



More Science, Less Art: Successful HVAC Design

RESNET Building Performance Conference
San Diego, CA
February 17th, 2015

Learn more at energystar.gov

Art restoration: More art, less science

HVAC design: More science, less art



Ecce Homo de Elías García Martínez.



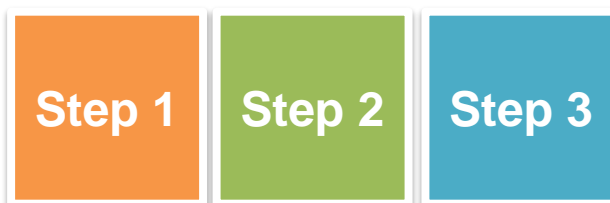
Agenda

- Basics of Manual J, S, & D – the Cliff Notes version.
- Top 10 most common HVAC problems:
 - Greg Cobb – President of iEngineer and Sonoran Air Consulting
 - Ted Konechne – Vice President Tempo Mechanical
- How Raters play a critical role in successful HVAC design.

Basics of Manual J, S, & D

Basics of Manual J, S, & D

- The three steps of Steps of HVAC design
 - Step 1: Calculate heating & cooling loads
 - Step 2: Select equipment
 - Step 3: Design ductwork



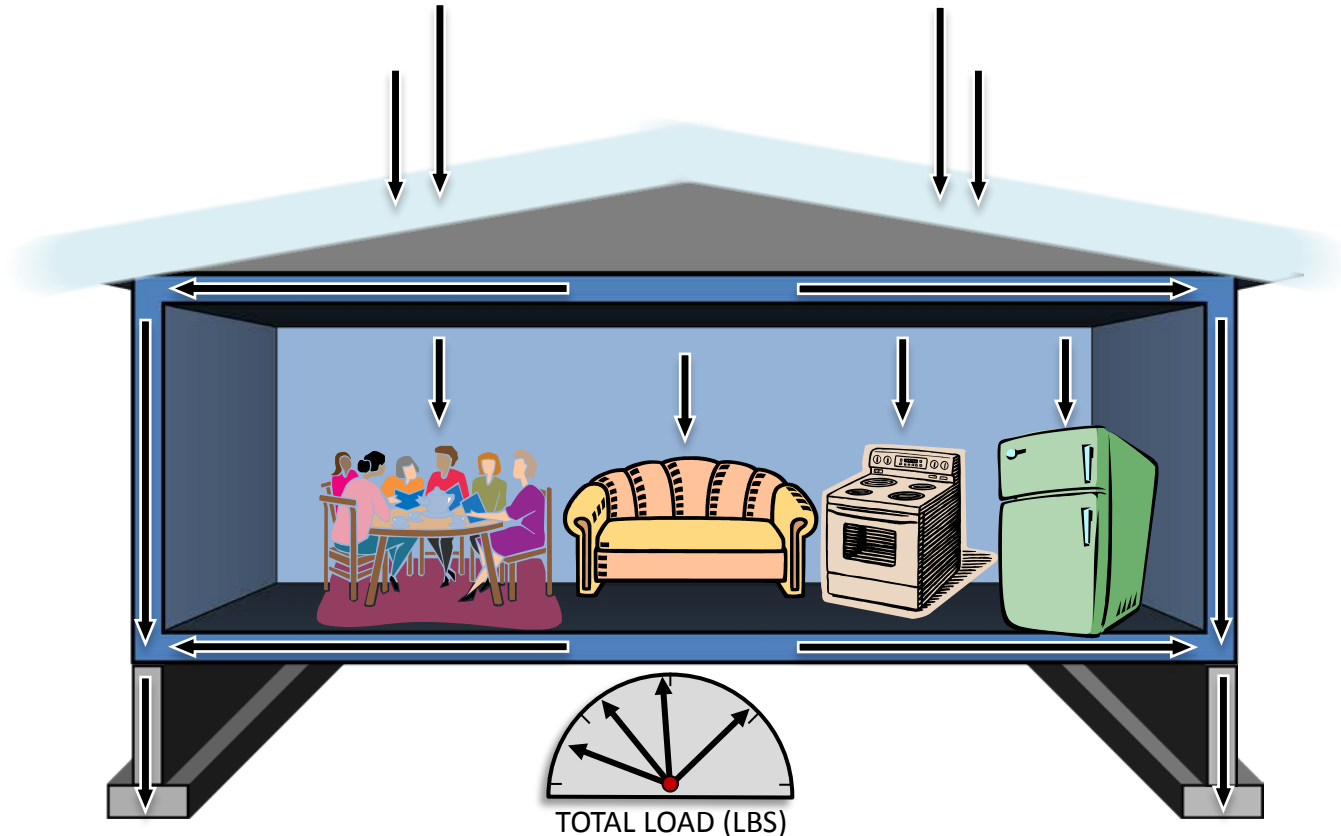
Step 1: Calculate heating & cooling loads



Step 1:

Calculate heating & cooling loads

- Structural Load: The weight that must be supported by a foundation at any particular time.

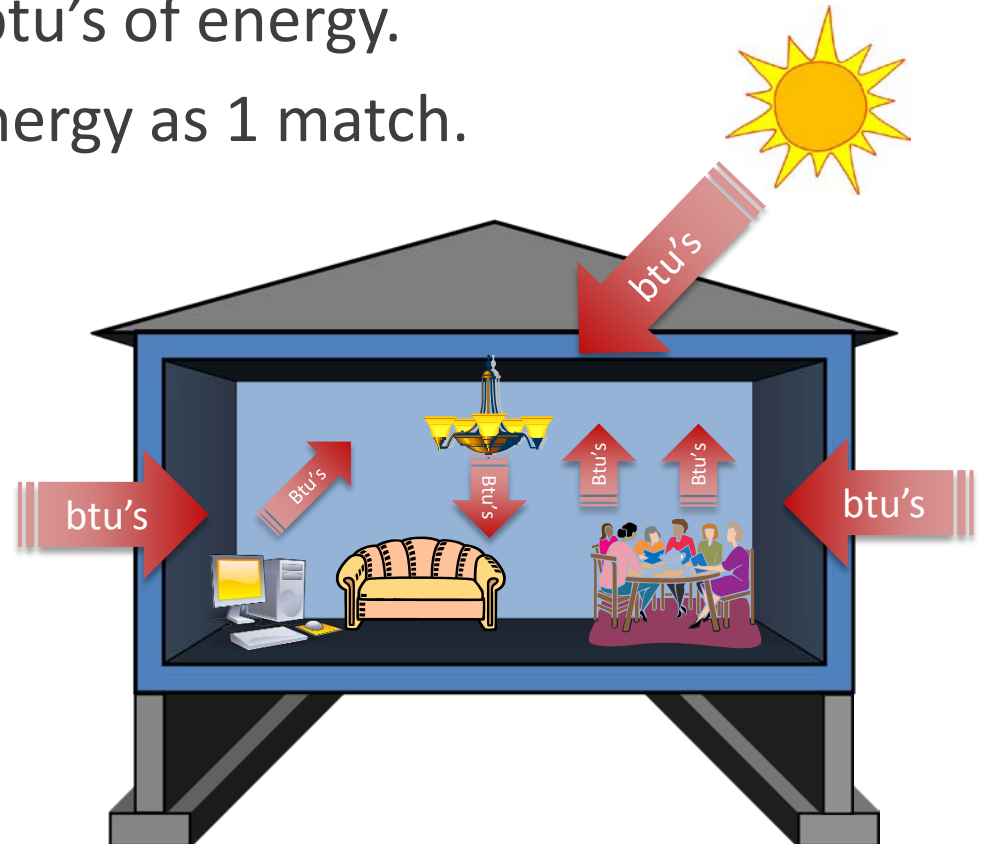
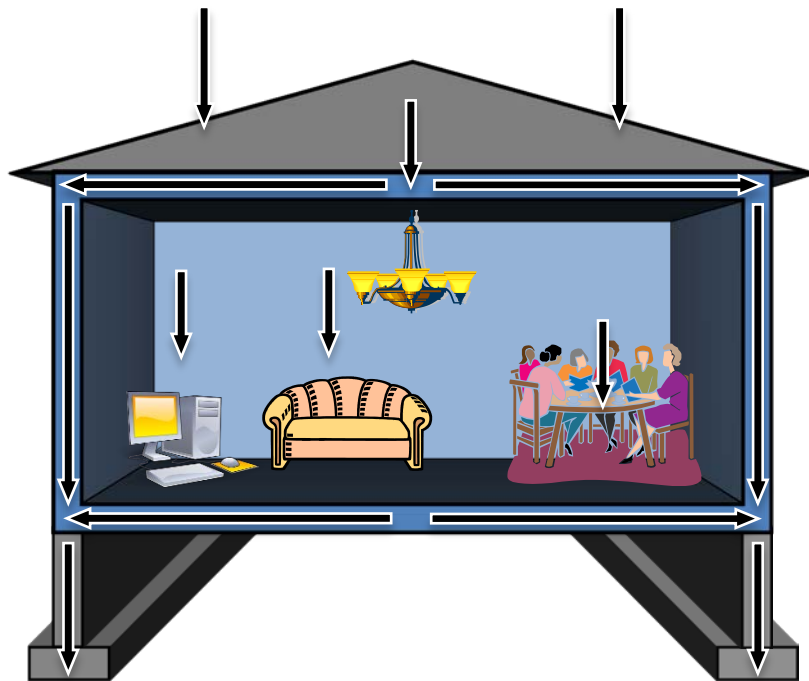


Step 1:

Calculate heating & cooling loads



- Structural load measured in pounds of weight..
..Cooling load measured in btu's of energy.
- 1 btu has about the same energy as 1 match.



Step 1:

Calculate heating & cooling loads



- Think of heating & cooling equipment as just “BTU machines”.

You, sir, look uncomfortable
– can I interest you in a
BTU machine?



Step 1: Calculate heating & cooling loads



Load Calculation Process

HVAC Designer

Step 1. Gather inputs



Step 2. Calculate load



Step 3. Verify inputs?

HERS Rater

Step 1. Gather inputs



Step 2. Calculate rating



Step 3. Verify inputs

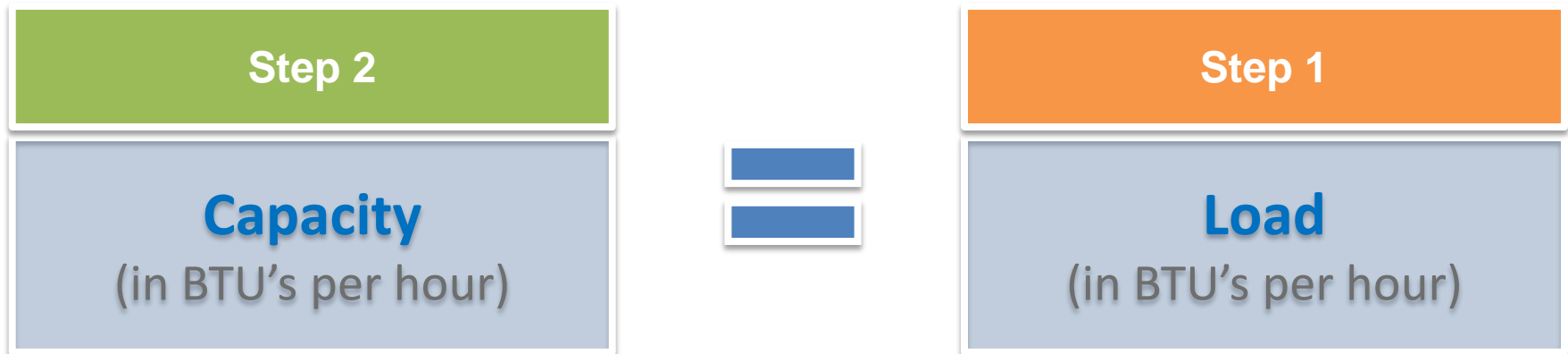
Step 2: Select Equipment



Step 2: Select Equipment



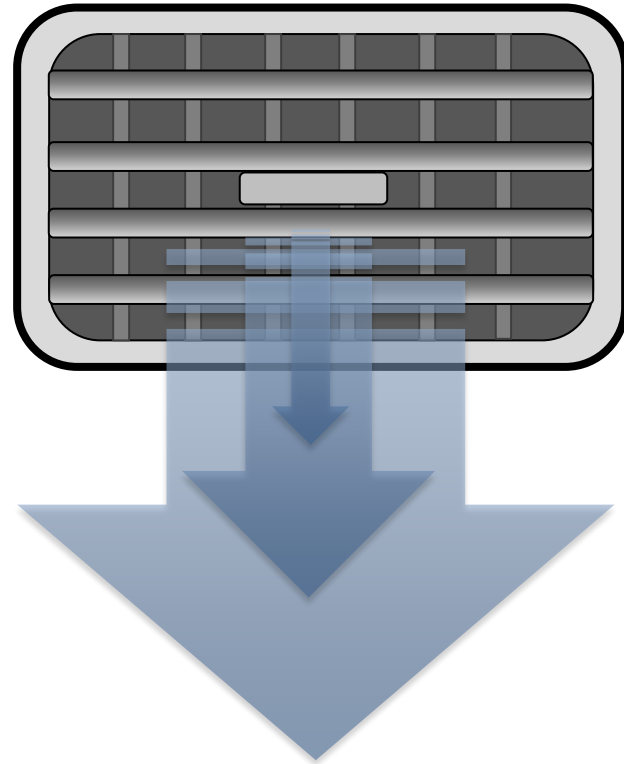
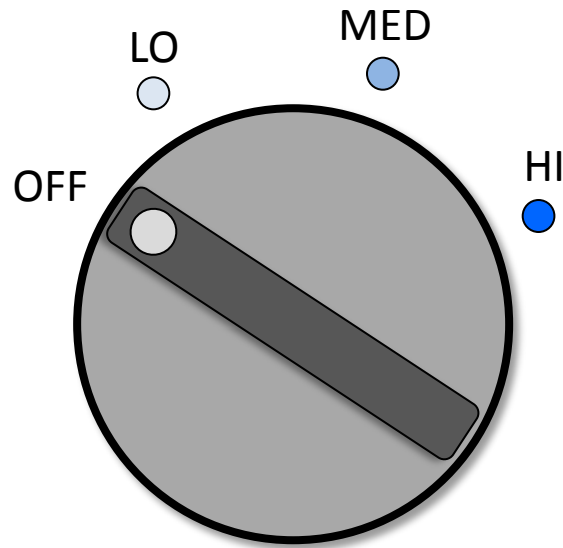
Super-Simple Equipment Selection Goal



Step 2: Select Equipment



- Heating and cooling equipment generally has just two modes – on & off.
- It is NOT the same as selecting a cooling setting for your car:



Step 2: Select Equipment



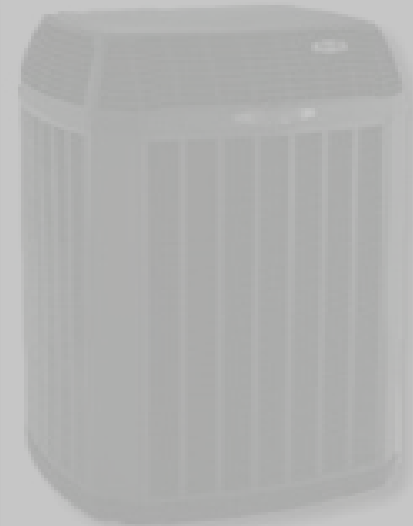
- “Nominal capacity” means “in name only”.
- Nominal capacity is not relevant to the ENERGY STAR program or to code compliance.



1.5 tons
18 kBTU/hr



3 tons
36 kBTU/hr



5 tons
60 kBTU/hr

Nominal
Capacity

Step 2: Select Equipment



- Design capacity depends on design conditions.
- Does this equipment meet the calculated load of **33 kBTU/h** at each of these locations?



3362 kBTU/h

Georgia
95 F



3364 kBTU/h

Arizona
105 F



3368 kBTU/h

New York
85 F

Step 3: Design Ductwork

Step 1

Step 2

Step 3

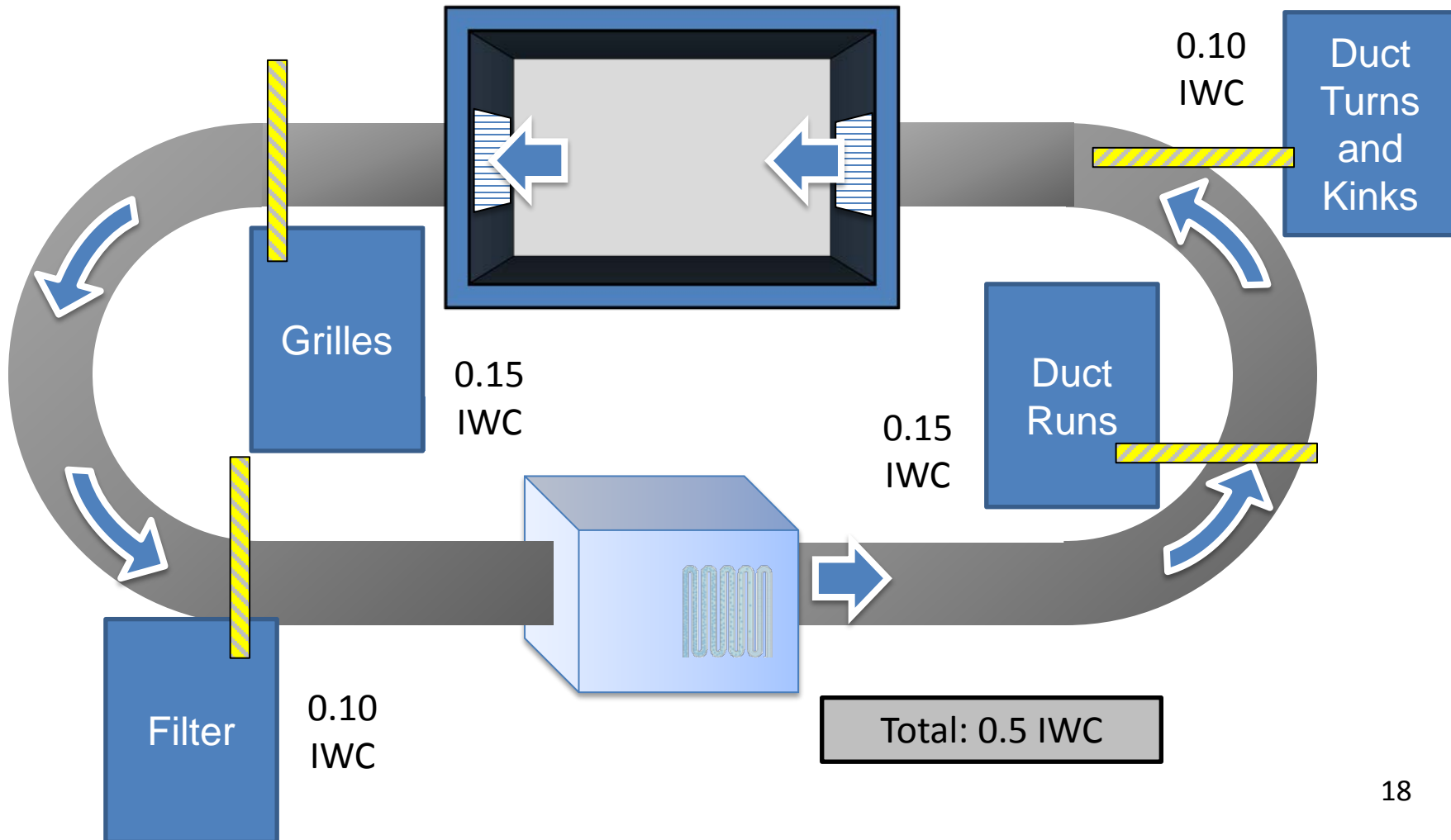
Step 3: Design Ductwork

- Driver must meet a 'budget' in dollars (\$).



Step 3: Design Ductwork

- Designer must meet a 'budget' in static pressure (IWC).



Step 3: Design Ductwork



G40UH-36A-070 PERFORMANCE													
External Static Pressure		Air Volume / Watts at Various Blower Speeds											
		High			Medium-High			Medium-Low			Low		
in. w.g.	Pa	cfm	L/s	Watts	cfm	L/s	Watts	cfm	L/s	Watts	cfm	L/s	Watts
0.00	0	1500	710	705	1290	610	565	985	465	455	830	390	375
0.05	12	1475	695	695	1275	600	555	980	465	445	820	385	365
0.10	25	1450	685	680	1255	590	545	970	460	440	810	380	360
0.15	37	1425	675	670	1240	585	535	965	455	430	805	380	355
0.20	50	1400	660	655	1225	580	525	955	450	425	795	375	350
0.25	62	1370	645	645	1205	570	510	945	445	415	790	375	345
0.30	75	1340	630	630	1180	555	500	930	440	405	780	370	335
0.40	100	1285	605	610	1140	540	475	900	425	390	745	350	325
0.50	125	1215	575	580	1080	510	450	865	410	375	705	335	310
0.60	150	1150	545	560	1015	480	430	810	380	355	655	310	290
0.70	175	1060	500	535	940	445	405	730	345	330	585	275	270
0.80	200	955	450	515	800	375	370	655	310	305	480	225	260
0.90	225	785	370	475	605	285	325	585	275	270	410	195	255

NOTE - All air data is measured external to unit with 1 in. (25 mm) cleanable filter (not furnished - field provided) in place. Also see Filter Air Resistance table.

Summary

- The three steps of Steps of HVAC design
 - Step 1: Calculate heating & cooling loads
 - Step 2: Select equipment
 - Step 3: Design ductwork
- We also have extended recorded versions of our J/S/D webinars



Step 3:

Design Ductwork



- Live Demo!

Top 10 HVAC Problems

Top 10 HVAC Problems



1. Rule of thumb of 400 sq. ft. per ton, isn't that good enough?
2. Manual J design temperatures – it gets hotter (or colder) than that here. I need to adjust my design temperature to have it work.

Top 10 HVAC Problems



3. I don't need to calculate the exact capacity for a piece of equipment. Can't I just back off of the AHRI value by 30%?
4. I don't need a duct design, I can figure it out in the field, right?

Top 10 HVAC Problems



5. I started using Manual J and I had comfort problems. It clearly doesn't work. I should go back to my tried and true rule of thumb, correct?
6. Lot specific design is too complex and doesn't provide any benefits. Isn't a basic worst case design good enough?

Top 10 HVAC Problems



7. Expired AHRI equals bad equipment selection
8. Manual J Design values not matching the energy star checklist (we design to 75@100 because the ASHRAE tables are too low)

Top 10 HVAC Problems



9. Fresh air compliance methods how are they designed and how do they work?
10. Static Pressure in system design is one inch of static really the number?

Raters' Role in HVAC Design

HVAC-related Rater tasks

1. Check key load calculation inputs.
2. Check HVAC system size relative to load calculation.
3. Assess duct installation, insulation, leakage, & pressure balancing.

What we're doing to help

1. Working on standard design reports
2. Clarifying our policy like design temp guidance
3. Providing free webinars - let us know if you want the record version of our J/S/D webinars.
4. Producing new training videos that will help you understand the concept of static pressure and how to determine airflow using it

What you can do

1. Continue to learn:
 - Come see our presentation on Rev 08,
 - Take J/S/D classes to better understand what the design process
2. Help educate builders and contractors about the importance of proper HVAC design and how you help deliver that with ES.
3. Get the key efficiency parameters from your projected rating into the hands of the designer.



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