air conditioner turns off, it still has stored cooling (moisture) sitting in it. The stored cooling can be delivered to the home or business if the fan runs longer.
Compressor shuts off...

Indoor Fan keeps running...

(high energy use)

(low energy use)
Western Cooling Control™

- Compressor on Fan on
  - On time logged
- Compressor off Fan on
  - Time varies with logged compressor time
  - Evaporates off the coil
  = Cool air

Over 100,000 successfully installed
Good Design vs. Barely Enough

- 600 to 800 CFM/ton vs. 350 CFM/ton
- 0.15 to 0.26 Watts/CFM vs. 0.45 Watts/CFM
- 600 to 1000 sq. ft. / ton vs. ???
- Unmeasurable to 2% Duct Leakage vs. 5% Lkg.
- 4” Deep Filter Box vs. 2” Deep
- R-38 Duct Insulation vs. R-8 Duct Insulation
- Variable Fan-off Time Delay vs. 60 to 90 sec.
- Heat Pump HSPF 9.5 vs. 8.2
- EER 12.5 vs. SEER 14
- Refrigerant Charge Correct
- Filter Location Label
Other Topics

• Furnaces
• Two Speed
• Variable Speed
• Zoning
• Whole House Fans
• Attic Fans
• More Examples
Efficiency with 20% Duct Loss

Sensible EER BPM at unit

Sensible EER with BPM

Elapsed Seconds
Furnace Fan Watt Draw

New Construction AC Fan Watts
2010 Survey Chitwood, Wilcox & Proctor
Fan Watts at Same Cooling CFM

Average Reduction 47%