

NW Ductless Heat Pump PROJECT



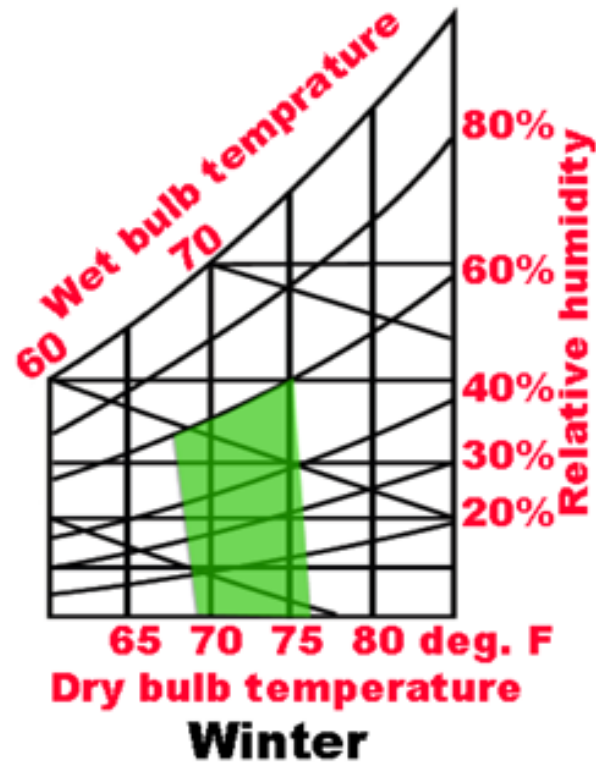
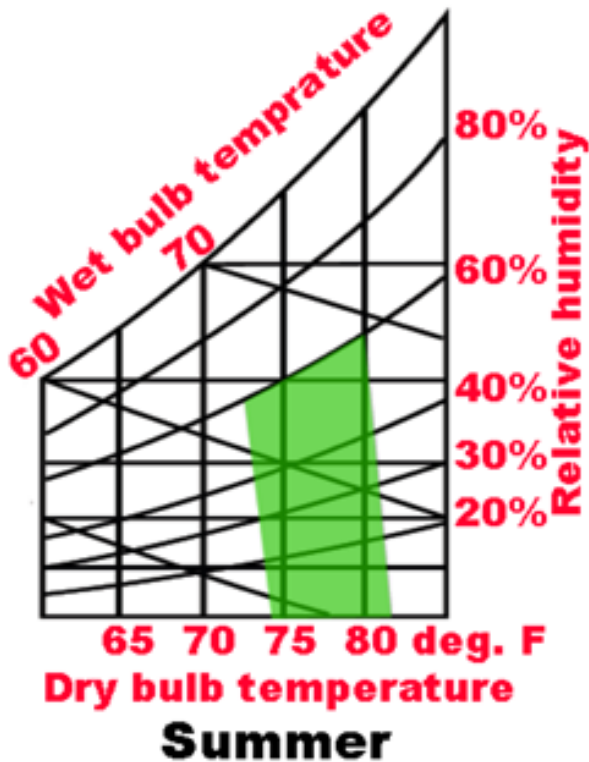
Does Sizing Matter?

Bruce Manclark, Delta T

Thomas Anreise, NW Ductless Heat Pump Project

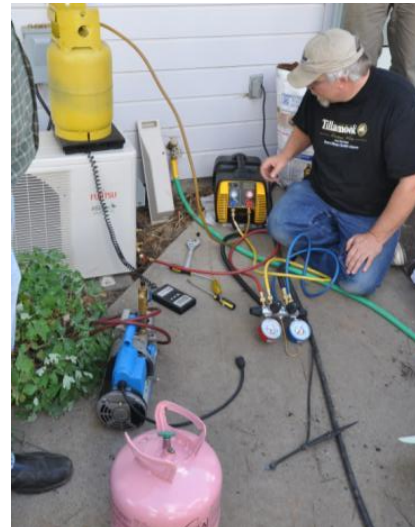
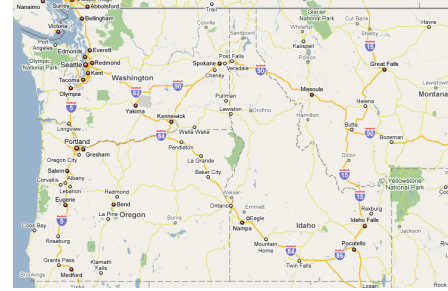
Sizing Ductless Heat Pumps in The Northwest

Or everybody wins if we increase comfort

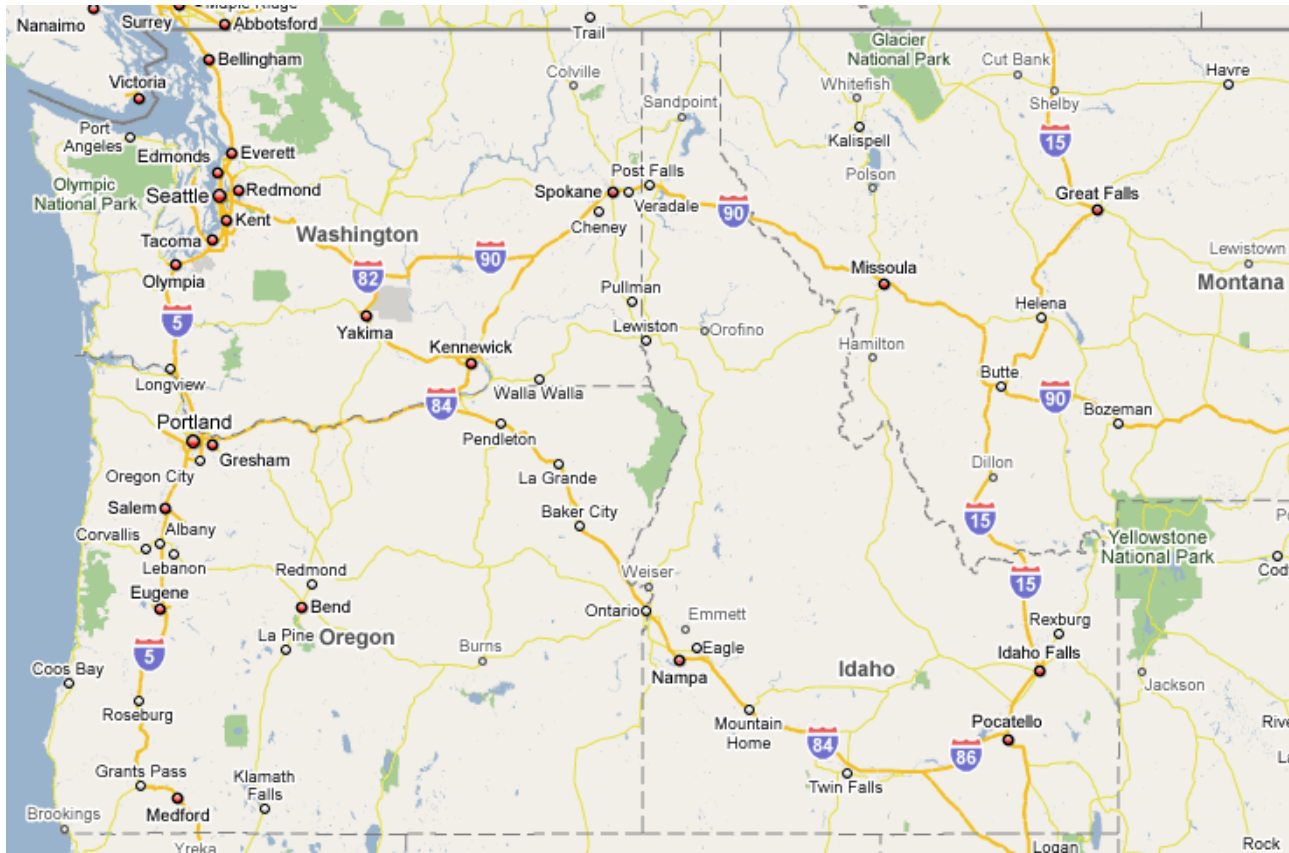


What Correct Sizing Means

- To the Region
- To the Homeowner
- To the Contractor



What Correct Sizing Means: To The Region



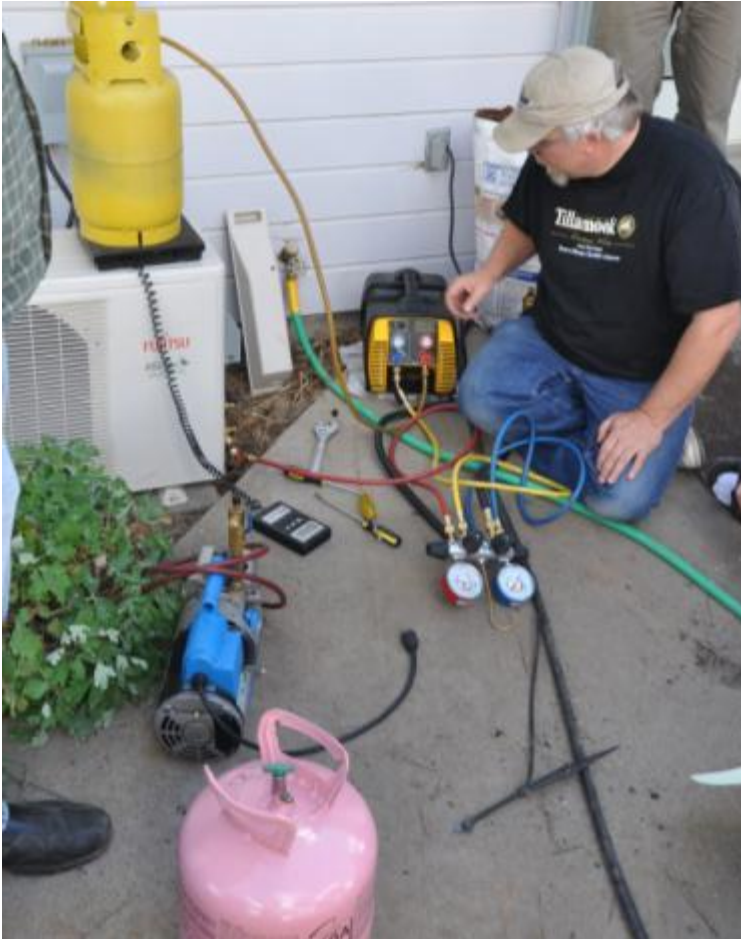
Maximum Market Share, Good Energy Savings

To The Homeowner



- COMFORT, COMFORT, COMFORT,
...savings

What Correct Sizing Means to The Contractor



Comfortable customers that
tell their friends and...

Pay their bill on time!

That Old ACCA Process Has Very Little To Do With Sizing DHPs

The ACCA Process

- Manual “J” calculates heat loss/heat gain
- Manual “S” guides in the selection process
- Manual “D” guides in the duct design process

With the Northwest ENERGY STAR Homes program the process can be simplified



Easy sizing For New Construction- About 10 BTU per Sq foot at 70 F inside and 20 F Outside

Heating Quick Sizing Chart

Lookup ΔT and sqft to determine heating load

ΔT	House Size (sqft)											
	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800
36	4,692	6,256	7,820	9,384	10,948	12,512	14,076	15,639	17,203	18,767	20,331	21,895
38	4,952	6,603	8,254	9,905	11,556	13,207	14,857	16,508	18,159	19,810	21,461	23,112
40	5,213	6,951	8,689	10,426	12,164	13,902	15,639	17,377	19,115	20,853	22,590	24,328
42	5,474	7,298	9,123	10,948	12,772	14,597	16,421	18,246	20,071	21,895	23,720	25,544
44	5,734	7,646	9,557	11,469	13,380	15,292	17,203	19,115	21,026	22,938	24,849	26,761
46	5,995	7,994	9,992	11,990	13,989	15,987	17,985	19,984	21,982	23,981	25,979	27,977
48	6,256	8,341	10,426	12,512	14,597	16,682	18,767	20,853	22,938	25,023	27,108	29,194
50	6,516	8,689	10,861	13,033	15,205	17,377	19,549	21,721	23,894	26,066	28,238	30,410
52	6,777	9,036	11,295	13,554	15,813	18,072	20,331	22,590	24,849	27,108	29,367	31,626
54	7,038	9,384	11,730	14,076	16,421	18,767	21,113	23,459	25,805	28,151	30,497	32,843
56	7,298	9,731	12,164	14,597	17,030	19,462	21,895	24,328	26,761	29,194	31,626	34,059
58	7,559	10,079	12,598	15,118	17,638	20,158	22,677	25,197	27,717	30,236	32,756	35,276

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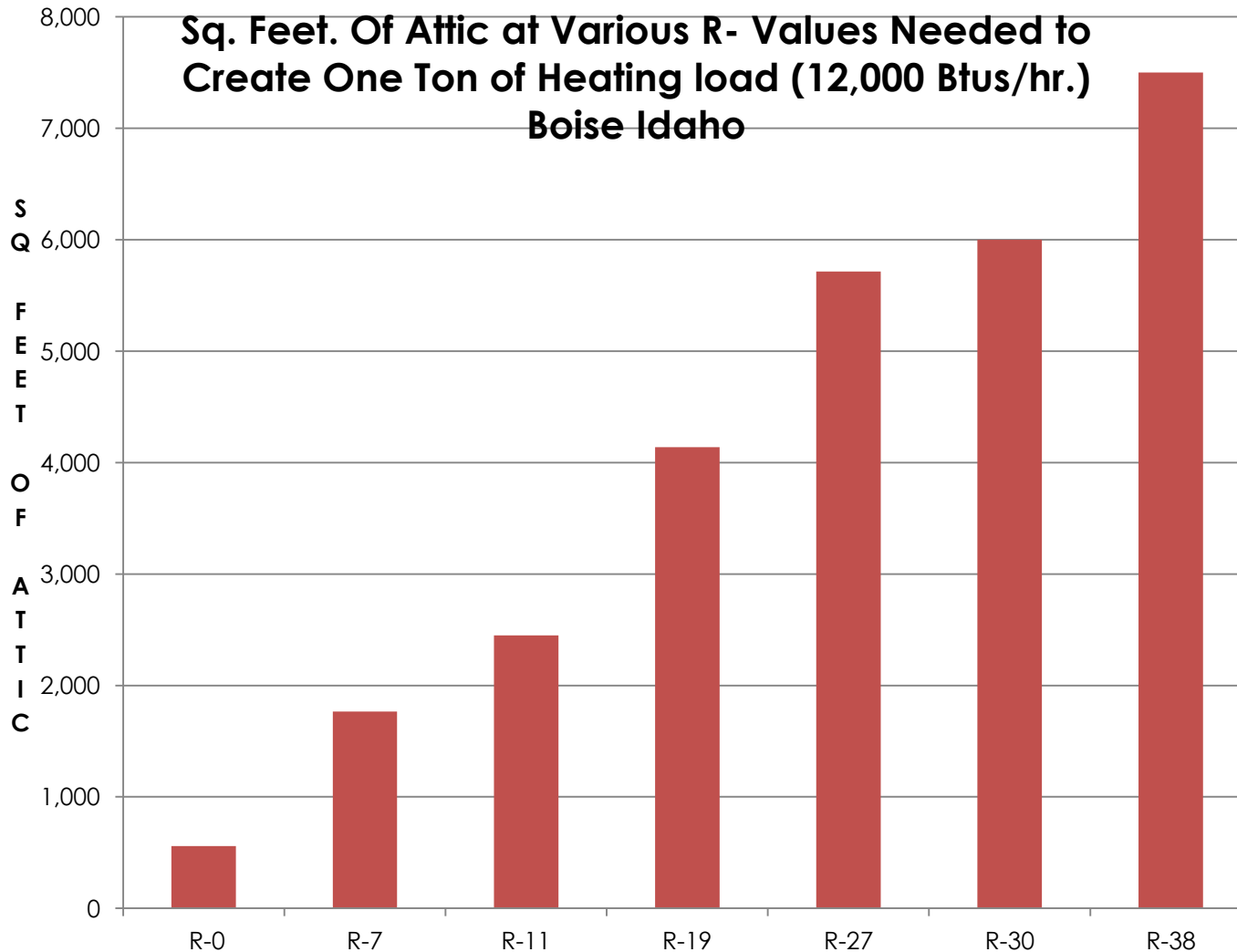
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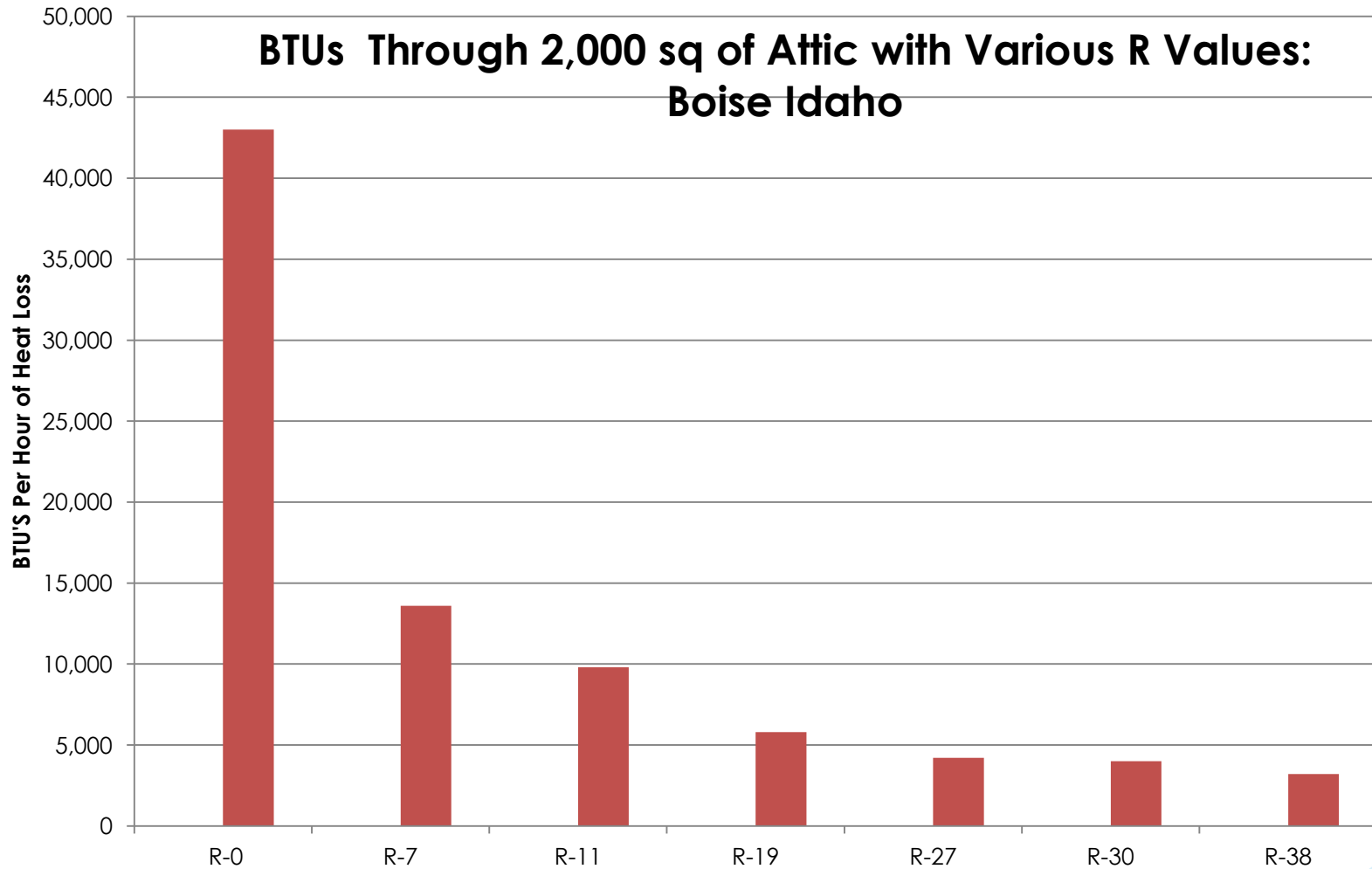
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Conditioned Floor Area X 10

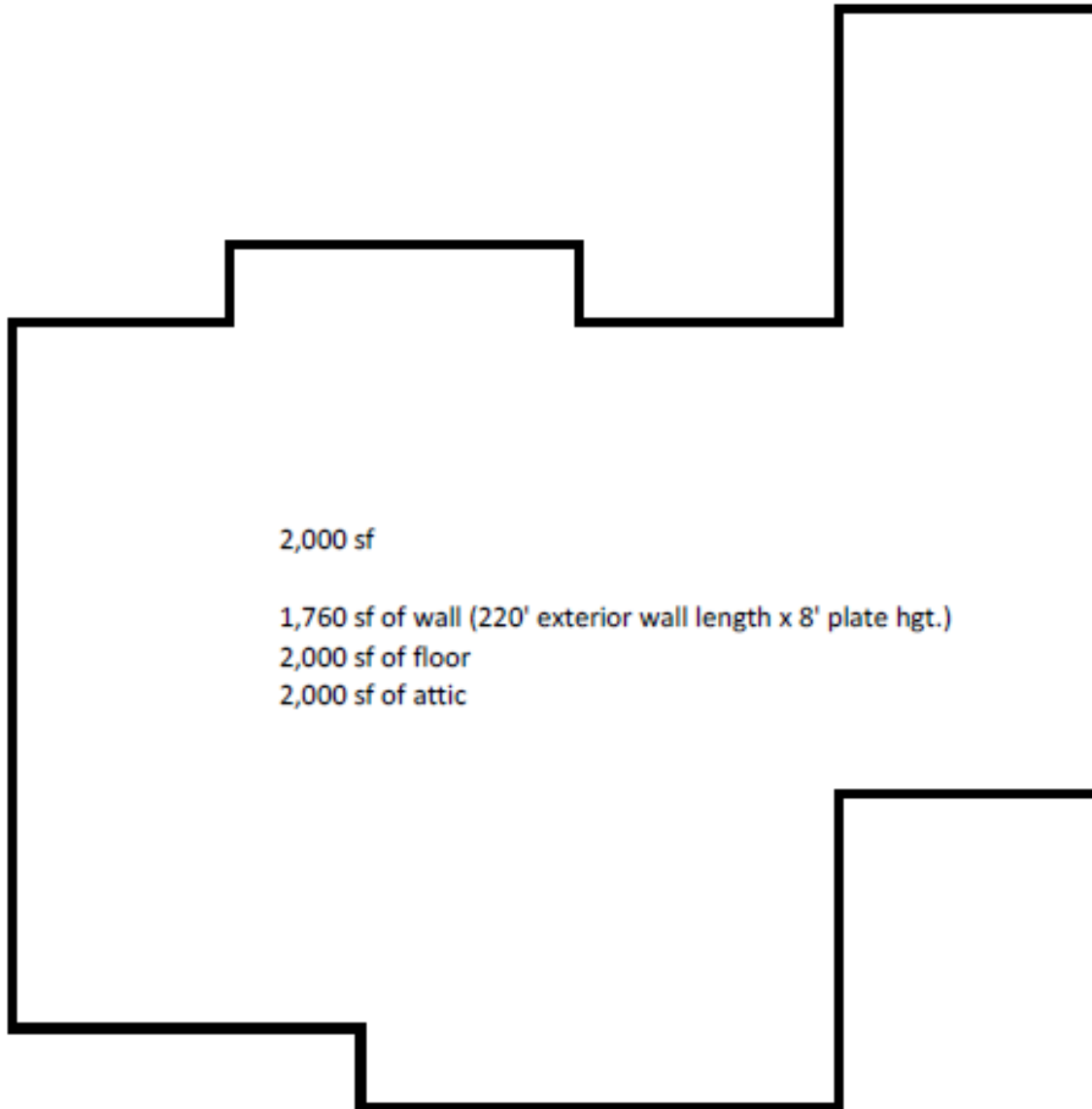
Heat loss is about R values more than Square Footage



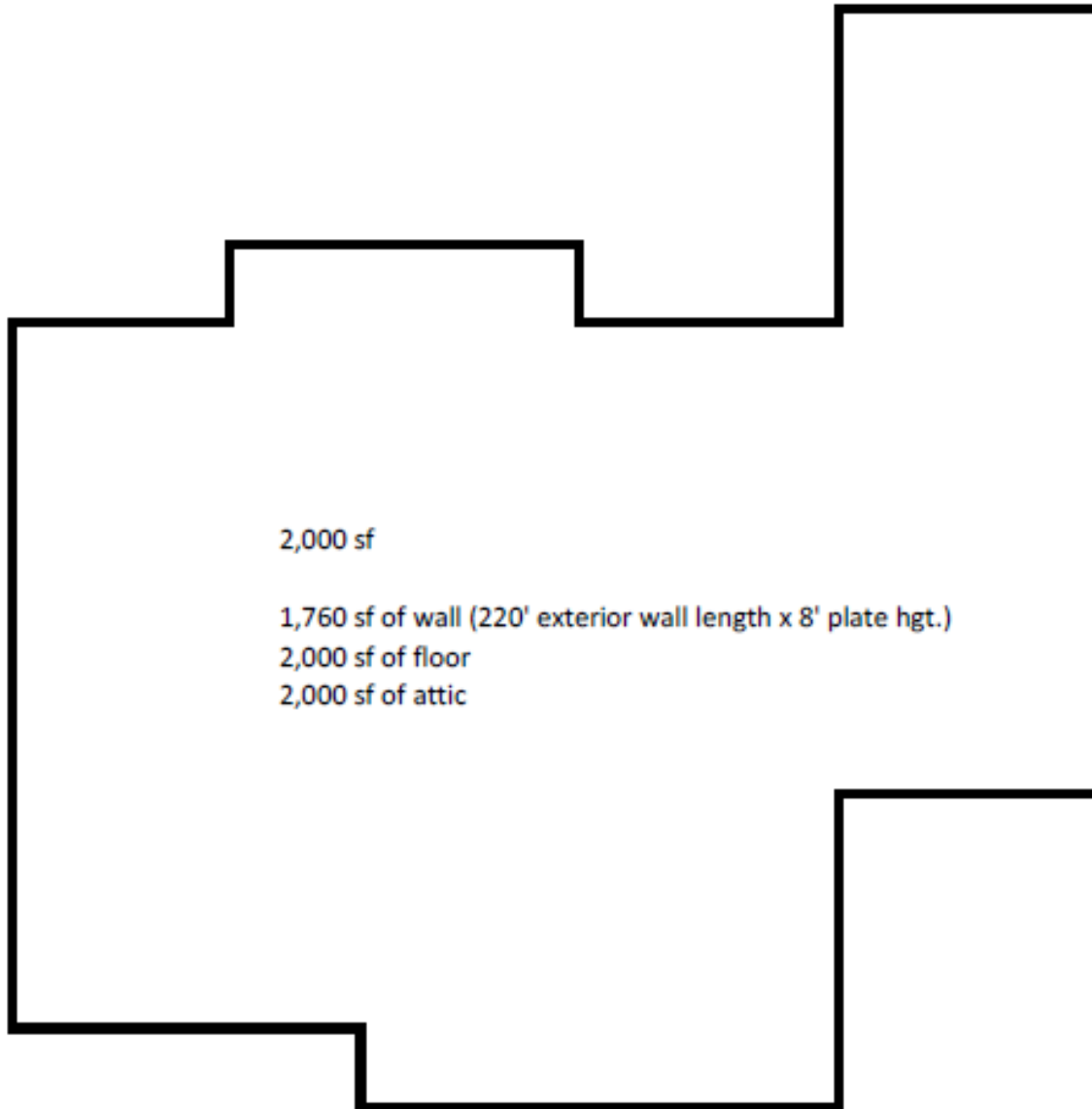
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Heat loss is about R values more than Square Footage



2,000 sf

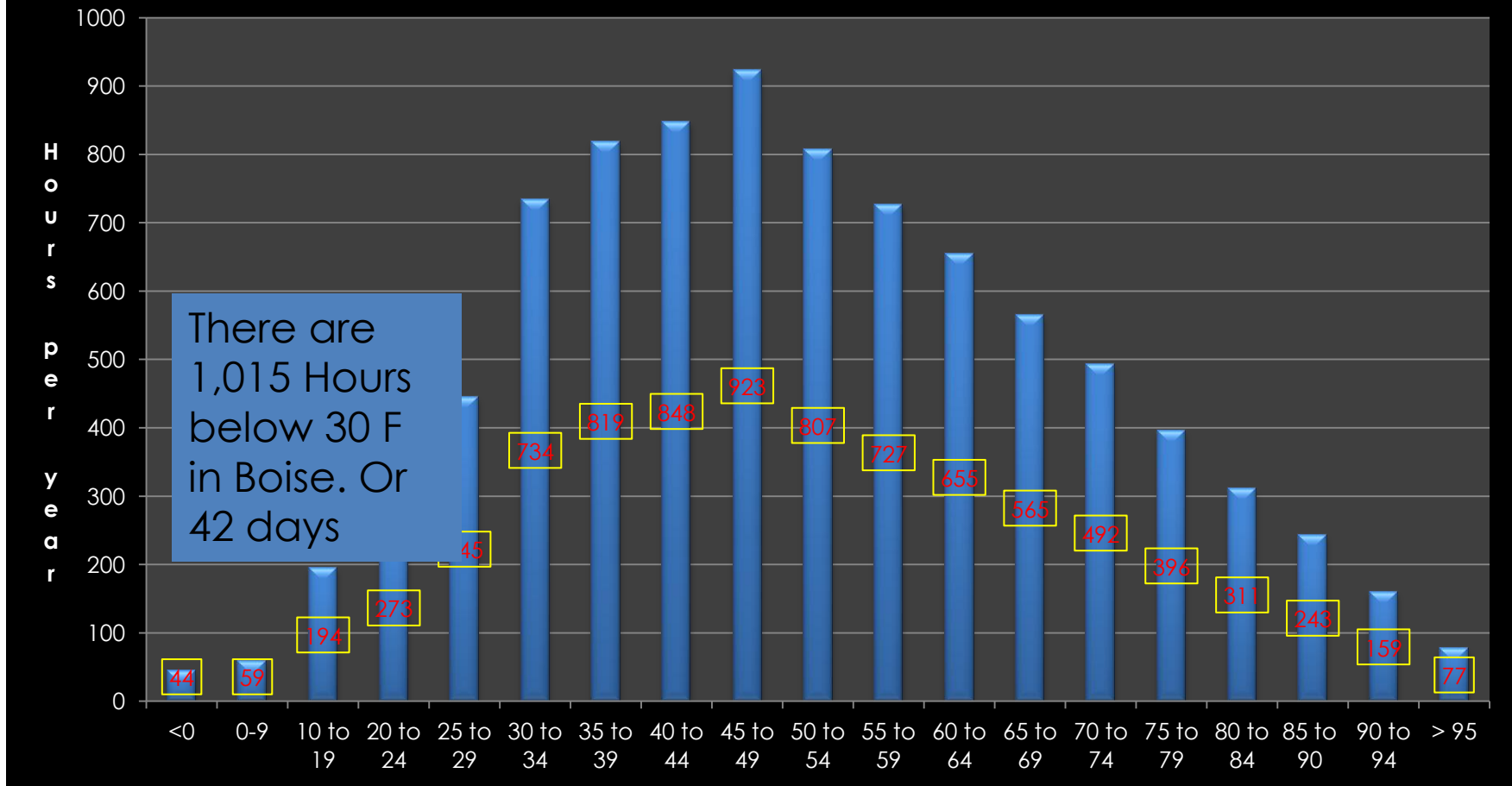
1,760 sf of wall (220' exterior wall length x 8' plate hgt.)

2,000 sf of floor

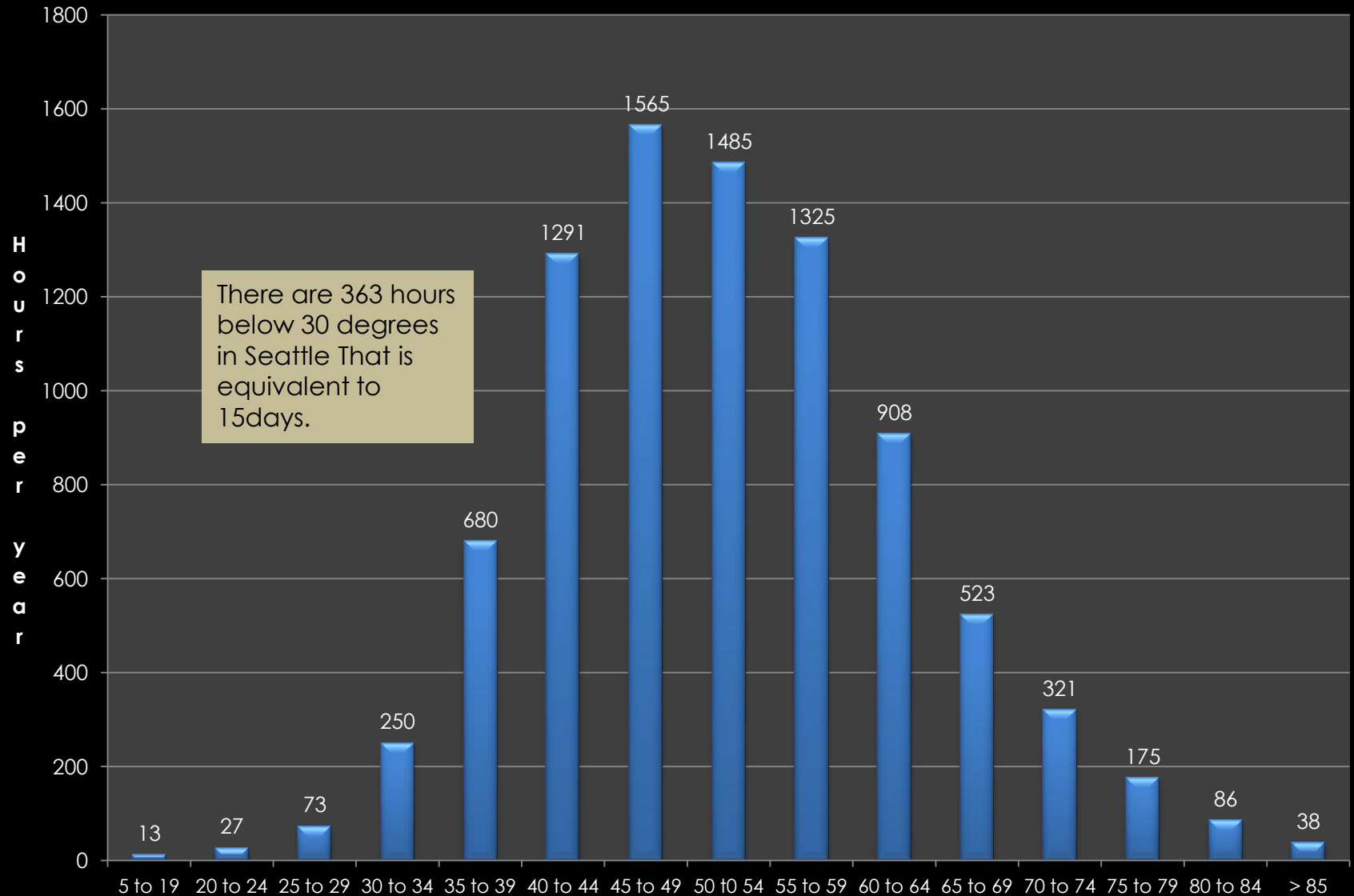
2,000 sf of attic

E-star home (Boise)	Old home (Boise)
11930	32256
3364	23200
3150	11466
<hr/>	<hr/>
18444	66922
<hr/>	<hr/>
9 btu/sq ft	33 btu/sq ft

Temperature Bins for Boise



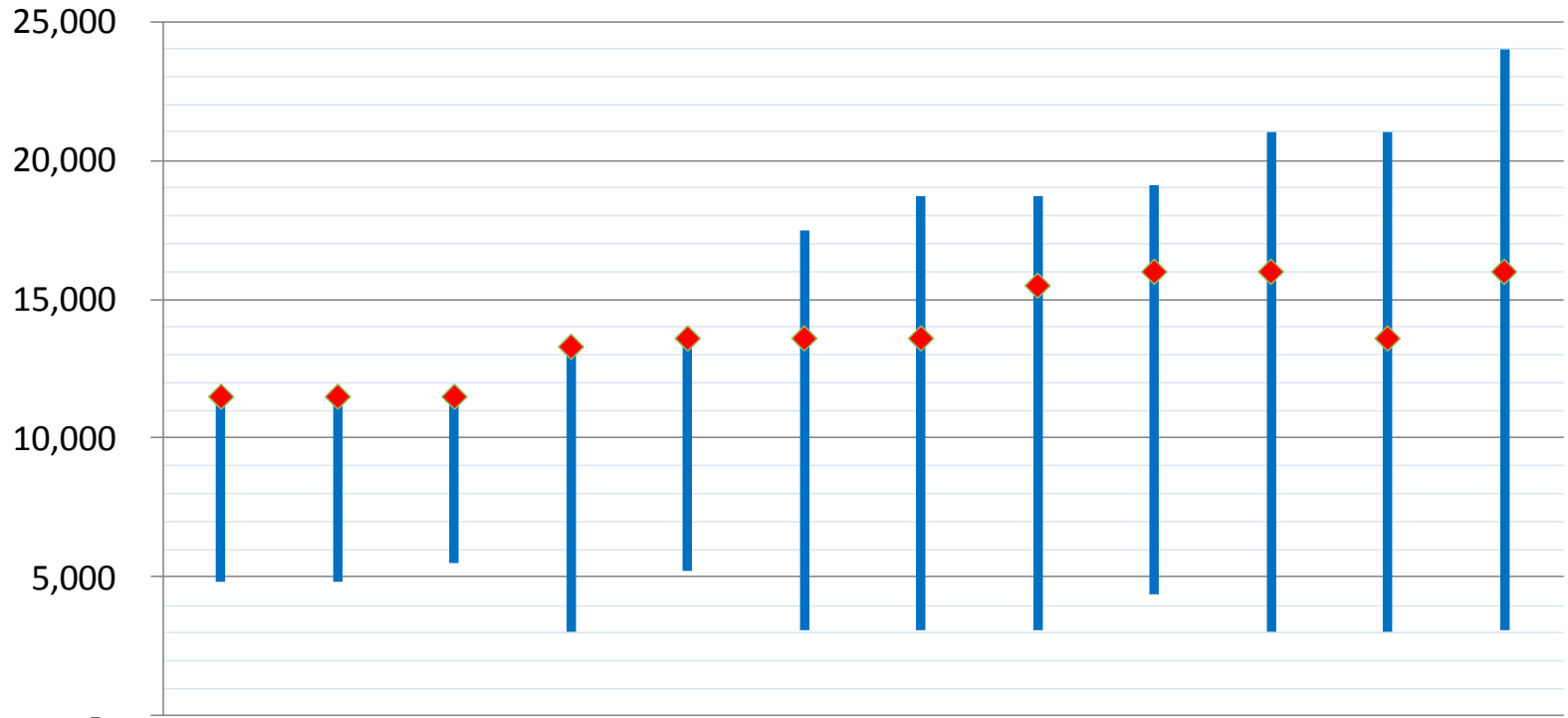
Seattle Temperature Bins



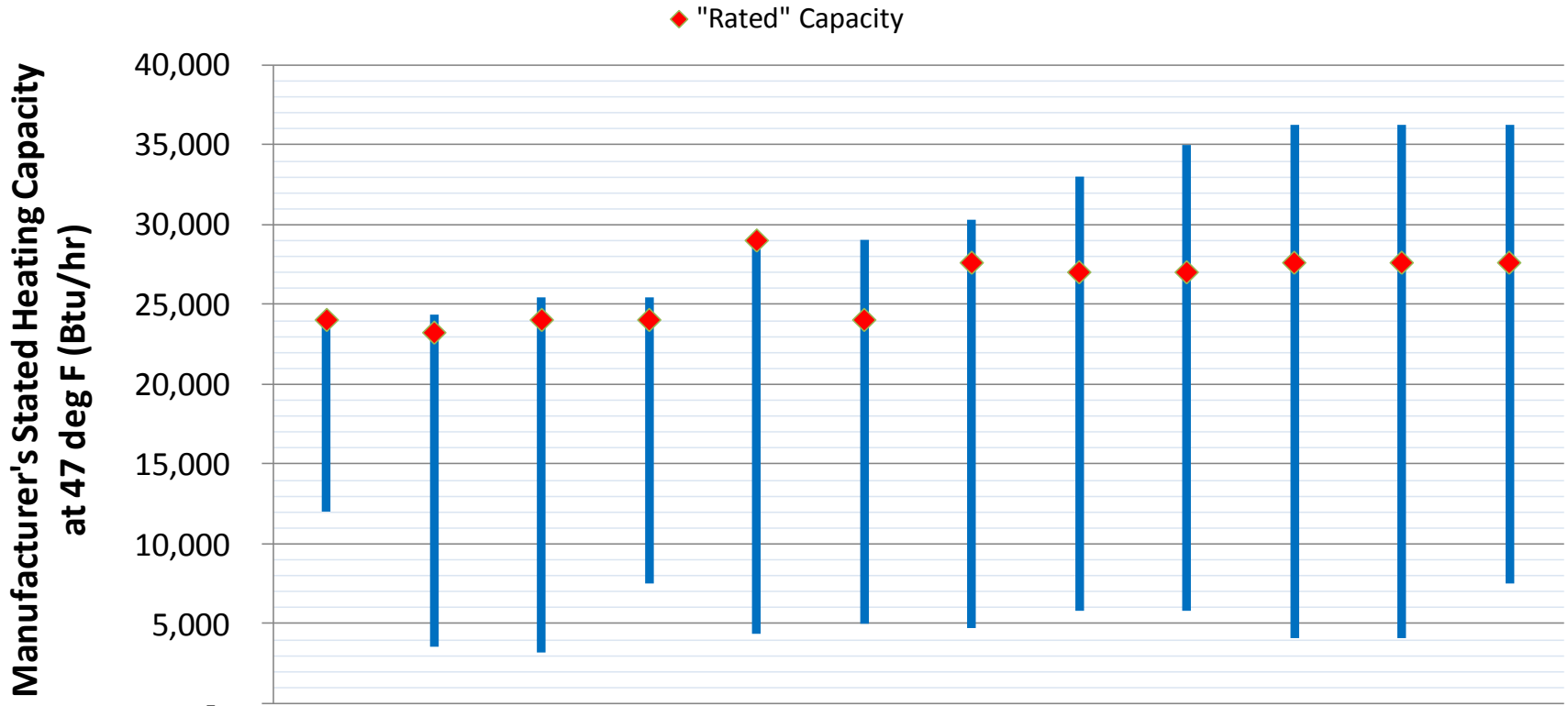
Comparison of Nominal 1-ton DHP Models

◆ "Rated" Capacity

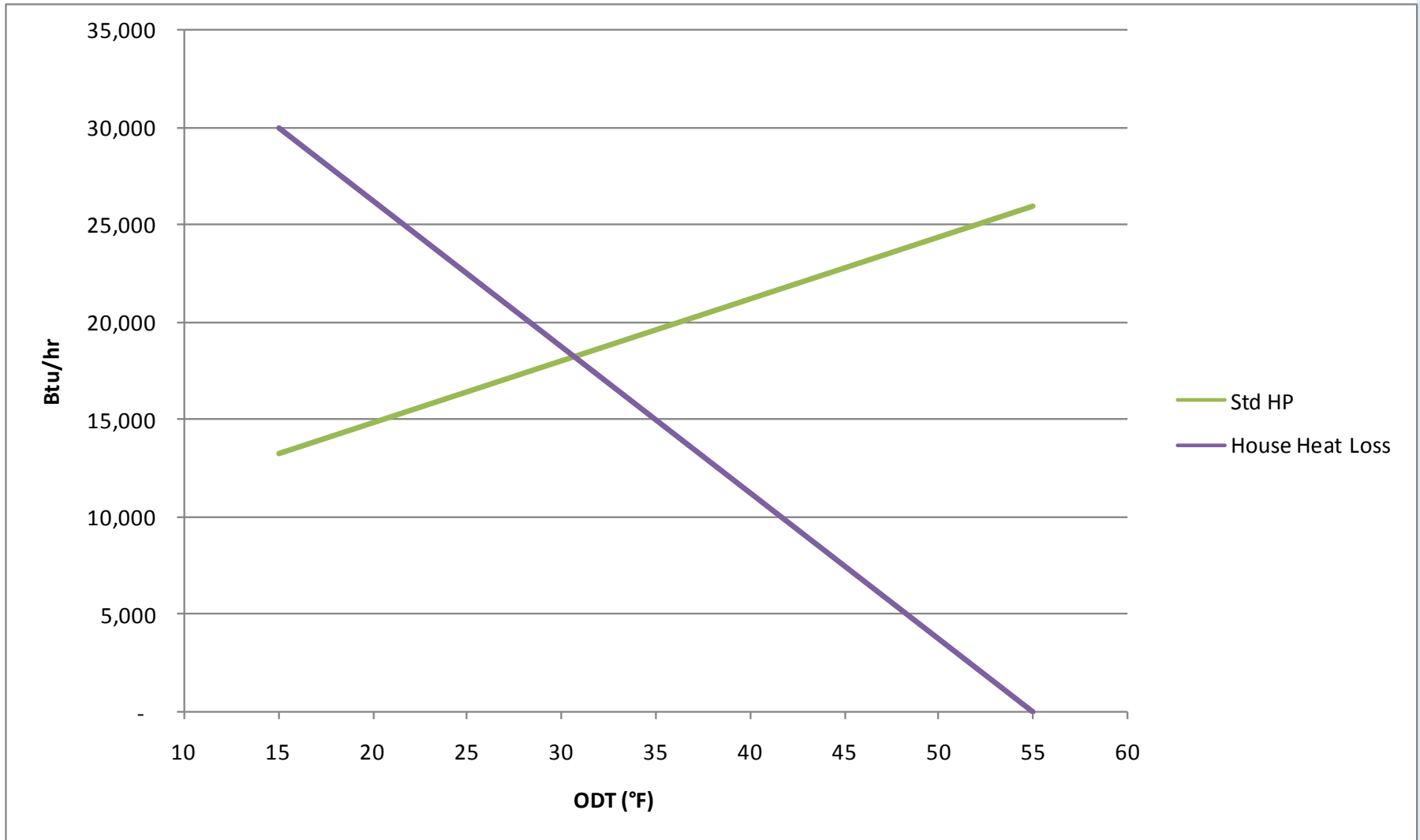
Manufacturer's Stated Heating Capacity
at 47 deg F (Btu/hr)



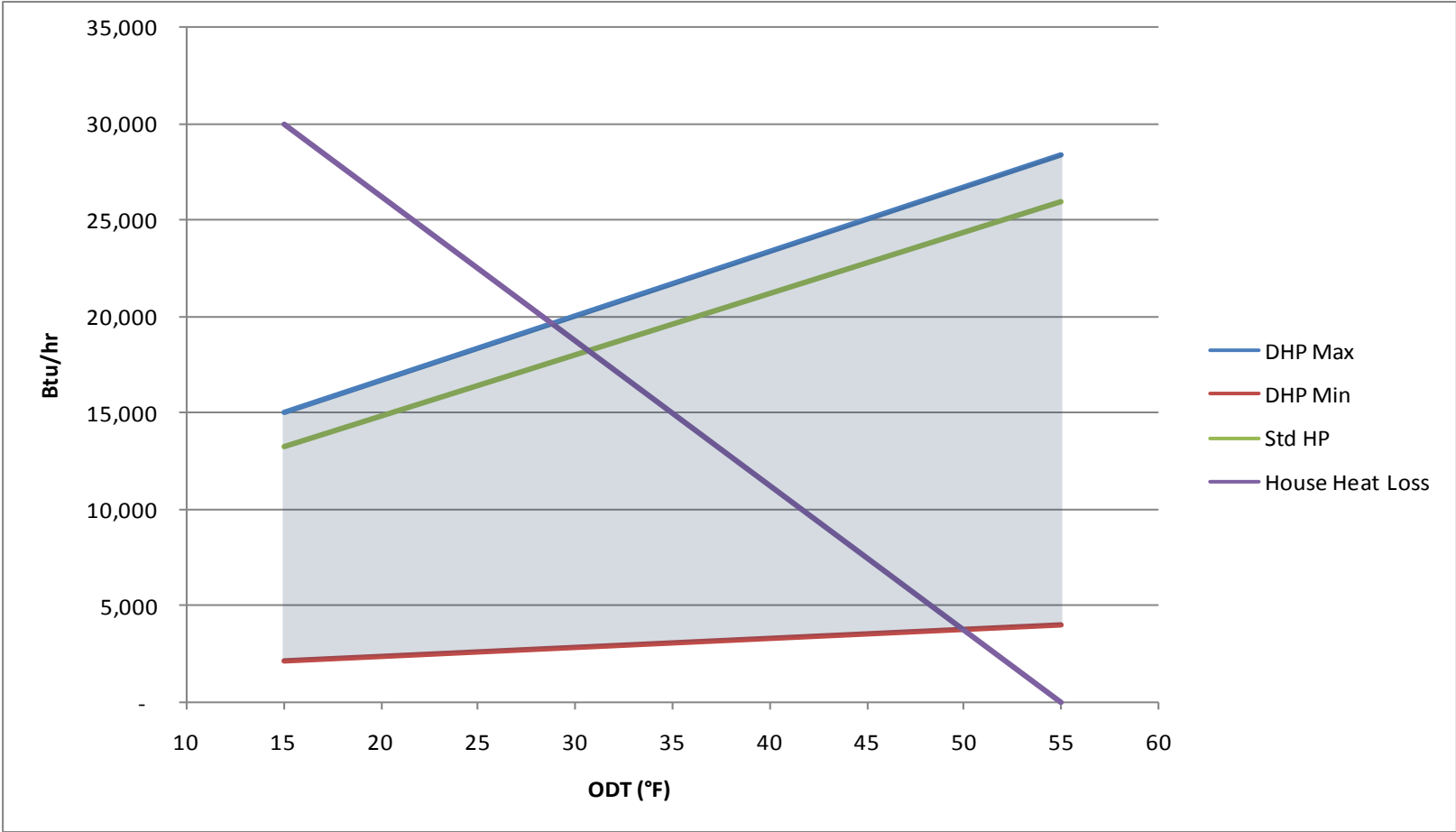
Comparison of Nominal 2-ton DHP Models



“Normal Heat Pump Sizing”



DHP Capacity



Backwards World: Efficiency goes up at part load conditions

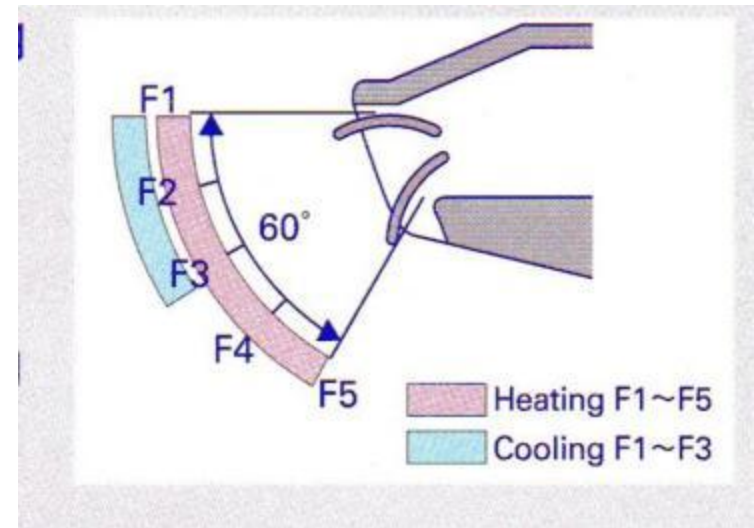
- Average Coefficient of Performance of Nominal 1-ton Units at 47 deg F:
 - Lowest Compressor Frequency: 4.7
 - Rated Compressor Frequency: 3.6
 - Highest Compressor Frequency: 3.0



Sizing DHPS Also Means Sizing and Placing of that really Cool Diffuser

1: Let the flow go. Don't block the throw of the indoor unit. No close walls, beds, etc

2: Try to align larger units with central hallways



My Spidey Sense About Comfort and Ductless Heat Pumps or Why are folks so Happy With DHPs

Hot air in winter,
even when cold

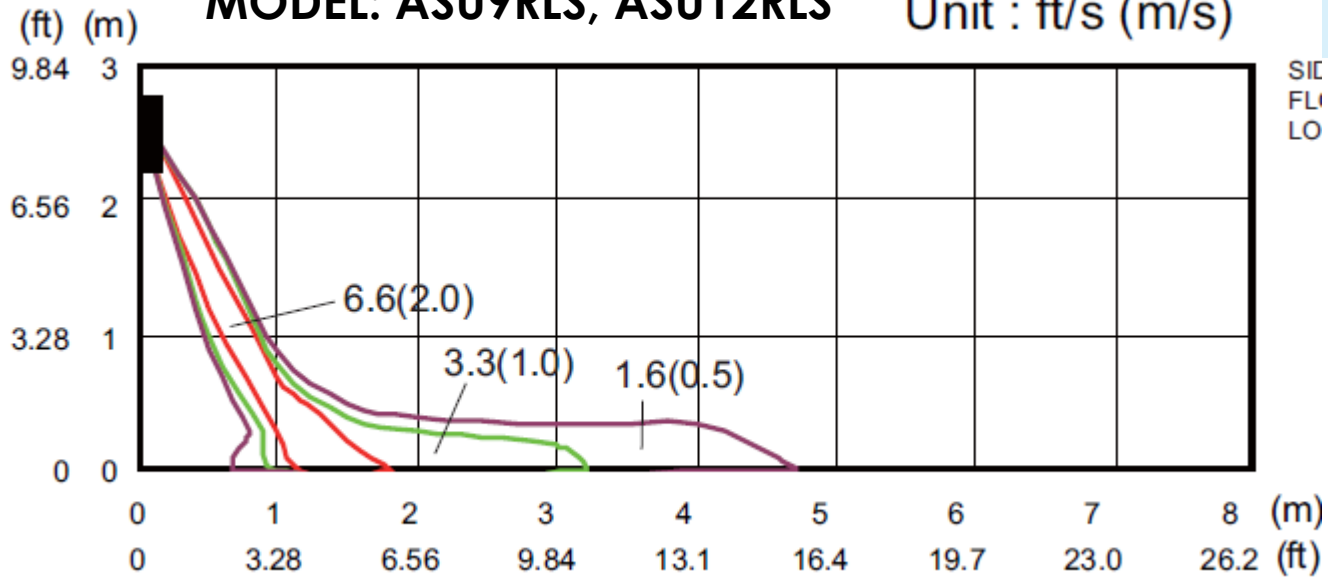
Super smart
diffusers, warm
floors in winter,
great throw and
spread

Almost continuous
airflow, thermal
stratification kept
to a minimum



MODEL: ASU9RLS, ASU12RLS

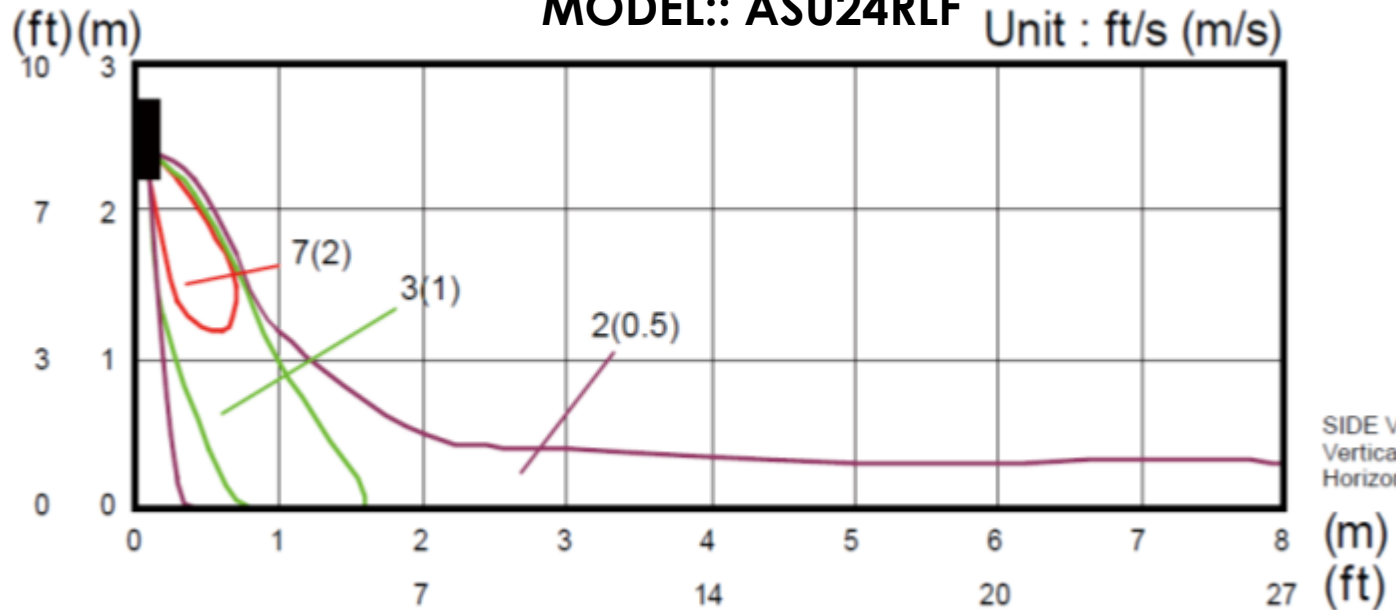
Unit : ft/s (m/s)



SIDE
FLU
LO

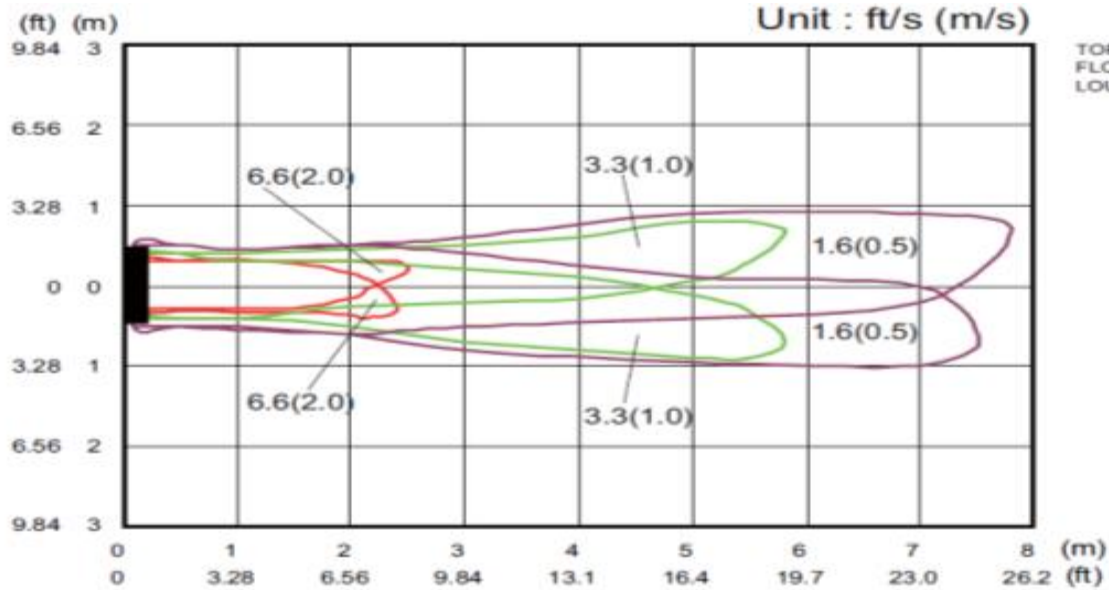
MODEL:: ASU24RLF

Unit : ft/s (m/s)

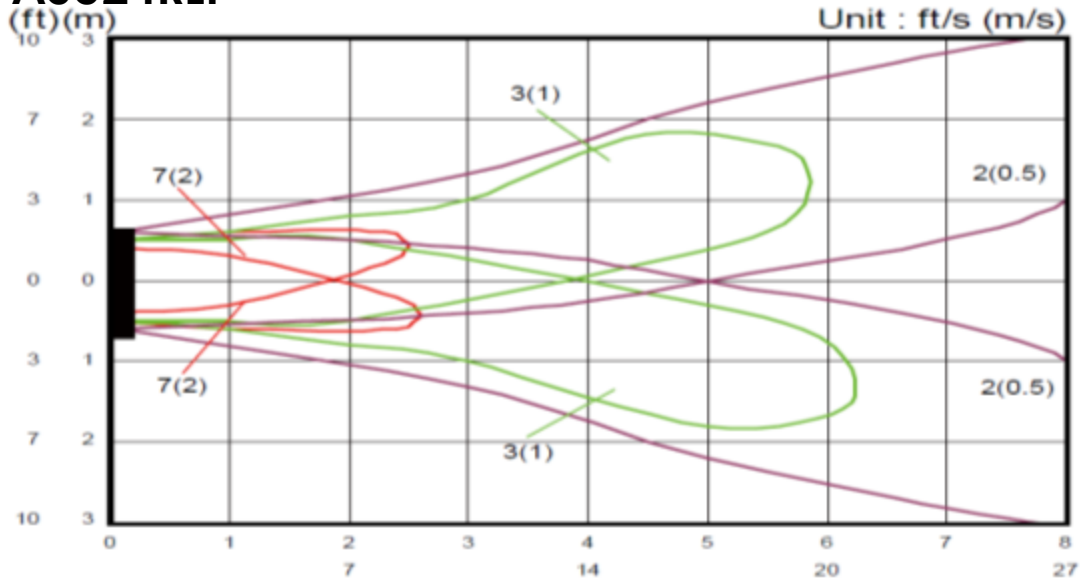


SIDE V
Vertical
Horizor

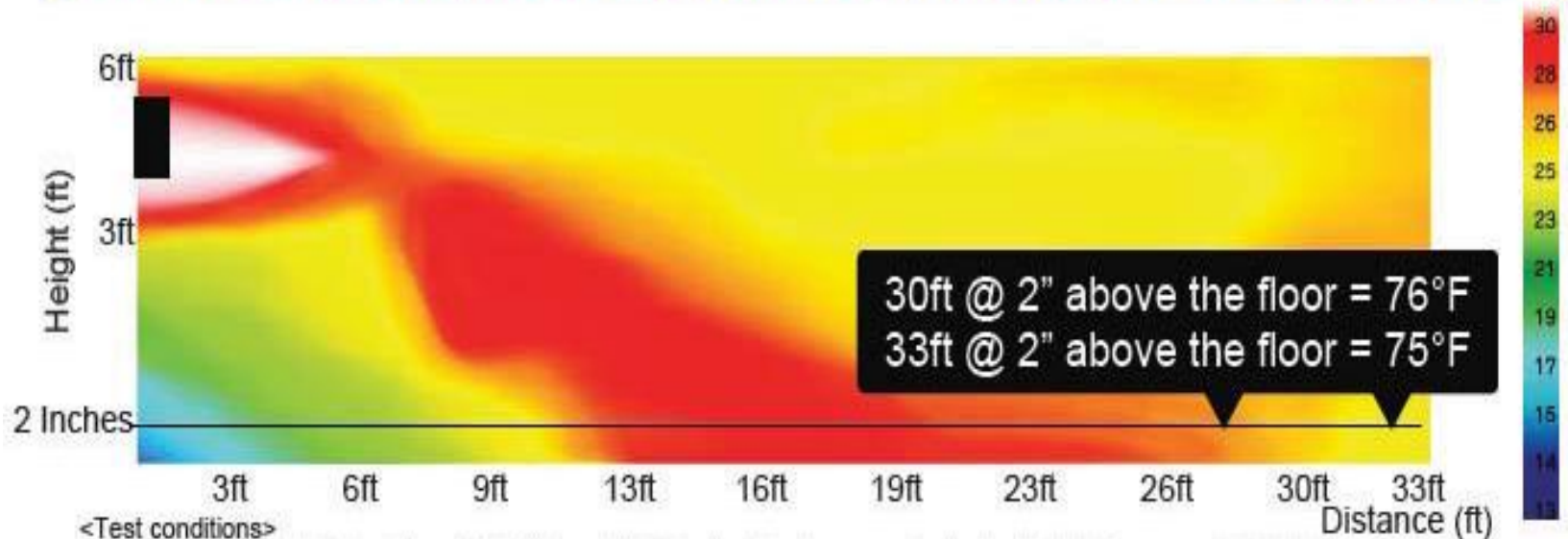
MODEL: ASU9RLS, ASU12RLS



MODEL:: ASU24RLF



Effective Air Throw & Temperature Distribution for Larger Rooms



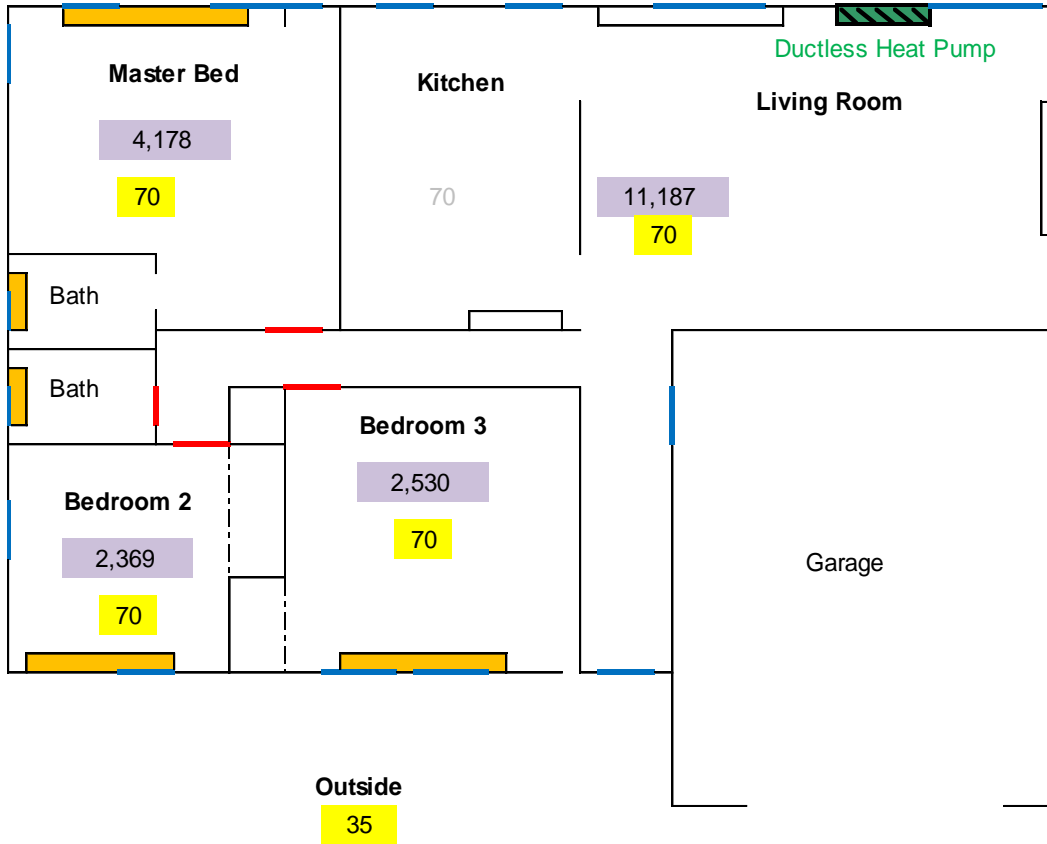
<Test conditions>

Outdoor temp.: 35°F R/C setting: 73°F, "Powerful" 30 min. later the operation is started. Test room : 350ft² Test model :

FTX04011/11

35°F 70°F Throughout the House

Cold Day, Bedroom Doors Closed, Resistance setting = 70



	1-ton HP	2-ton HP
DHP Capacity	12,000	20,000
House Heat Load	20,263	
Load on DHP	11,187	11,187
Load on Resistance	9,076	9,076

DHP Load	55%	55%
Resistance Load	45%	45%

DHP Load Factor	93%	56%
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Units = btu/hr

35°F ... “Temperature Float” Allowed

Cold Day, Bedroom Doors Open, Resistance setting = 60



	1-ton HP	2-ton HP
DHP Capacity	12,000	20,000
House Heat Load	17,918	
Load on DHP	12,000	17,918
Load on Resistance	5,918	0

DHP Load	67%	100%
Resistance Load	33%	0%

DHP Load Factor	100%	90%
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Units = btu/hr

What We Think We Know About Sizing

- Air distribution matters: don't block the air flow. Larger room, larger system.
- Float Vs No Float. If no float, size downwards
- In colder climates, install larger system
- Benefits happens regardless of system size
- Align larger units with central hallways
- Go bigger in colder climates