LAZY A/C with KEN GEHRING

President Emeritus at Therma-Stor

The Weather on Earth

Weather in most regions range from very comfortable to life threatening.

Because weather depends on massive weather systems moving around the earth, you may have weather typical of the last season, current season or the next season.

Weather systems typically pass in 1-14 days.

Follow man's search for survival and comfort.

Outline

Weather's Seasonal
Impact on the House
as a System

Current Best Practices

Concerns

The Lazy A/C

The Gold Standard

Four Seasons of the year in a “Green Grass Climate”

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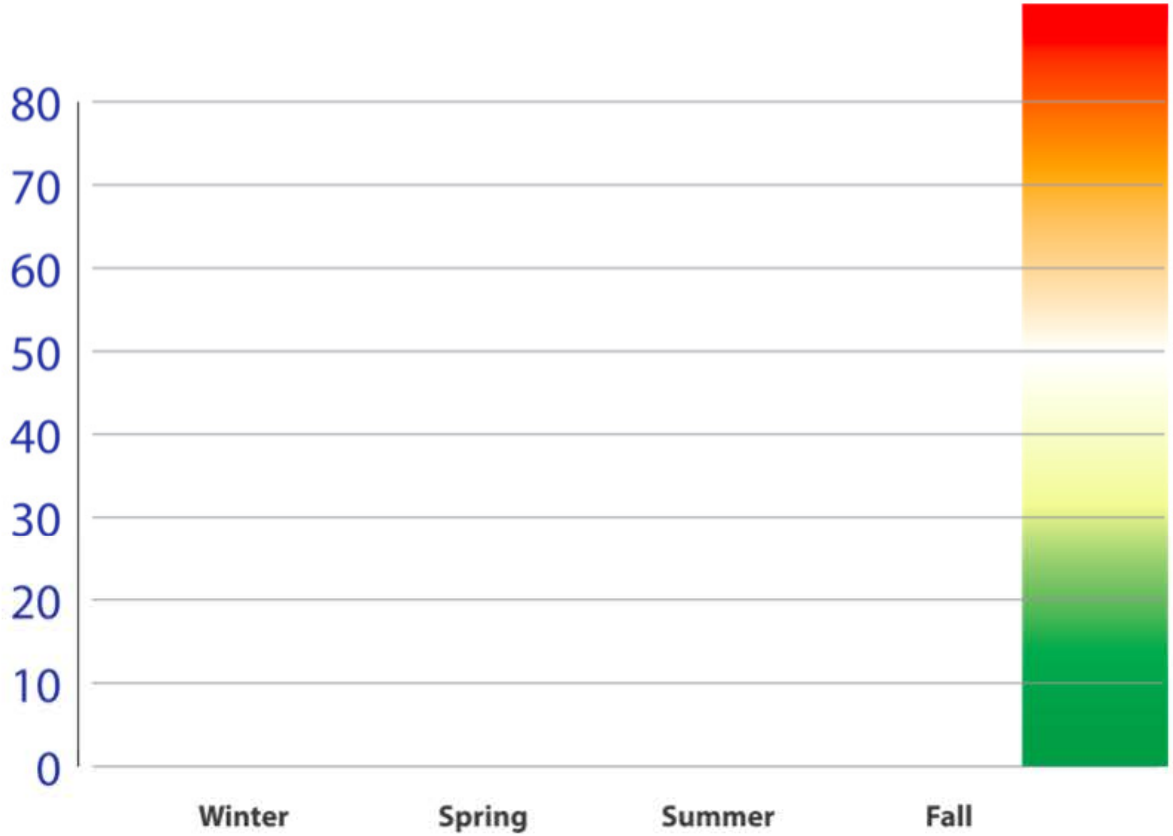

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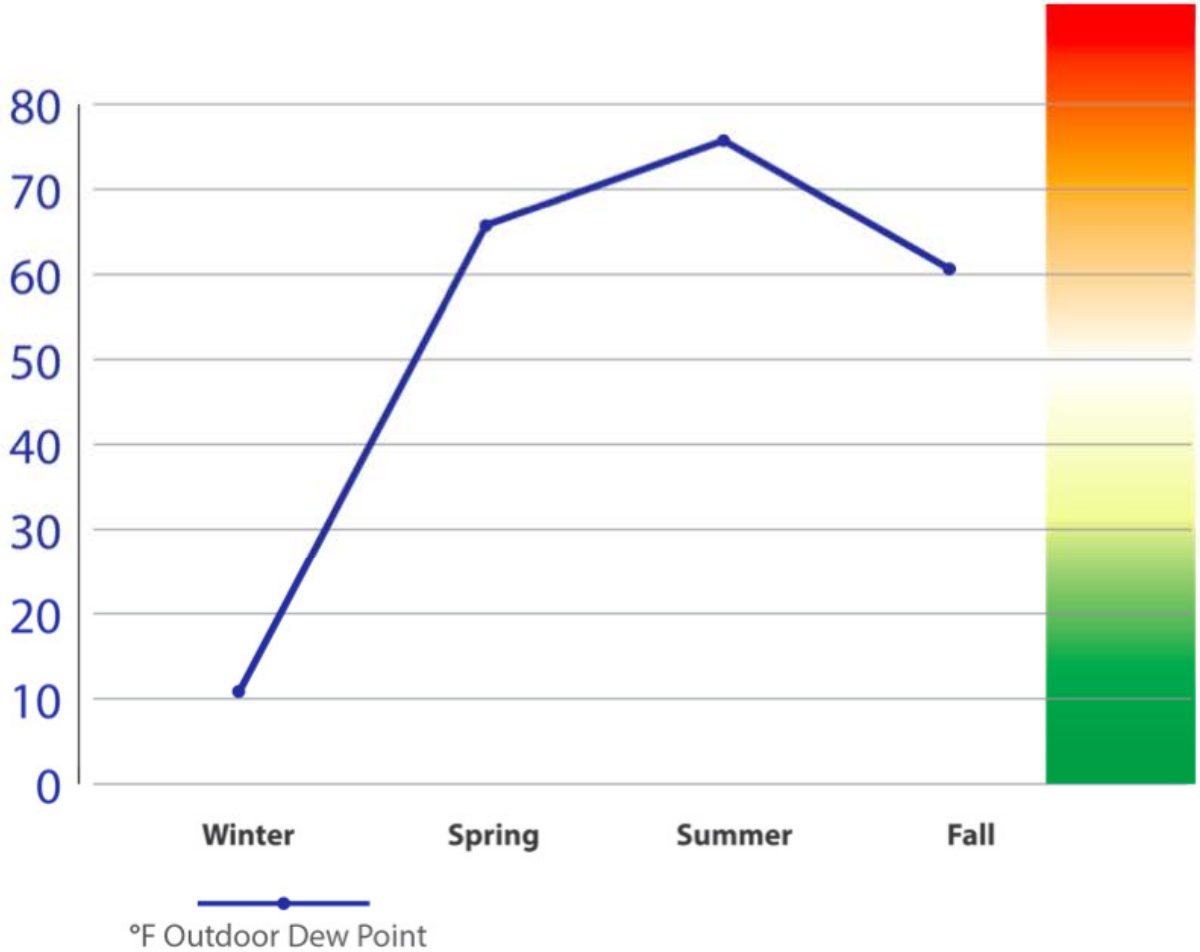

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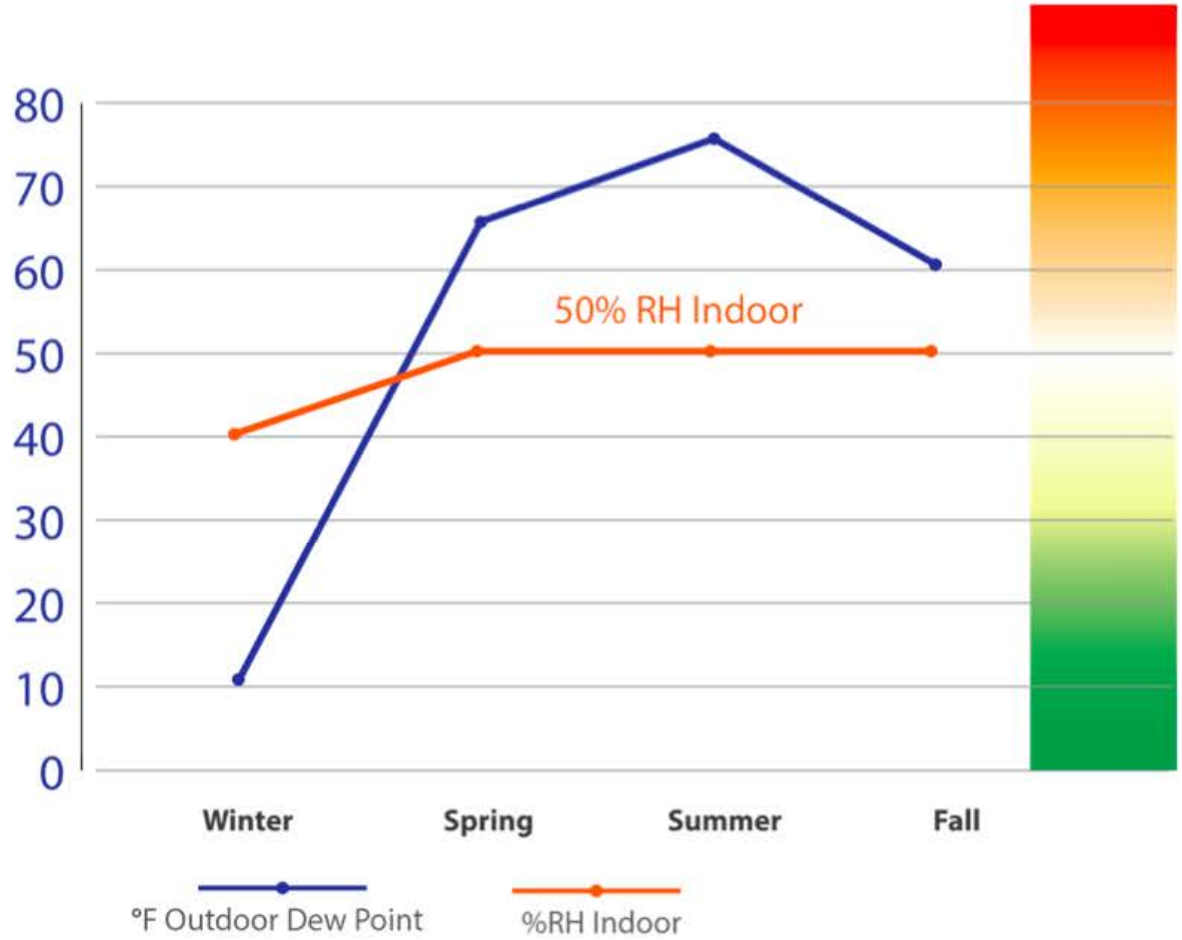

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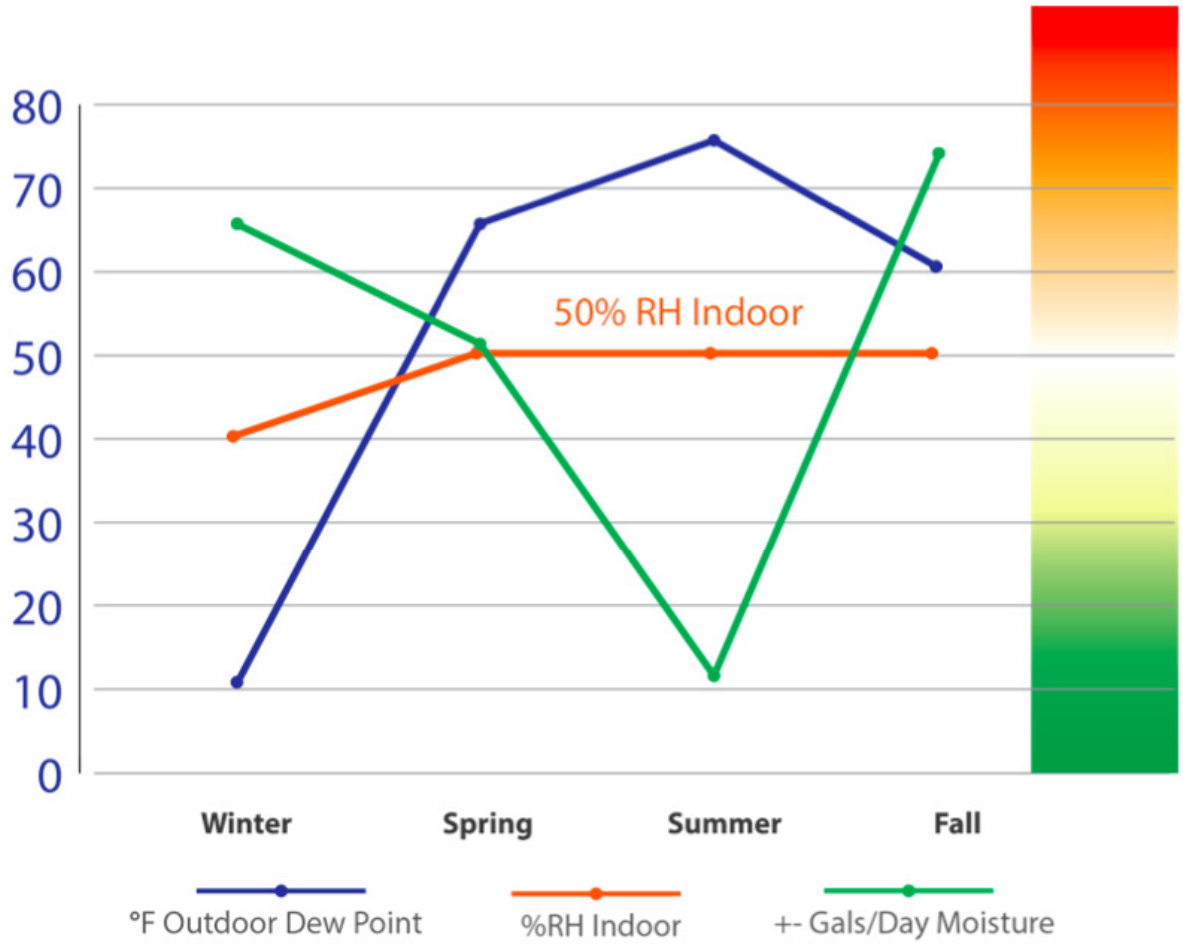

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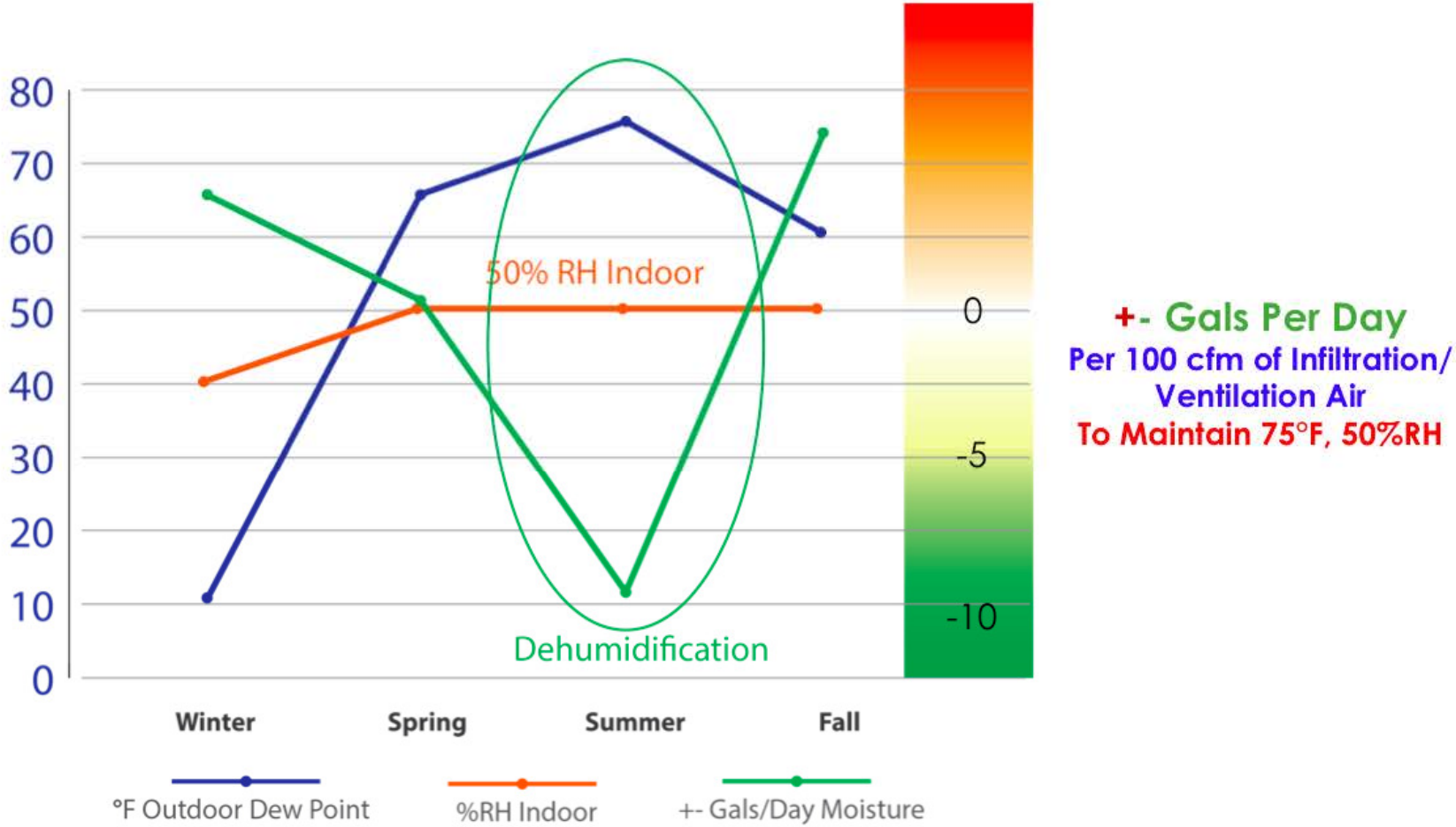

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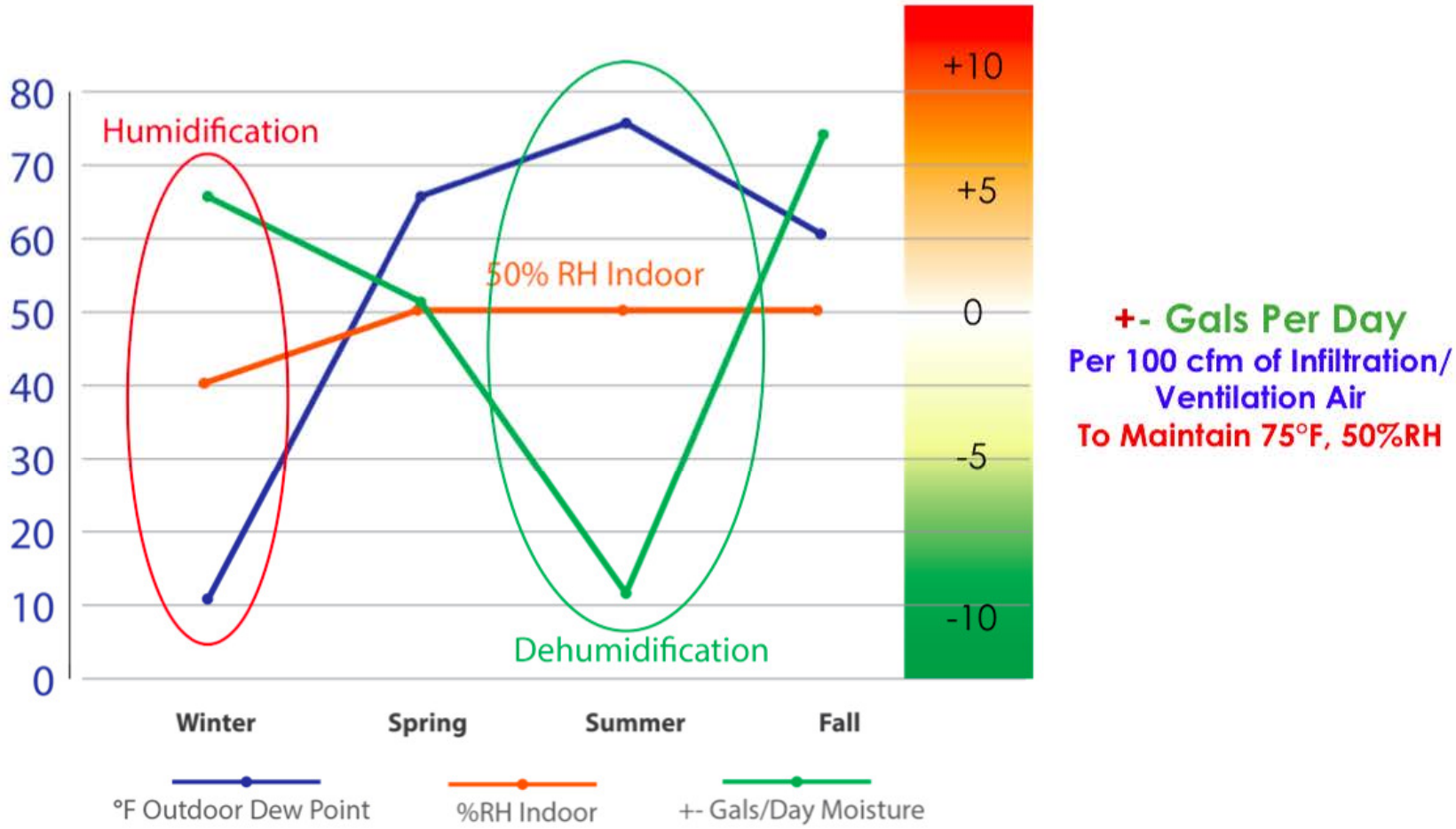
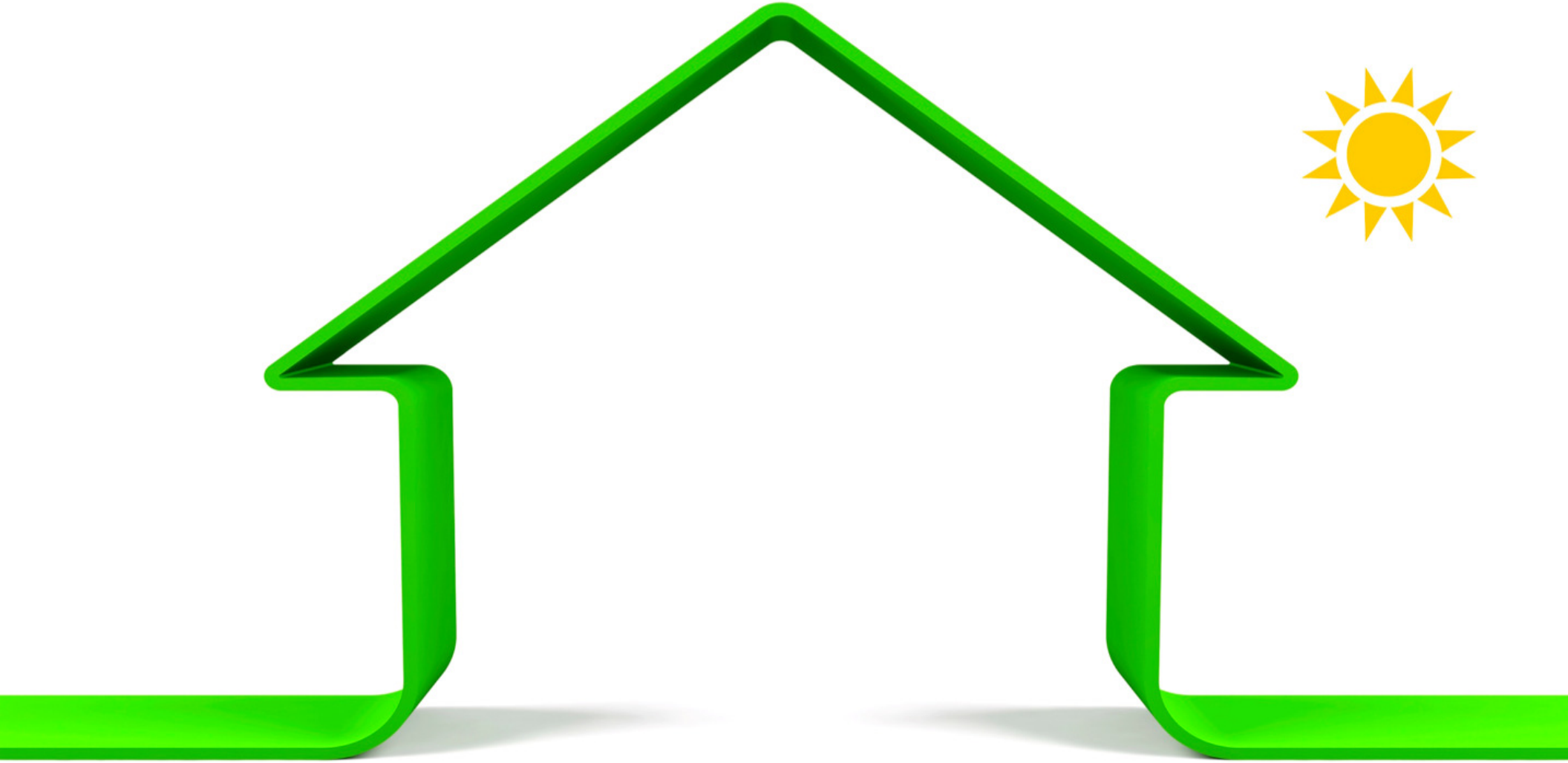
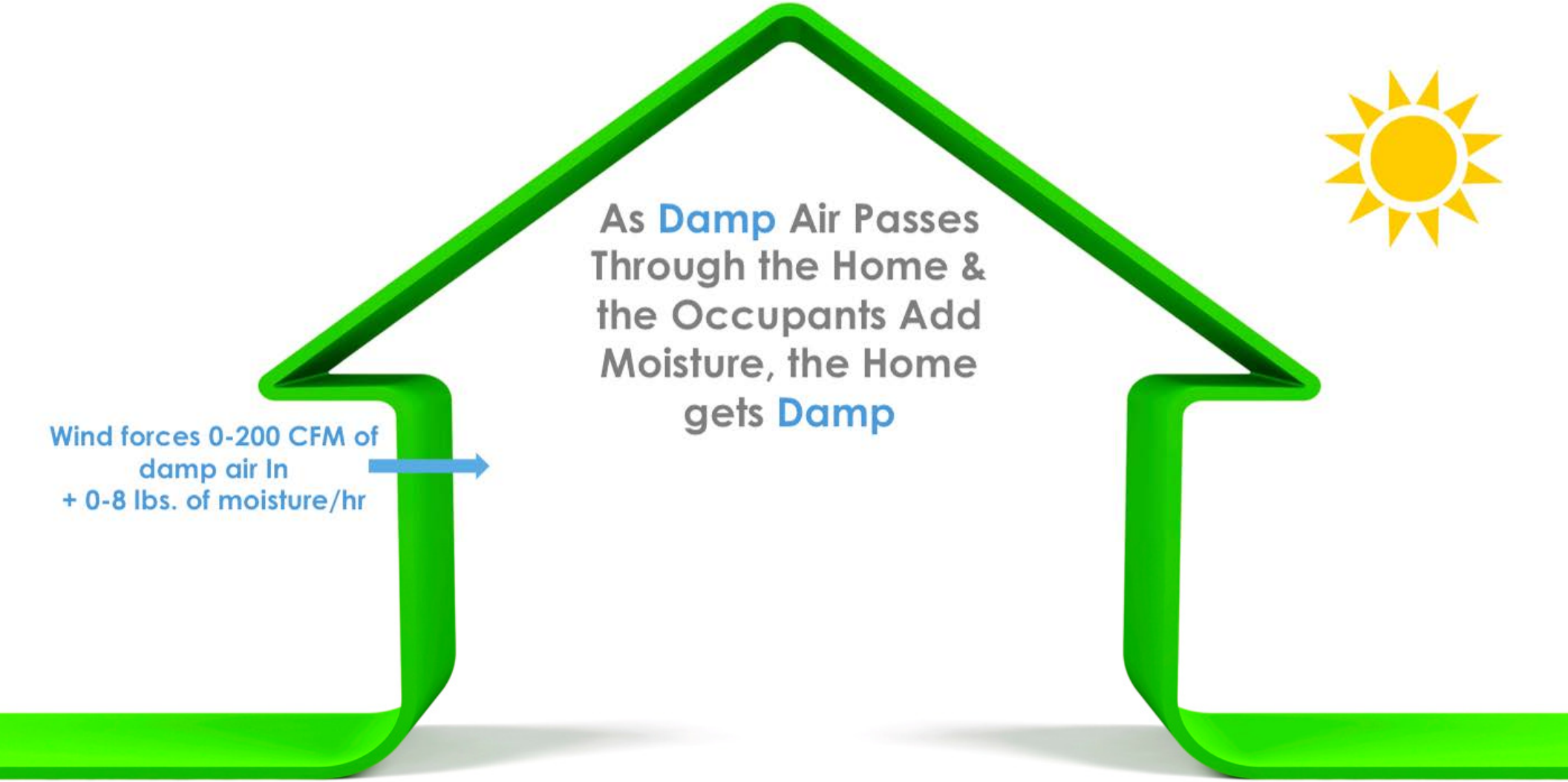


The House as a System



As Damp Air Passes Through the Home & the Occupants Add Moisture, the Home gets Damp


As Damp Air Passes Through the Home & the Occupants Add Moisture, the Home gets Damp
Wind forces 0-200 CFM of damp air In
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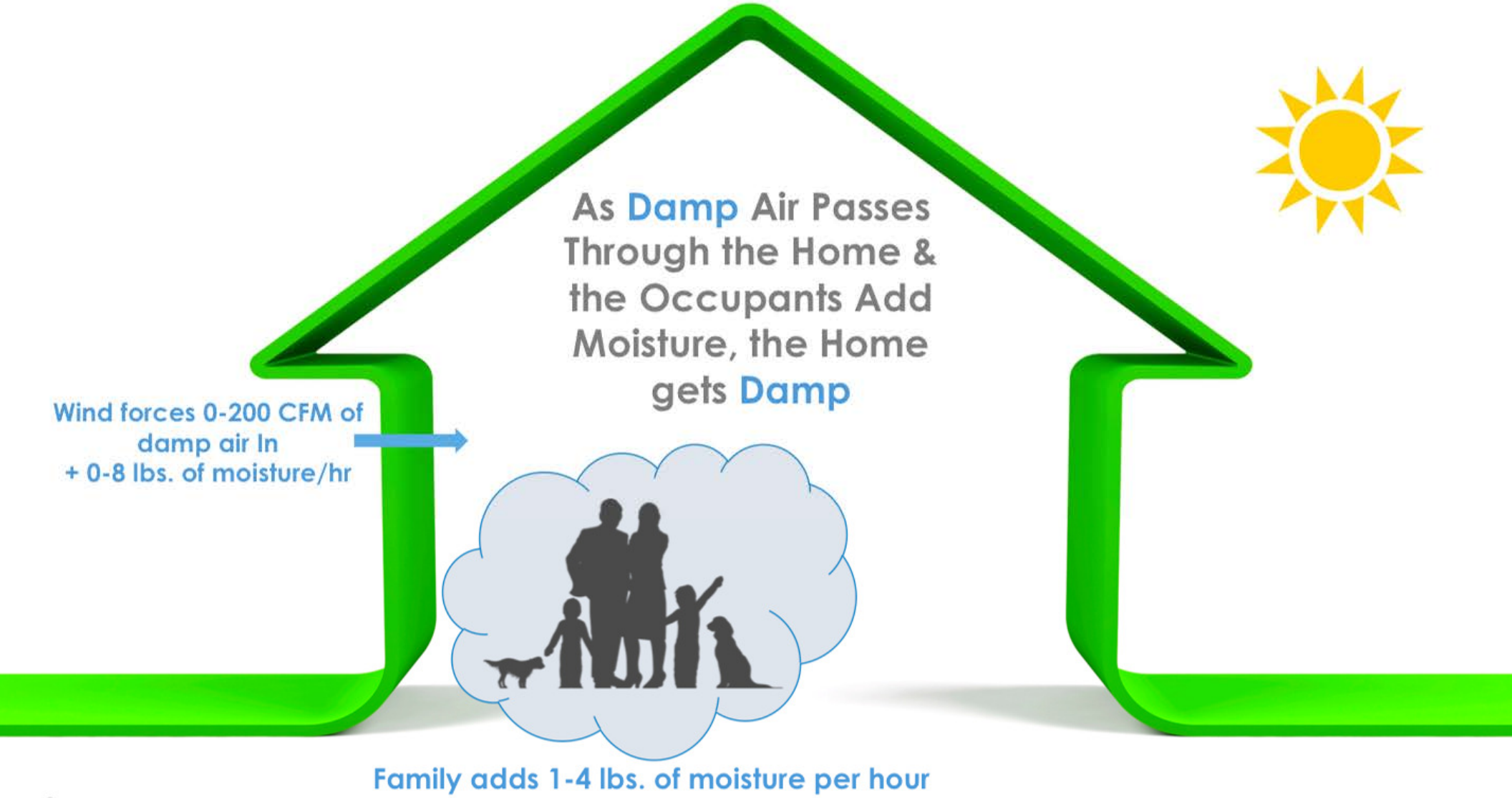
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Wind forces 0-200 CFM of damp air In
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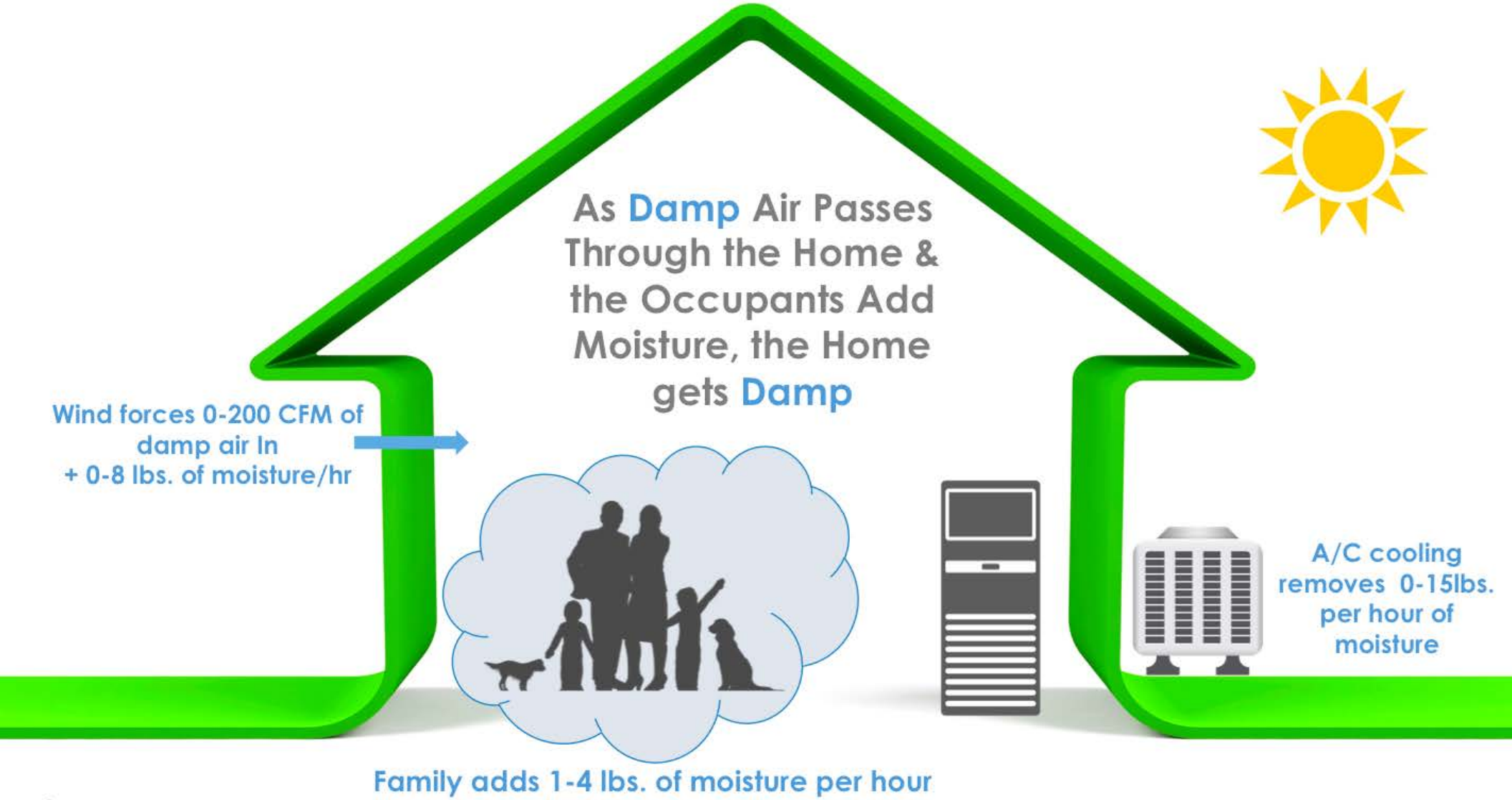
Family adds 1-4 lbs. of moisture per hour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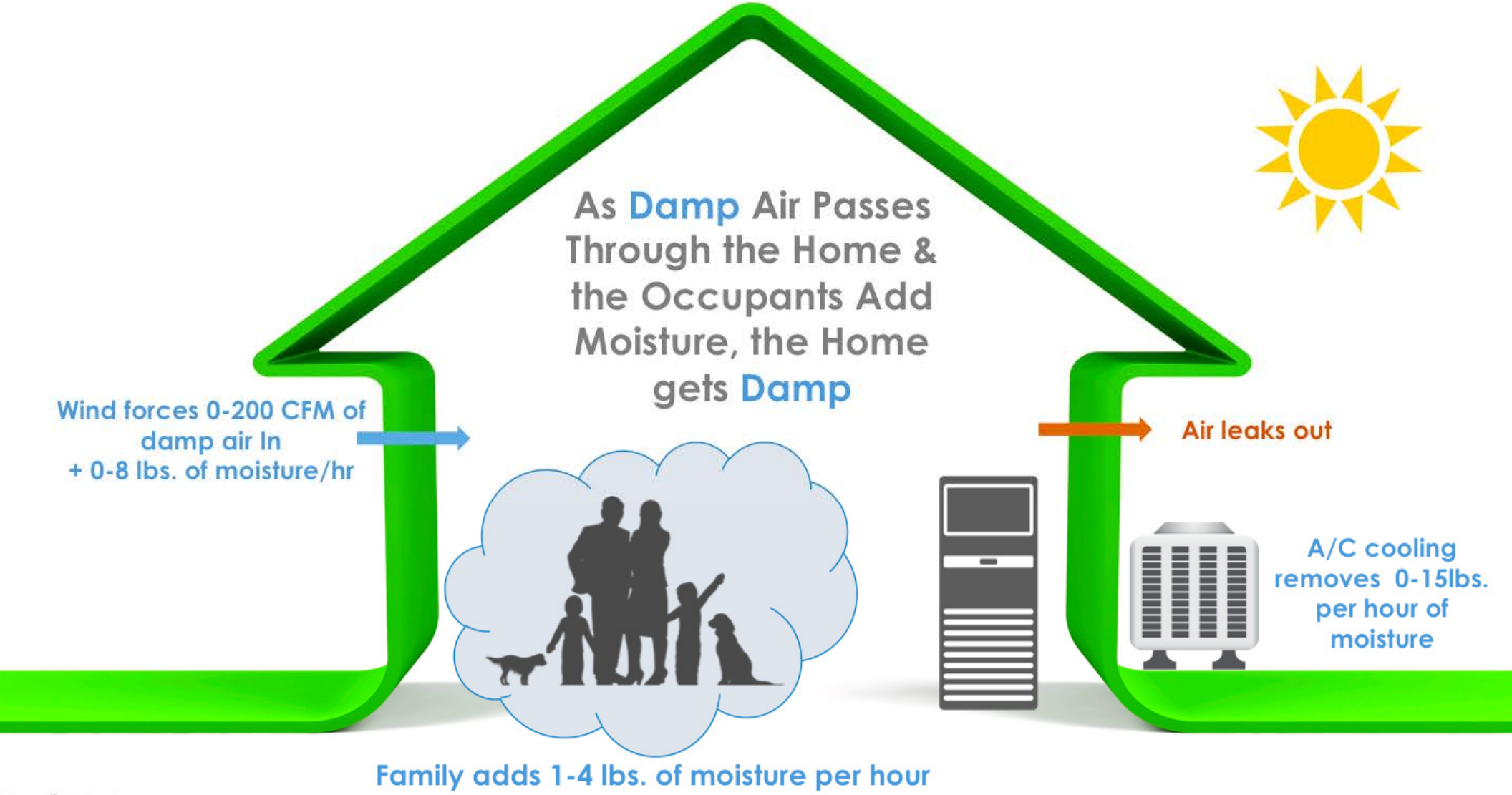
A/C cooling removes 0-15lbs. per hour of moisture
Family adds 1-4 lbs. of moisture per hour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Wind forces 0-200 CFM of damp air In
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Air leaks out
A/C cooling removes 0-15lbs. per hour of moisture
Family adds 1-4 lbs. of moisture per hour

Complete IAQ:

Dehumidification in Warm-Humid CZs

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Install equipment with sufficient latent capacity to maintain indoor RH ≤ 60%.

Options are:

- Additional dehumidification system(s), OR
- Central HVAC system with additional controls to operate in dehumidification mode.

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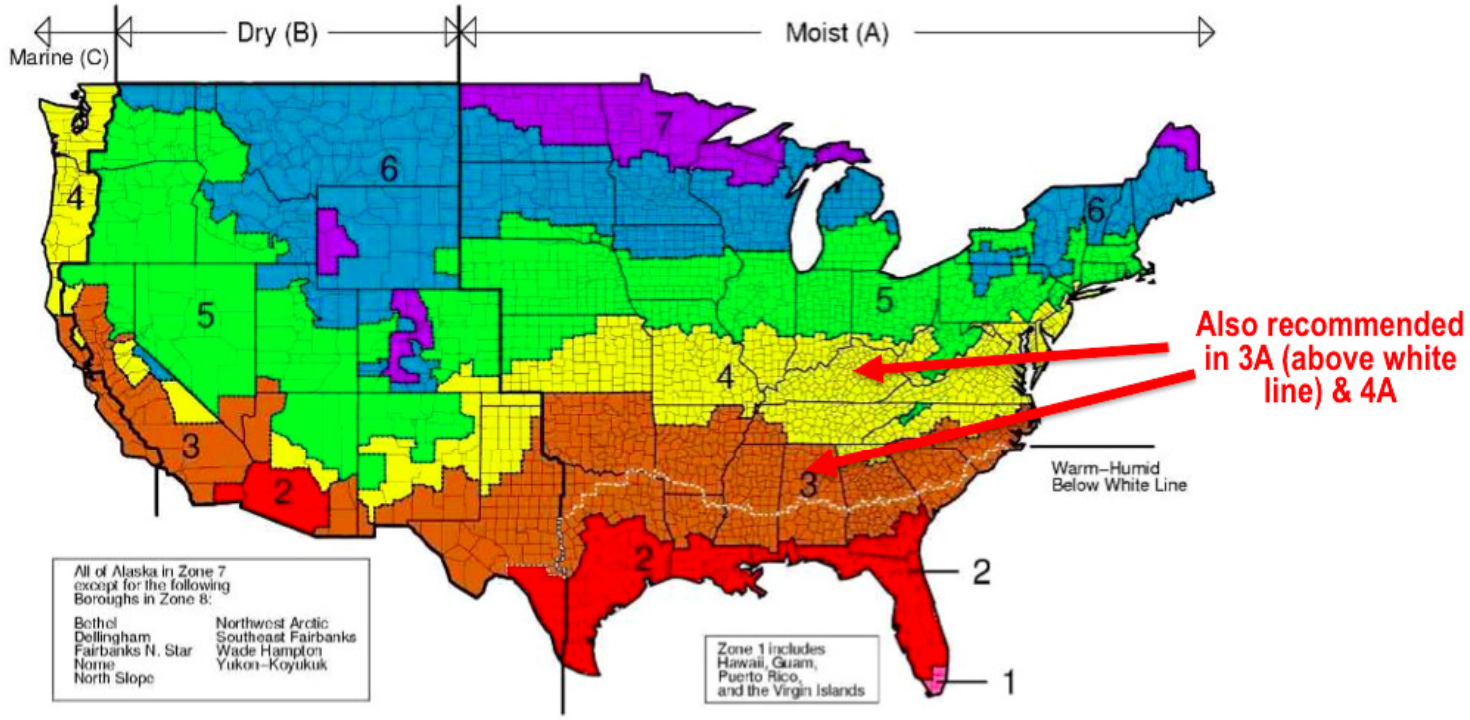
HVAC+
Dehumidification in Warm-Humid CZs

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy



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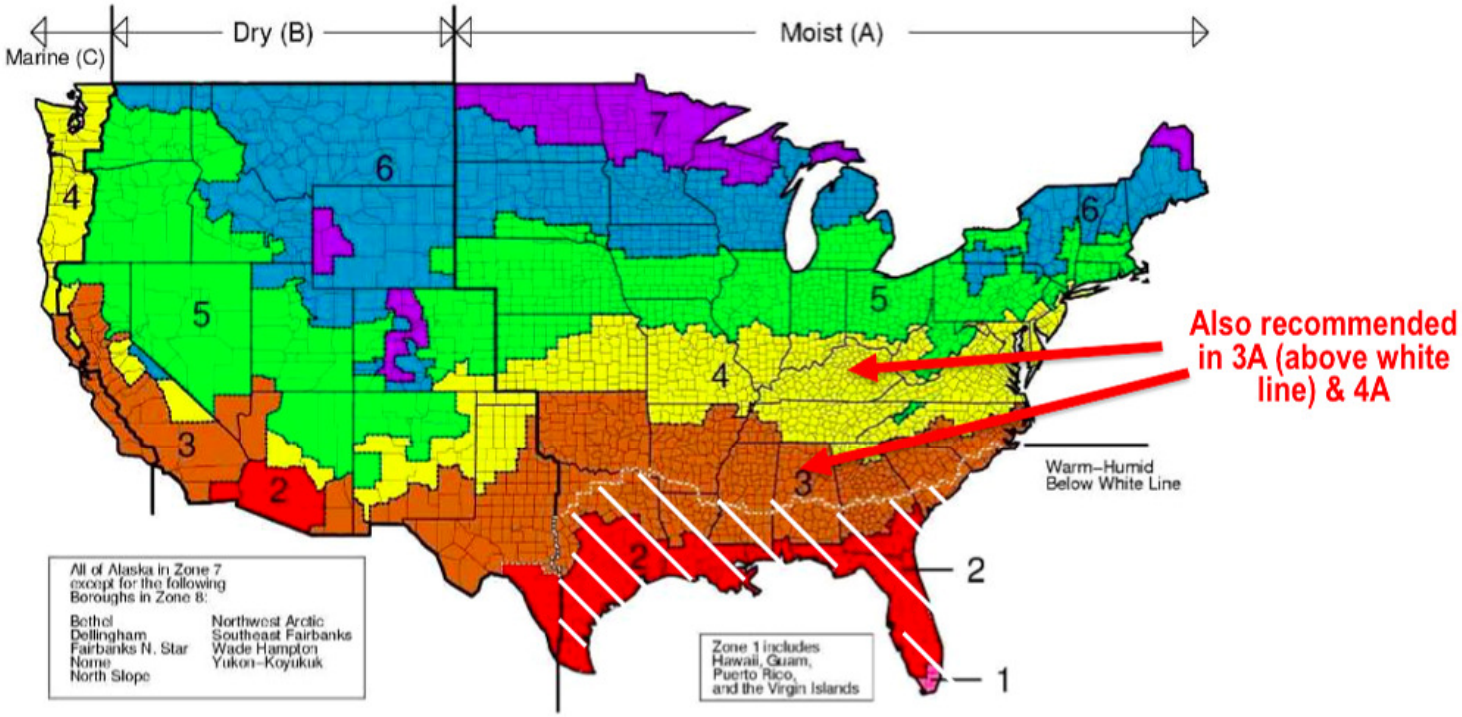

Best Practices

Design Indoor Cooling Temp.: 78 °F

Design Outdoor Cooling Temp.: 93 °F

Temp. Difference Cooling: 15°F

Indoor Humidity: 50 ▼ Grains difference: 53

Chetan Mehta

4510 Colony Oaks Coart

Area: Houston Hobby Airport, TX

Front Door Orientation: South West ▼

Design Indoor Heating Temp.: 69 °F

Design Outdoor Heating Temp.: 34 °F

Temp. Difference Heating: 35°F

Whole House Load Calculator

TD:Cool:15°F Heat:35°F	Sq. ft. - types 1 and 2		shading	Sq. ft. - types 1 and 2		shading	Sq. ft. - types 1 and 2			Sq. ft.
Outside Wall: North	1:	2:	Windows x	1: 12.5	2: 12.5	Glass Doors x	1:	2:	Doors	
Outside Wall: South	1:	2:	Windows ▼	1:	2:	Glass Doors ▼	1:	2:	Doors	
Outside Wall: E & W	1:	2:	Windows ▼	1: 12.5	2:	Glass Doors ▼	1:	2:	Doors	
Outside Wall: NE & NW	1: 1500	2:	Windows x	1: 36	2: 110	Glass Doors x	1:	2:	Doors	
Outside Wall: SE & SW	1: 1440	2:	Windows ▼	1: 75	2: 96	Glass Doors ▼	1:	2:	Doors	
Sky Lights	N:	S:	E-W:	NE-NW:		SE-SW:				
Floor - (linear ft. if slab)	1: 144	2:	Basement	Walls-above grade		below grade		Sq. ft.		
Ceiling	1: 170	2:	Basement	Floor --		width 23 ft. or ▼		feet below grade:	2 ft. ▼	
Number of Appliances	2	Fireplaces 1 ▼								
Number of People	4		Fresh Air	recommended:		71 CFM				
Conditioned - Sq. ft.:	2640		Cubic Ft: 22440	Construction	Average ▼		Duct System:	Attic ▼	R-4 ▼	below av ▼

Calculate Load	Total Btu's Cooling	Sensible Load	Latent Load	Total Btu's Heating
	36577	29407	7170	42432

manual_s

Sizing Calculator based on Manual S

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Outside Wall: NE & NW	1: 1500 2:	Windows x	1: 36 2: 110	Glass Doors x	1: 2:	Doors	
Outside Wall: SE & SW	1: 1440 2:	Windows ▼	1: 75 2: 96	Glass Doors ▼	1: 2:	Doors	
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Ceiling	1: 170 2:	Basement	Floor --	width 23 ft. or ▼	feet below grade:	2 ft. ▼	
Number of Appliances	2 Fireplaces 1 ▼						
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5/7/2016

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Choosing the Right Equipment

Condensing Unit

Nominal Tons	Power Supply V-ph-Hz	Rated Current	Capacity BTU	Performance Air Flow / Noise	Liquid Pipe	Gas Pipe	Price (full system)
1.5	208-230/1/60	6.65 A	17500	1500 CFM / 62 DB (A)	⅜"	¾"	$1336
2.0	208-230/1/60	8.75 A	23000	1580 CFM / 62 DB (A)	⅜"	¾"	$1432
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3.5	208-230/1/60	22.1 A	42000	4200 CFM / 65 DB (A)	⅜"	⅞"	$1764
4.0	208-230/1/60	24.3 A	48000	4400 CFM / 65 DB (A)	⅜"	1⅛"	$1985
5.0	208-230/1/60	29.4 A	57500	4250 CFM / 65 DB (A)	⅜"	1⅛"	$2118

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Choosing the Right Equipment (Safety Factor?)

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Air Handler

Nominal Tons	Power Supply V-ph-Hz	Rated Current	Capacity BTU	Performance Air Flow / Noise	Liquid Pipe	Gas Pipe	Price (full system)
1.5	208-230/1/60	1.5 A	18000	650 CFM / 45 DB (A)	3/8"	3/4"	$1336
2.0	208-230/1/60	1.5 A	22400	800 CFM / 48 DB (A)	3/8"	3/4"	$1432
2.5	208-230/1/60	2.0 A	29000	950 CFM / 53 DB (A)	3/8"	3/4"	$1532
3.0	208-230/1/60	2.0 A	36000	1350CFM / 53 DB (A)	3/8"	7/8"	$1674
3.5	208-230/1/60	2.0 A	42000	1350CFM / 55 DB (A)	3/8"	7/8"	$1764
4.0	208-230/1/60	2.0 A	48000	1600CFM / 55 DB (A)	3/8"	1 1/8"	$1985
5.0	208-230/1/60	3.0 A	57000	1960CFM / 58 DB (A)	3/8"	1 1/8"	$2118

HVAC system has been sized according to industry best practices, it is installed, collect $, some would consider this done – right?

HVAC system has been sized according to industry best practices, it is installed, collect $, some would consider this done – right?

WRONG!

HVAC system has been sized according to industry best practices, it is installed, collect $, some would consider this done – right?

WRONG!

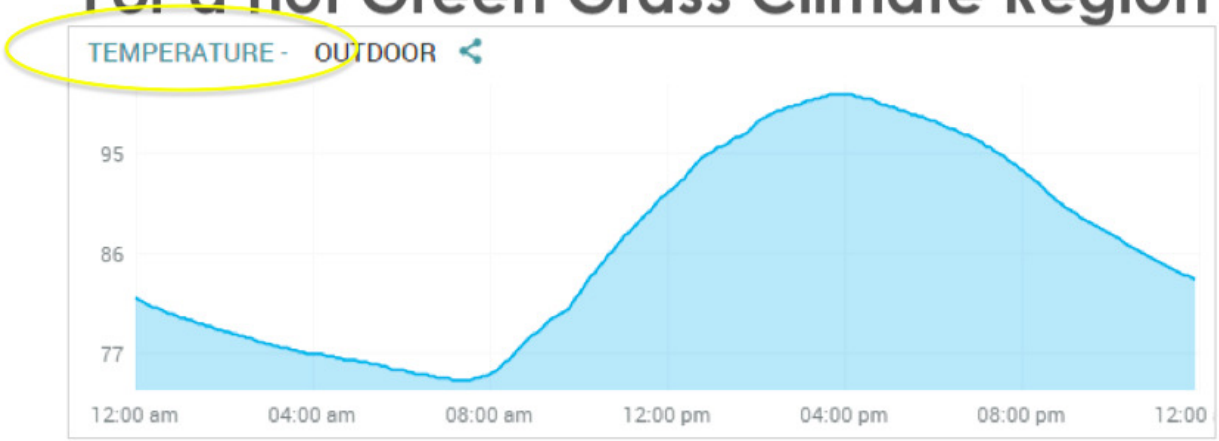
Concern – the system has been sized for peak load conditions, but the house sees mostly partial and no-load conditions

OUTDOOR TEMP / % RH MANUAL J LOADS

For a hot Green Grass Climate Region

OUTDOOR TEMP / % RH MANUAL J LOADS

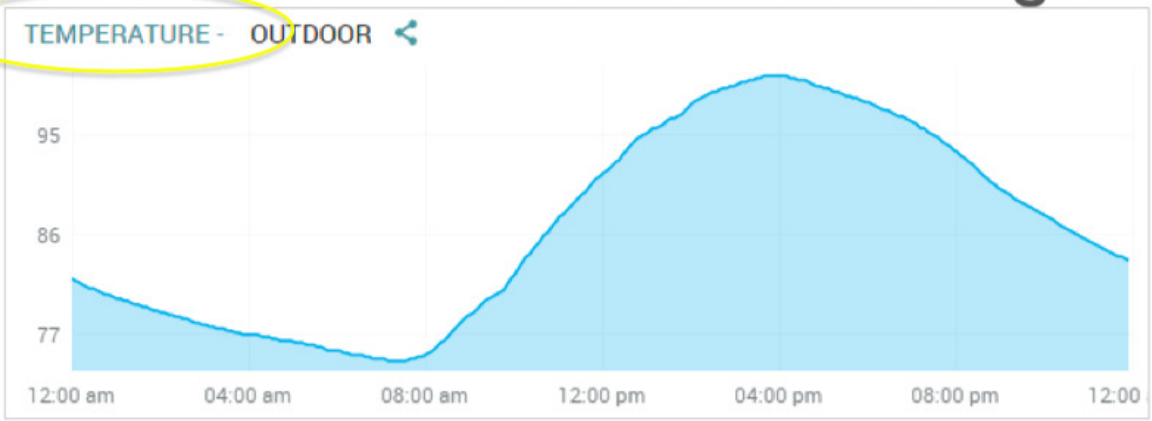
For a hot Green Grass Climate Region



OUTDOOR TEMP / % RH MANUAL J LOADS

For a hot Green Grass Climate Region

Sensible Load
90% to near zero
most days



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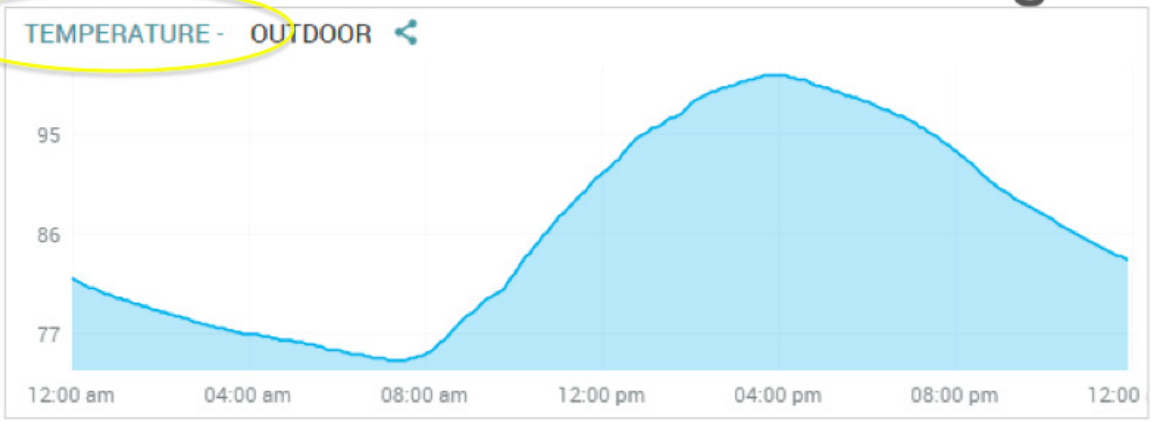

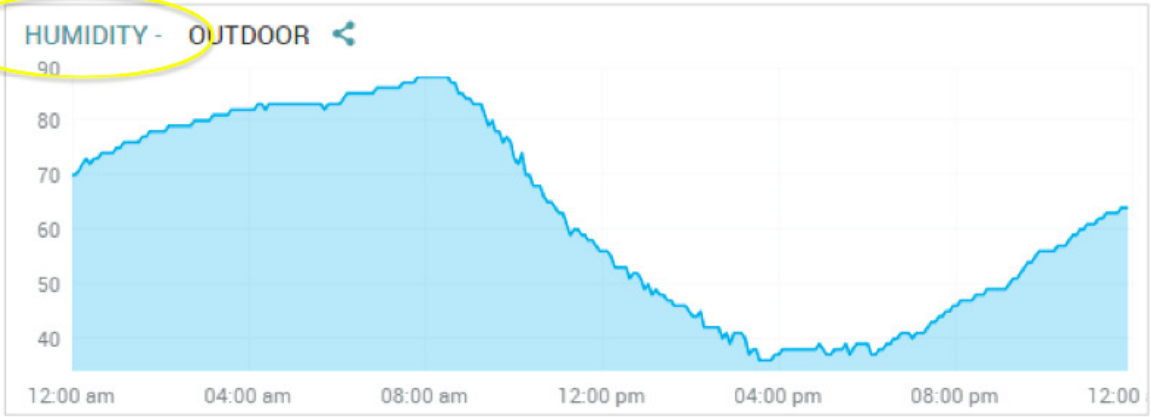

OUTDOOR TEMP / % RH MANUAL J LOADS

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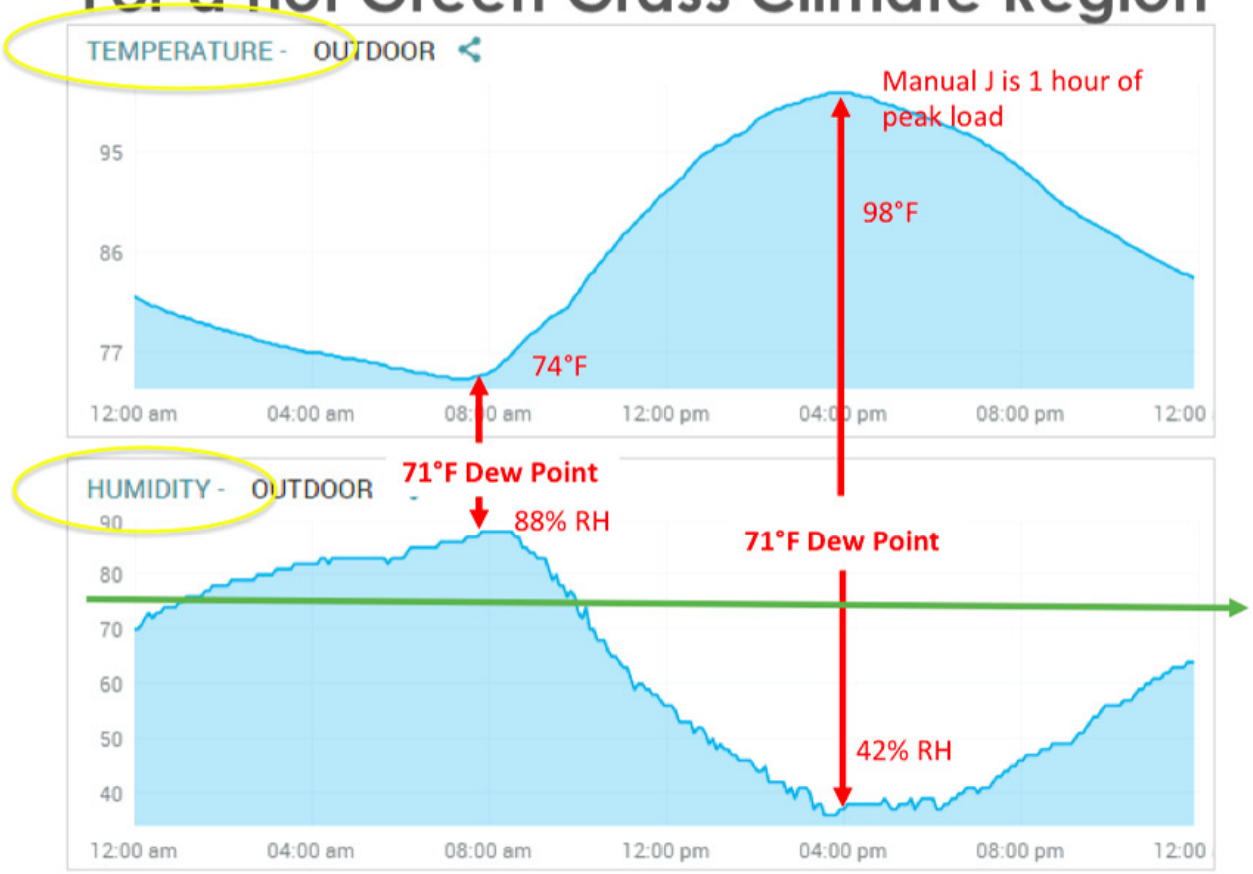

OUTDOOR TEMP / % RH MANUAL J LOADS

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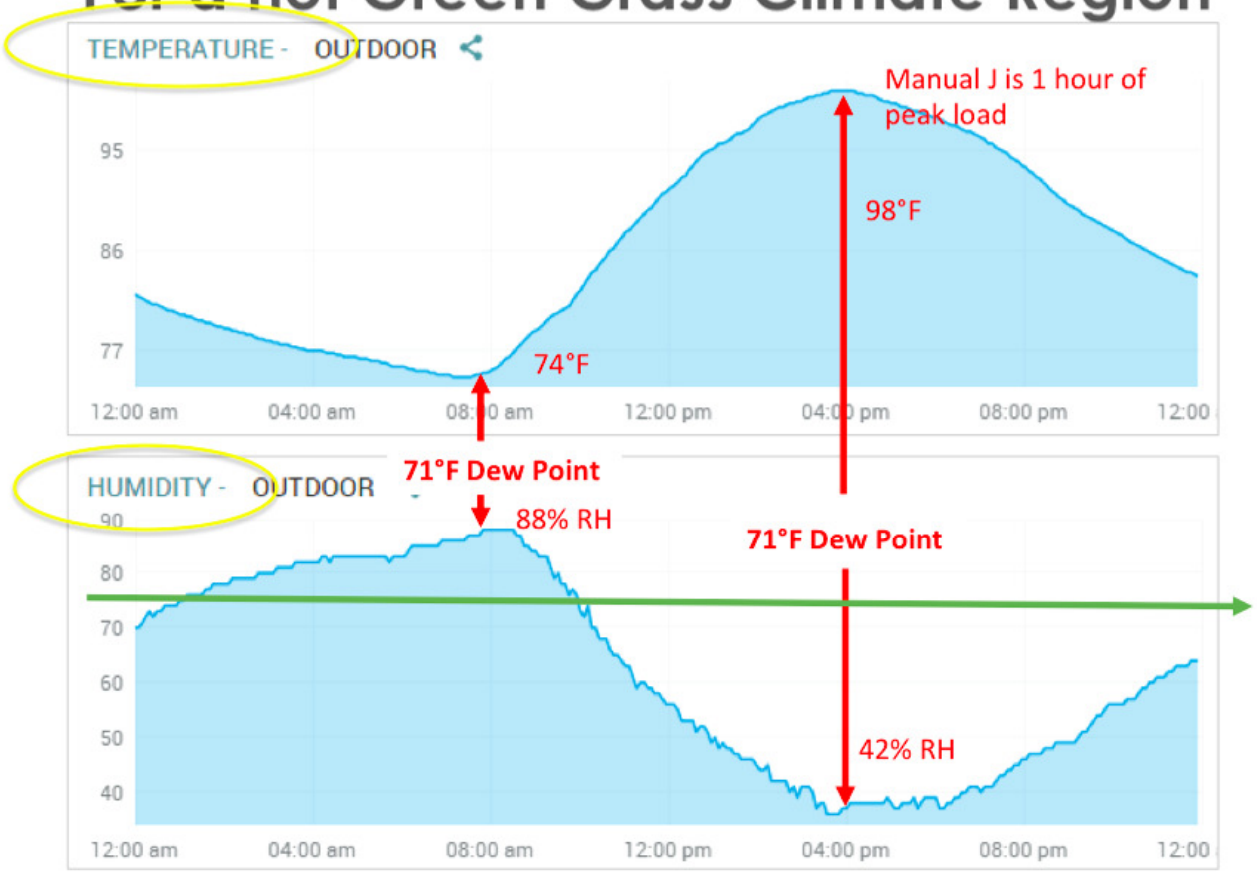

Latent load is fairly uniform throughout the day and night

New Example: Manual J Load Calculation

In a green grass climate 3,000 sq. ft. home @ peak load times of the day + heat/moisture from occupants.

New Example: Manual J Load Calculation

In a green grass climate 3,000 sq. ft. home @ peak load times of the day + heat/moisture from occupants.

45,000 btus per hour sensible

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In a green grass climate 3,000 sq. ft. home @ peak load times of the day + heat/moisture from occupants.

45,000 btus per hour sensible

12,000 btus per hour latent

New Example: Manual J Load Calculation

In a green grass climate 3,000 sq. ft. home @ peak load times of the day + heat/moisture from occupants.

45,000 btus per hour sensible

12,000 btus per hour latent

57,000 btus per hour cooling

New Example: Manual J Load Calculation

In a green grass climate 3,000 sq. ft. home @ peak load times of the day + heat/moisture from occupants.

45,000 btus per hour sensible

12,000 btus per hour latent

57,000 btus per hour cooling

ON a hot day 4 hours per day declining to near zero at night

New Example: Manual J Load Calculation

In a green grass climate 3,000 sq. ft. home @ peak load times of the day + heat/moisture from occupants.

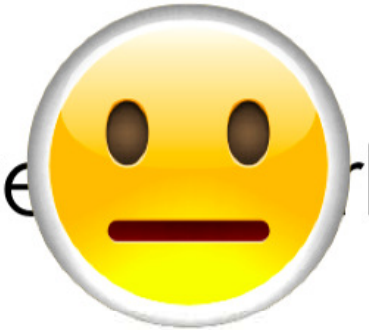
45,000 btus per hour sensible

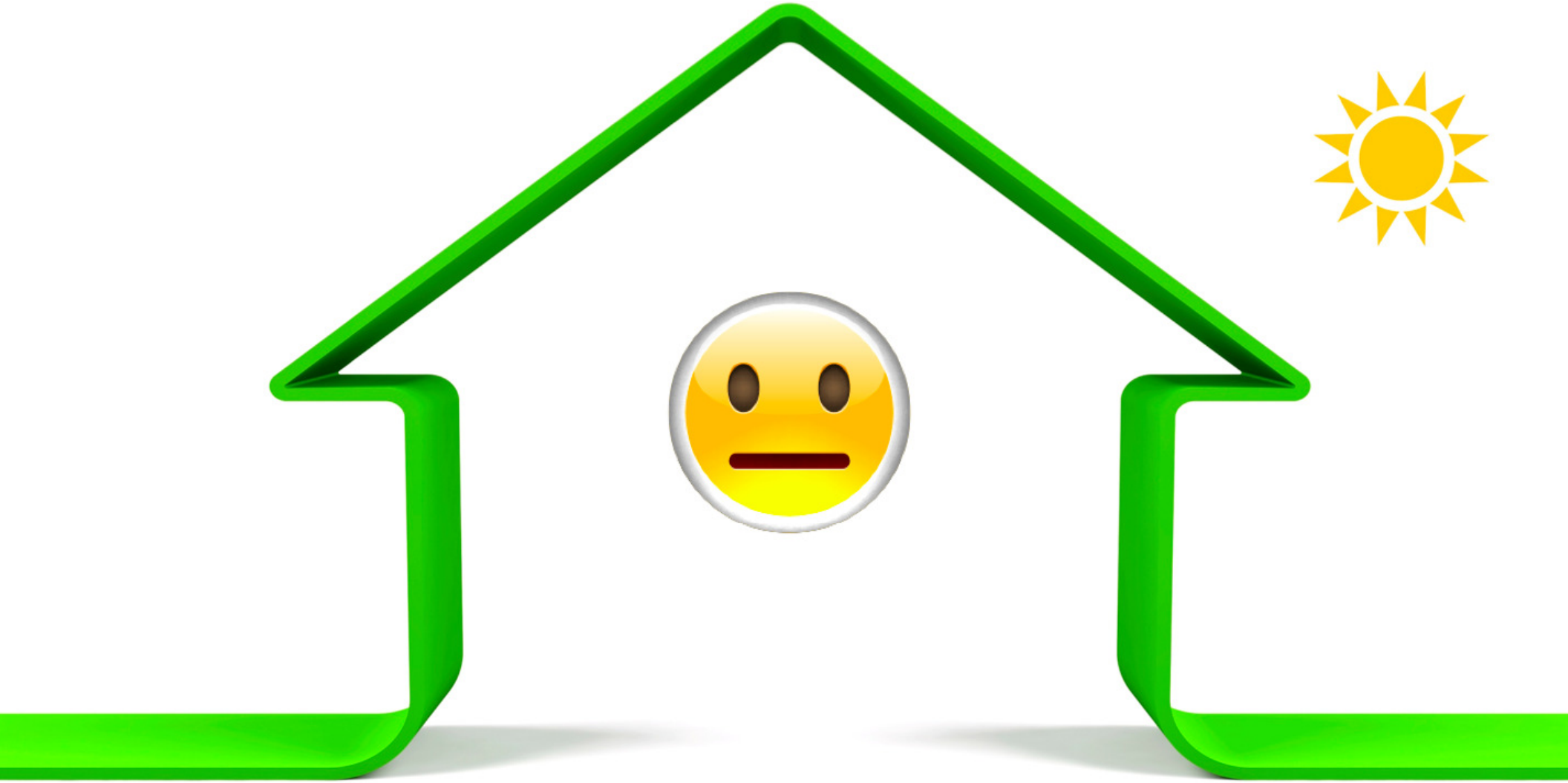
12,000 btus per hour latent

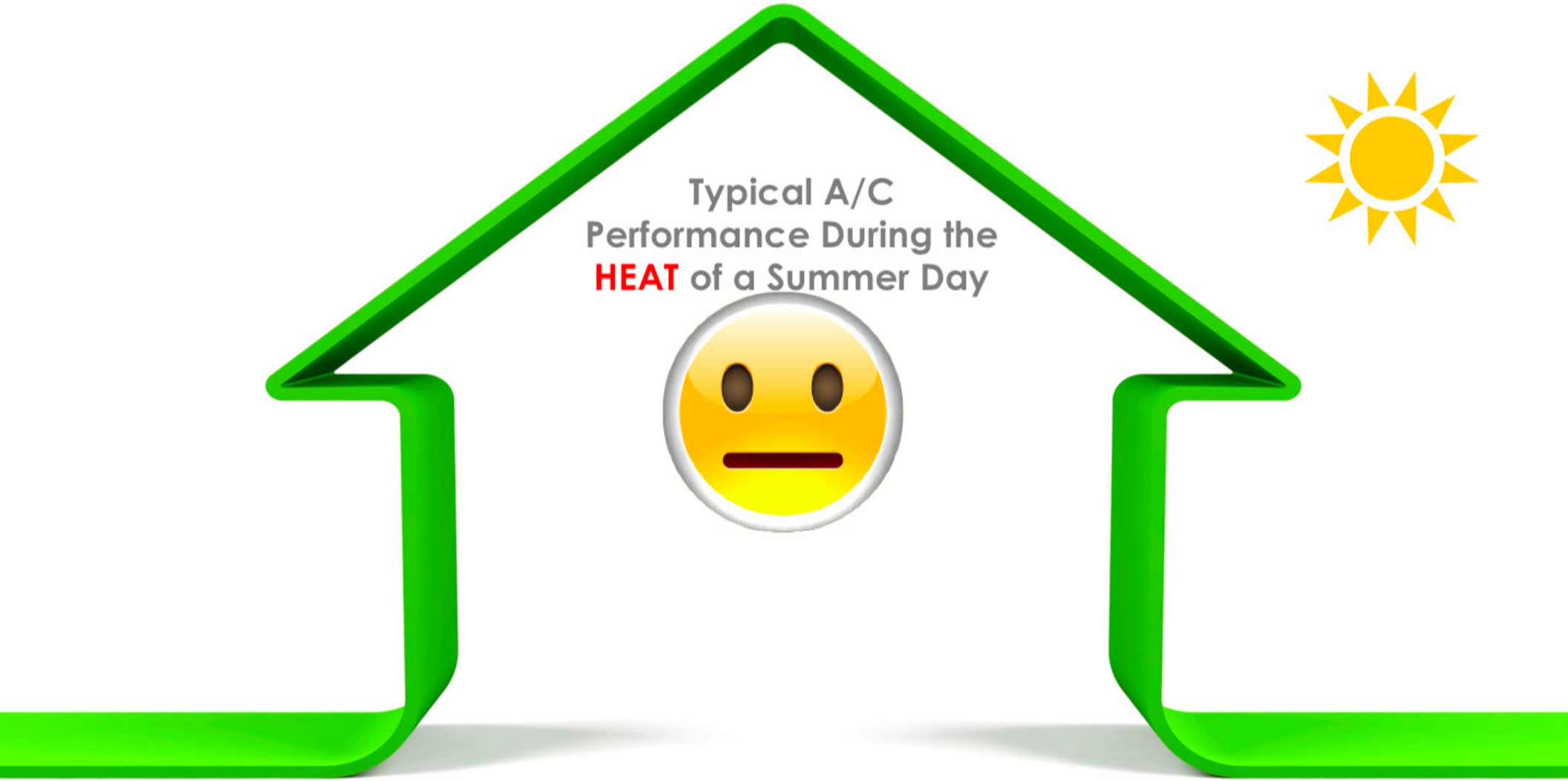
57,000 btus per hour cooling

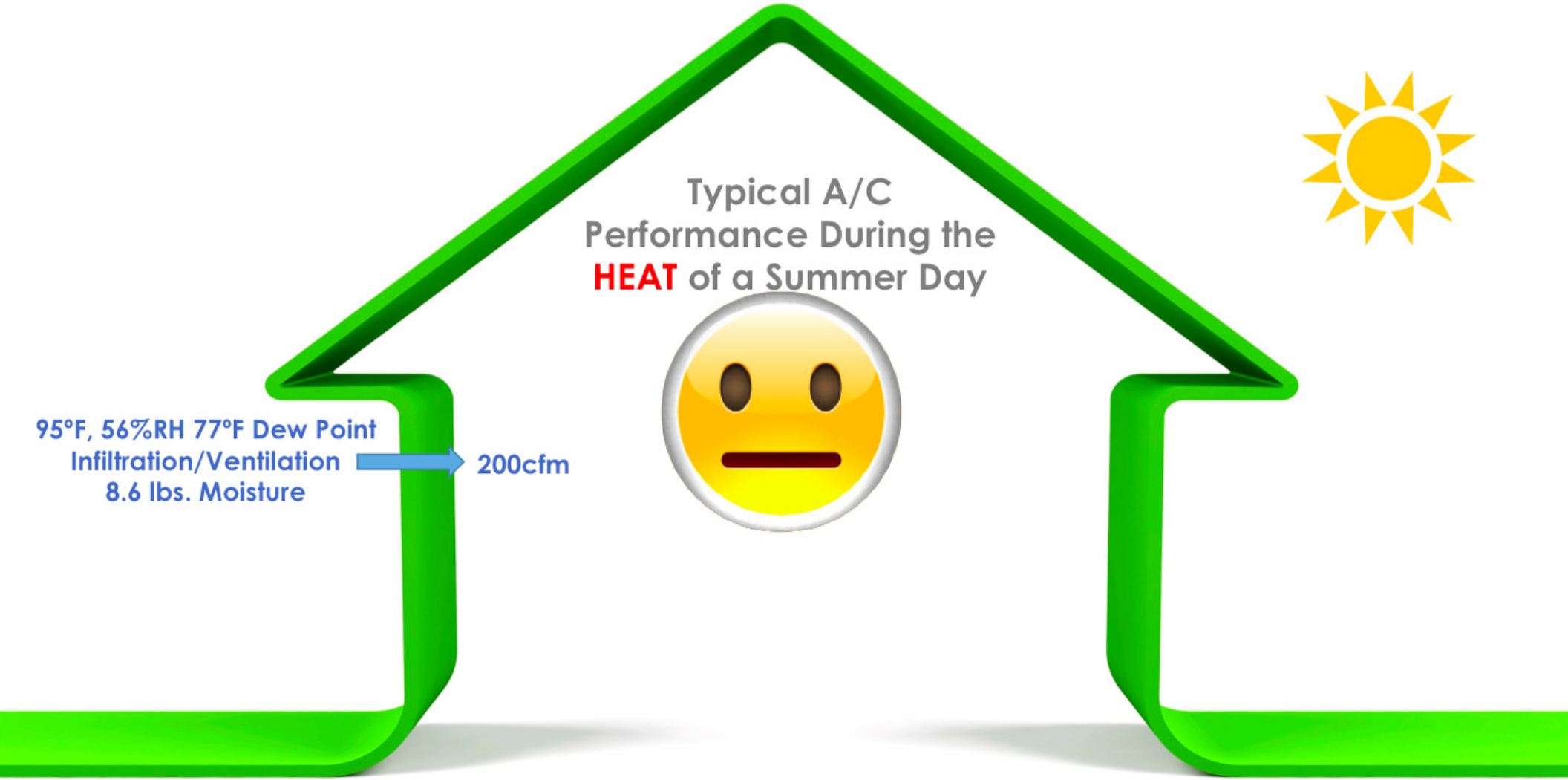
ON a hot day 4 hours per day declining to near zero at night

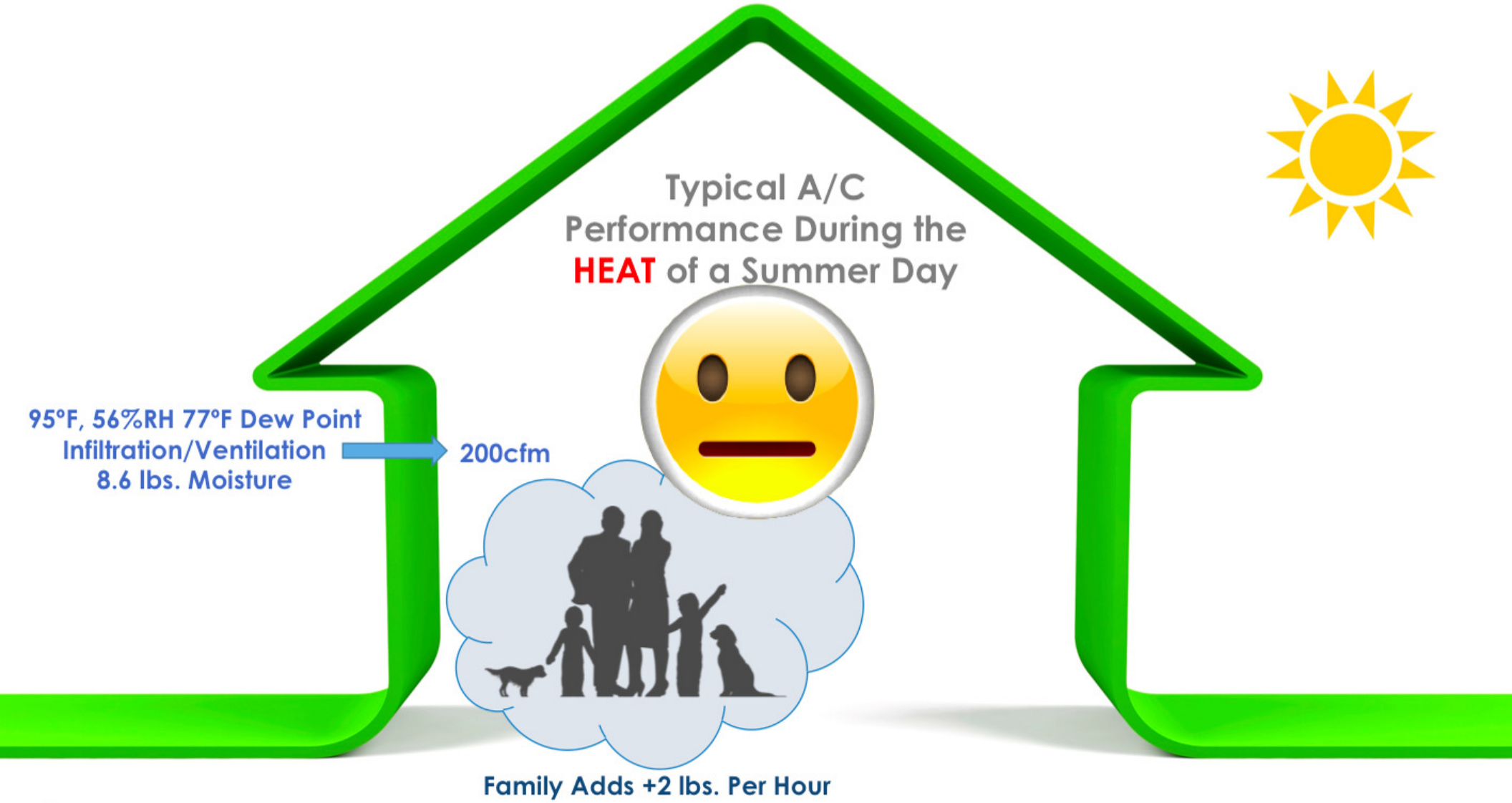
Potential 24 hours per day

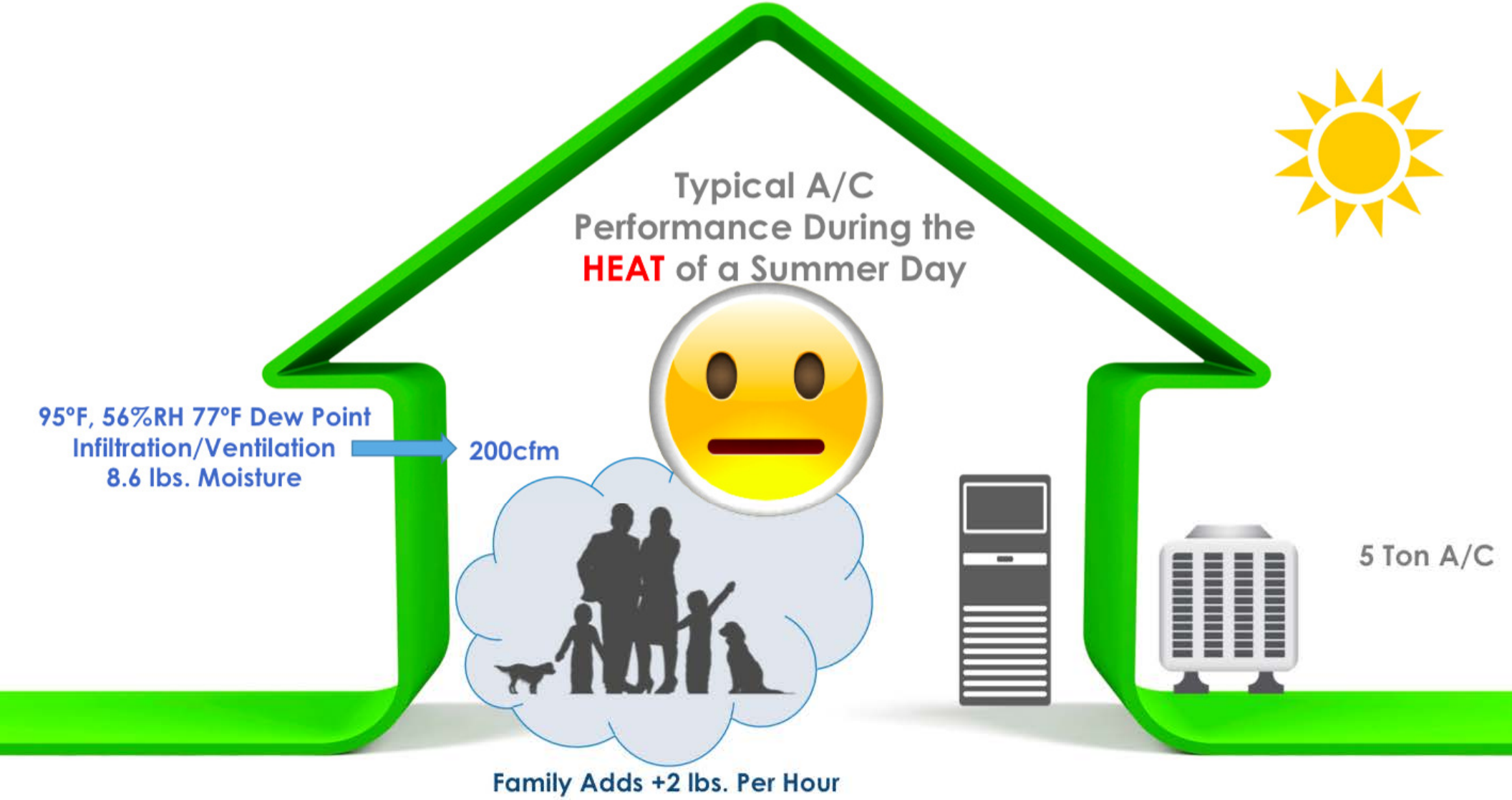
Best Practice Syste  rks at Design Load

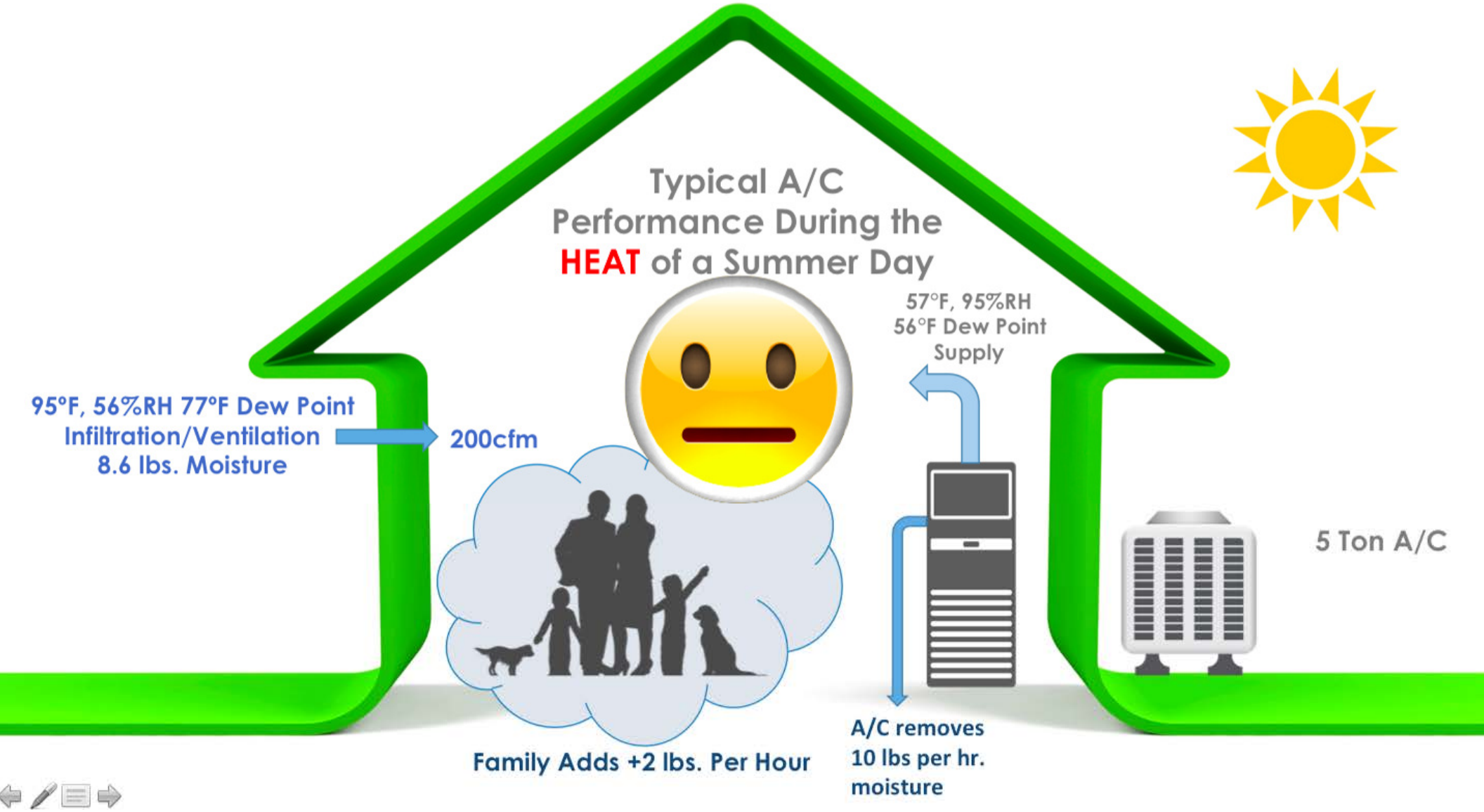


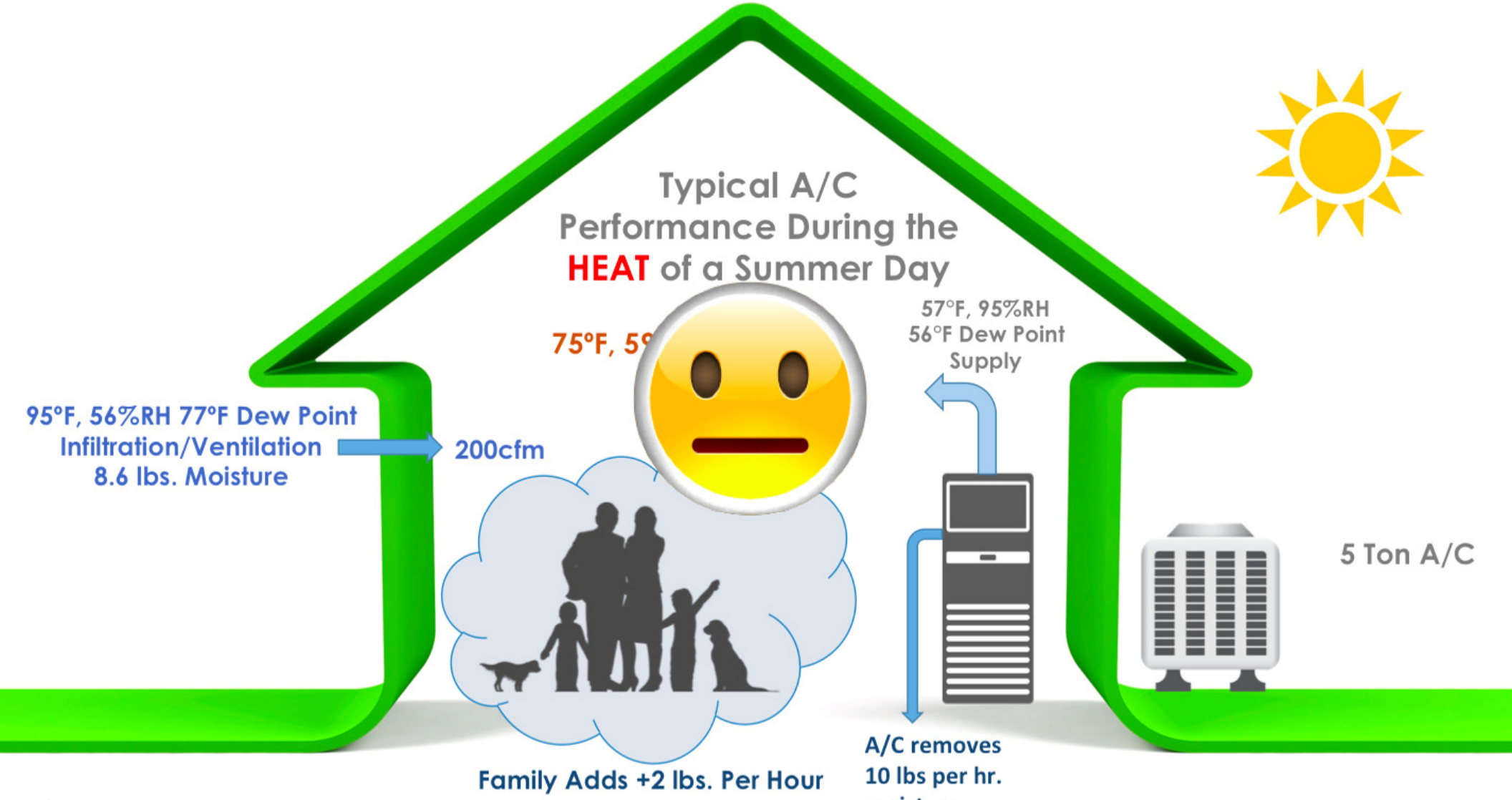

Typical A/C
Performance During the
HEAT of a Summer Day

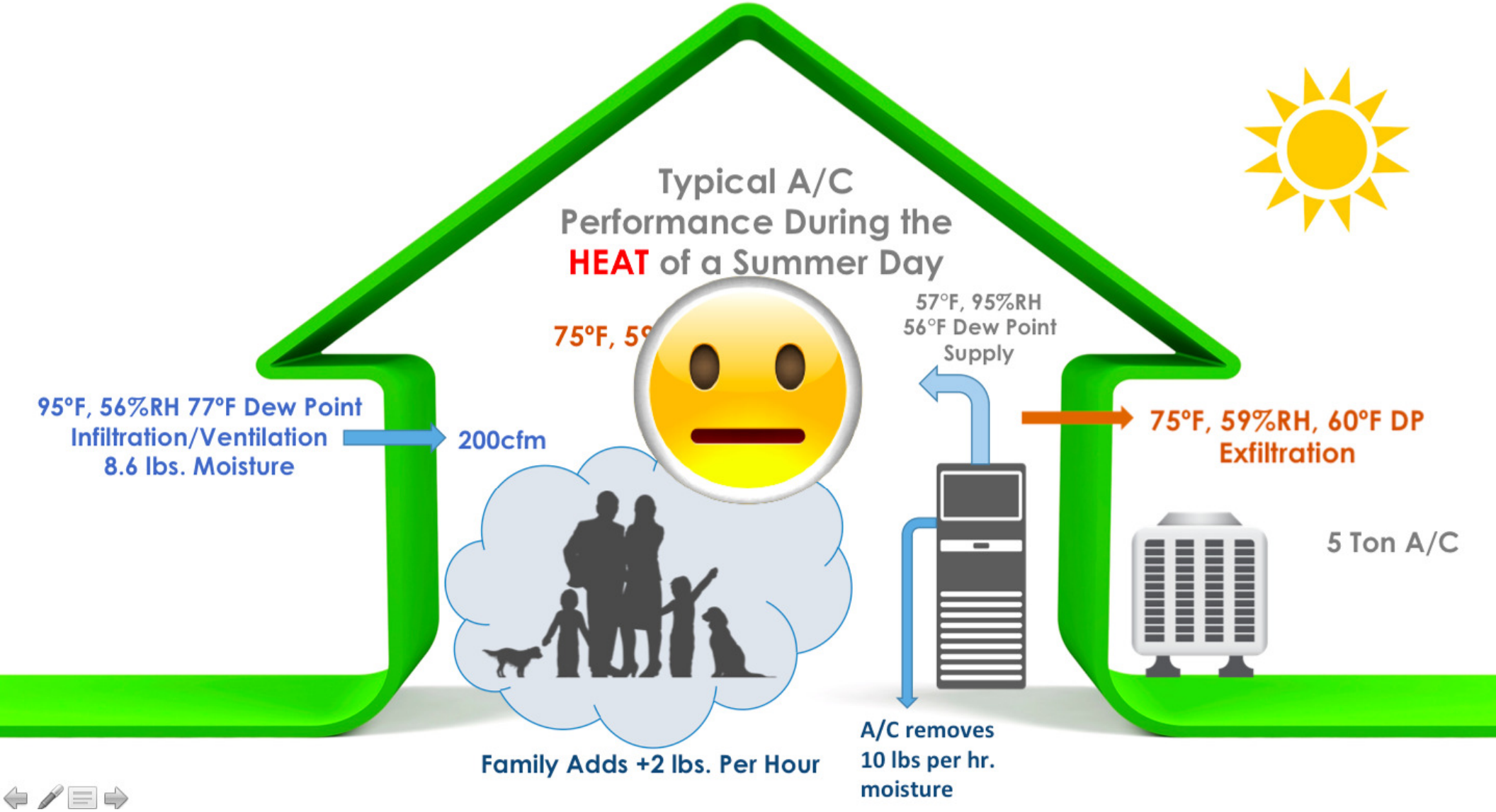

Typical A/C
Performance During the
HEAT of a Summer Day
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm

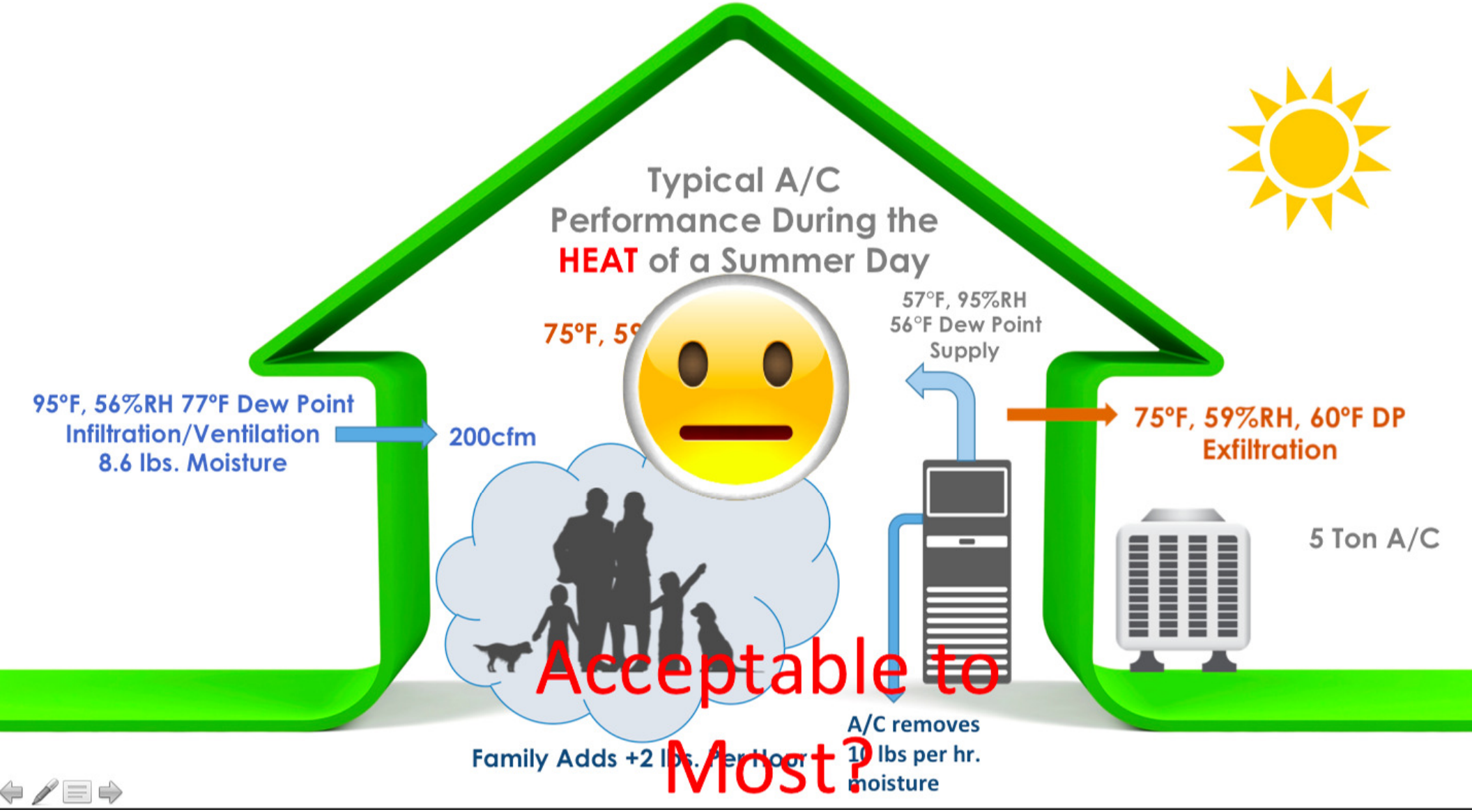

Typical A/C
Performance During the
HEAT of a Summer Day
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm
Family Adds +2 lbs. Per Hour


Typical A/C
Performance During the
HEAT of a Summer Day
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm
5 Ton A/C
Family Adds +2 lbs. Per Hour


Typical A/C
Performance During the
HEAT of a Summer Day
57°F, 95%RH
56°F Dew Point
Supply
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm
5 Ton A/C
Family Adds +2 lbs. Per Hour
A/C removes
10 lbs per hr.
moisture

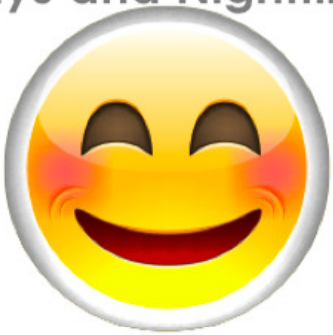

Typical A/C
Performance During the
HEAT of a Summer Day
75°F, 5
57°F, 95%RH
56°F Dew Point
Supply
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm
5 Ton A/C
Family Adds +2 lbs. Per Hour
A/C removes
10 lbs per hr.
moisture

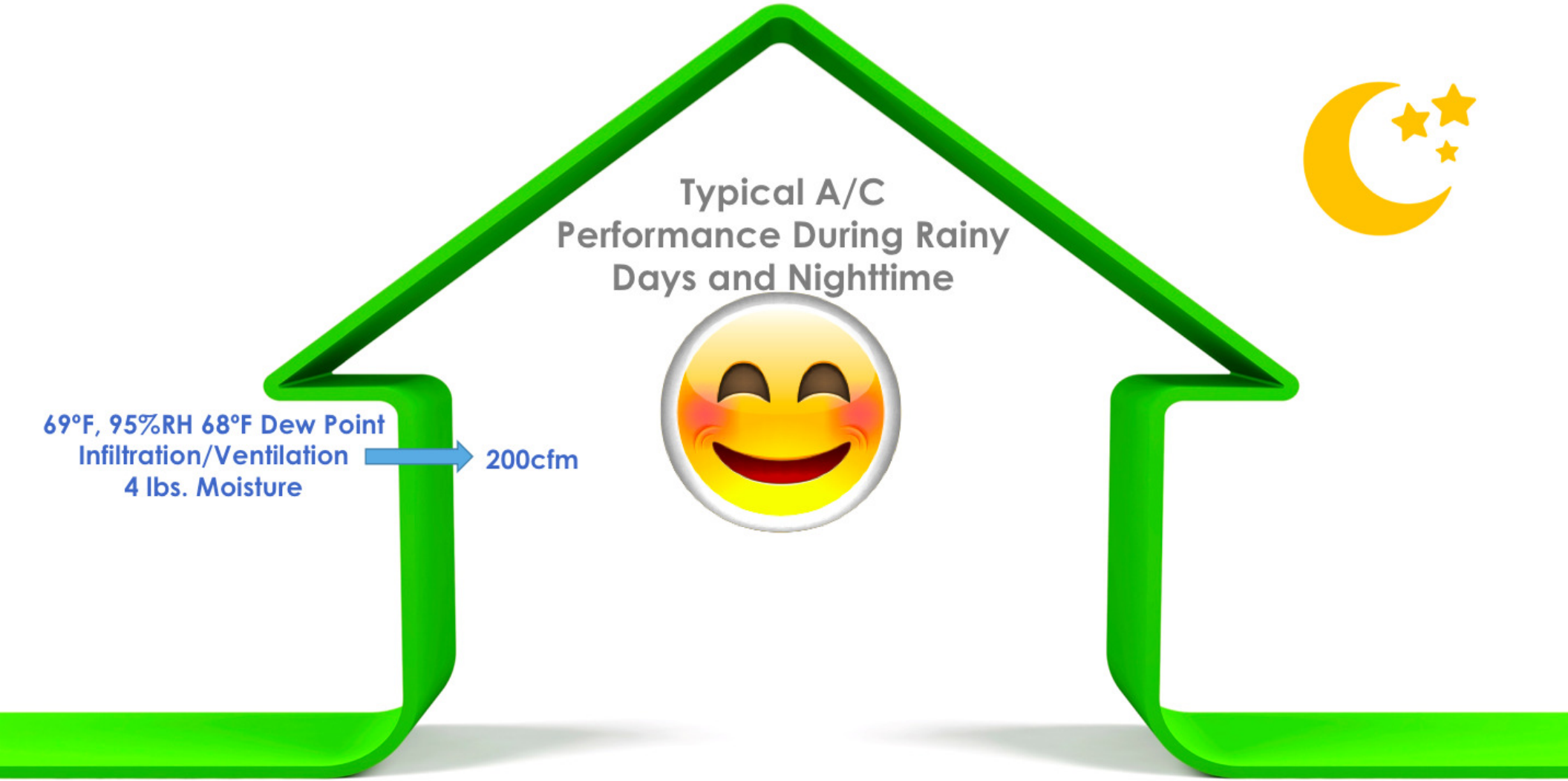

Typical A/C
Performance During the
HEAT of a Summer Day
75°F, 59
57°F, 95%RH
56°F Dew Point
Supply
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm
75°F, 59%RH, 60°F DP
Exfiltration
5 Ton A/C
Family Adds +2 lbs. Per Hour
A/C removes
10 lbs per hr.
moisture

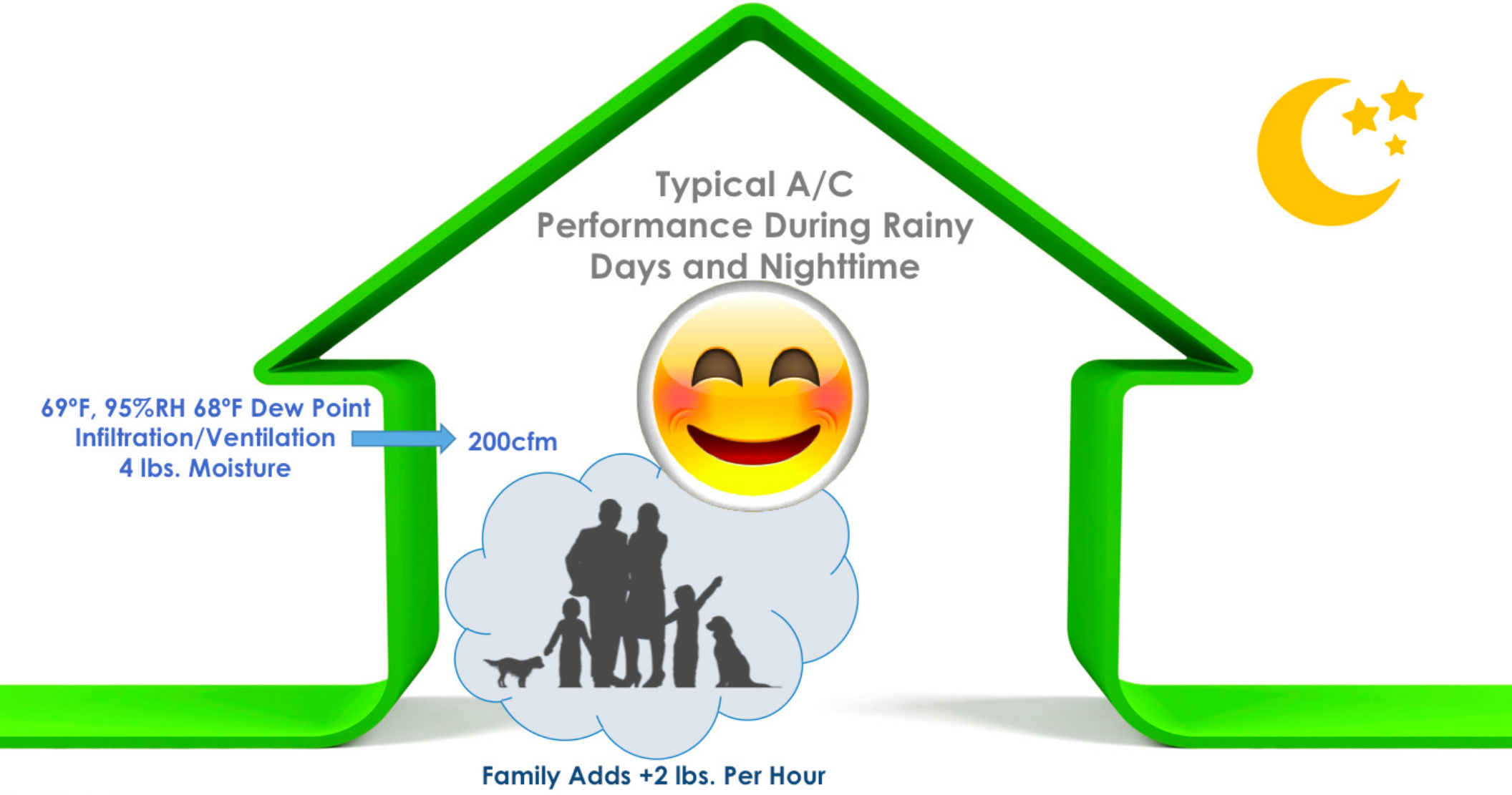

Typical A/C
Performance During the
HEAT of a Summer Day
75°F, 59
57°F, 95%RH
56°F Dew Point
Supply
95°F, 56%RH 77°F Dew Point
Infiltration/Ventilation
8.6 lbs. Moisture
200cfm
75°F, 59%RH, 60°F DP
Exfiltration
5 Ton A/C
Acceptable to
Most?
Family Adds +2 lbs. Per Hour
A/C removes
10 lbs per hr.
moisture

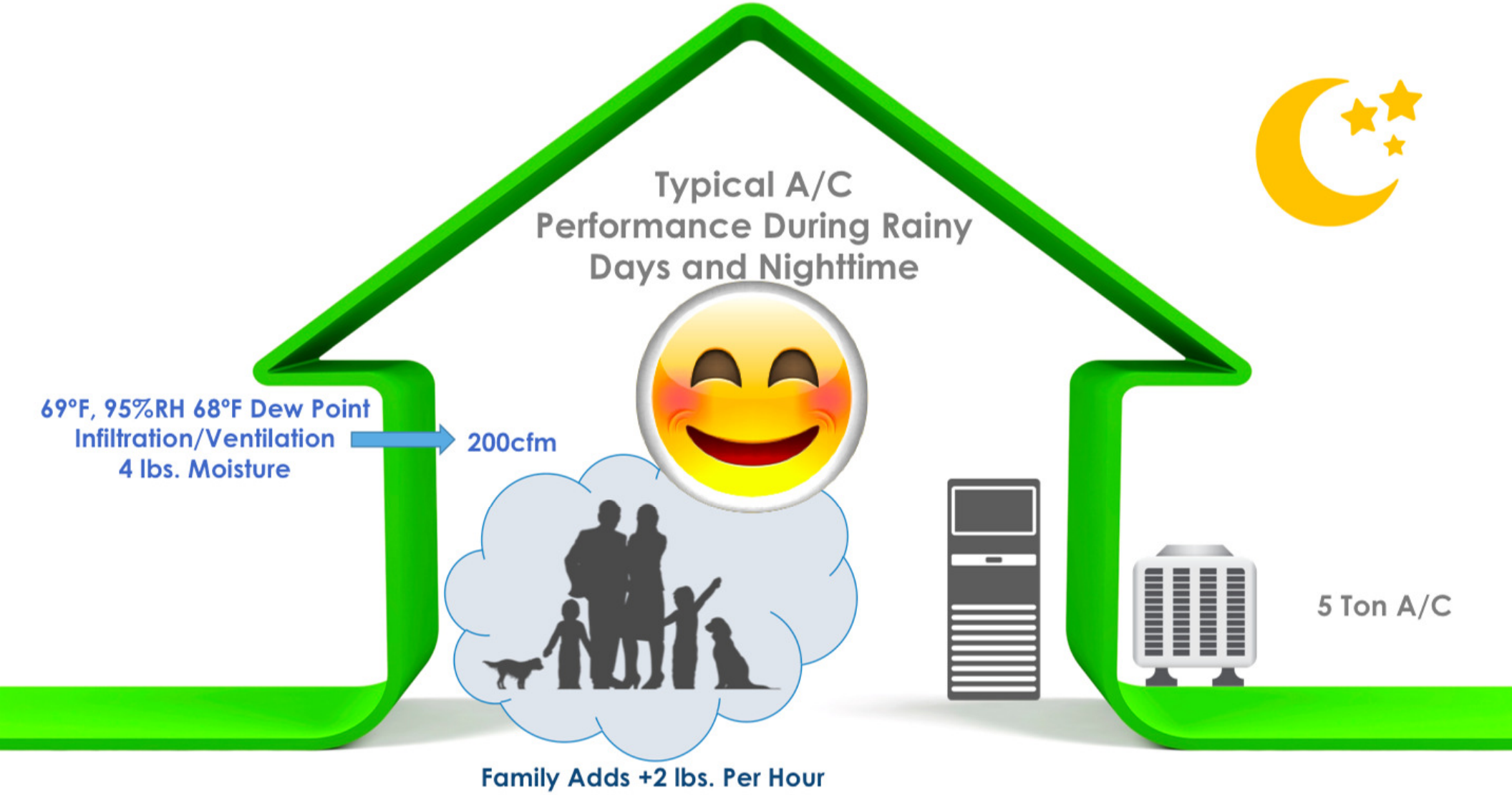
Best practice s doesn't work at 70F and rainy (o sensible load)

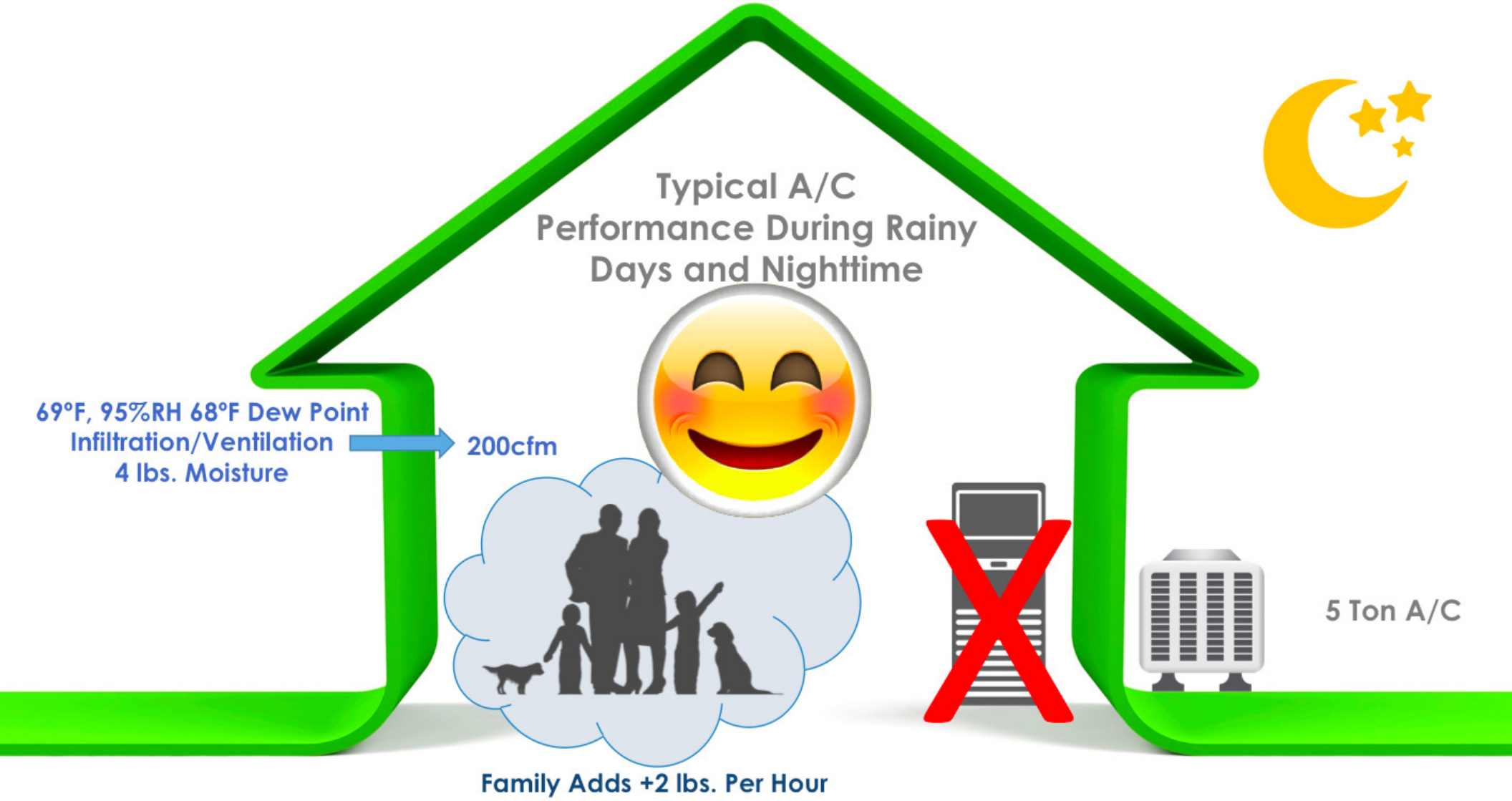
Typical A/C Performance During Rainy Days and Nighttime

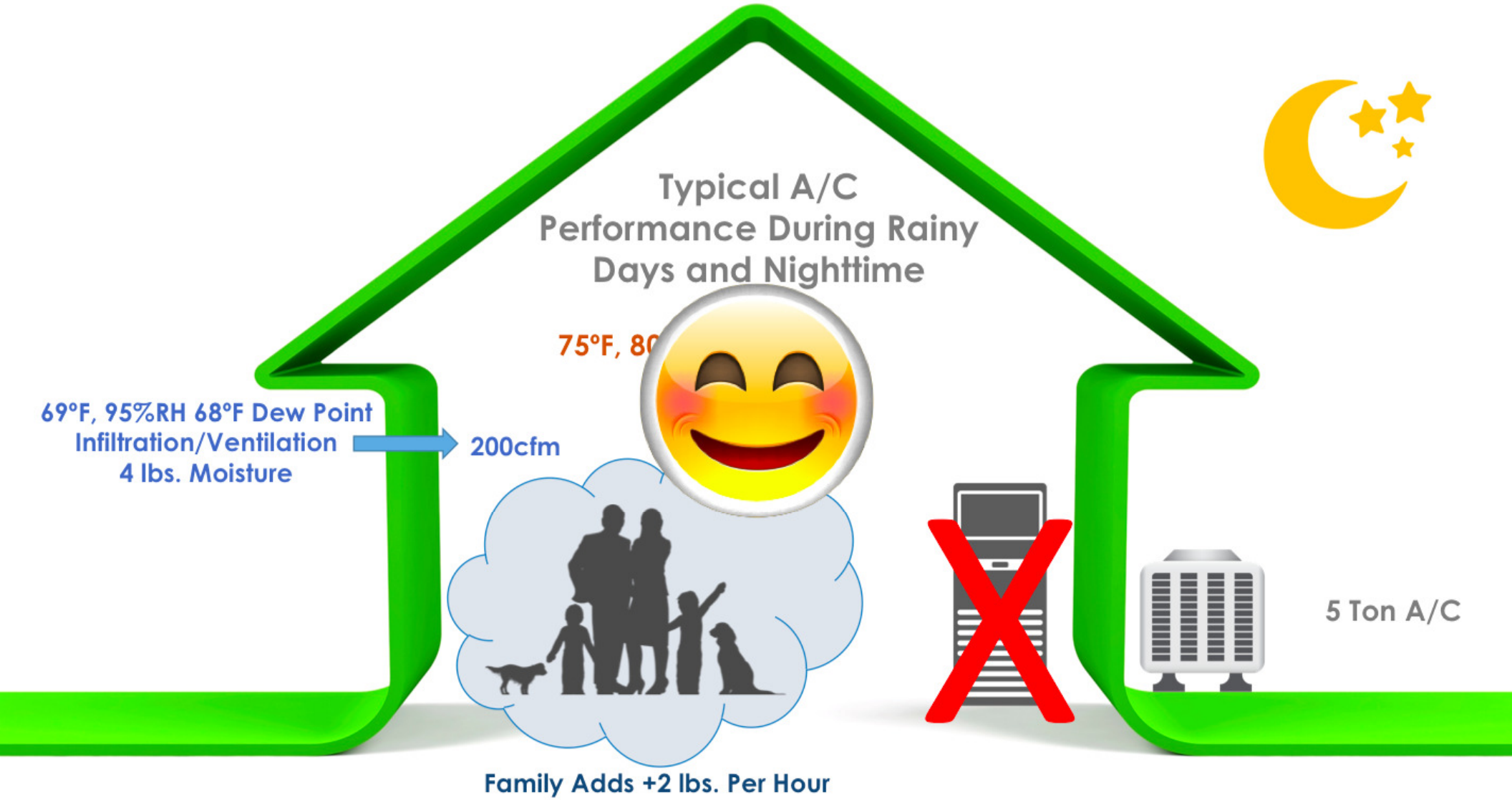


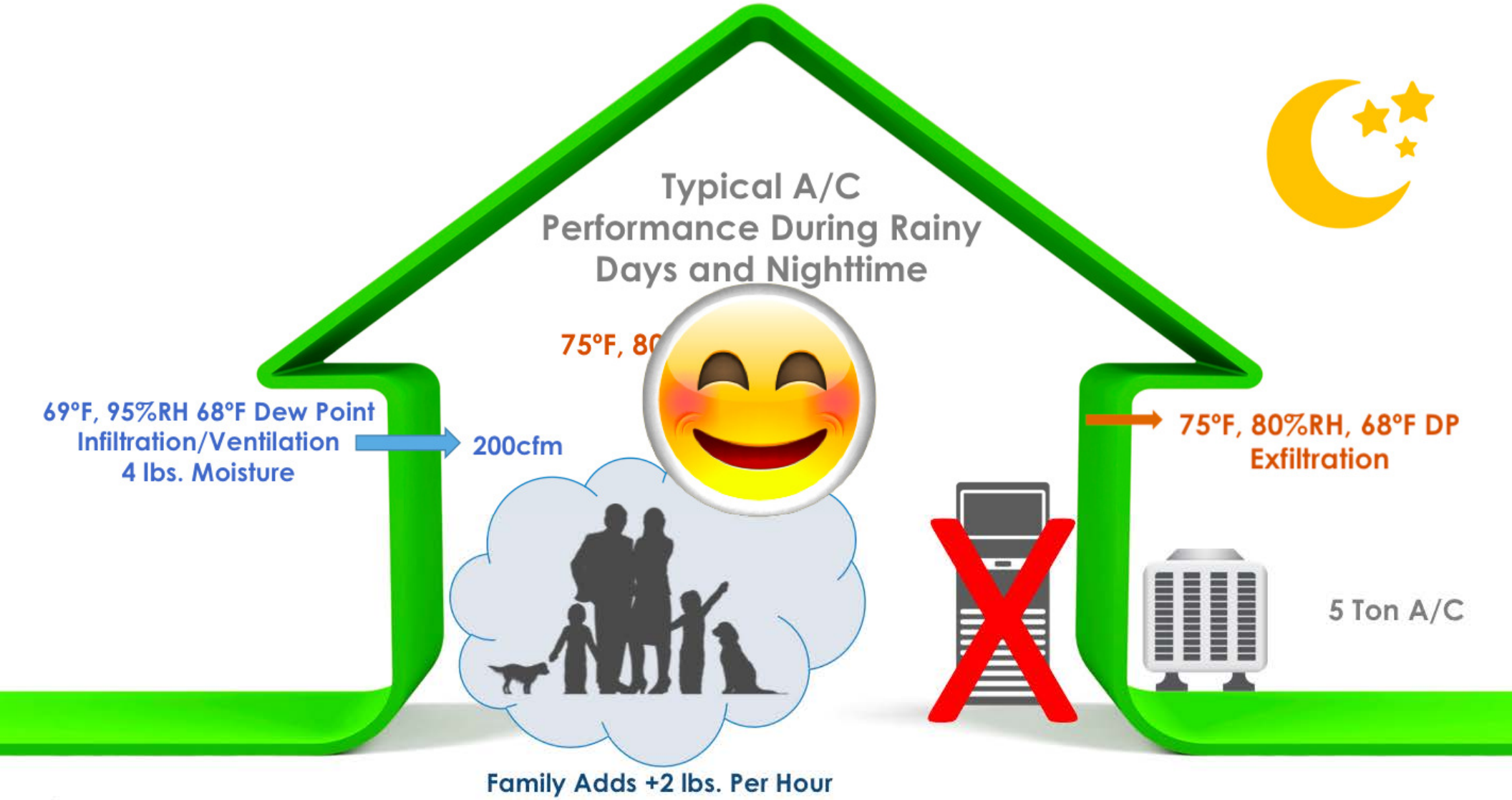

Typical A/C
Performance During Rainy
Days and Nighttime
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm

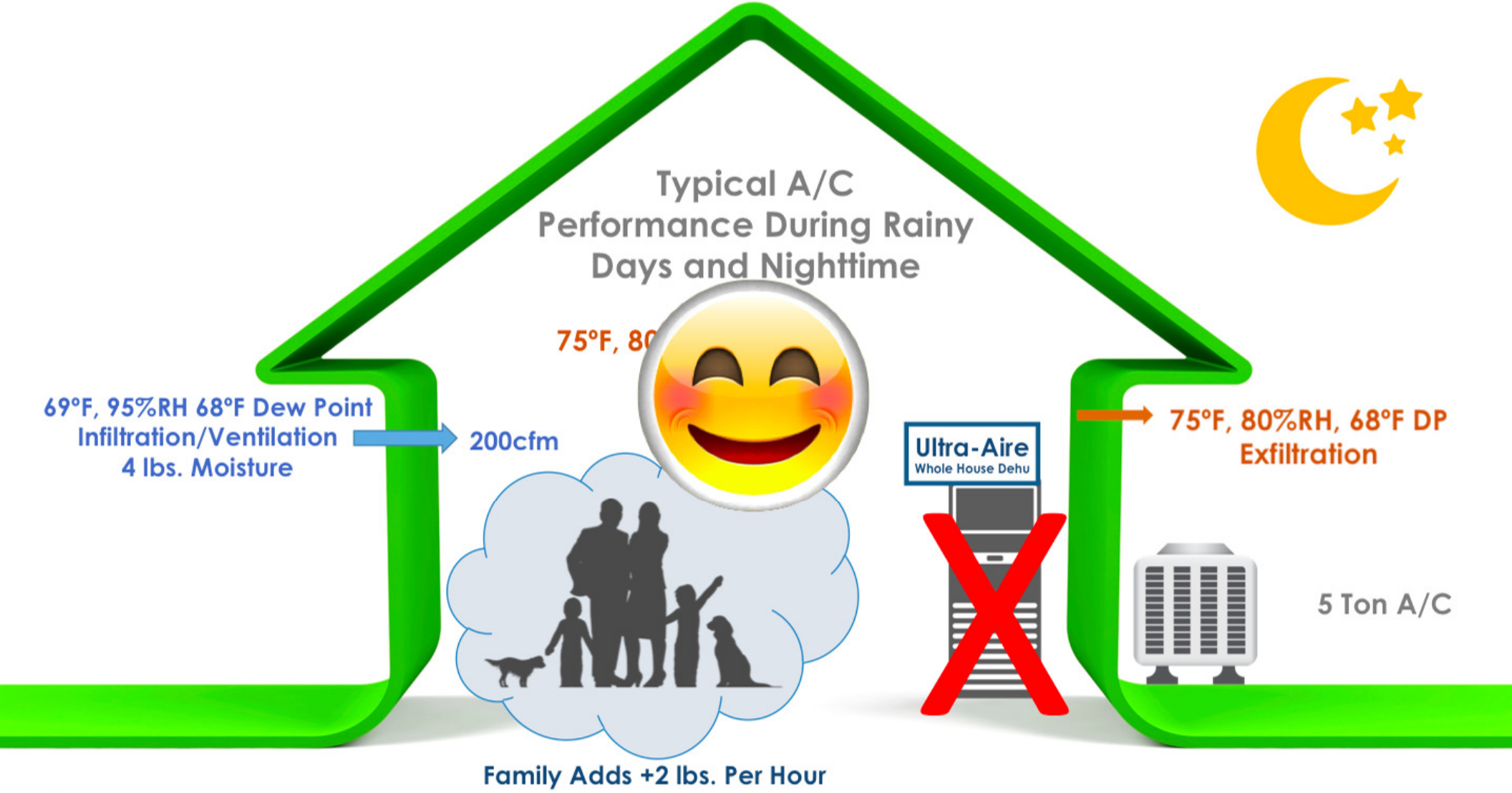

Typical A/C
Performance During Rainy
Days and Nighttime
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
Family Adds +2 lbs. Per Hour

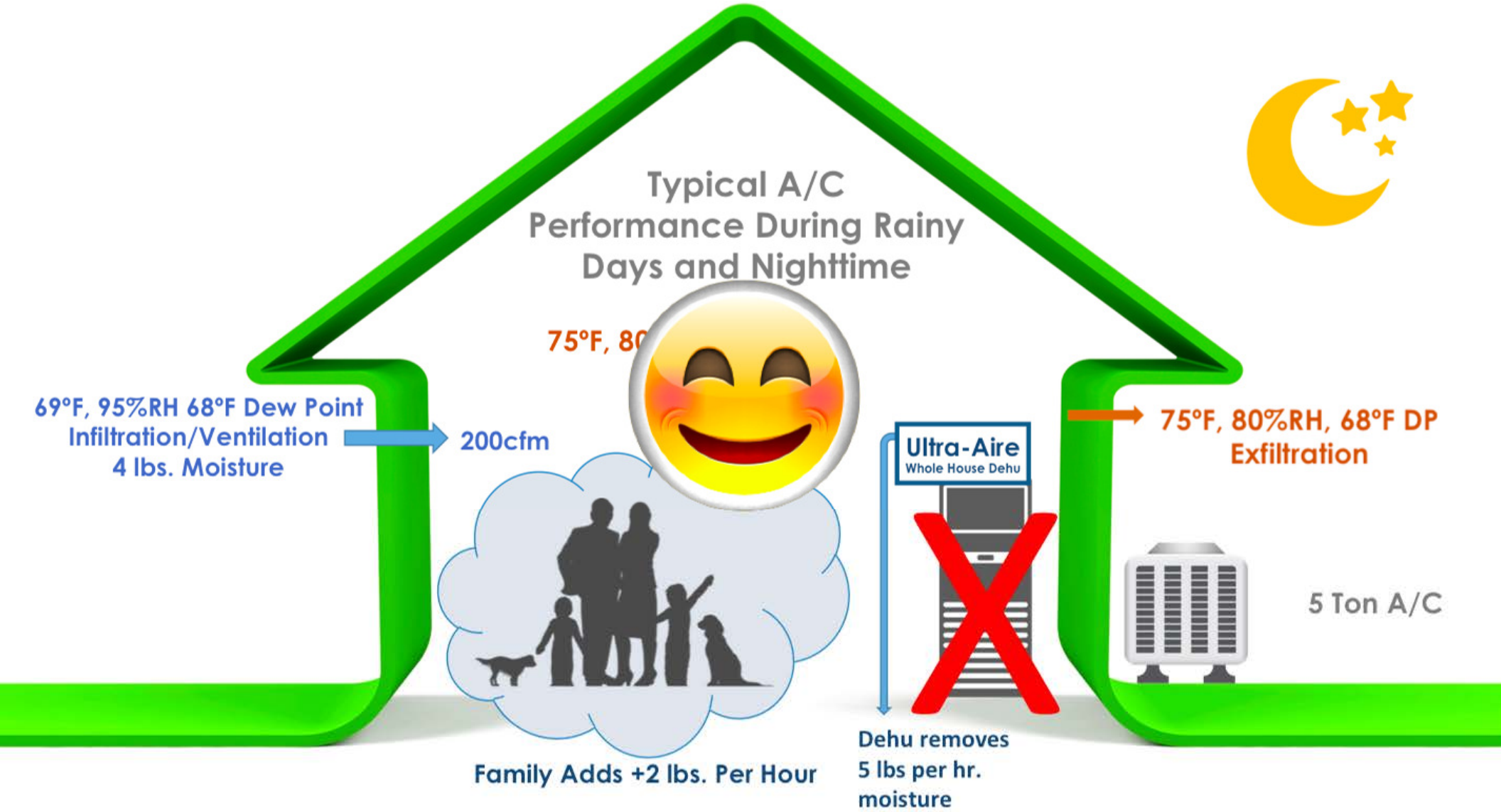

Typical A/C
Performance During Rainy
Days and Nighttime
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
5 Ton A/C
Family Adds +2 lbs. Per Hour

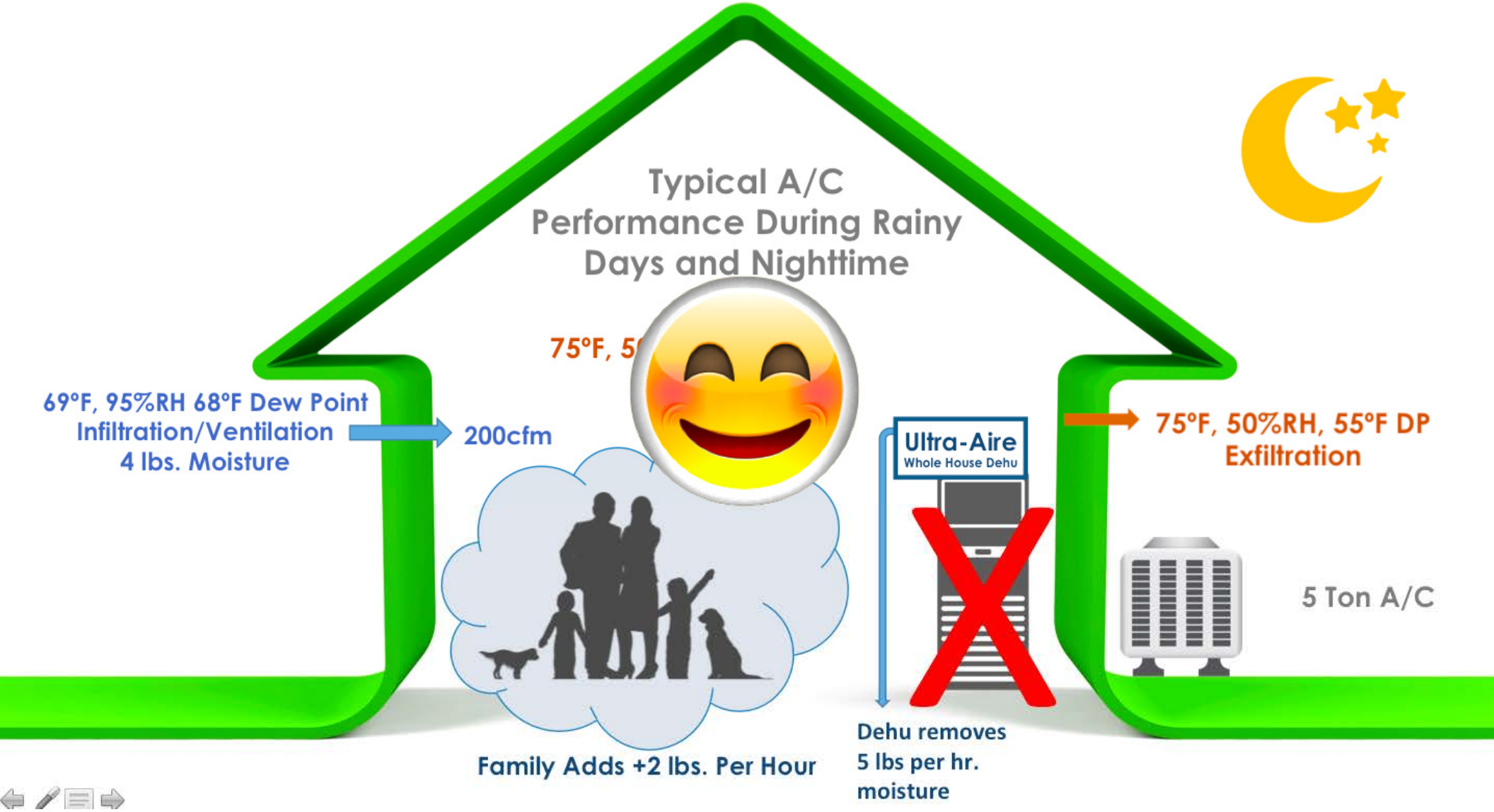

Typical A/C
Performance During Rainy
Days and Nighttime
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
5 Ton A/C
Family Adds +2 lbs. Per Hour


Typical A/C
Performance During Rainy
Days and Nighttime
75°F, 80
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
5 Ton A/C
Family Adds +2 lbs. Per Hour

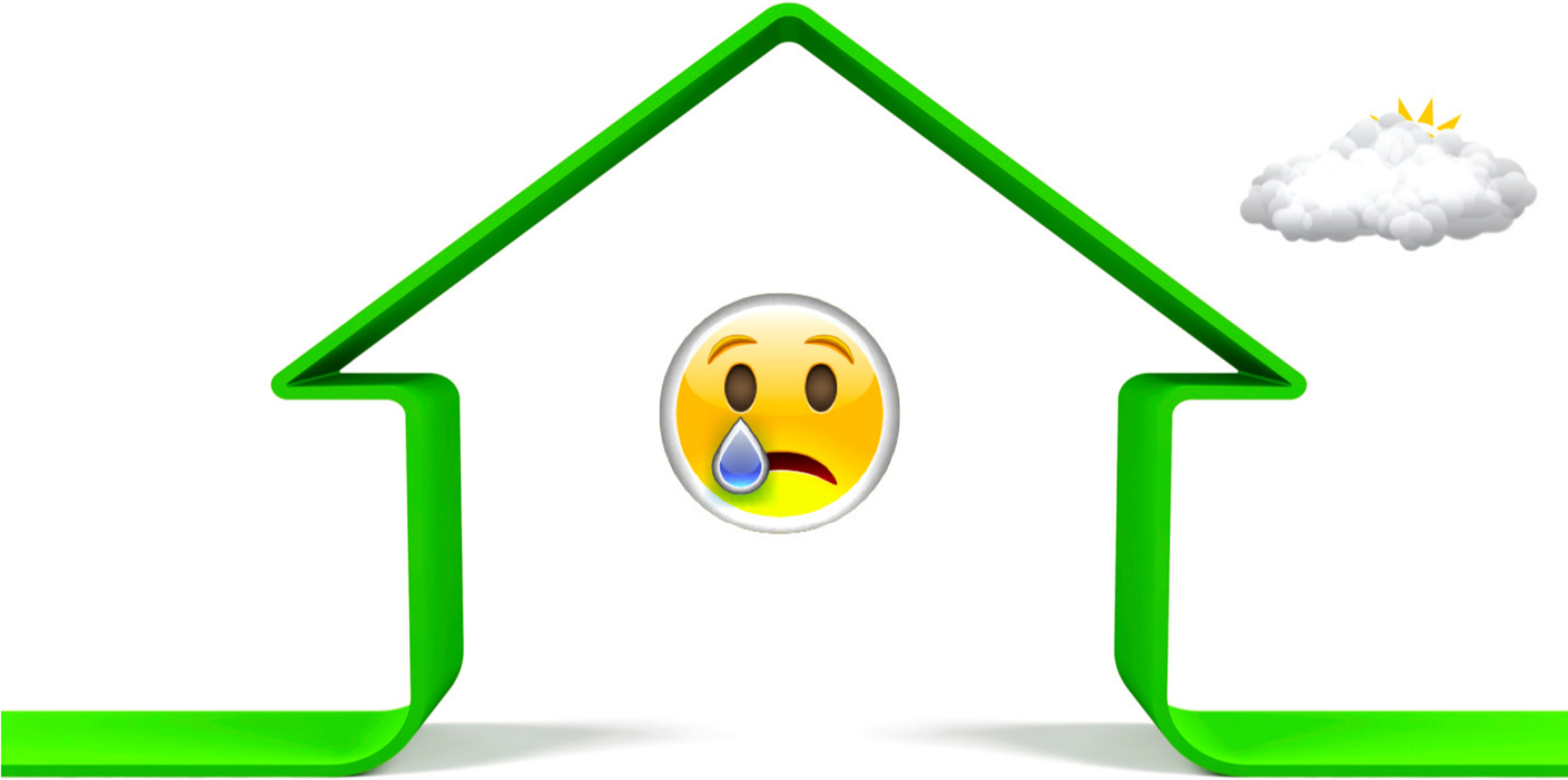

Typical A/C
Performance During Rainy
Days and Nighttime
75°F, 80
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
75°F, 80%RH, 68°F DP
Exfiltration
5 Ton A/C
Family Adds +2 lbs. Per Hour

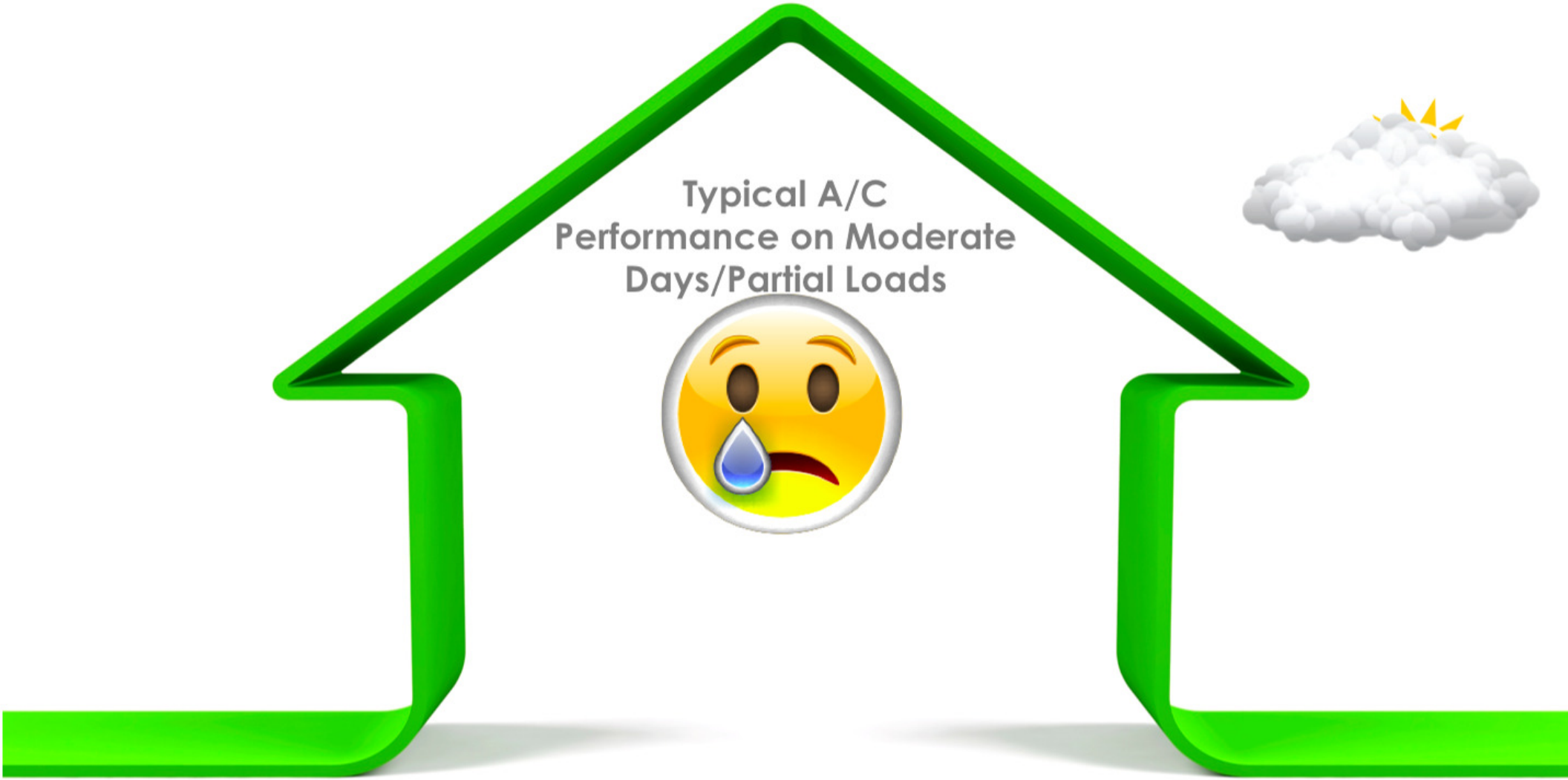

Typical A/C
Performance During Rainy
Days and Nighttime
75°F, 80
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
Ultra-Aire
Whole House Dehu
75°F, 80%RH, 68°F DP
Exfiltration
5 Ton A/C
Family Adds +2 lbs. Per Hour

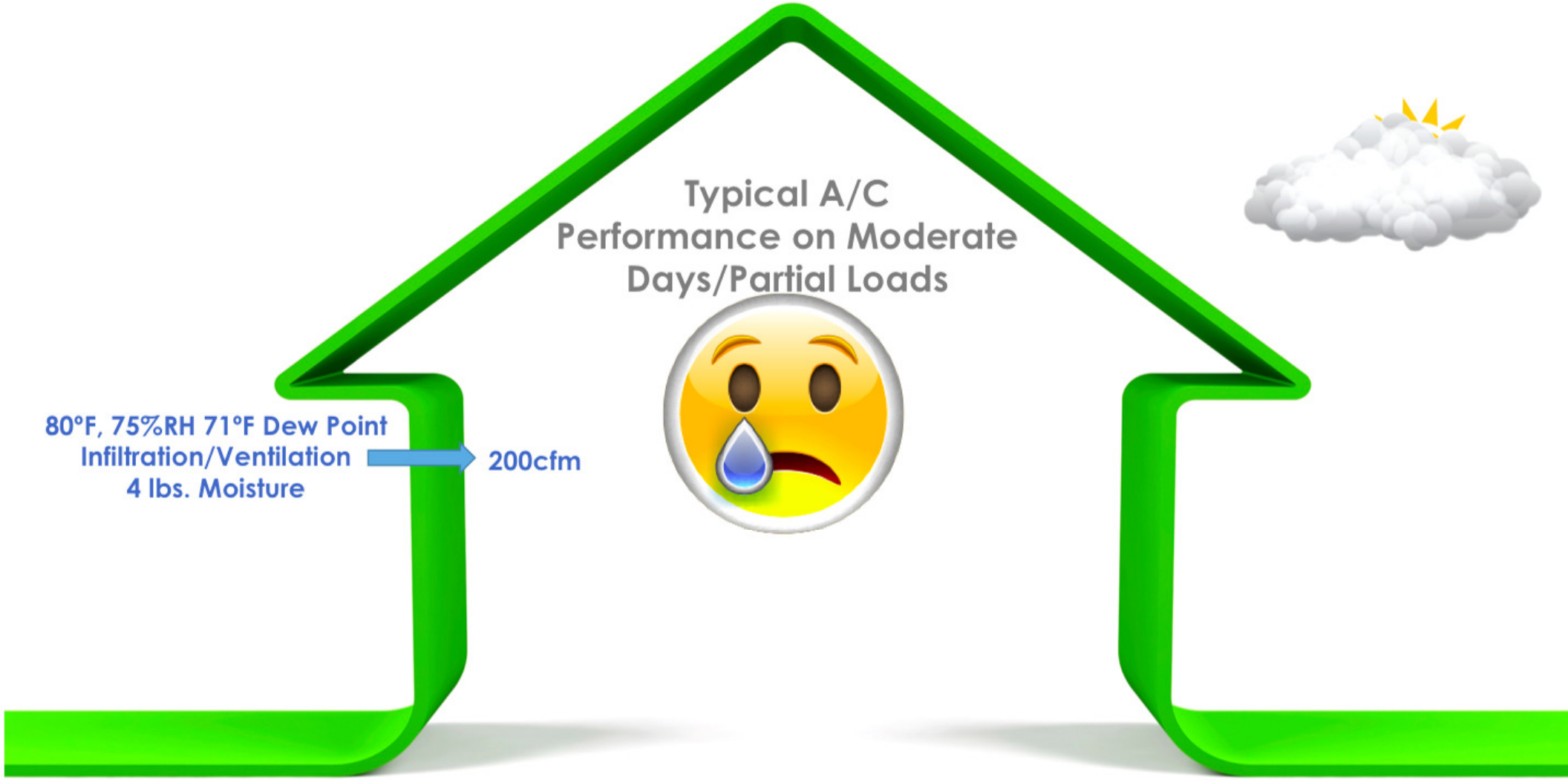

Typical A/C
Performance During Rainy
Days and Nighttime
75°F, 80
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
Ultra-Aire
Whole House Dehu
75°F, 80%RH, 68°F DP
Exfiltration
5 Ton A/C
Family Adds +2 lbs. Per Hour
Dehu removes
5 lbs per hr.
moisture

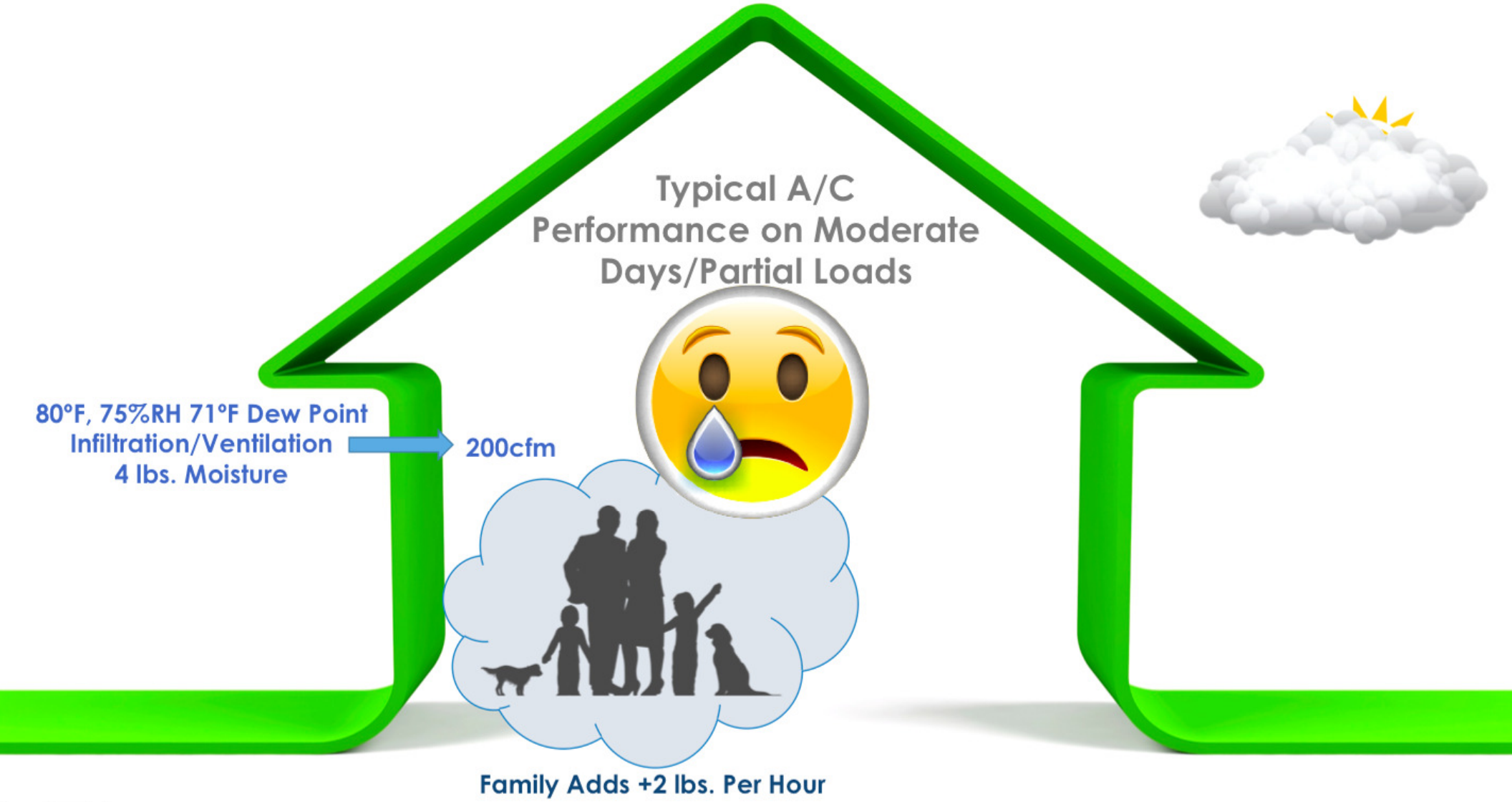

Typical A/C
Performance During Rainy
Days and Nighttime
75°F, 5
69°F, 95%RH 68°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
Ultra-Aire
Whole House Dehu
75°F, 50%RH, 55°F DP
Exfiltration
5 Ton A/C
Family Adds +2 lbs. Per Hour
Dehu removes
5 lbs per hr.
moisture

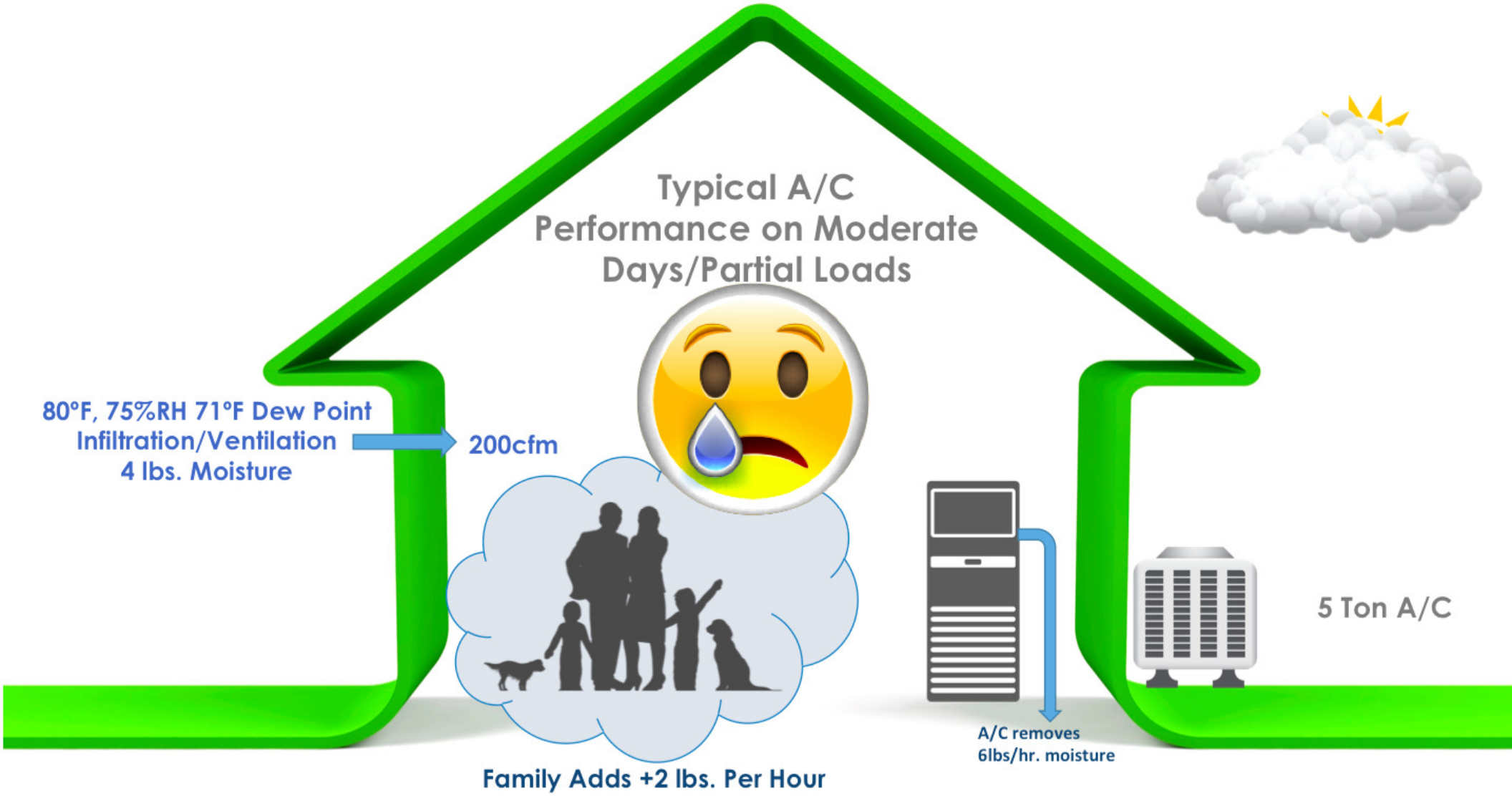
Best Practices artial Load Day

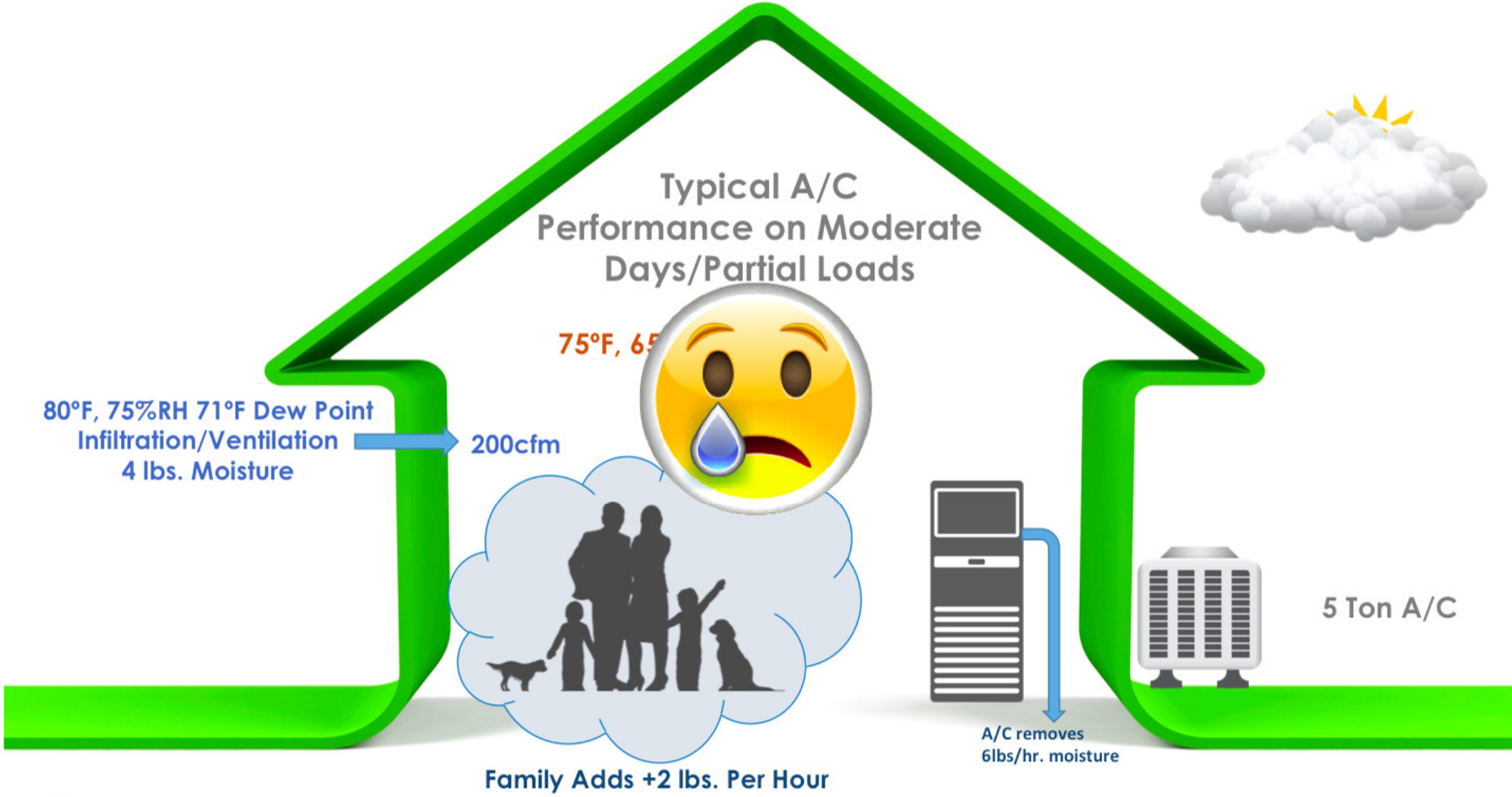


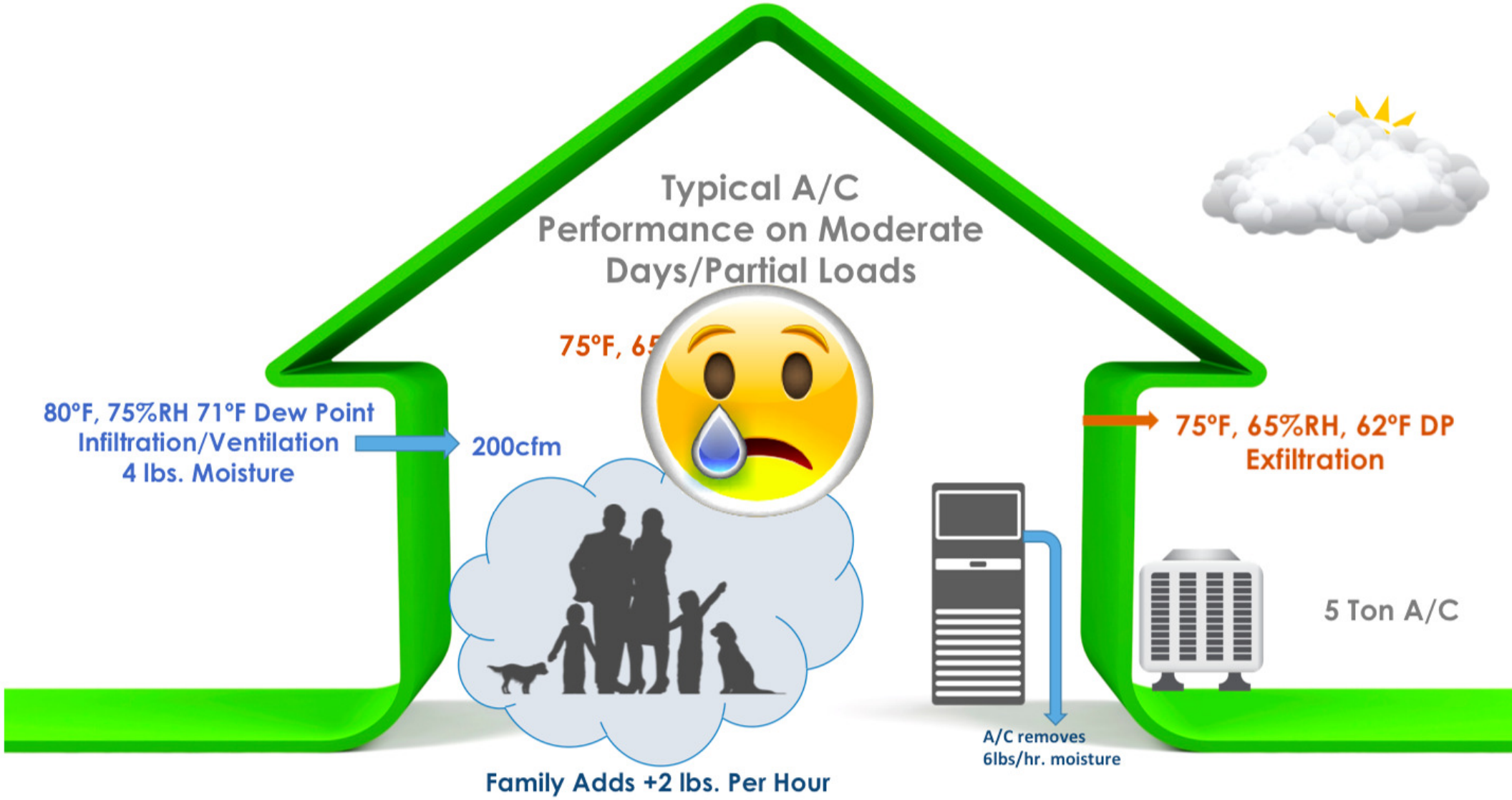

Typical A/C
Performance on Moderate
Days/Partial Loads

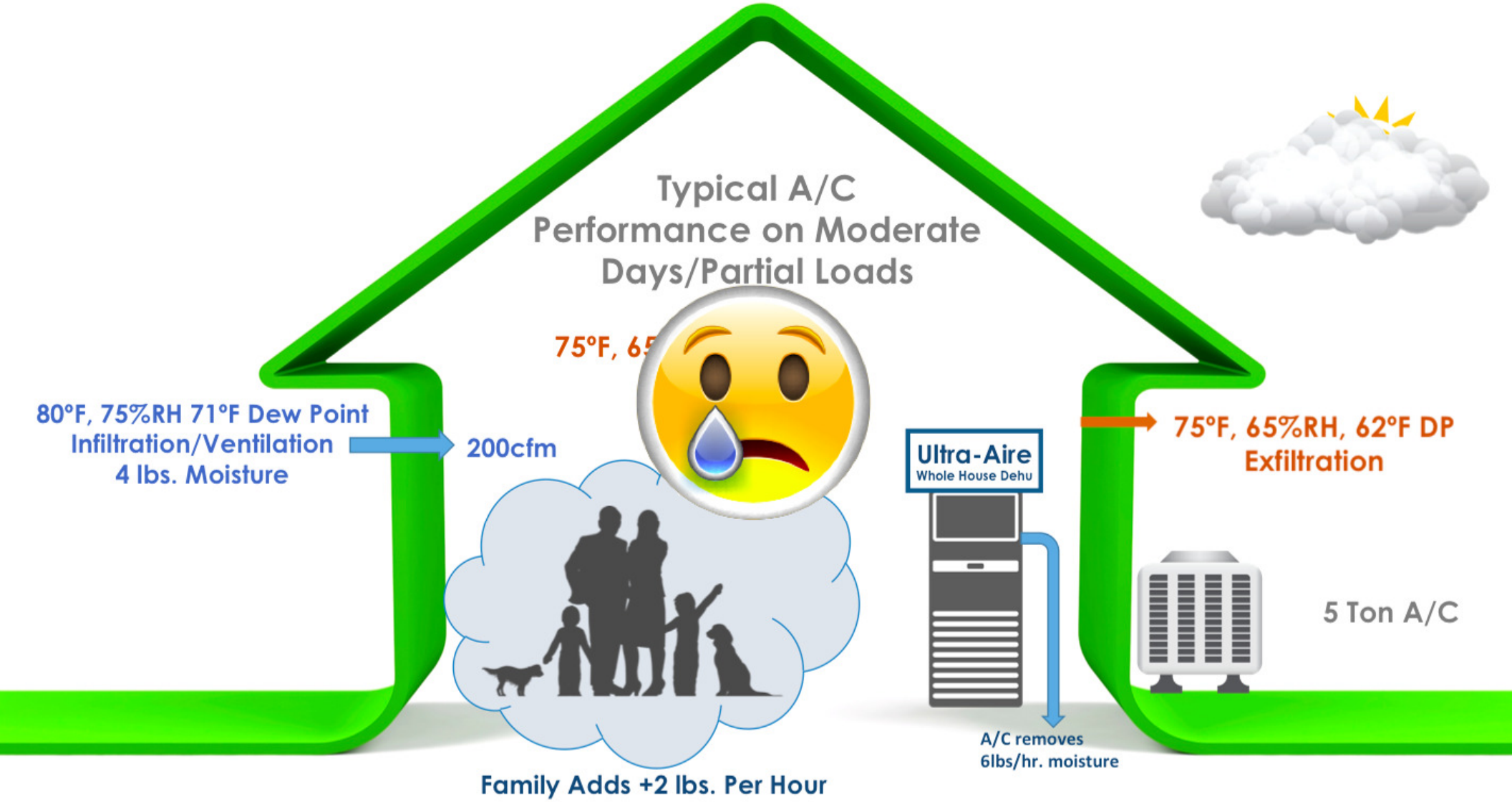

Typical A/C
Performance on Moderate
Days/Partial Loads
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm

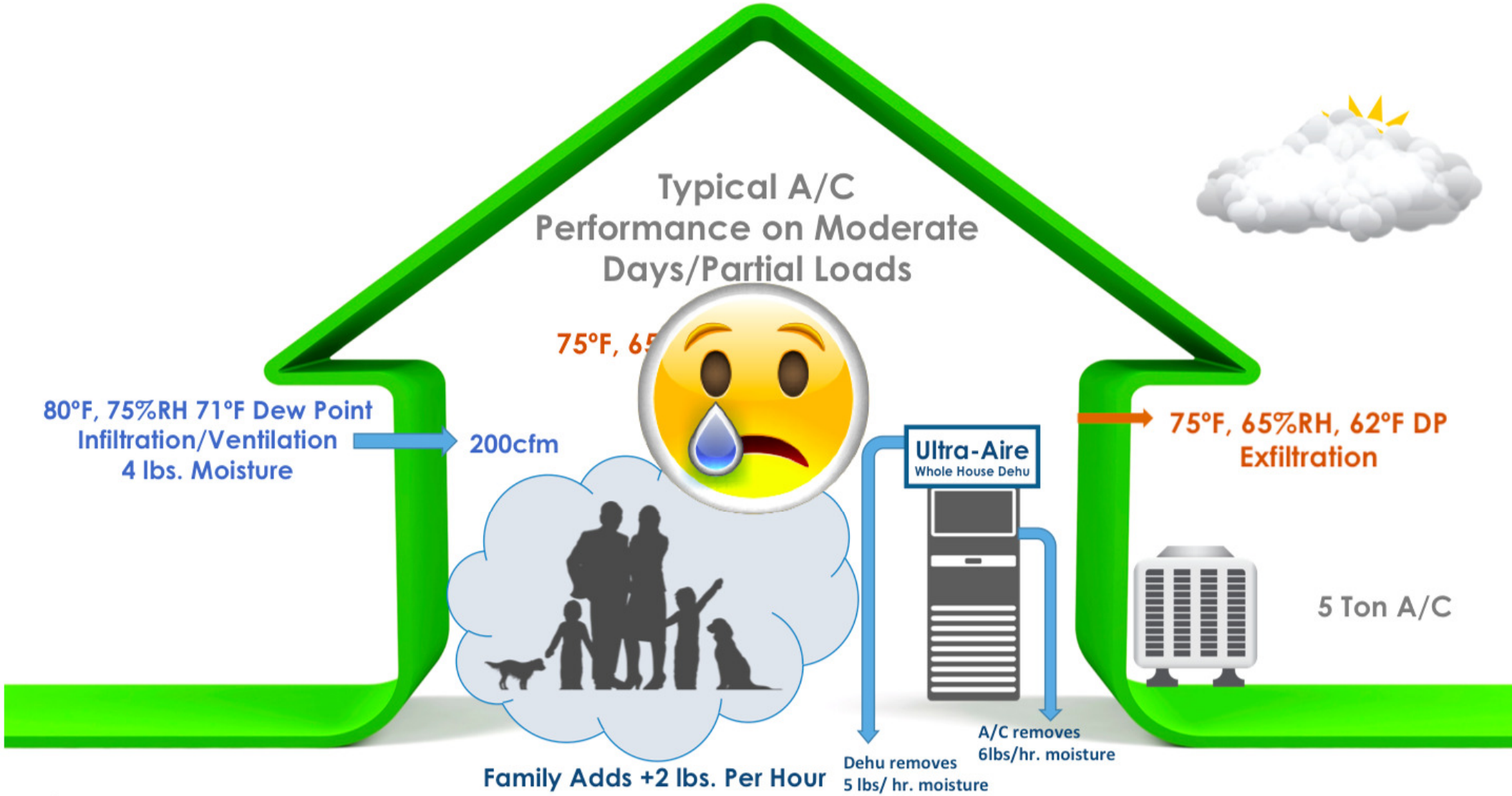

Typical A/C
Performance on Moderate
Days/Partial Loads
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
Family Adds +2 lbs. Per Hour


Typical A/C
Performance on Moderate
Days/Partial Loads
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
5 Ton A/C
A/C removes
6lbs/hr. moisture
Family Adds +2 lbs. Per Hour


Typical A/C
Performance on Moderate
Days/Partial Loads
75°F, 65
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
5 Ton A/C
A/C removes
6lbs/hr. moisture
Family Adds +2 lbs. Per Hour


Typical A/C
Performance on Moderate
Days/Partial Loads
75°F, 65
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
75°F, 65%RH, 62°F DP
Exfiltration
5 Ton A/C
A/C removes
6lbs/hr. moisture
Family Adds +2 lbs. Per Hour


Typical A/C
Performance on Moderate
Days/Partial Loads
75°F, 65
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
200cfm
Ultra-Aire
Whole House Dehu
75°F, 65%RH, 62°F DP
Exfiltration
5 Ton A/C
A/C removes
6lbs/hr. moisture
Family Adds +2 lbs. Per Hour


Typical A/C
Performance on Moderate
Days/Partial Loads
75°F, 65
80°F, 75%RH 71°F Dew Point
Infiltration/Ventilation
4 lbs. Moisture
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Dehu removes
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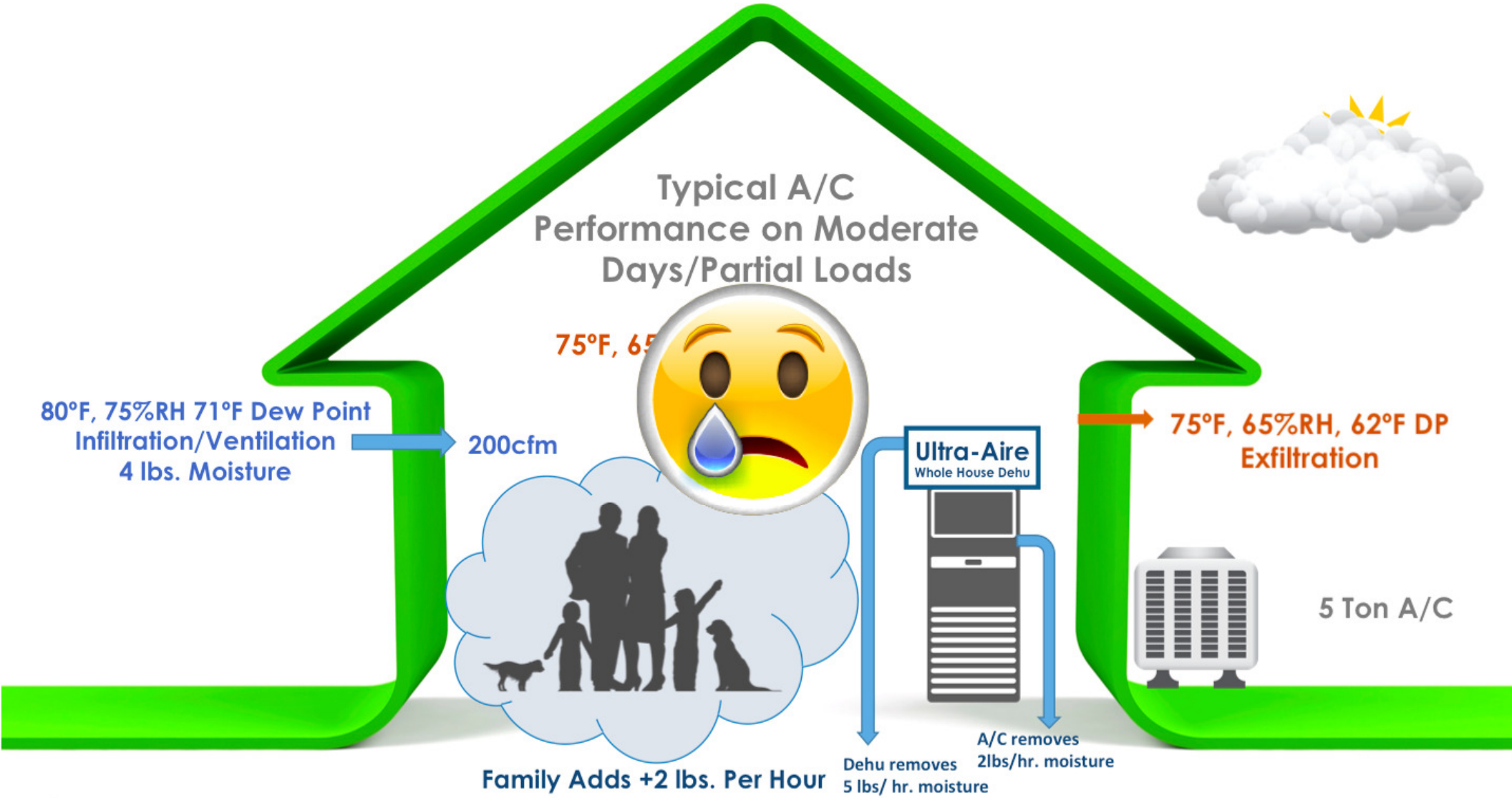
Family Adds +2 lbs. Per Hour


Typical A/C
Performance on Moderate
Days/Partial Loads
75°F, 65
80°F, 75%RH 71°F Dew Point
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4 lbs. Moisture
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Exfiltration
5 Ton A/C
Family Adds +2 lbs. Per Hour
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5 lbs/ hr. moisture
A/C removes
2lbs/hr. moisture

WHAT…

Is a disappointed home owner's next step to solve this problem after complaining to the A/C contractor??

WHAT…

Is a disappointed home owner's next step to solve this problem after complaining to the A/C contractor??

Of Course, search on the internet for a solution to this disappointing comfort issue.

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Thread: oversized unit

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05-10-2016, 07:15 PM #1

superfittertech
Professional Member*

Join Date: Jun 2004
Location: St Paul, minnesota
Posts: 1,500
Post Likes

oversized unit

Help. I have a foam house approximately 2600 square ft. upstairs 960 sq ft the indoor unit is a Bryant 38MVC060-14 furnace with a CNRVP2417ACAABAA cased "N" coil and a 20 year old Lennox 2 ton condensing unit. Obviously oversized. load calcs slightly under 1 ton. The problem is I need to replace the condensing unit, but I'm unable to find anything less than a 1.5 ton unit. Thought about using an EPR valve with a hot gas bypass valve as I've done a few times in the past, but I really don't want to travel down that road again. Does anyone know if they still make a 1 ton condensing unit anymore? (R-410A of course). The unit already has a honeywell VNT5070E1000 erv. I can't get the humidity below 60%

05-11-2016, 07:13 AM #5

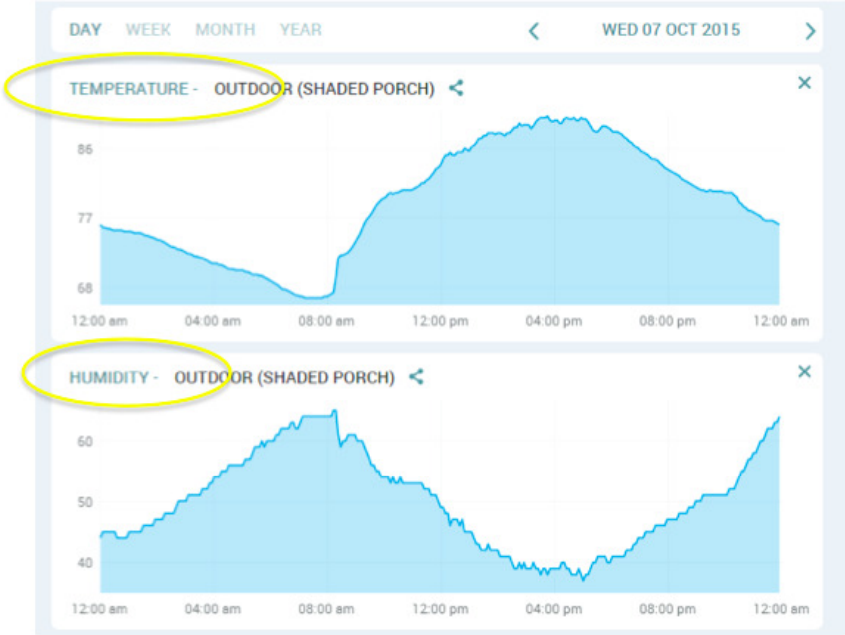
teddy bear
Sponsor & Professional Member*

Join Date: Jun 2003
Location: Madison, WI/Cape Coral, FL
Posts: 7,535
Post Likes

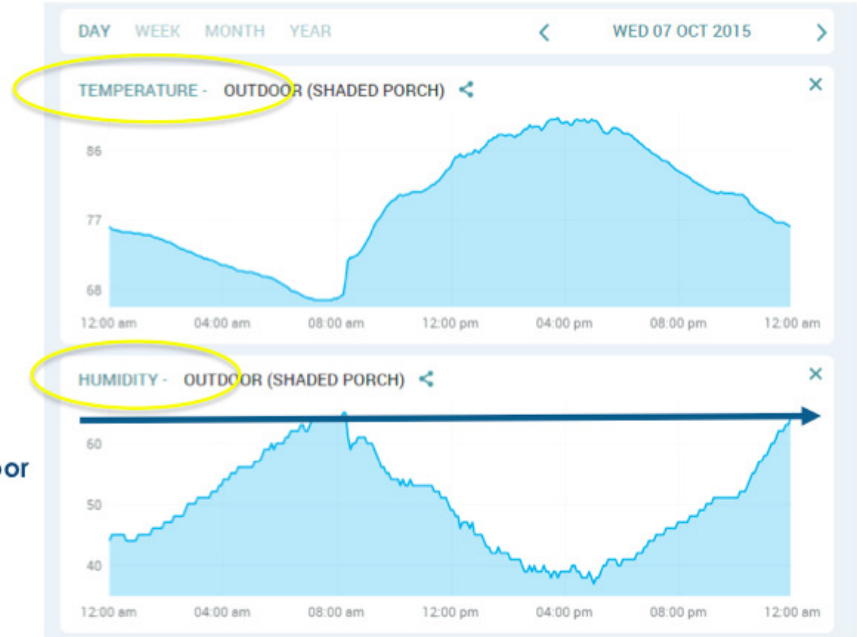
You need something that will remove 3-4 lbs. of moisture per hour minimum without any sensible cooling load for the damp evenings, occupants moisture,and moisture in the fresh air.
Add a small whole house dehumidifier and you have 50%RH during low/no sensible cooling loads and high outdoor dew points.
Also for the many days when there is no sensible cooling load, turn off the a/c and let the dehumidifier keep the home dry for pennies.
Over-cooling is costly and uncomfortable compare to a high efficiency whole house like the Ultra-Aire 70H.
Your thoughts?
Regards Teddy Bear

TEXAS HOME

TEXAS HOME

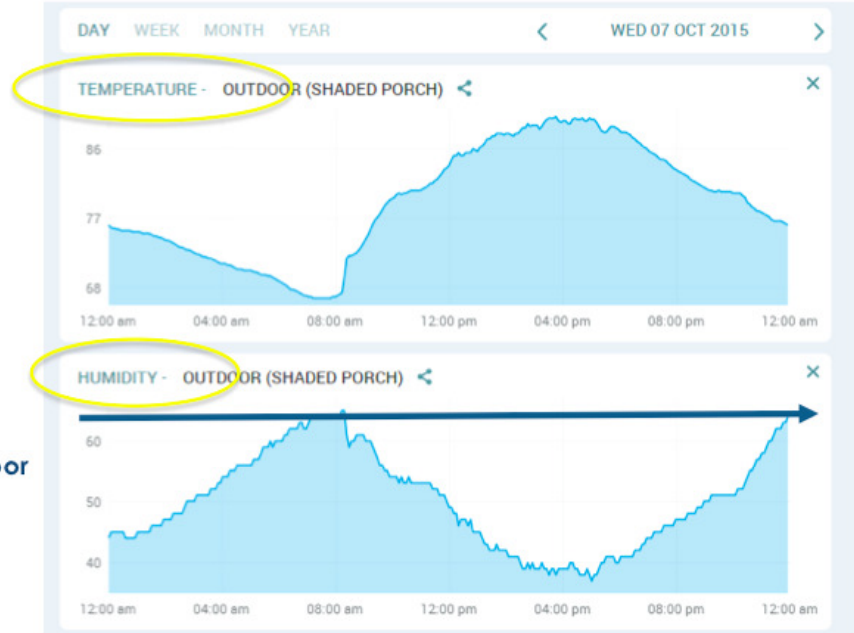

DAY
WEEK
MONTH
YEAR
WED 07 OCT 2015
TEMPERATURE - OUTDOOR (SHADED PORCH)
86
77
68
12:00 am
04:00 am
08:00 am
12:00 pm
04:00 pm
08:00 pm
12:00 am
HUMIDITY - OUTDOOR (SHADED PORCH)
60
50
40
12:00 am
04:00 am
08:00 am
12:00 pm
04:00 pm
08:00 pm
12:00 am

TEXAS HOME

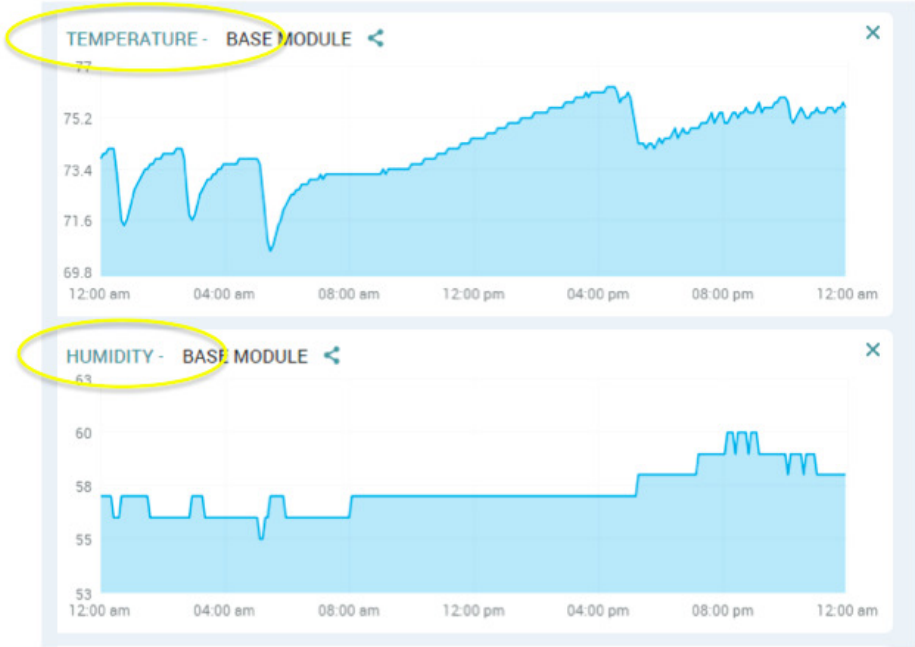


63°F Outdoor Dew Point

TEXAS HOME



63°F Outdoor Dew Point



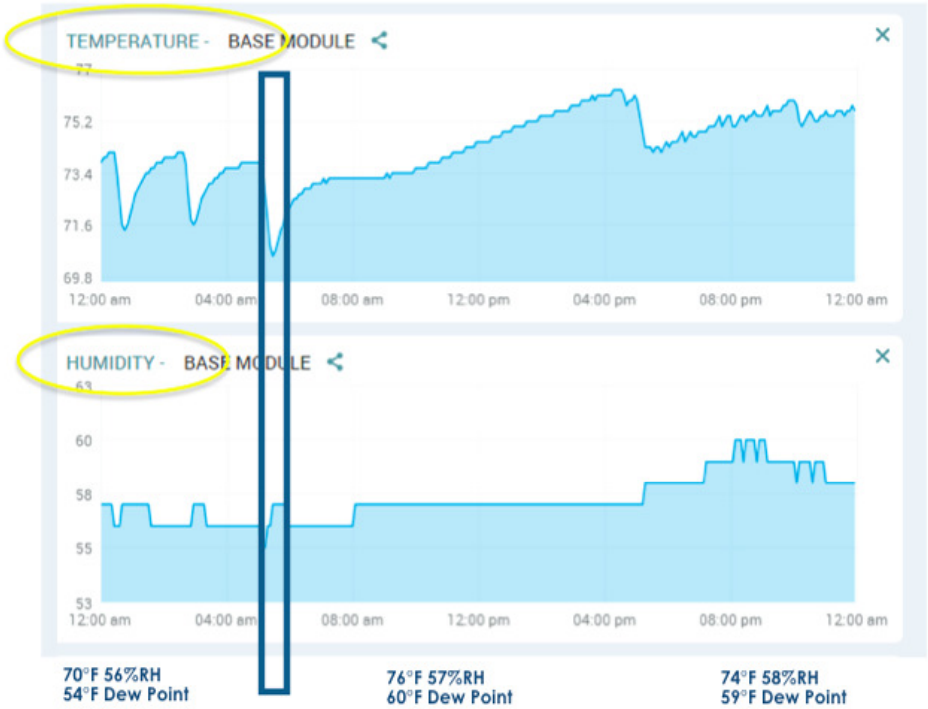
70°F 56%RH
54°F Dew Point

76°F 57%RH
60°F Dew Point

74°F 58%RH
59°F Dew Point

TEXAS HOME

DAY WEEK MONTH YEAR
WED 07 OCT 2015
TEMPERATURE - OUTDOOR (SHADED PORCH)
86
77
68
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
HUMIDITY - OUTDOOR (SHADED PORCH)
60
50
40
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
63°F Outdoor Dew Point


TEMPERATURE - BASE MODULE
77
75.2
73.4
71.6
69.8
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
HUMIDITY - BASE MODULE
63
60
58
55
53
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
70°F 56%RH
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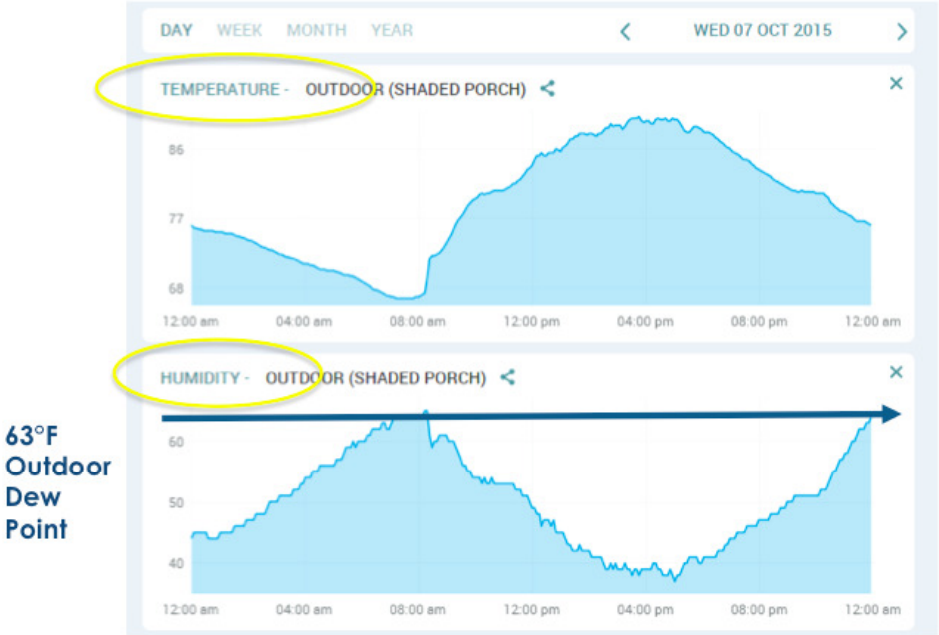
TEXAS HOME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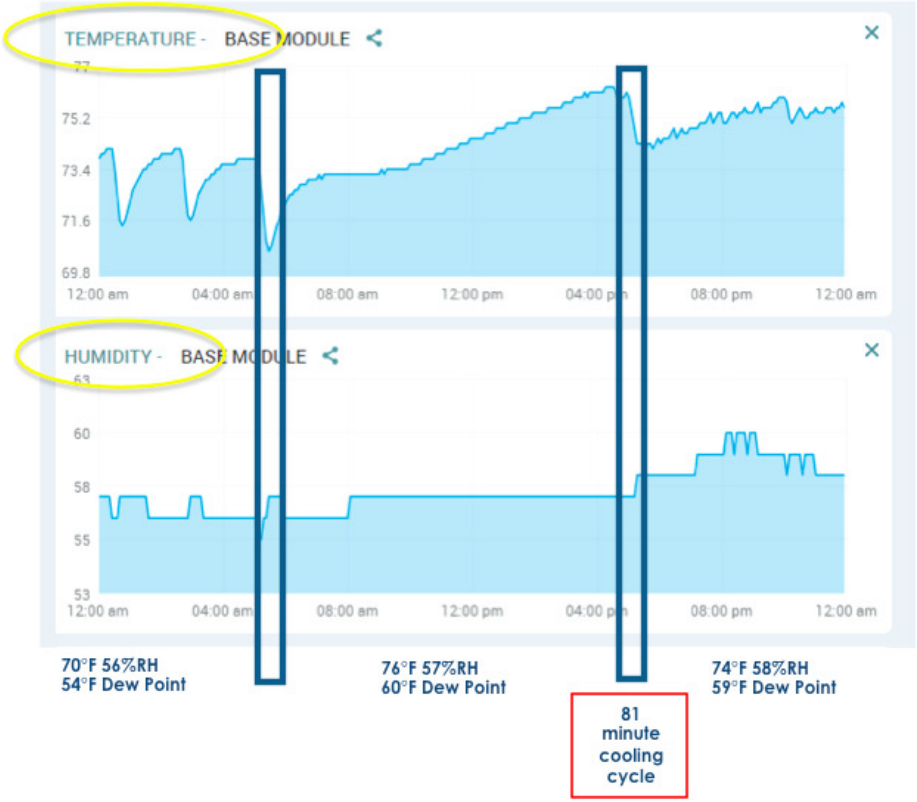
TEMPERATURE - BASE MODULE
75.2
73.4
71.6
69.8
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
HUMIDITY - BASE MODULE
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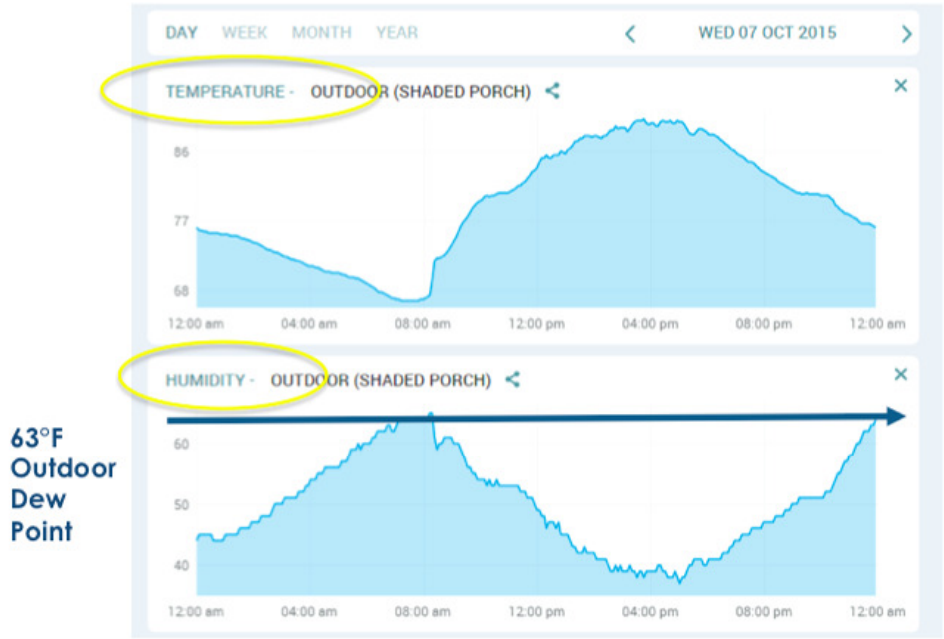
58
55
53
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
70°F 56%RH
54°F Dew Point
76°F 57%RH
60°F Dew Point
74°F 58%RH
59°F Dew Point
81 minute cooling cycle

TEXAS HOME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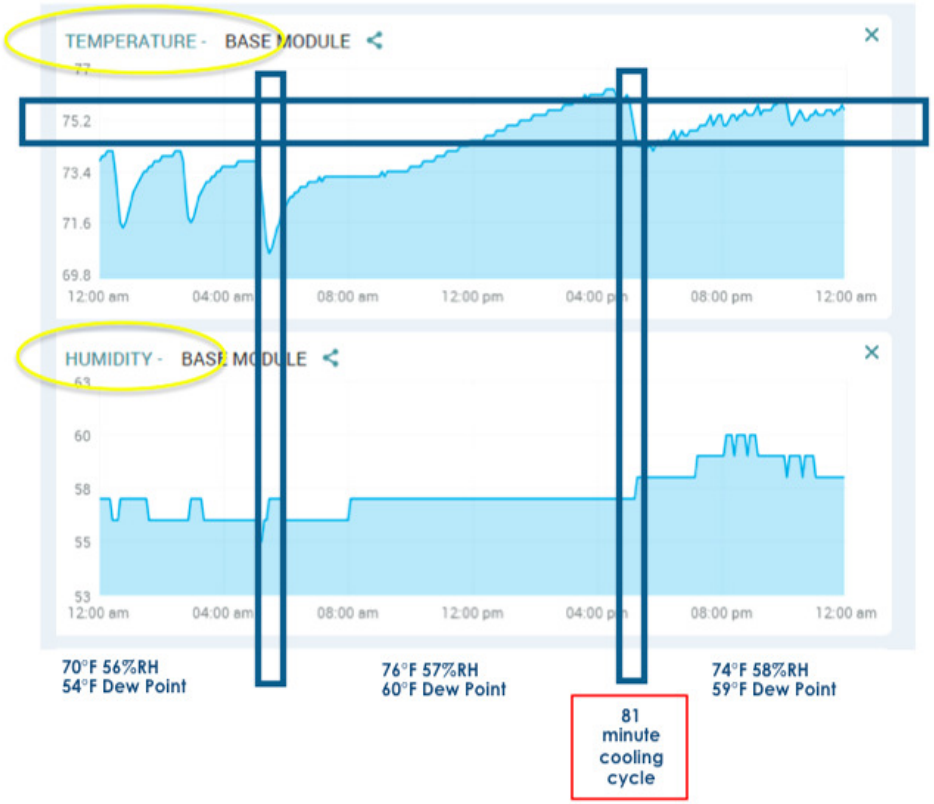
63°F Outdoor Dew Point


TEMPERATURE - BASE MODULE
75.2
73.4
71.6
69.8
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
HUMIDITY - BASE MODULE
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58
55
53
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70°F 56%RH
54°F Dew Point
76°F 57%RH
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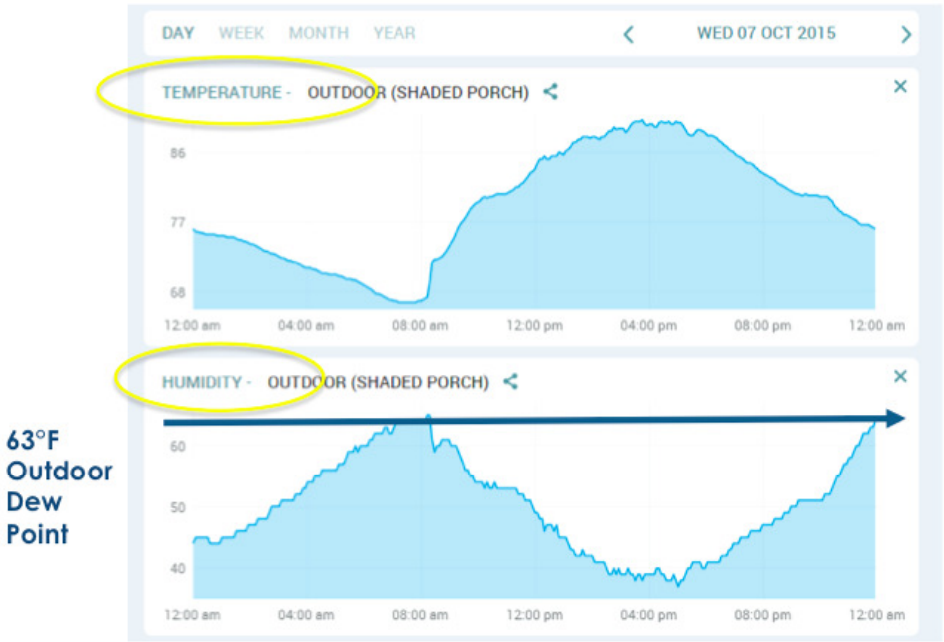
74°F 58%RH
59°F Dew Point
81 minute cooling cycle

TEXAS HOME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68
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63°F Outdoor Dew Point

TEMPERATURE - BASE MODULE
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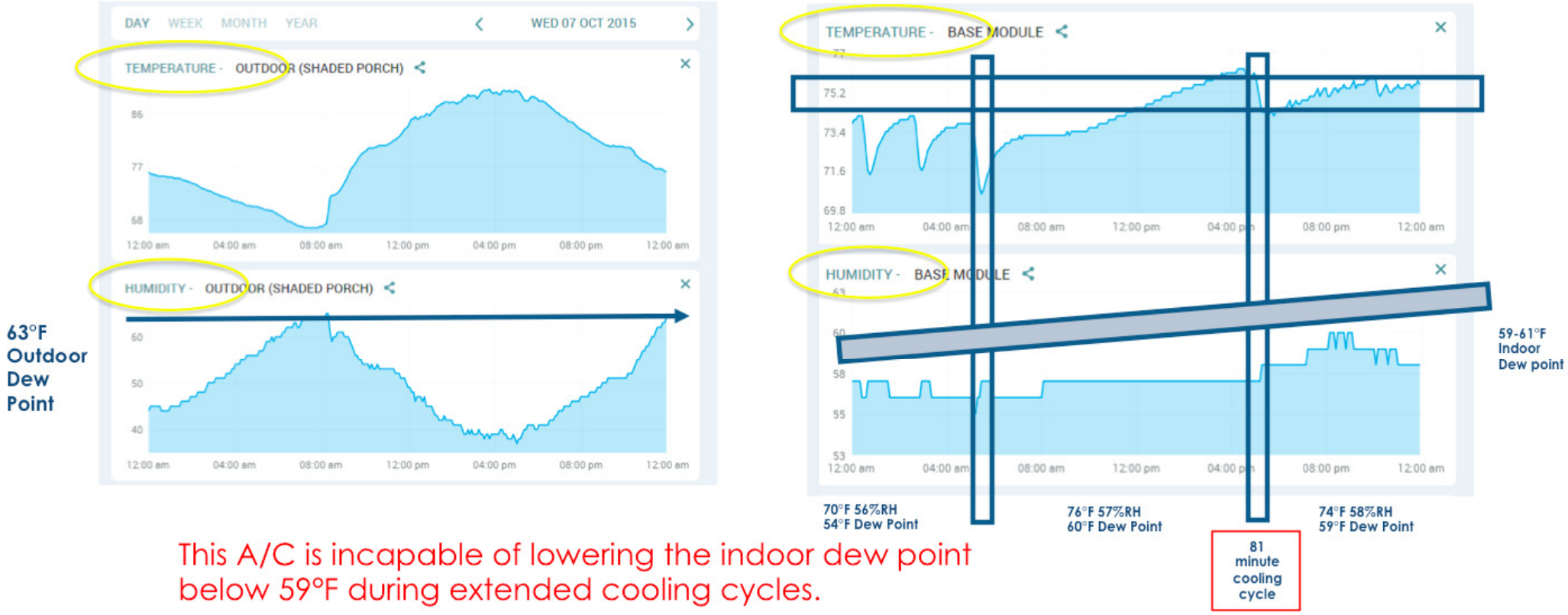
HUMIDITY - BASE MODULE
58
55
53
12:00 am 04:00 am 08:00 am 12:00 pm 04:00 pm 08:00 pm 12:00 am
59-61°F Indoor Dew point
70°F 56%RH 54°F Dew Point
76°F 57%RH 60°F Dew Point
74°F 58%RH 59°F Dew Point
81 minute cooling cycle

TEXAS HOME

This A/C is incapable of lowering the indoor dew point below 59°F during extended cooling cycles.

TEXAS HOME



This A/C is incapable of lowering the indoor dew point below 59°F during extended cooling cycles.

Possible reasons for lack of %RH reduction?

FOCUS…

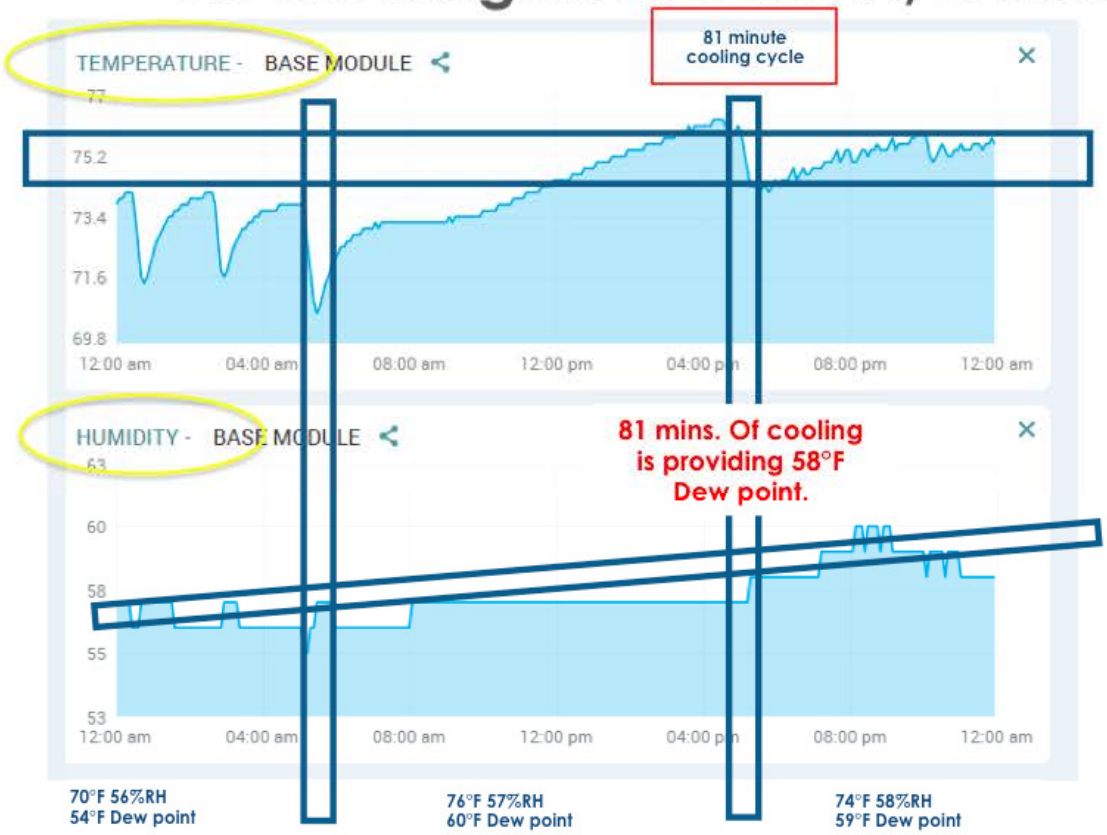
On the longest of 5 ton A/C runs

FOCUS…

On the longest of 5 ton A/C runs

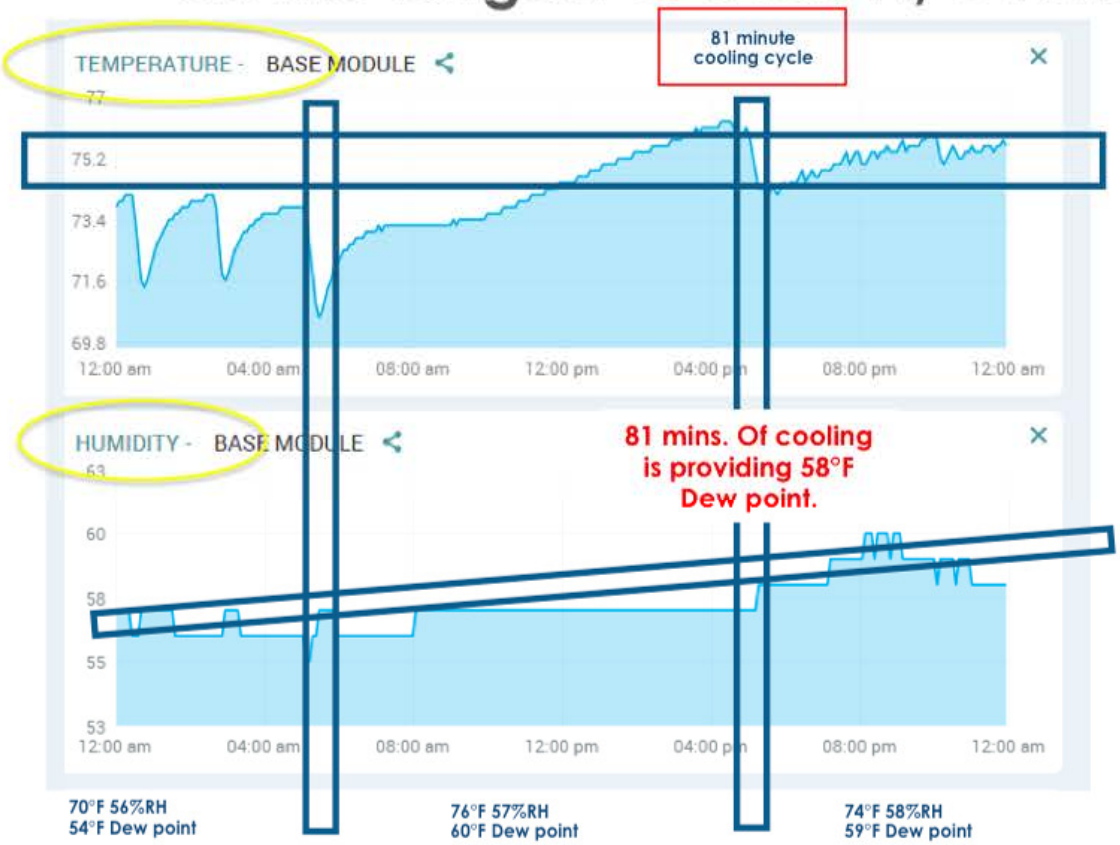
FOCUS…

On the longest of 5 ton A/C runs



FOCUS…

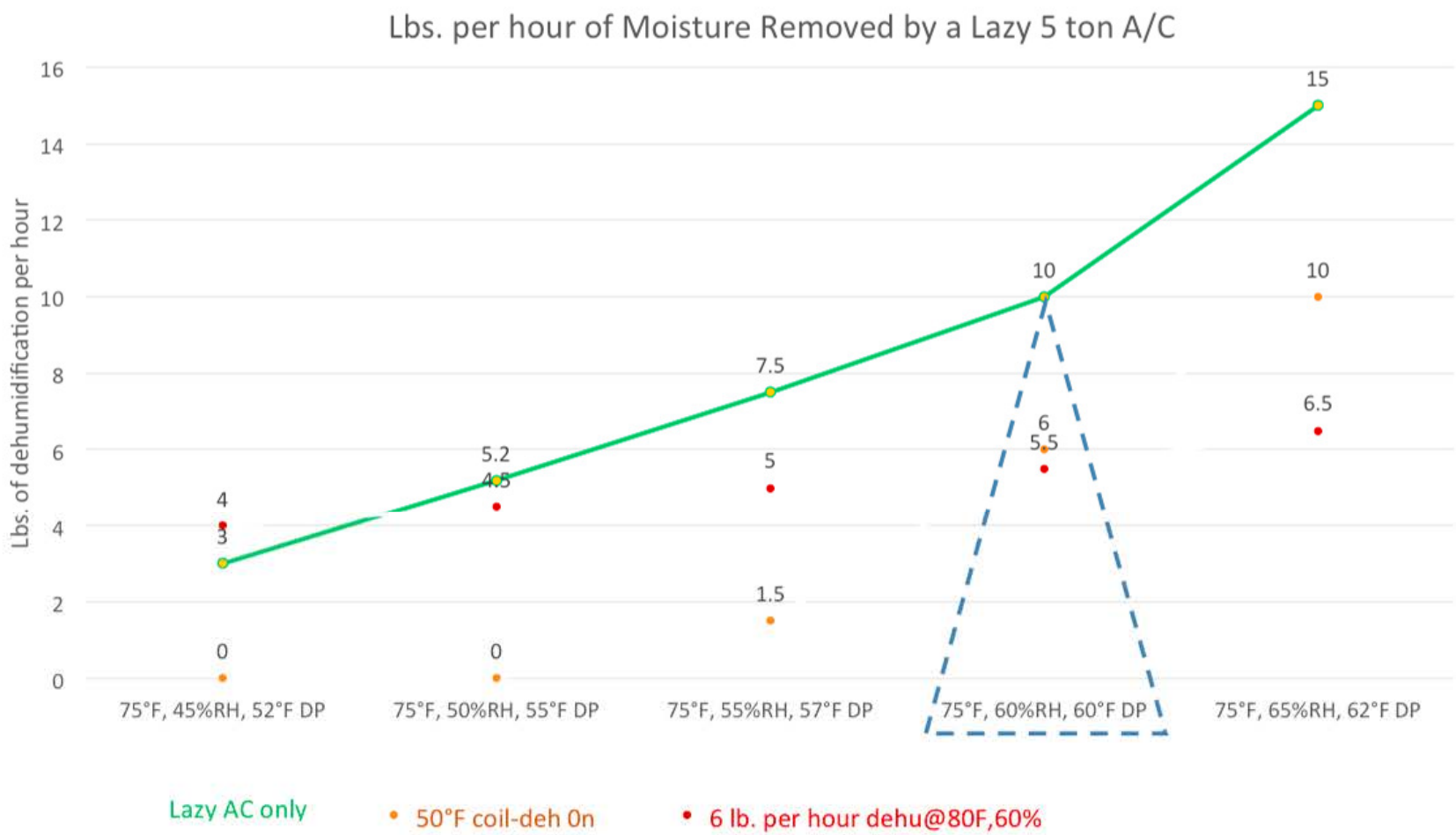
On the longest of 5 ton A/C runs

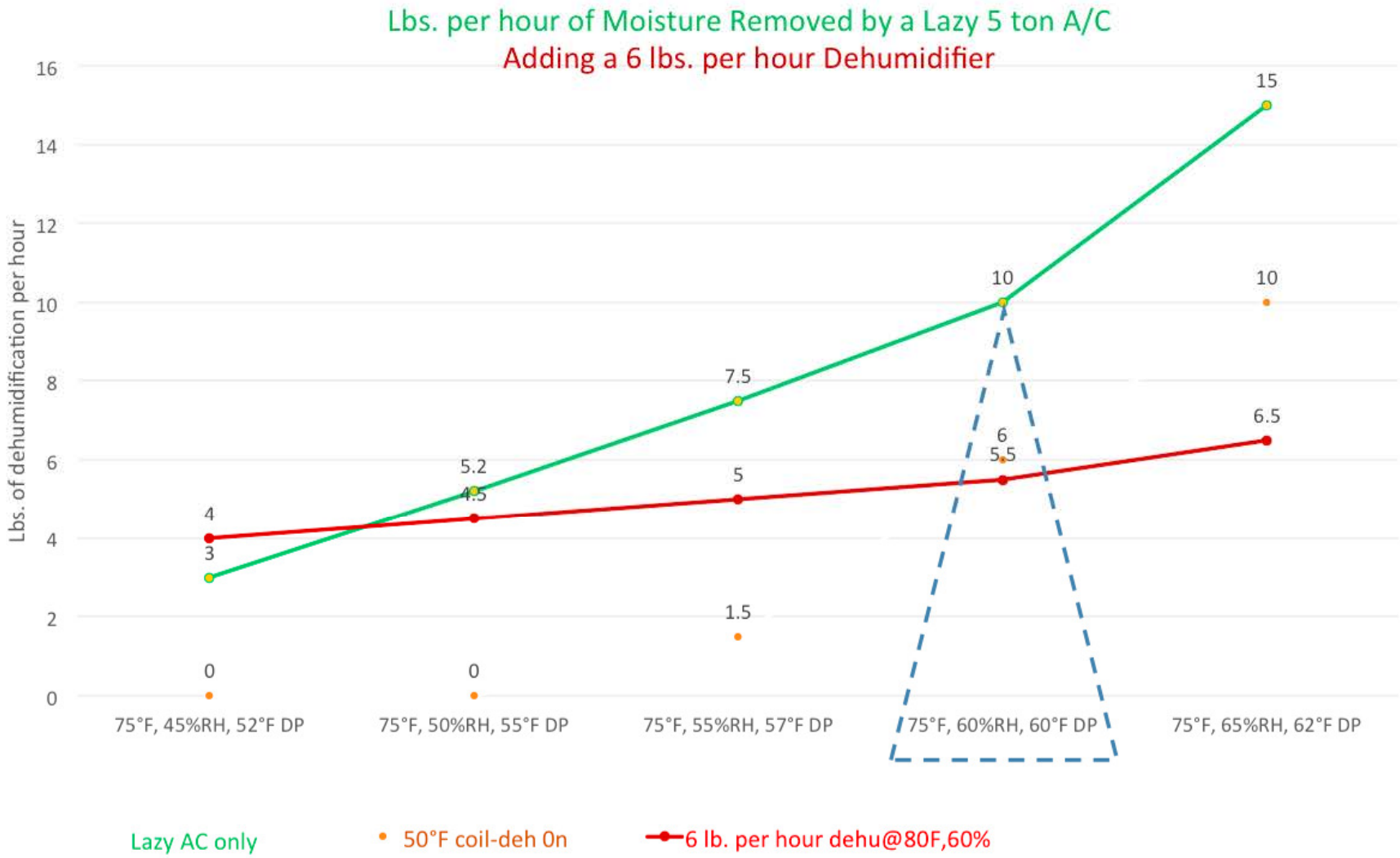


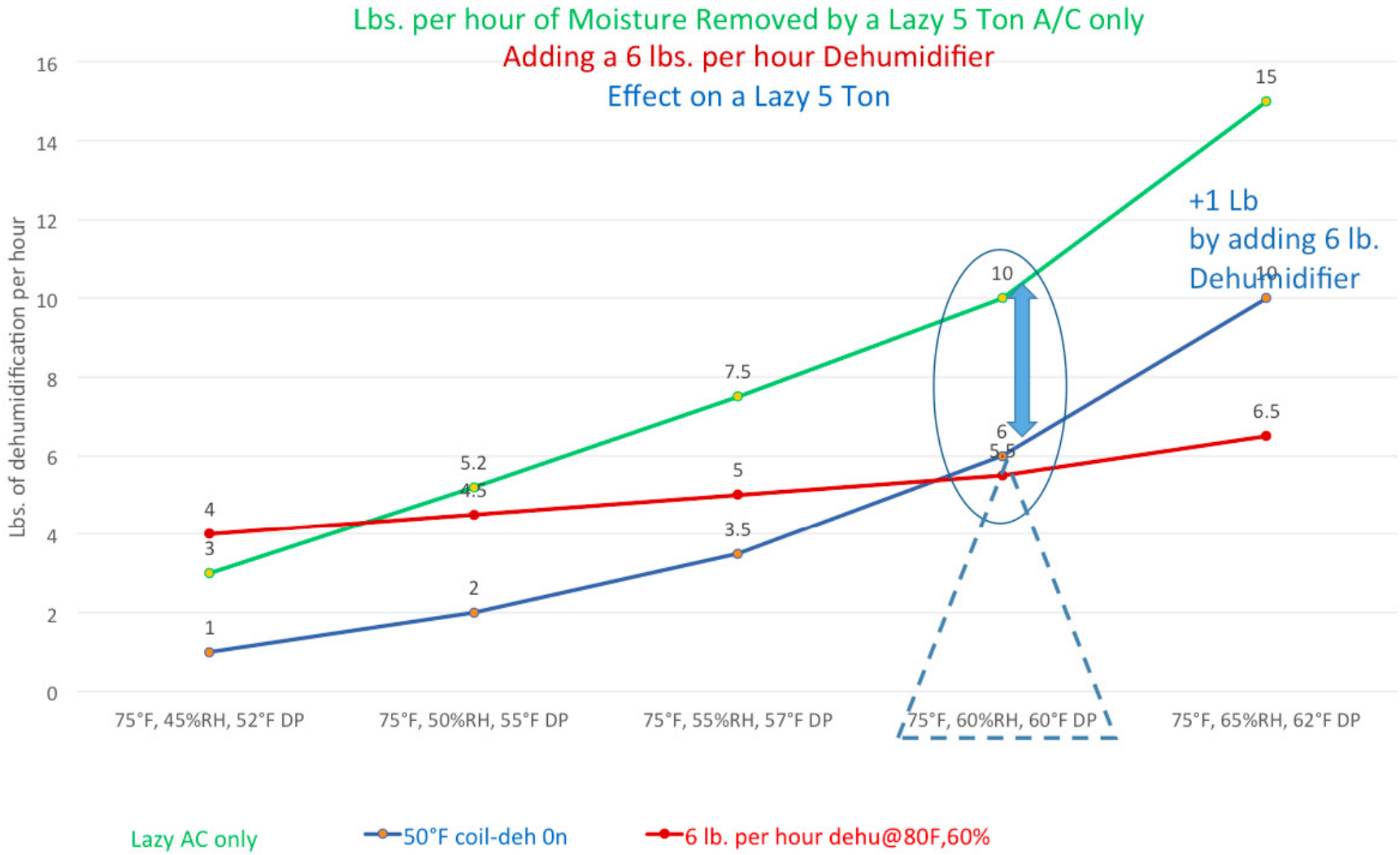
Adding 150 pint whole house dehumidifier did not change this home much.

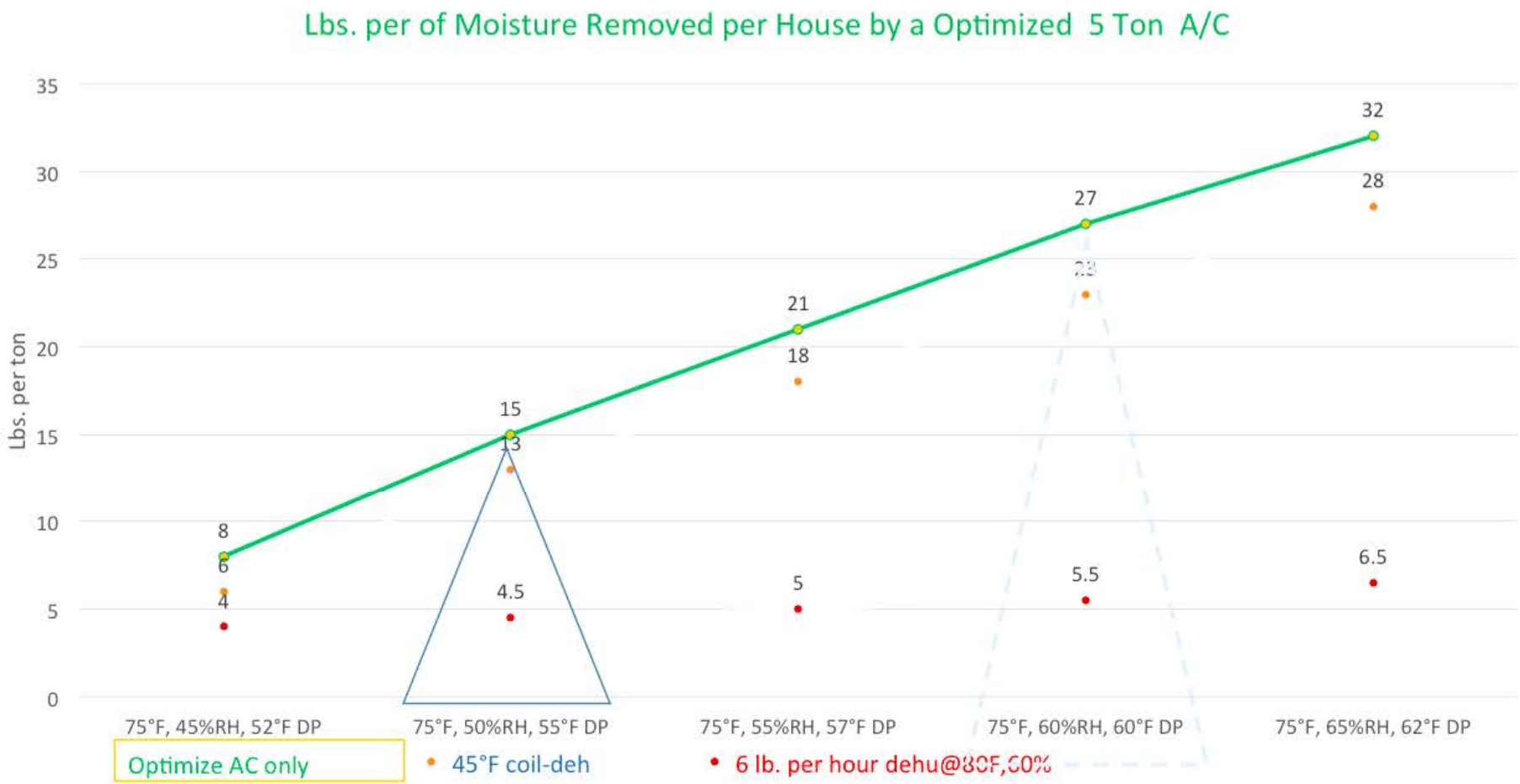
What is going on?

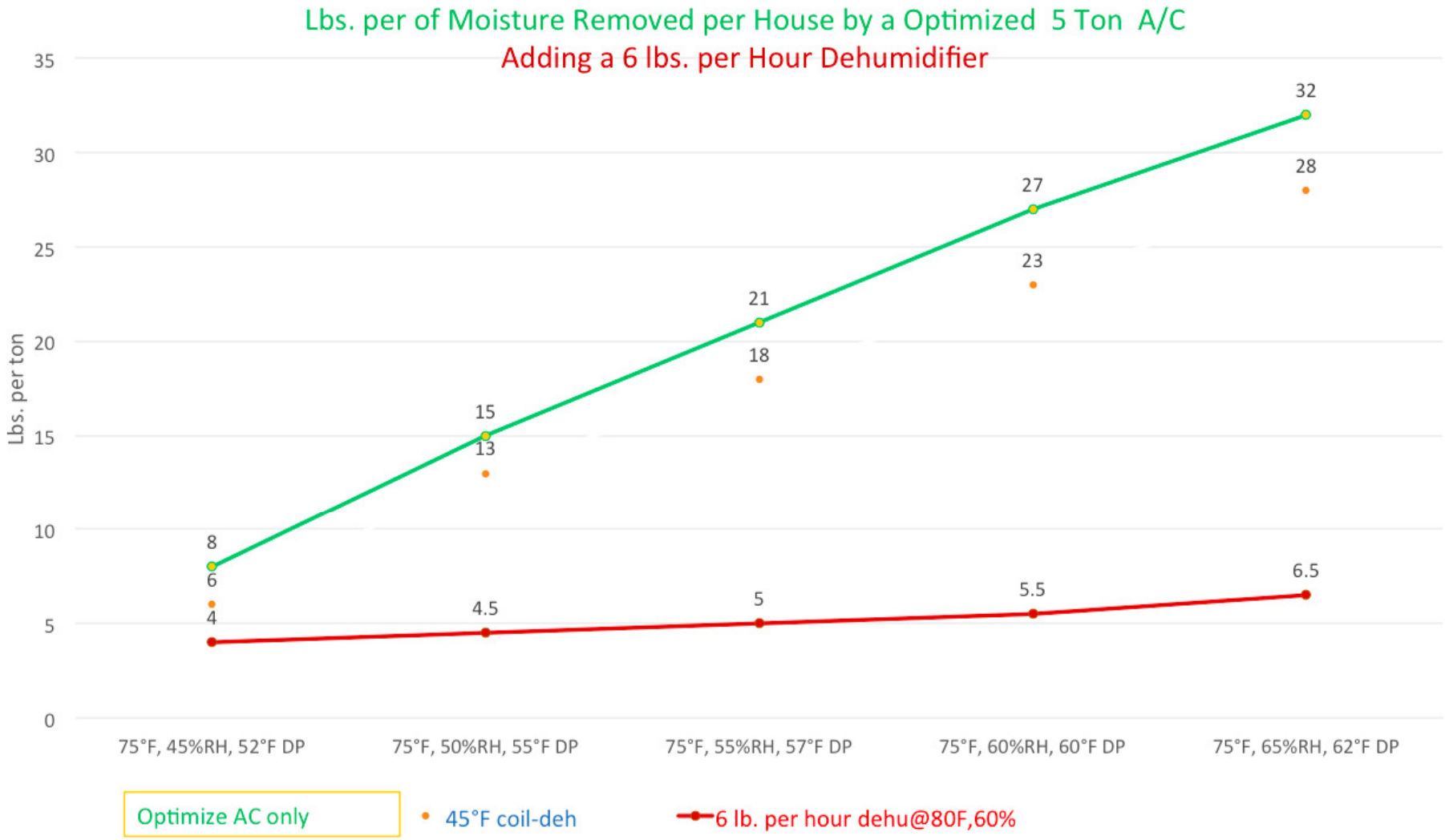
The Lazy A/C!

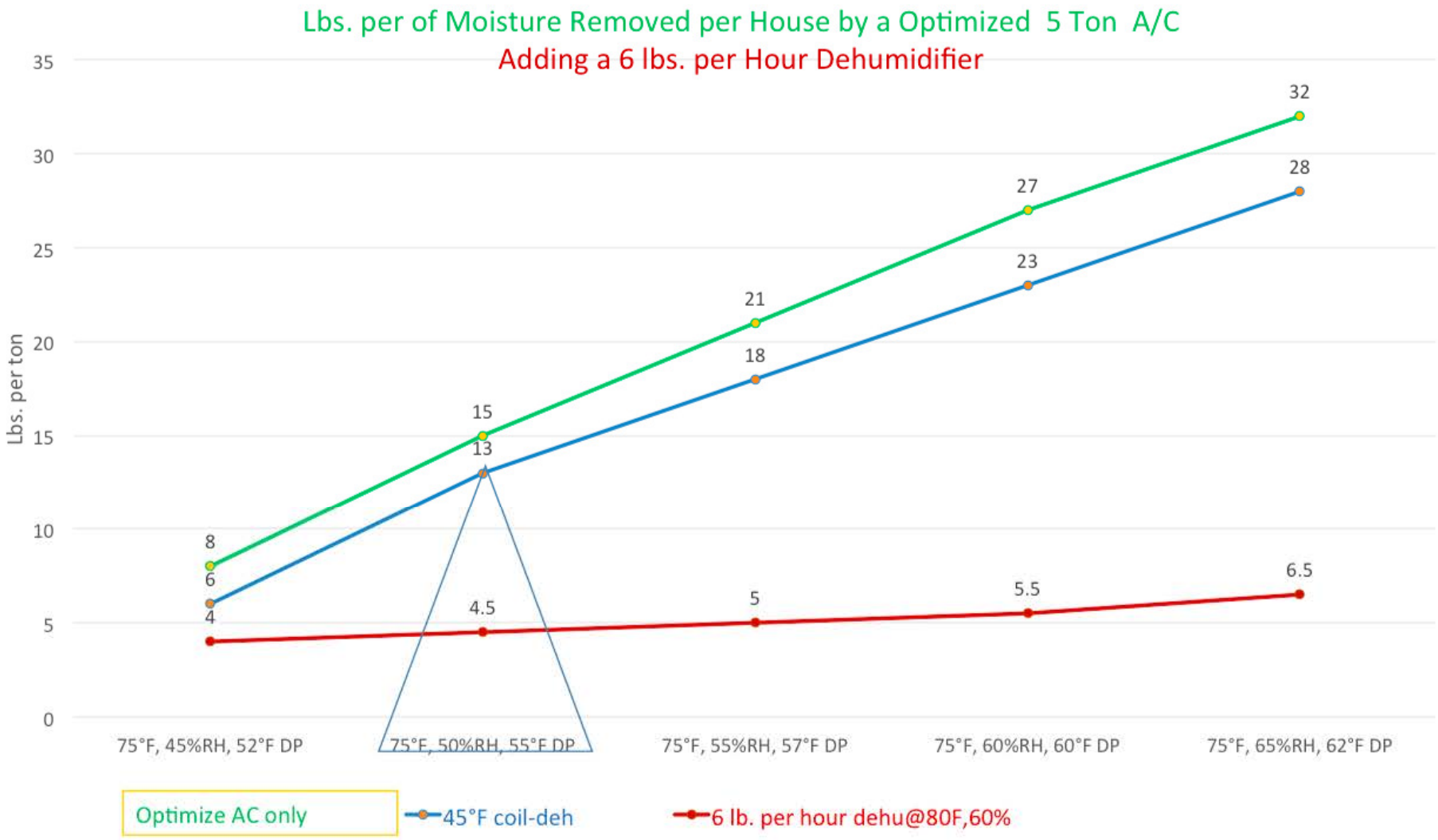

Lbs. per hour of Moisture Removed by a Lazy 5 ton A/C
Lbs. of dehumidification per hour
16
14
12
10
8
6
4
2
0
15
10
10
7.5
6.5
6
5.5
5.2
4.5
5
4
3
1.5
0
0
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Lazy AC only
50°F coil-deh 0n
6 lb. per hour dehu@80F,60%

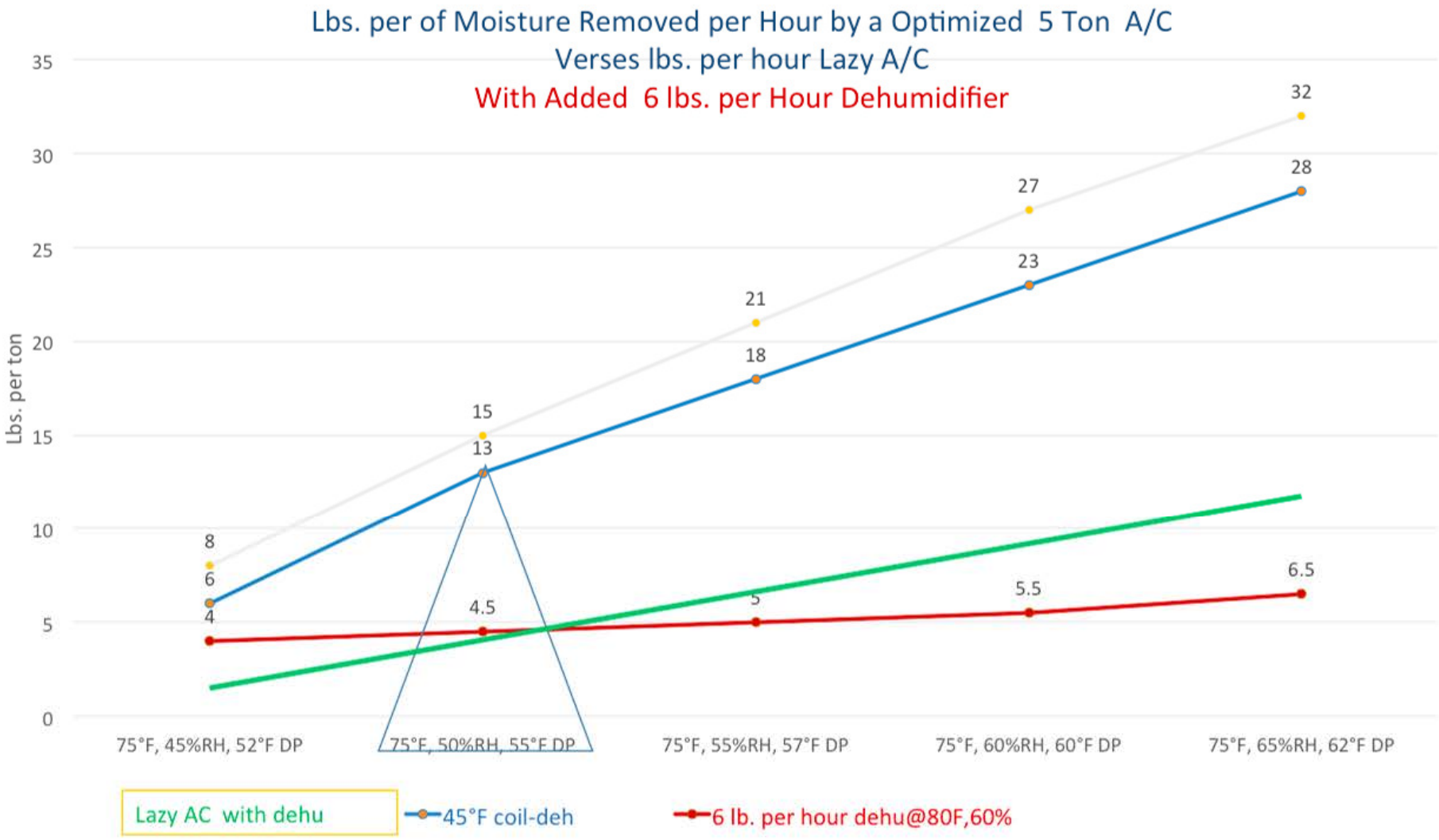

Lbs. per hour of Moisture Removed by a Lazy 5 ton A/C
Adding a 6 lbs. per hour Dehumidifier
Lbs. of dehumidification per hour
16
14
12
10
8
6
4
2
0
15
10
10
7.5
6.5
6
5.5
5.2
4.5
5
4
3
1.5
0
0
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Lazy AC only
50°F coil-deh 0n
6 lb. per hour dehu@80F,60%


Lbs. per hour of Moisture Removed by a Lazy 5 Ton A/C only
Adding a 6 lbs. per hour Dehumidifier
Effect on a Lazy 5 Ton
Lbs. of dehumidification per hour
16
14
12
10
8
6
4
2
0
15
10
7.5
5.2
4.5
4
3
1
2
3.5
5
6
5.5
6.5
10
+1 Lb
by adding 6 lb.
Dehumidifier
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Lazy AC only
50°F coil-deh 0n
6 lb. per hour dehu@80F,60%


Lbs. per of Moisture Removed per House by a Optimized 5 Ton A/C
Lbs. per ton
35
30
25
20
15
10
5
0
8
6
4
15
13
4.5
21
18
5
27
23
5.5
32
28
6.5
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Optimize AC only
45°F coil-deh
6 lb. per hour dehu@80F,60%


Lbs. per of Moisture Removed per House by a Optimized 5 Ton A/C
Adding a 6 lbs. per Hour Dehumidifier
Lbs. per ton
35
30
25
20
15
10
5
0
8
15
21
27
32
6
13
18
23
28
4
4.5
5
5.5
6.5
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Optimize AC only
45°F coil-deh
6 lb. per hour dehu@80F,60%


Lbs. per of Moisture Removed per House by a Optimized 5 Ton A/C
Adding a 6 lbs. per Hour Dehumidifier
Lbs. per ton
35
30
25
20
15
10
5
0
32
28
27
23
21
18
15
13
8
6
4
4.5
5
5.5
6.5
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Optimize AC only
45°F coil-deh
6 lb. per hour dehu@80F,60%


Lbs. per of Moisture Removed per Hour by a Optimized 5 Ton A/C
Verses lbs. per hour Lazy A/C
With Added 6 lbs. per Hour Dehumidifier
Lbs. per ton
35
30
25
20
15
10
5
0
8
6
4
15
13
4.5
21
18
5
27
23
5.5
32
28
6.5
75°F, 45%RH, 52°F DP
75°F, 50%RH, 55°F DP
75°F, 55%RH, 57°F DP
75°F, 60%RH, 60°F DP
75°F, 65%RH, 62°F DP
Lazy AC with dehu
45°F coil-deh
6 lb. per hour dehu@80F,60%

How to Fix the Lazy AC

Step 1) Adjust the airflow to get desired evaporator coil temperature.

Step 2) Verify you have achieved the desired evaporator coil temperature – three options:

1) Measure suction line pressure
2) Measure dew point off the supply
3) Measure condensate at 75F/50%

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

RATINGS

NOTE - Cooling capacities are gross and do not include indoor coil blower motor heat deduction. Heating capacities include defrost cycles in the temperature range where they occur.
NOTE - Heating performance outdoor temperature 70% relative humidity. Indoor temperature 70°F (21°).
NOTE - For Temperatures and Capacities not shown in tables, see bulletin — Cooling Unit Rating Table Correction Factor Data in Miscellaneous Engineering Data section.

HP26-060 — CH33-62D-F - CH23-68 - COOLING CAPACITY

Entering Wet Bulb Temperature	Total Air Volume		Outdoor Air Temperature Entering Outdoor Coil																							
			85°F (29°C)						95°F (35°C)						105°F (41°C)						115°F (46°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	59.2	17.3	4.11	.75	.89	1.00	57.1	16.7	4.64	.76	.91	1.00	54.9	16.1	5.23	.78	.93	1.00	52.6	15.4	5.90	.79	.95	1.00
	1950	920	60.4	17.7	4.13	.78	.93	1.00	58.2	17.1	4.65	.79	.95	1.00	56.0	16.4	5.24	.80	.96	1.00	53.7	15.7	5.91	.82	.98	1.00
	2150	1015	61.4	18.0	4.13	.81	.96	1.00	59.3	17.4	4.66	.82	.98	1.00	57.1	16.7	5.25	.84	.99	1.00	54.9	16.1	5.92	.86	1.00	1.00
67°F (19°C)	1750	825	62.8	18.4	4.15	.58	.72	.86	60.6	17.8	4.67	.59	.74	.88	58.2	17.1	5.26	.60	.75	.89	55.7	16.3	5.93	.61	.77	.91
	1950	920	63.8	18.7	4.15	.60	.75	.90	61.5	18.0	4.67	.61	.77	.91	59.1	17.3	5.28	.62	.78	.93	56.5	16.6	5.94	.63	.80	.96
	2150	1015	64.7	19.0	4.16	.62	.78	.93	62.3	18.3	4.69	.62	.80	.95	59.8	17.5	5.28	.64	.81	.97	57.2	16.8	5.94	.65	.83	.99
71°F (22°C)	1750	825	67.0	19.6	4.18	.43	.57	.70	64.6	18.9	4.70	.43	.57	.71	62.1	18.2	5.30	.44	.58	.73	59.4	17.4	5.97	.44	.59	.74
	1950	920	68.0	19.9	4.19	.44	.58	.73	65.5	19.2	4.71	.44	.59	.74	62.9	18.4	5.31	.44	.60	.76	60.1	17.6	5.98	.45	.61	.78
	2150	1015	68.8	20.2	4.19	.44	.60	.76	66.2	19.4	4.72	.45	.61	.78	63.6	18.6	5.31	.45	.62	.79	60.8	17.8	5.98	.46	.64	.81

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

RATINGS

NOTE - Cooling capacities are gross and do not include indoor coil blower motor heat deduction. Heating capacities include defrost cycles in the temperature range where they occur.
NOTE - Heating performance outdoor temperature 70% relative humidity. Indoor temperature 70°F (21°).
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			85°F (29°C)						95°F (35°C)						105°F (41°C)						115°F (46°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	59.2	17.3	4.11	.75	.89	1.00	57.1	16.7	4.64	.76	.91	1.00	54.9	16.1	5.23	.78	.93	1.00	52.6	15.4	5.90	.79	.95	1.00
	1950	920	60.4	17.7	4.13	.78	.93	1.00	58.2	17.1	4.65	.79	.95	1.00	56.0	16.4	5.24	.80	.96	1.00	53.7	15.7	5.91	.82	.98	1.00
	2150	1015	61.4	18.0	4.13	.81	.96	1.00	59.3	17.4	4.66	.82	.98	1.00	57.1	16.7	5.25	.84	.99	1.00	54.9	16.1	5.92	.86	1.00	1.00
67°F (19°C)	1750	825	62.8	18.4	4.15	.58	.72	.86	60.6	17.8	4.67	.59	.74	.88	58.2	17.1	5.26	.60	.75	.89	55.7	16.3	5.93	.61	.77	.91
	1950	920	63.8	18.7	4.15	.60	.75	.90	61.5	18.0	4.67	.61	.77	.91	59.1	17.3	5.28	.62	.78	.93	56.5	16.6	5.94	.63	.80	.96
	2150	1015	64.7	19.0	4.16	.62	.78	.93	62.3	18.3	4.69	.62	.80	.95	59.8	17.5	5.28	.64	.81	.97	57.2	16.8	5.94	.65	.83	.99
71°F (22°C)	1750	825	67.0	19.6	4.18	.43	.57	.70	64.6	18.9	4.70	.43	.57	.71	62.1	18.2	5.30	.44	.58	.73	59.4	17.4	5.97	.44	.59	.74
	1950	920	68.0	19.9	4.19	.44	.58	.73	65.5	19.2	4.71	.44	.59	.74	62.9	18.4	5.31	.44	.60	.76	60.1	17.6	5.98	.45	.61	.78
	2150	1015	68.8	20.2	4.19	.44	.60	.76	66.2	19.4	4.72	.45	.61	.78	63.6	18.6	5.31	.45	.62	.79	60.8	17.8	5.98	.46	.64	.81

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

RATINGS

NOTE - Cooling capacities are gross and do not include indoor coil blower motor heat deduction. Heating capacities include defrost cycles in the temperature range where they occur.
NOTE - Heating performance outdoor temperature 70% relative humidity. Indoor temperature 70°F (21°).
NOTE - For Temperatures and Capacities not shown in tables, see bulletin — Cooling Unit Rating Table Correction Factor Data in Miscellaneous Engineering Data section.

HP26-060 — CH33-62D-F - CH23-68 - COOLING CAPACITY

Entering Wet Bulb Temperature	Total Air Volume		Outdoor Air Temperature Entering Outdoor Coil																							
			85°F (29°C)						95°F (35°C)						105°F (41°C)						115°F (46°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	59.2	17.3	4.11	.75	.89	1.00	57.1	16.7	4.64	.76	.91	1.00	54.9	16.1	5.23	.78	.93	1.00	52.6	15.4	5.90	.79	.95	1.00
	1950	920	60.4	17.7	4.13	.78	.93	1.00	58.2	17.1	4.65	.79	.95	1.00	56.0	16.4	5.24	.80	.96	1.00	53.7	15.7	5.91	.82	.98	1.00
	2150	1015	61.4	18.0	4.13	.81	.96	1.00	59.3	17.4	4.66	.82	.98	1.00	57.1	16.7	5.25	.84	.99	1.00	54.9	16.1	5.92	.86	1.00	1.00
67°F (19°C)	1750	825	62.8	18.4	4.15	.58	.72	.86	60.6	17.8	4.67	.59	.74	.88	58.2	17.1	5.26	.60	.75	.89	55.7	16.3	5.93	.61	.77	.91
	1950	920	63.8	18.7	4.15	.60	.75	.90	61.5	18.0	4.67	.61	.77	.91	59.1	17.3	5.28	.62	.78	.93	56.5	16.6	5.94	.63	.80	.96
	2150	1015	64.7	19.0	4.16	.62	.78	.93	62.3	18.3	4.69	.62	.80	.95	59.8	17.5	5.28	.64	.81	.97	57.2	16.8	5.94	.65	.83	.99
71°F (22°C)	1750	825	67.0	19.6	4.18	.43	.57	.70	64.6	18.9	4.70	.43	.57	.71	62.1	18.2	5.30	.44	.58	.73	59.4	17.4	5.97	.44	.59	.74
	1950	920	68.0	19.9	4.19	.44	.58	.73	65.5	19.2	4.71	.44	.59	.74	62.9	18.4	5.31	.44	.60	.76	60.1	17.6	5.98	.45	.61	.78
	2150	1015	68.8	20.2	4.19	.44	.60	.76	66.2	19.4	4.72	.45	.61	.78	63.6	18.6	5.31	.45	.62	.79	60.8	17.8	5.98	.46	.64	.81

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Increasing/decreasing air flow to change the sensible/latent cooling ratio

RATINGS

NOTE - Cooling capacities are gross and do not include indoor coil blower motor heat deduction. Heating capacities include defrost cycles in the temperature range where they occur.
NOTE - Heating performance outdoor temperature 70% relative humidity. Indoor temperature 70°F (21°).
NOTE - For Temperatures and Capacities not shown in tables, see bulletin — Cooling Unit Rating Table Correction Factor Data in Miscellaneous Engineering Data section.

HP26-060 — CH33-62D-F - CH23-68 - COOLING CAPACITY

Entering Wet Bulb Temperature	Total Air Volume		Outdoor Air Temperature Entering Outdoor Coil																							
			85°F (29°C)						95°F (35°C)						105°F (41°C)						115°F (46°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	59.2	17.3	4.11	.75	.89	1.00	57.1	16.7	4.64	.76	.91	1.00	54.9	16.1	5.23	.78	.93	1.00	52.6	15.4	5.90	.79	.95	1.00
	1950	920	60.4	17.7	4.13	.78	.93	1.00	58.2	17.1	4.65	.79	.95	1.00	56.0	16.4	5.24	.80	.96	1.00	53.7	15.7	5.91	.82	.98	1.00
	2150	1015	61.4	18.0	4.13	.81	.96	1.00	59.3	17.4	4.66	.82	.98	1.00	57.1	16.7	5.25	.84	.99	1.00	54.9	16.1	5.92	.86	1.00	1.00
67°F (19°C)	1750	825	62.8	18.4	4.15	.58	.72	.86	60.6	17.8	4.67	.59	.74	.88	58.2	17.1	5.26	.60	.75	.89	55.7	16.3	5.93	.61	.77	.91
	1950	920	63.8	18.7	4.15	.60	.75	.90	61.5	18.0	4.67	.61	.77	.91	59.1	17.3	5.28	.62	.78	.93	56.5	16.6	5.94	.63	.80	.96
	2150	1015	64.7	19.0	4.16	.62	.78	.93	62.3	18.3	4.69	.62	.80	.95	59.8	17.5	5.28	.64	.81	.97	57.2	16.8	5.94	.65	.83	.99
71°F (22°C)	1750	825	67.0	19.6	4.18	.43	.57	.70	64.6	18.9	4.70	.43	.57	.71	62.1	18.2	5.30	.44	.58	.73	59.4	17.4	5.97	.44	.59	.74
	1950	920	68.0	19.9	4.19	.44	.58	.73	65.5	19.2	4.71	.44	.59	.74	62.9	18.4	5.31	.44	.60	.76	60.1	17.6	5.98	.45	.61	.78
	2150	1015	68.8	20.2	4.19	.44	.60	.76	66.2	19.4	4.72	.45	.61	.78	63.6	18.6	5.31	.45	.62	.79	60.8	17.8	5.98	.46	.64	.81

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Increasing/decreasing air flow to change the sensible/latent cooling ratio

RATINGS

NOTE - Cooling capacities are gross and do not include indoor coil blower motor heat deduction. Heating capacities include defrost cycles in the temperature range where they occur.
NOTE - Heating performance outdoor temperature 70% relative humidity. Indoor temperature 70°F (21°).
NOTE - For Temperatures and Capacities not shown in tables, see bulletin — Cooling Unit Rating Table Correction Factor Data in Miscellaneous Engineering Data section.

HP26-060 — CH33-62D-F - CH23-68 - COOLING CAPACITY

Entering Wet Bulb Temperature	Total Air Volume		Outdoor Air Temperature Entering Outdoor Coil																							
			85°F (29°C)						95°F (35°C)						105°F (41°C)						115°F (46°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	59.2	17.3	4.11	.75	.89	1.00	57.1	16.7	4.64	.76	.91	1.00	54.9	16.1	5.23	.78	.93	1.00	52.6	15.4	5.90	.79	.95	1.00
	1950	920	60.4	17.7	4.13	.78	.93	1.00	58.2	17.1	4.65	.79	.95	1.00	56.0	16.4	5.24	.80	.96	1.00	53.7	15.7	5.91	.82	.98	1.00
	2150	1015	61.4	18.0	4.13	.81	.96	1.00	59.3	17.4	4.66	.82	.98	1.00	57.1	16.7	5.25	.84	.99	1.00	54.9	16.1	5.92	.86	1.00	1.00
67°F (19°C)	1750	825	62.8	18.4	4.15	.58	.72	.86	60.6	17.8	4.67	.59	.74	.88	58.2	17.1	5.26	.60	.75	.89	55.7	16.3	5.93	.61	.77	.91
	1950	920	63.8	18.7	4.15	.60	.75	.90	61.5	18.0	4.67	.61	.77	.91	59.1	17.3	5.28	.62	.78	.93	56.5	16.6	5.94	.63	.80	.96
	2150	1015	64.7	19.0	4.16	.62	.78	.93	62.3	18.3	4.69	.62	.80	.95	59.8	17.5	5.28	.64	.81	.97	57.2	16.8	5.94	.65	.83	.99
71°F (22°C)	1750	825	67.0	19.6	4.18	.43	.57	.70	64.6	18.9	4.70	.43	.57	.71	62.1	18.2	5.30	.44	.58	.73	59.4	17.4	5.97	.44	.59	.74
	1950	920	68.0	19.9	4.19	.44	.58	.73	65.5	19.2	4.71	.44	.59	.74	62.9	18.4	5.31	.44	.60	.76	60.1	17.6	5.98	.45	.61	.78
	2150	1015	68.8	20.2	4.19	.44	.60	.76	66.2	19.4	4.72	.45	.61	.78	63.6	18.6	5.31	.45	.62	.79	60.8	17.8	5.98	.46	.64	.81

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Increasing/decreasing air flow to change the sensible/latent cooling ratio

RATINGS

NOTE - Cooling capacities are gross and do not include indoor coil blower motor heat deduction. Heating capacities include defrost cycles in the temperature range where they occur.
NOTE - Heating performance outdoor temperature 70% relative humidity. Indoor temperature 70°F (21°).
NOTE - For Temperatures and Capacities not shown in tables, see bulletin — Cooling Unit Rating Table Correction Factor Data in Miscellaneous Engineering Data section.

HP26-060 — CH33-62D-F - CH23-68 - COOLING CAPACITY

Entering Wet Bulb Temperature	Total Air Volume		Outdoor Air Temperature Entering Outdoor Coil																							
			85°F (29°C)						95°F (35°C)						105°F (41°C)						115°F (46°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	59.2	17.3	4.11	.75	.89	1.00	57.1	16.7	4.64	.76	.91	1.00	54.9	16.1	5.23	.78	.93	1.00	52.6	15.4	5.90	.79	.95	1.00
	1950	920	60.4	17.7	4.13	.78	.93	1.00	58.2	17.1	4.65	.79	.95	1.00	56.0	16.4	5.24	.80	.96	1.00	53.7	15.7	5.91	.82	.98	1.00
	2150	1015	61.4	18.0	4.13	.81	.96	1.00	59.3	17.4	4.66	.82	.98	1.00	57.1	16.7	5.25	.84	.99	1.00	54.9	16.1	5.92	.86	1.00	1.00
67°F (19°C)	1750	825	62.8	18.4	4.15	.58	.72	.86	60.6	17.8	4.67	.59	.74	.88	58.2	17.1	5.26	.60	.75	.89	55.7	16.3	5.93	.61	.77	.91
	1950	920	63.8	18.7	4.15	.60	.75	.90	61.5	18.0	4.67	.61	.77	.91	59.1	17.3	5.28	.62	.78	.93	56.5	16.6	5.94	.63	.80	.96
	2150	1015	64.7	19.0	4.16	.62	.78	.93	62.3	18.3	4.69	.62	.80	.95	59.8	17.5	5.28	.64	.81	.97	57.2	16.8	5.94	.65	.83	.99
71°F (22°C)	1750	825	67.0	19.6	4.18	.43	.57	.70	64.6	18.9	4.70	.43	.57	.71	62.1	18.2	5.30	.44	.58	.73	59.4	17.4	5.97	.44	.59	.74
	1950	920	68.0	19.9	4.19	.44	.58	.73	65.5	19.2	4.71	.44	.59	.74	62.9	18.4	5.31	.44	.60	.76	60.1	17.6	5.98	.45	.61	.78
	2150	1015	68.8	20.2	4.19	.44	.60	.76	66.2	19.4	4.72	.45	.61	.78	63.6	18.6	5.31	.45	.62	.79	60.8	17.8	5.98	.46	.64	.81

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Typical 5 ton HP

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Typical 5 ton HP

Entering Wet Bulb Tempera-ture	Total Air Volume		95°F (35°C)					
			Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T)		
						Dry Bulb		
	cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
63°F (17°C)	1750	825	57.1	16.7	4.64	.76	.91	1.00
	1950	920	58.2	17.1	4.65	.79	.95	1.00
	2150	1015	59.3	17.4	4.66	.82	.98	1.00
	2350	1.00	60.4			.85		

Dehumidification lbs./hr

14 lbs. @45°F coil temp — Optimized A/C Coil

12 lbs. @47°F coil temp

10 lbs. @50°F coil temp

8 lbs. @55°F coil temp — Lazy A/C Setup

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Typical 5 ton HP

Slowing the air flow increases the lbs. per hour of dehumidification and slows sensible cooling

	Entering Wet Bulb Temperature	Total Air Volume		95°F (35°C)					
				Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T)		
							Dry Bulb		
		cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C
50%RH @75°F	63°F (17°C)	1750	825	57.1	16.7	4.64	.76	.91	1.00
		1950	920	58.2	17.1	4.65	.79	.95	1.00
		2150	1015	59.3	17.4	4.66	.82	.98	1.00
		2350	1.00	60.4			.85		

Dehumidification lbs./hr

14 lbs. @45°F coil temp — Optimized A/C Coil

12 lbs. @47°F coil temp

10 lbs. @50°F coil temp

8 lbs. @55°F coil temp — Lazy A/C Setup

SPECIFICATION FOR A TYPICAL 5 TON HEAT PUMP

Total Cooling Capacity

Typical 5 ton HP

Slowing the air flow increases the lbs. per hour of dehumidification and slows sensible cooling

	Entering Wet Bulb Temperature	Total Air Volume		95°F (35°C)						
				Total Cooling Capacity		Comp Motor kW Input	Sensible To Total Ratio (S/T) Dry Bulb			
		cfm	L/s	kBtuh	kW		75°F 24°C	80°F 27°C	85°F 29°C	Dehumidification lbs./hr
50%RH @75°F	63°F (17°C)	1750	825	57.1	16.7	4.64	.76	.91	1.00	14 lbs. @45°F coil temp
		1950	920	58.2	17.1	4.65	.79	.95	1.00	12 lbs. @47°F coil temp
		2150	1015	59.3	17.4	4.66	.82	.98	1.00	10 lbs. @50°F coil temp
		2350		60.4			.85		1.00	8 lbs. @55°F coil temp

Optimized A/C Coil

Lazy A/C Setup

How to Fix the Lazy AC

Step 1) Adjust the airflow to get desired evaporator coil temperature.

Step 2) Verify you have achieved the desired evaporator coil temperature – three options:

1) Measure suction line pressure
2) Measure dew point off the supply
3) Measure condensate at 75F/50%

Option 1) Measure the suction line pressure and compare to the temperature / pressure chart

TEMPERATURE / PRESSURE CHART

For Target Cooling Coil Temperatures (°F)

TEMPERATURE / PRESSURE CHART

For Target Cooling Coil Temperatures (°F)

Temperature °F	°C	R22	R407C Liquid Press.	R407C Vapor Press.	R417A Liquid Press.	R417A Vapor Press.	R410A
-40	-40.0	0.5	3.0	4.4	0.5	4.2	11.6
-35	-37.2	2.6	5.4	0.6	2.4	0.8	14.9
-30	-34.4	4.9	8.0	1.8	4.5	1.5	18.5
-25	-31.7	7.4	10.9	4.1	6.9	3.6	22.5
-20	-28.9	10.1	14.1	6.6	9.4	5.9	26.9
-15	-26.1	13.2	17.6	9.4	12.2	8.4	31.7
-10	-23.3	16.5	21.3	12.5	15.2	11.2	36.8
-5	-20.6	20.1	25.4	15.9	18.5	14.3	42.5
0	-17.8	24.0	29.9	19.6	22.0	17.6	48.6
5	-15.0	28.2	34.7	23.6	25.9	21.2	55.2
10	-12.2	32.8	39.9	28.0	30.0	25.1	62.3
15	-9.4	37.7	45.6	32.8	34.5	29.3	70.0
20	-6.7	43.0	51.6	38.0	39.3	33.9	78.3
25	-3.9	48.8	58.2	43.6	44.5	38.9	87.3
30	-1.1	54.9	65.2	49.6	50.8	44.2	96.8
35	1.7	61.5	72.6	56.1	56.0	49.9	107
40	4.4	68.5	80.7	63.1	62.4	56.1	118
45	7.2	76.0	89.2	70.6	69.2	62.7	130
50	10.0	84.0	98.3	78.7	76.4	69.8	142
55	12.8	92.6	108	87.3	87.2	77.3	155
60	15.6	102	118	96.8	95.7	85.4	170
65	18.3	111	129	106	105	93.9	185
70	21.1	121	141	117	114	103	201
75	23.9	132	153	128	124	113	217
80	26.7	144	166	140	134	123	235
85	29.4	156	180	153	146	134	254
90	32.2	168	195	166	157	145	274
95	35.0	182	210	181	170	158	295
100	37.8	196	226	196	183	170	317
105	40.6	211	243	211	197	184	340
110	43.3	226	261	229	211	198	365
115	46.1	243	280	247	225	212	391
120	48.9	260	300	266	241	227	418
125	51.7	278	321	286	258	244	446
130	54.4	297	342	307	275	261	476
135	57.2	317	365	329	293	279	507
140	60.0	337	389	353	312	297	539
145	62.8	359	-	-	-	-	573
150	65.6	382	-	-	-	-	608

TEMPERATURE / PRESSURE CHART

For Target Cooling Coil Temperatures (°F)

Temperature °F	°C	R22	R407C Liquid Press.	R407C Vapor Press.	R417A Liquid Press.	R417A Vapor Press.	R410A
-40	-40.0	0.5	3.0	4.4	0.5	4.2	11.6
-35	-37.2	2.6	5.4	0.6	2.4	0.8	14.9
-30	-34.4	4.9	8.0	1.8	4.5	1.5	18.5
-25	-31.7	7.4	10.9	4.1	6.9	3.6	22.5
-20	-28.9	10.1	14.1	6.6	9.4	5.9	26.9
-15	-26.1	13.2	17.6	9.4	12.2	8.4	31.7
-10	-23.3	16.5	21.3	12.5	15.2	11.2	36.8
-5	-20.6	20.1	25.4	15.9	18.5	14.3	42.5
0	-17.8	24.0	29.9	19.6	22.0	17.6	48.6
5	-15.0	28.2	34.7	23.6	25.9	21.2	55.2
10	-12.2	32.8	39.9	28.0	30.0	25.1	62.3
15	-9.4	37.7	45.6	32.8	34.5	29.3	70.0
20	-6.7	43.0	51.6	38.0	39.3	33.9	78.3
25	-3.9	48.8	58.2	43.6	44.5	38.9	87.3
30	-1.1	54.9	65.2	49.6	50.8	44.2	96.8
35	1.7	61.5	72.6	56.1	56.0	49.9	107
40	4.4	68.5	80.7	63.1	62.4	56.1	118
45	7.2	76.0	89.2	70.6	69.2	62.7	130
50	10.0	84.0	98.3	78.7	76.4	69.8	142
55	12.8	92.6	108	87.3	87.2	77.3	155
60	15.6	102	118	96.8	95.7	85.4	170
65	18.3	111	129	106	105	93.9	185
70	21.1	121	141	117	114	103	201
75	23.9	132	153	128	124	113	217
80	26.7	144	166	140	134	123	235
85	29.4	156	180	153	146	134	254
90	32.2	168	195	166	157	145	274
95	35.0	182	210	181	170	158	295
100	37.8	196	226	196	183	170	317
105	40.6	211	243	211	197	184	340
110	43.3	226	261	229	211	198	365
115	46.1	243	280	247	225	212	391
120	48.9	260	300	266	241	227	418
125	51.7	278	321	286	258	244	446
130	54.4	297	342	307	275	261	476
135	57.2	317	365	329	293	279	507
140	60.0	337	389	353	312	297	539
145	62.8	359	-	-	-	-	573
150	65.6	382	-	-	-	-	608

Cooling coil temp for
75°F, 50%RH, 55°F Dew point.

TEMPERATURE / PRESSURE CHART

For Target Cooling Coil Temperatures (°F)

Temperature °F	°C	R22	R407C Liquid Press.	R407C Vapor Press.	R417A Liquid Press.	R417A Vapor Press.	R410A
-40	-40.0	0.5	3.0	4.4	0.5	4.2	11.6
-35	-37.2	2.6	5.4	0.6	2.4	0.8	14.9
-30	-34.4	4.9	8.0	1.8	4.5	1.5	18.5
-25	-31.7	7.4	10.9	4.1	6.9	3.6	22.5
-20	-28.9	10.1	14.1	6.6	9.4	5.9	26.9
-15	-26.1	13.2	17.6	9.4	12.2	8.4	31.7
-10	-23.3	16.5	21.3	12.5	15.2	11.2	36.8
-5	-20.6	20.1	25.4	15.9	18.5	14.3	42.5
0	-17.8	24.0	29.9	19.6	22.0	17.6	48.6
5	-15.0	28.2	34.7	23.6	25.9	21.2	55.2
10	-12.2	32.8	39.9	28.0	30.0	25.1	62.3
15	-9.4	37.7	45.6	32.8	34.5	29.3	70.0
20	-6.7	43.0	51.6	38.0	39.3	33.9	78.3
25	-3.9	48.8	58.2	43.6	44.5	38.9	87.3
30	-1.1	54.9	65.2	49.6	50.8	44.2	96.8
35	1.7	61.5	72.6	56.1	56.0	49.9	107
40	4.4	68.5	80.7	63.1	62.4	56.1	118
45	7.2	76.0	89.2	70.6	69.2	62.7	130
50	10.0	84.0	98.3	78.7	76.4	69.8	142
55	12.8	92.6	108	87.3	87.2	77.3	155
60	15.6	102	118	96.8	95.7	85.4	170
65	18.3	111	129	106	105	93.9	185
70	21.1	121	141	117	114	103	201
75	23.9	132	153	128	124	113	217
80	26.7	144	166	140	134	123	235
85	29.4	156	180	153	146	134	254
90	32.2	168	195	166	157	145	274
95	35.0	182	210	181	170	158	295
100	37.8	196	226	196	183	170	317
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115	46.1	243	280	247	225	212	391
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130	54.4	297	342	307	275	261	476
135	57.2	317	365	329	293	279	507
140	60.0	337	389	353	312	297	539
145	62.8	359	-	-	-	-	573
150	65.6	382	-	-	-	-	608

Outdoor air temperatures
70°F
80°F
90°F

Cooling coil temp for 75°F, 50%RH, 55°F Dew point.

Return conditions at typical outdoor conditions.

TEMPERATURE / PRESSURE CHART

For Target Cooling Coil Temperatures (°F)

Temperature °F	°C	R22	R407C Liquid Press.	R407C Vapor Press.	R417A Liquid Press.	R417A Vapor Press.	R410A
-40	-40.0	0.5	3.0	4.4	0.5	4.2	11.6
-35	-37.2	2.6	5.4	0.6	2.4	0.8	14.9
-30	-34.4	4.9	8.0	1.8	4.5	1.5	18.5
-25	-31.7	7.4	10.9	4.1	6.9	3.6	22.5
-20	-28.9	10.1	14.1	6.6	9.4	5.9	26.9
-15	-26.1	13.2	17.6	9.4	12.2	8.4	31.7
-10	-23.3	16.5	21.3	12.5	15.2	11.2	36.8
-5	-20.6	20.1	25.4	15.9	18.5	14.3	42.5
0	-17.8	24.0	29.9	19.6	22.0	17.6	48.6
5	-15.0	28.2	34.7	23.6	25.9	21.2	55.2
10	-12.2	32.8	39.9	28.0	30.0	25.1	62.3
15	-9.4	37.7	45.6	32.8	34.5	29.3	70.0
20	-6.7	43.0	51.6	38.0	39.3	33.9	78.3
25	-3.9	48.8	58.2	43.6	44.5	38.9	87.3
30	-1.1	54.9	65.2	49.6	50.8	44.2	96.8
35	1.7	61.5	72.6	56.1	56.0	49.9	107
40	4.4	68.5	80.7	63.1	62.4	56.1	118
45	7.2	76.0	89.2	70.6	69.2	62.7	130
50	10.0	84.0	98.3	78.7	76.4	69.8	142
55	12.8	92.6	108	87.3	87.2	77.3	155
60	15.6	102	118	96.8	95.7	85.4	170
65	18.3	111	129	106	105	93.9	185
70	21.1	121	141	117	114	103	201
75	23.9	132	153	128	124	113	217
80	26.7	144	166	140	134	123	235
85	29.4	156	180	153	146	134	254
90	32.2	168	195	166	157	145	274
95	35.0	182	210	181	170	158	295
100	37.8	196	226	196	183	170	317
105	40.6	211	243	211	197	184	340
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115	46.1	243	280	247	225	212	391
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130	54.4	297	342	307	275	261	476
135	57.2	317	365	329	293	279	507
140	60.0	337	389	353	312	297	539
145	62.8	359	-	-	-	-	573
150	65.6	382	-	-	-	-	608

Outdoor air temperatures
70°F
80°F
90°F

Cooling coil temp for 75°F, 50%RH, 55°F Dew point.

Return conditions at typical outdoor conditions.

Trained A/C techs know how to do this.

TEMPERATURE / PRESSURE CHART

For Target Cooling Coil Temperatures (°F)

Temperature °F	°C	R22	R407C Liquid Press.	R407C Vapor Press.	R417A Liquid Press.	R417A Vapor Press.	R410A
-40	-40.0	0.5	3.0	4.4	0.5	4.2	11.6
-35	-37.2	2.6	5.4	0.6	2.4	0.8	14.9
-30	-34.4	4.9	8.0	1.8	4.5	1.5	18.5
-25	-31.7	7.4	10.9	4.1	6.9	3.6	22.5
-20	-28.9	10.1	14.1	6.6	9.4	5.9	26.9
-15	-26.1	13.2	17.6	9.4	12.2	8.4	31.7
-10	-23.3	16.5	21.3	12.5	15.2	11.2	36.8
-5	-20.6	20.1	25.4	15.9	18.5	14.3	42.5
0	-17.8	24.0	29.9	19.6	22.0	17.6	48.6
5	-15.0	28.2	34.7	23.6	25.9	21.2	55.2
10	-12.2	32.8	39.9	28.0	30.0	25.1	62.3
15	-9.4	37.7	45.6	32.8	34.5	29.3	70.0
20	-6.7	43.0	51.6	38.0	39.3	33.9	78.3
25	-3.9	48.8	58.2	43.6	44.5	38.9	87.3
30	-1.1	54.9	65.2	49.6	50.8	44.2	96.8
35	1.7	61.5	72.6	56.1	56.0	49.9	107
40	4.4	68.5	80.7	63.1	62.4	56.1	118
45	7.2	76.0	89.2	70.6	69.2	62.7	130
50	10.0	84.0	98.3	78.7	76.4	69.8	142
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65	18.3	111	129	106	105	93.9	185
70	21.1	121	141	117	114	103	201
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90	32.2	168	195	166	157	145	274
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150	65.6	382	-	-	-	-	608

Outdoor air temperatures
70°F
80°F
90°F

Cooling coil temp for 75°F, 50%RH, 55°F Dew point.

Return conditions at typical outdoor conditions.

Trained A/C techs know how to do this.

Change the air flow through the cooling coil to get the desired coil temperature.

Option 2) Measure Dew Point at the Closest Supply

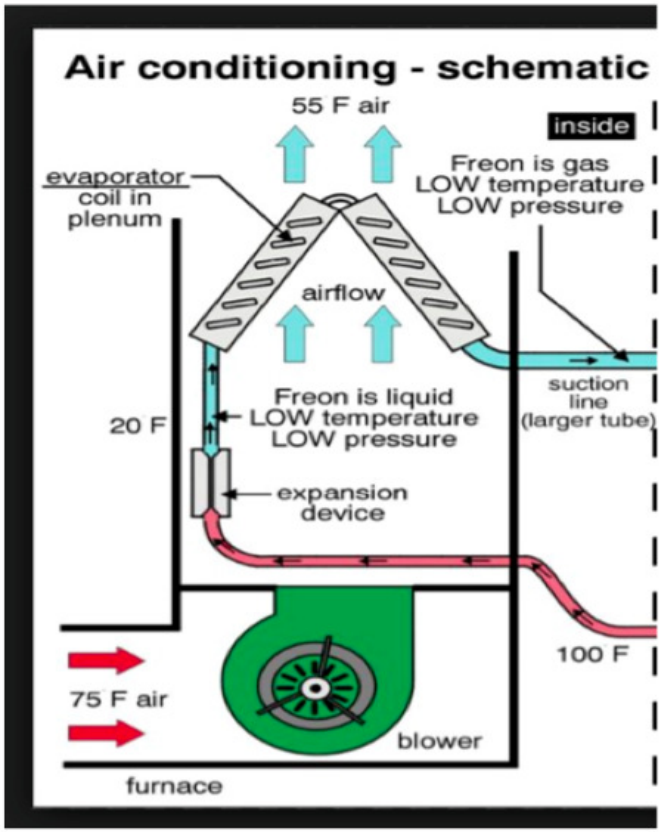
Aim for 49°F dew point (at least 5 degrees lower than desired ambient dew point)

Option 3) Measure Condensate Removal

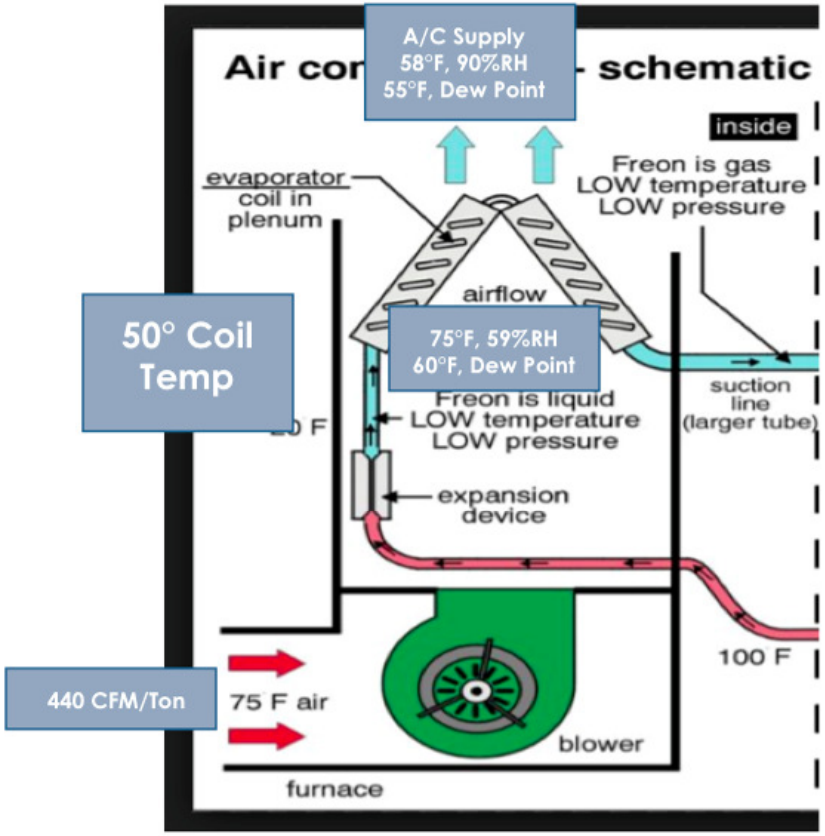
It can take up to 30 minutes of operation to wet the evaporator coil and get condensate dripping at a steady state rate out of the hose

Goal is 3 lbs of condensate per hour per ton of AC

Let's review How The Lazy A/C Operates

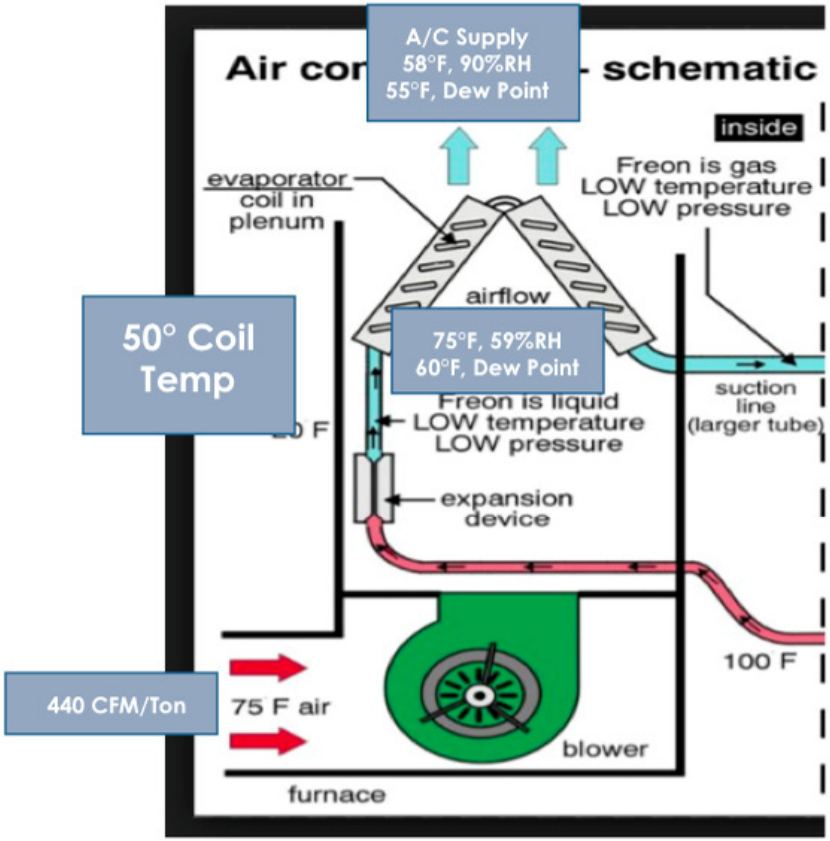


Let's review How The Lazy A/C Operates



THE A/C SYSTEM REQUIRES

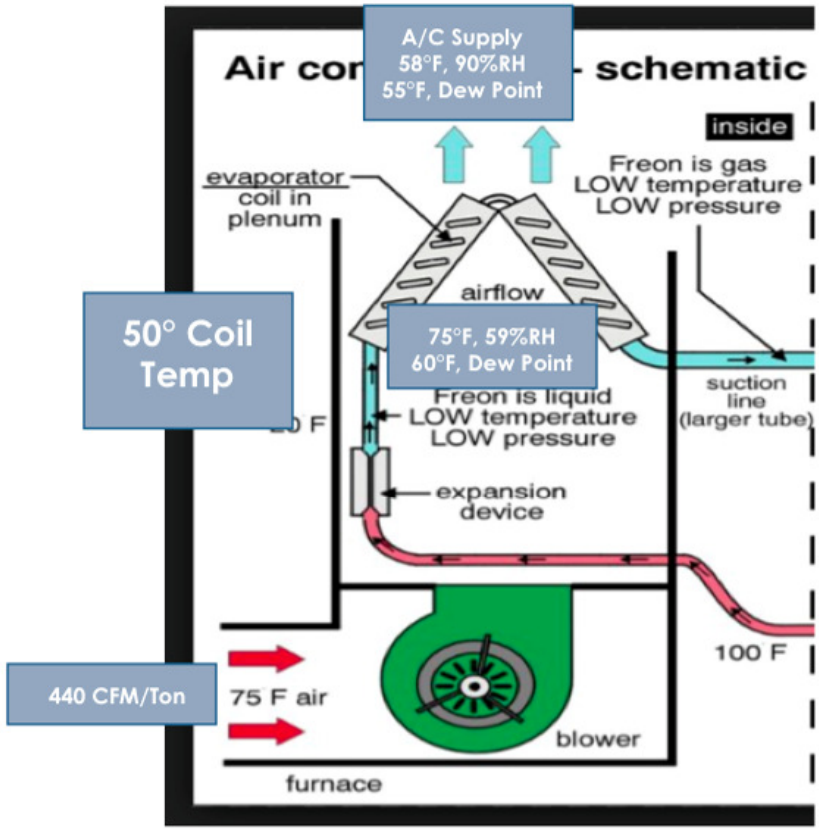
Let's review How The Lazy A/C Operates



THE A/C SYSTEM REQUIRES

Functioning components

Let's review How The Lazy A/C Operates

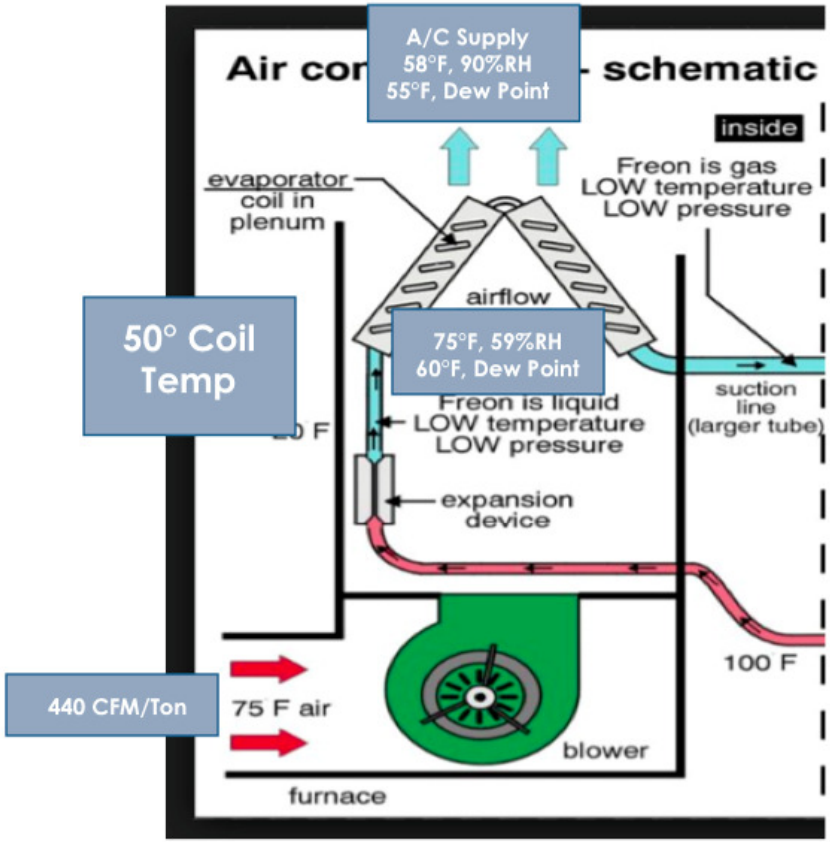


THE A/C SYSTEM REQUIRES

Functioning components

The correct amount of refrigerant

Let's review How The Lazy A/C Operates



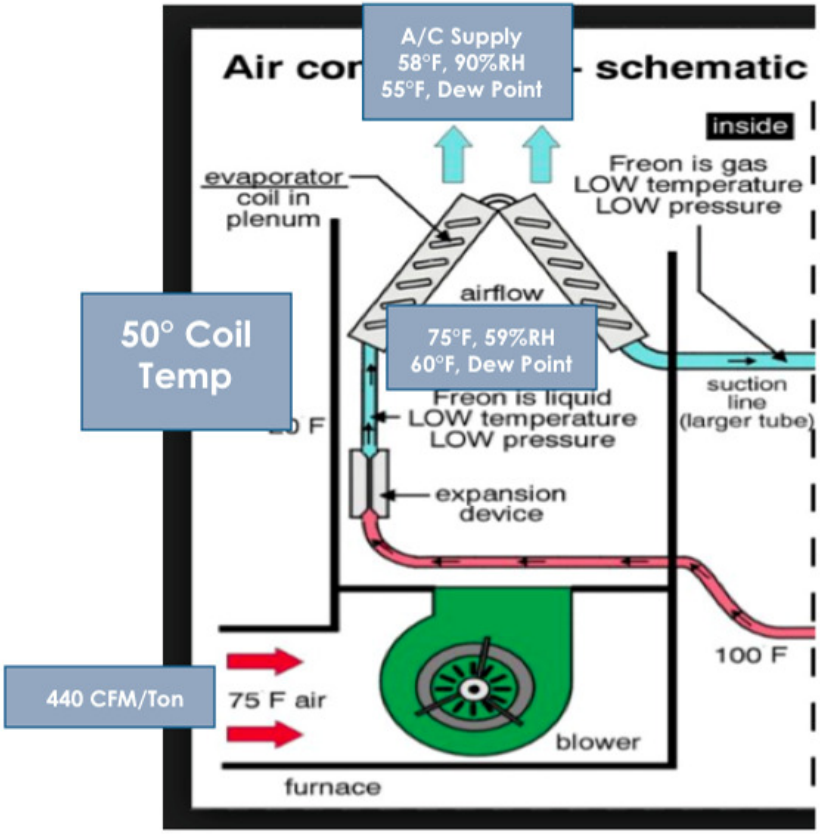
THE A/C SYSTEM REQUIRES

Functioning components

The correct amount of refrigerant

Unrestricted air flow through the hot outside condensing coil.

Let's review How The Lazy A/C Operates



THE A/C SYSTEM REQUIRES

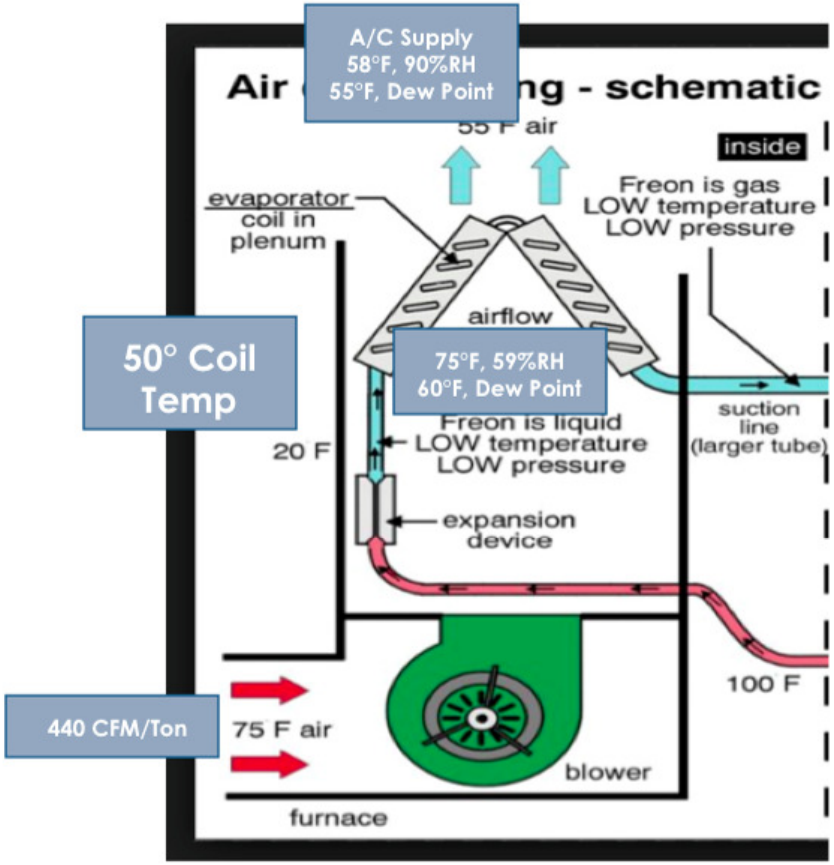
Functioning components

The correct amount of refrigerant

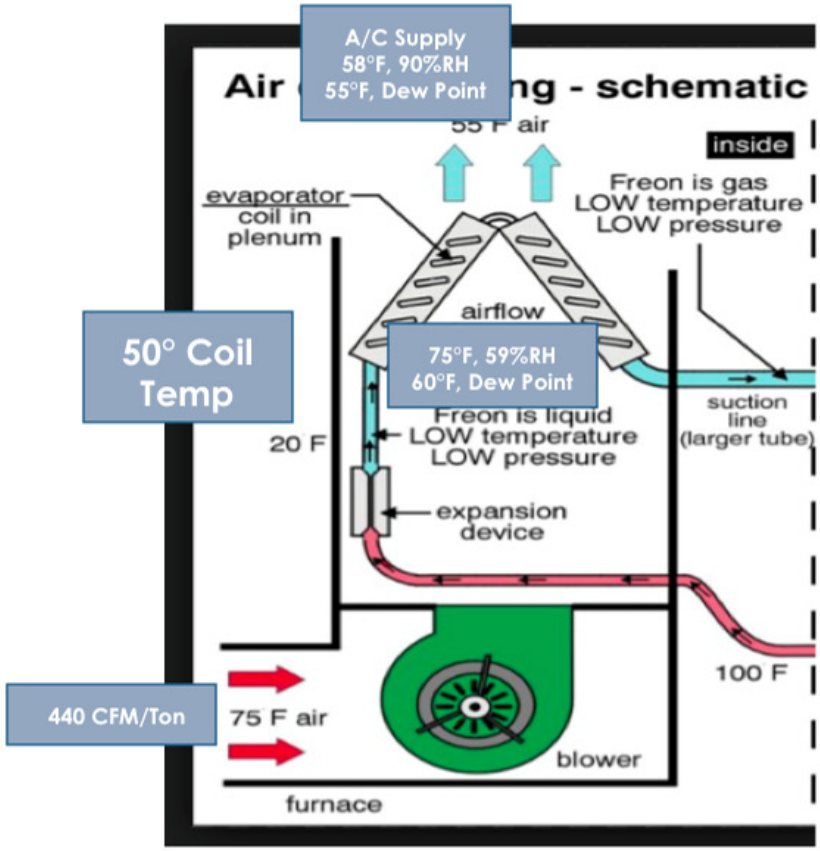
Unrestricted air flow through the hot outside condensing coil.

The quantity of air flow through the cold inside cooling coil determines the sensible and latent (moisture) removal

Let's review How The Lazy A/C Operates

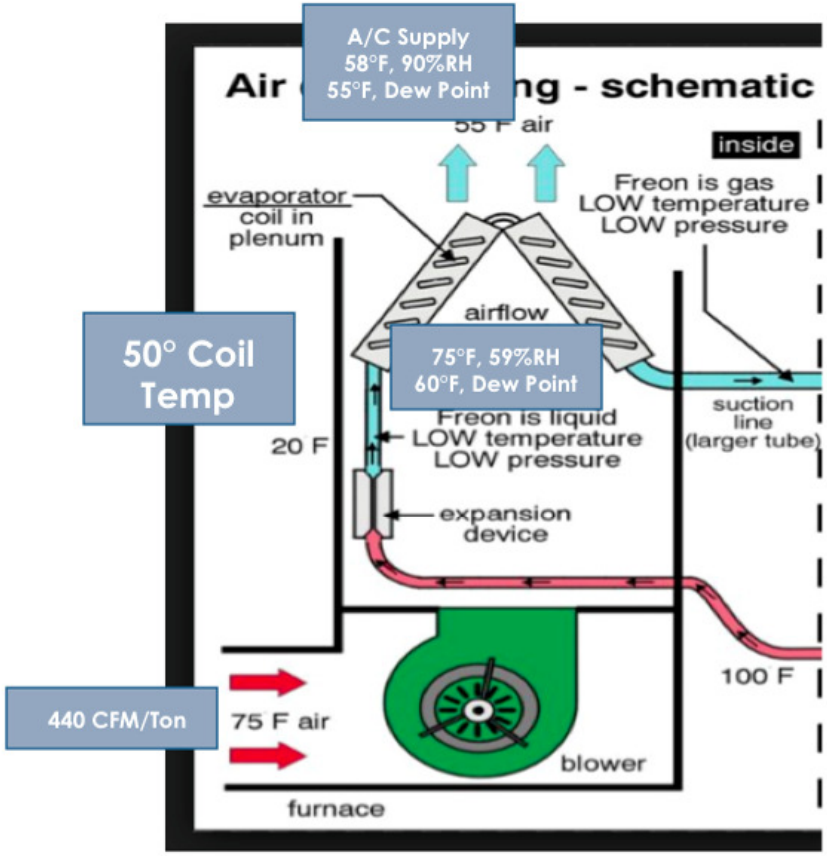


Let's review How The Lazy A/C Operates



At the Damp Home Condition,
1 ton of Lazy A/C Provides

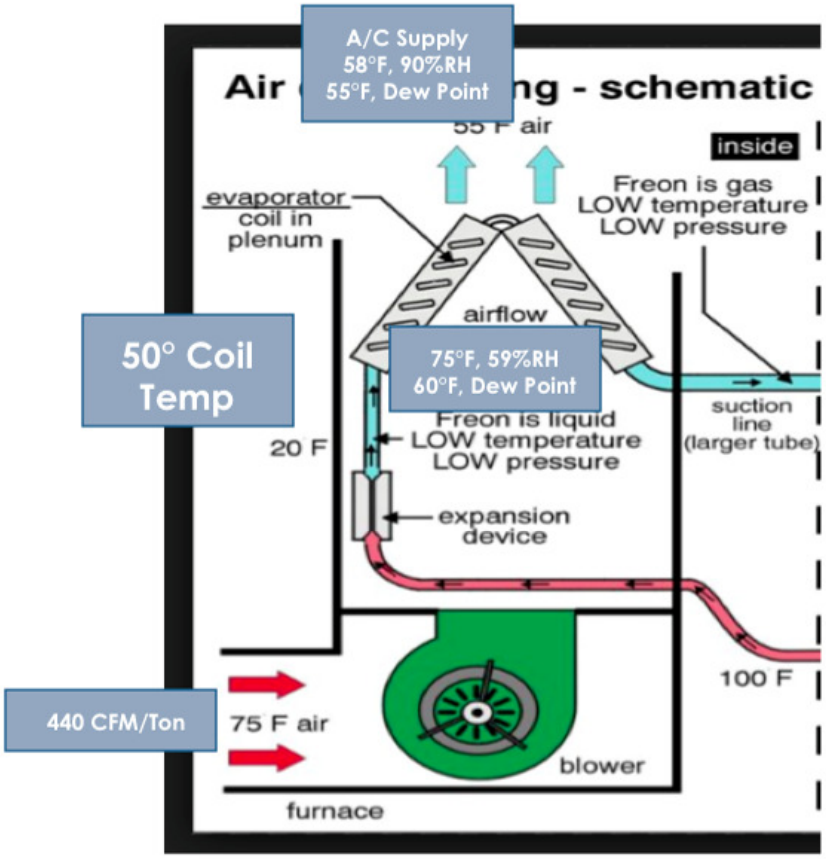
Let's review How The Lazy A/C Operates



At the Damp Home Condition,
1 ton of Lazy A/C Provides

12,000 btu per hour of total cooling
10,000 btu of sensible cooling
2,000 btu of latent cooling

Let's review How The Lazy A/C Operates

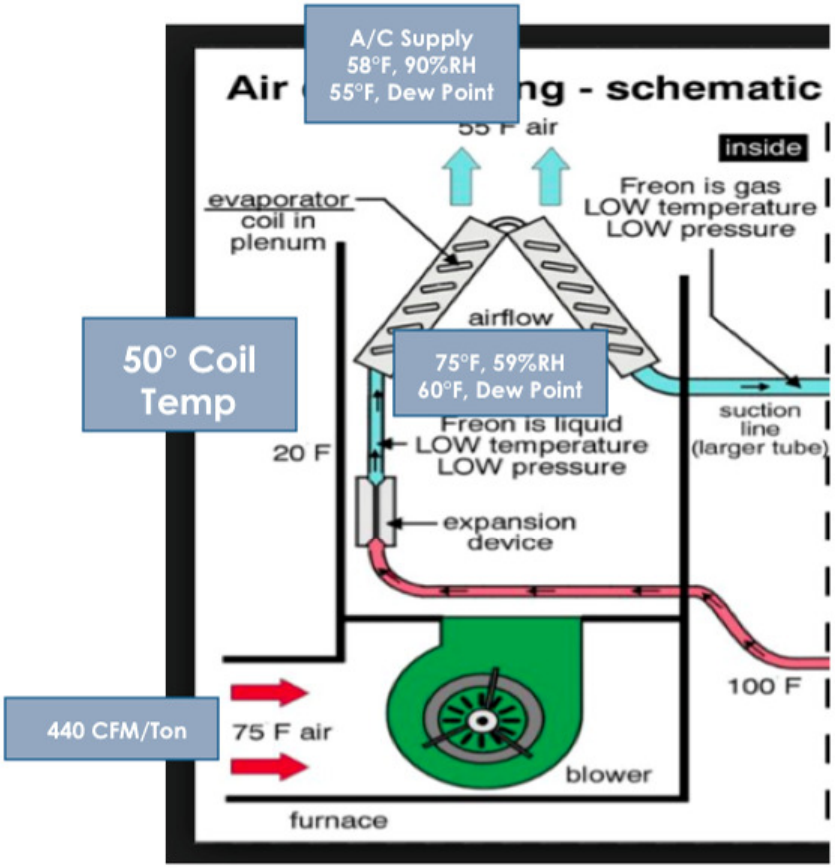


At the Damp Home Condition,
1 ton of Lazy A/C Provides

12,000 btu per hour of total cooling
10,000 btu of sensible cooling
2,000 btu of latent cooling

2 lbs. per hour of dehumidification
Uses the first lb. of condensate per ton of coil to load the coil/pan

Let's review How The Lazy A/C Operates



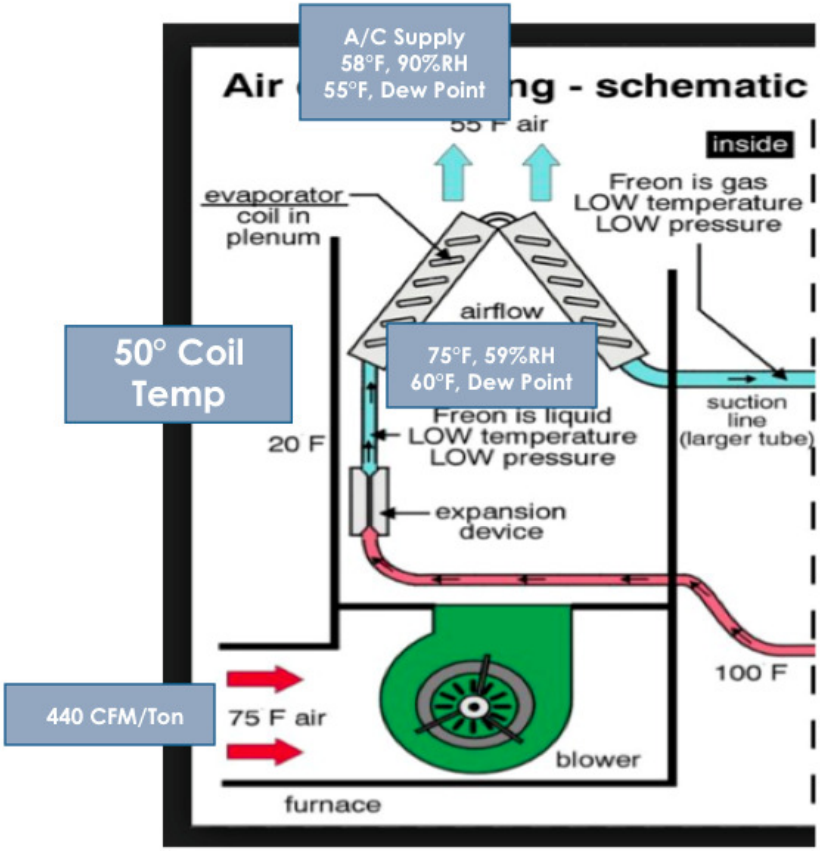
At the Damp Home Condition,
1 ton of Lazy A/C Provides

12,000 btu per hour of total cooling
10,000 btu of sensible cooling
2,000 btu of latent cooling

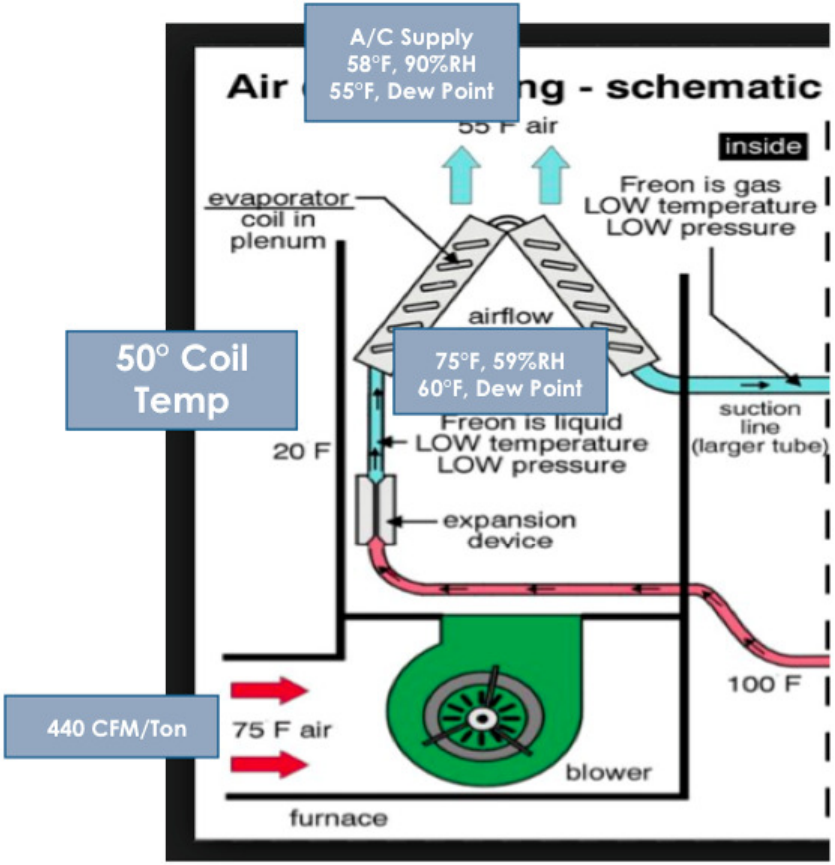
2 lbs. per hour of dehumidification
Uses the first lb. of condensate per ton of coil to load the coil/pan

A LAZY 5 ton A/C would remove only 10 lbs. per hour

Let's review How The A/C Operates

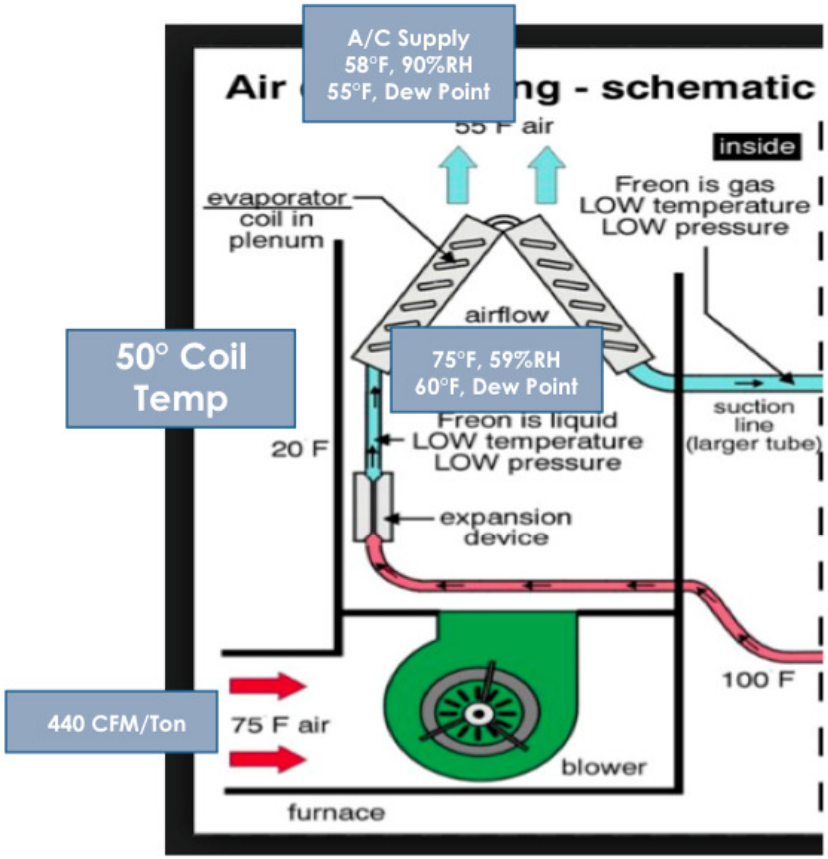


Let's review How The A/C Operates



Remember the typical A/C setup takes up to 30 minutes to wet its coil and drain pan. This is <u>before</u> any condensate drains.

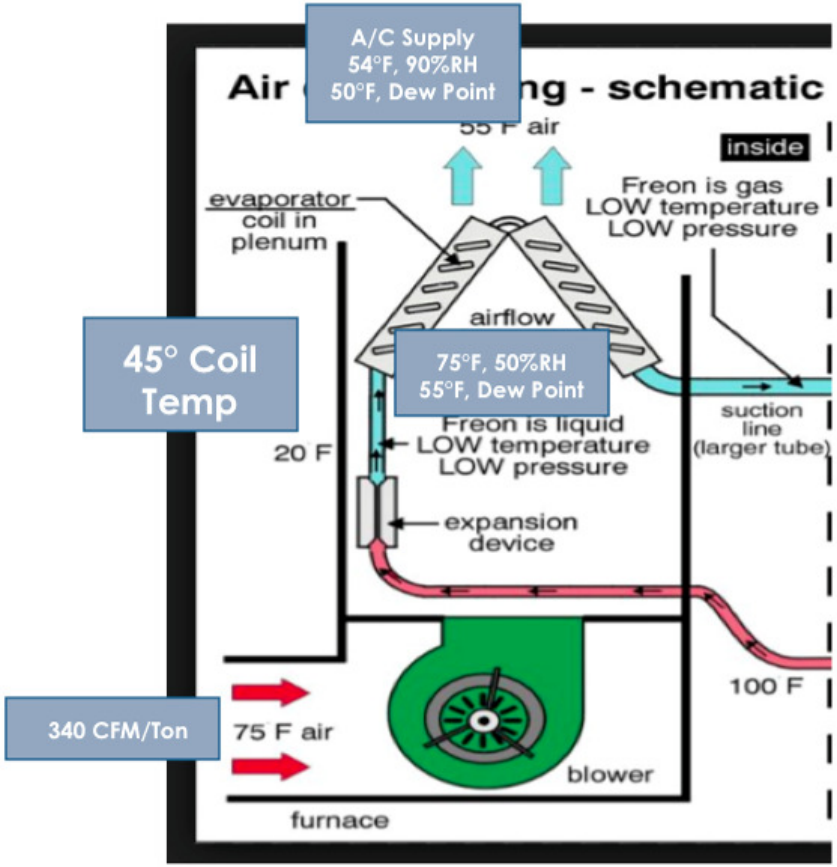
Let's review How The A/C Operates



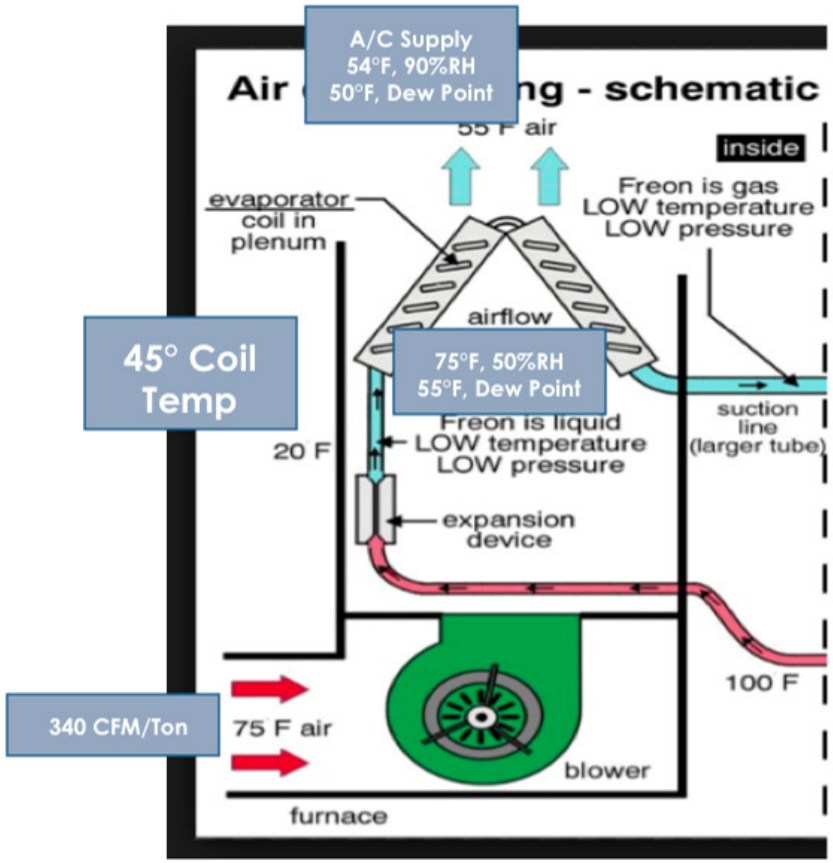
Remember the typical A/C setup takes up to 30 minutes to wet its coil and drain pan. This is <u>before</u> any condensate drains.

At the end of cooling cycle, moisture on the coil evaporates into the home in 30 minutes (Fan-On) or 90 minutes (Fan-Auto).

Optimize the A/C Setup for 50%RH

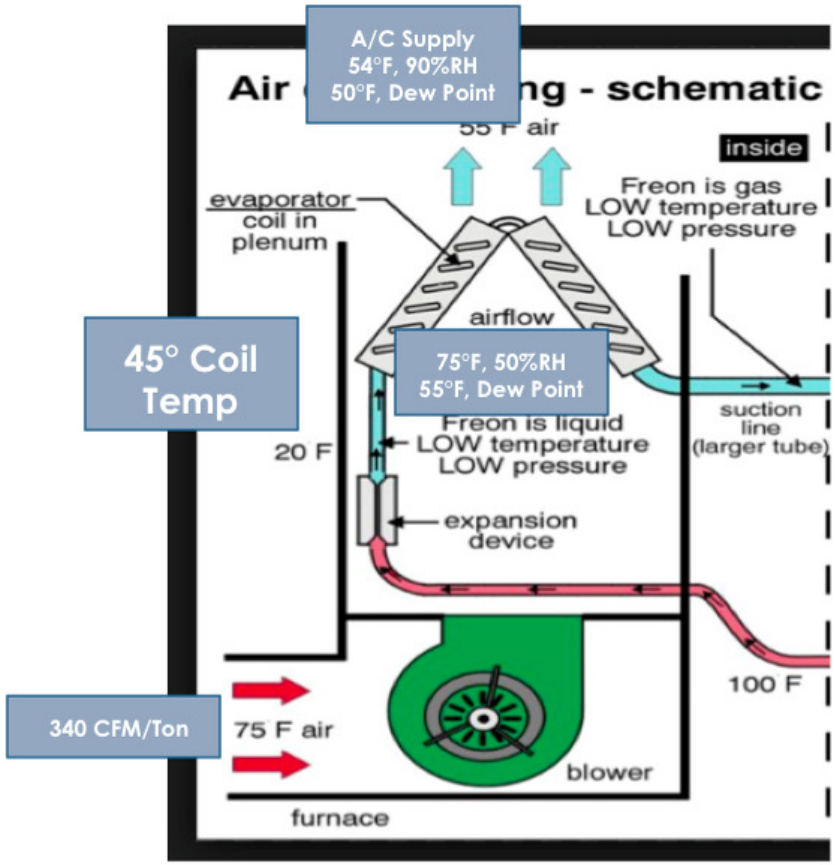


Optimize the A/C Setup for 50%RH



In a Green Grass Climate

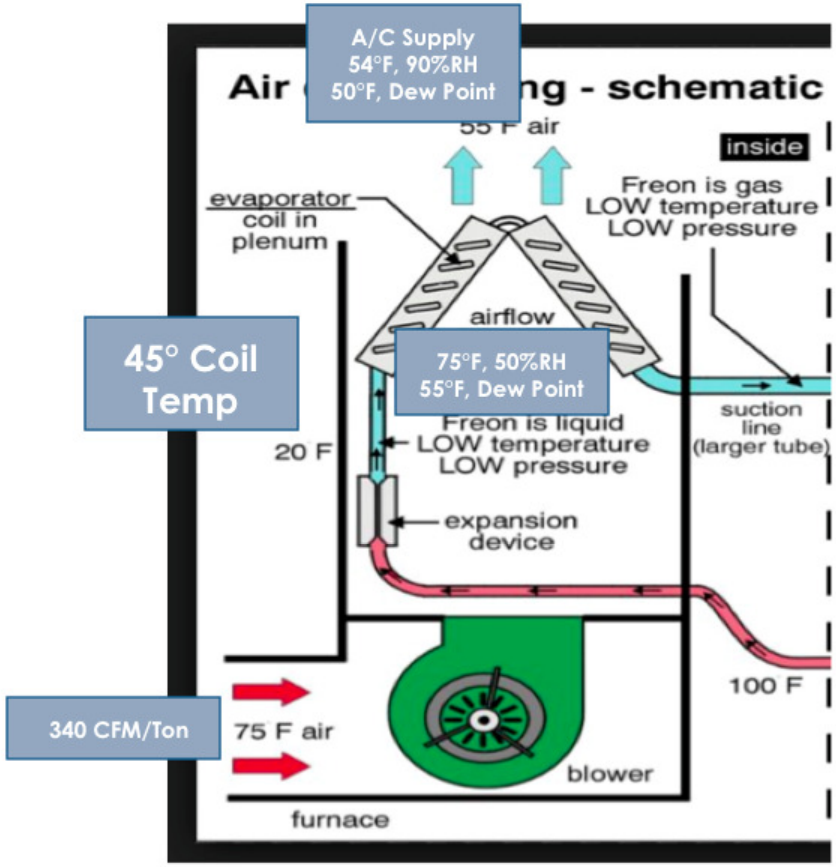
Optimize the A/C Setup for 50%RH



In a Green Grass Climate

Adjust the A/C air flow to get a <45°F coil temperature under typical conditions.

Optimize the A/C Setup for 50%RH



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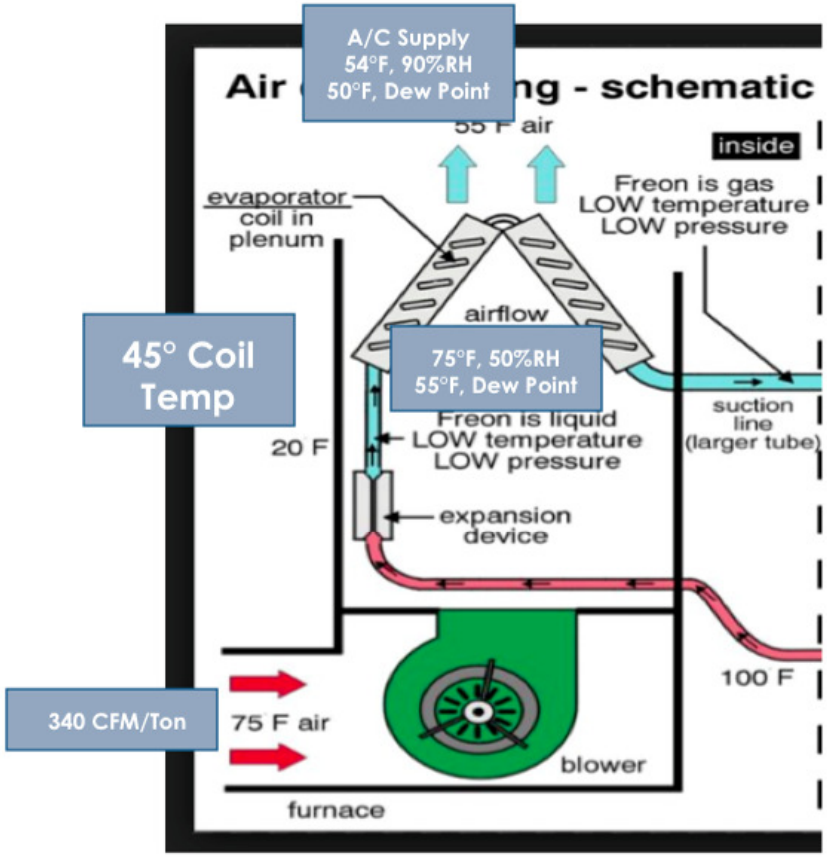

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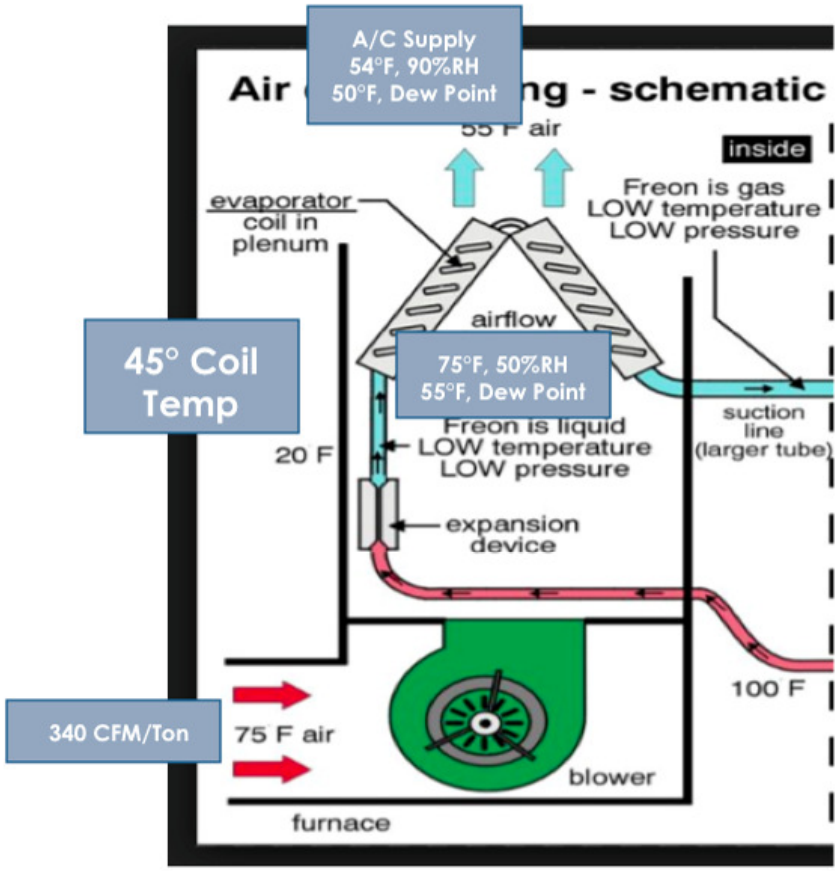

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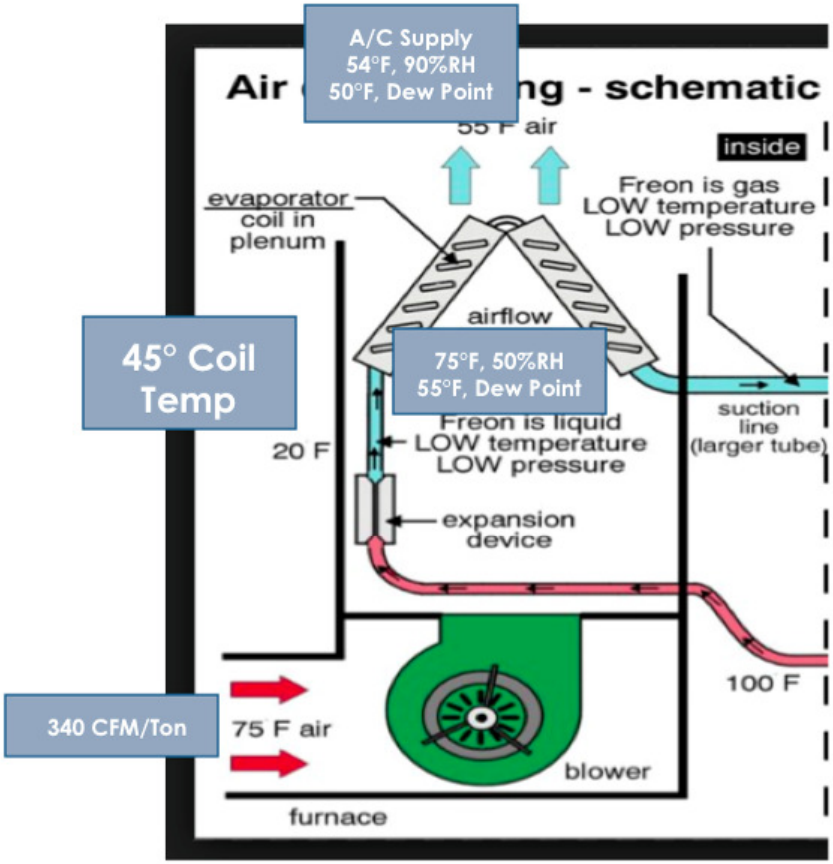

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5 ton removes 15 lbs. per hour

COLD COIL 45°F?

Meets Lennox Specs

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Entering Air

Dry Bulb	Rel. Humidity	Wet Bulb	Dew Point	Absolute Humidity
75 °F	50 %	62.8 °F	55.13 °F	66.14 grains/lb

T = 534.67 °R

Leaving Air

Dry Bulb	Rel. Humidity	Wet Bulb	Dew Point	Absolute Humidity
52. °F	90 %	50.69 °F	49.17 °F	52.93 grains/lb

T = 511.67 °R

Airflow

Altitude	Entering sCFM₁
500 ft	1750 ft³/min

Entering Standard CFM₁ converts to 1,828 Actual Dry Air Specific CFM for calculations

Cooling & Dehu

Sensible Cooling Btu/h	44,261
Latent Dehumidifying Btu/h	16,134
Total Cooling Btu/h	60,395
Tons Total Cooling	5.03 Tons
aCFM₁ /Ton	363 ft³/min
Dry Bulb Delta	23 °F
Sensible Heat Ratio	0.73
ṁₐ Dry Air Mass Flow	131.2 lb/min
Condensation Rate	14.87 lb/hr
hg₄ Water Vapor Enthalpy	1085.31

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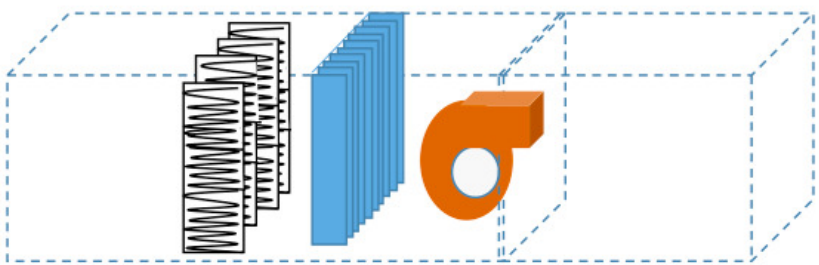

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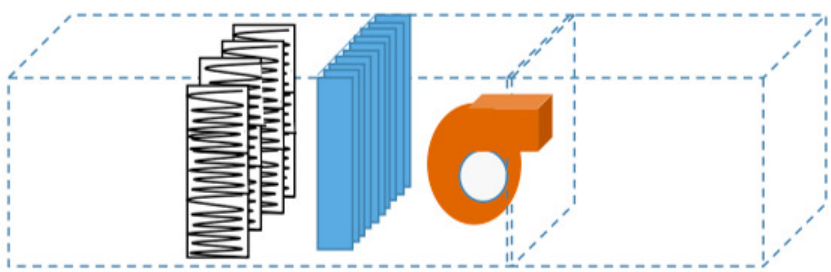

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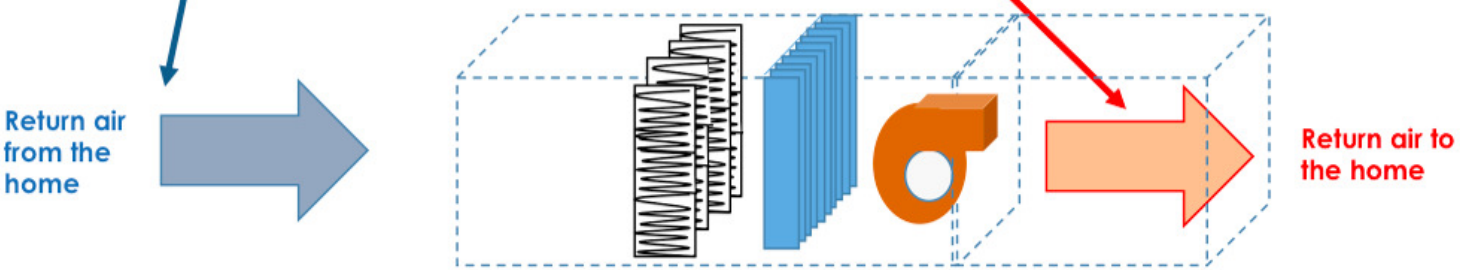

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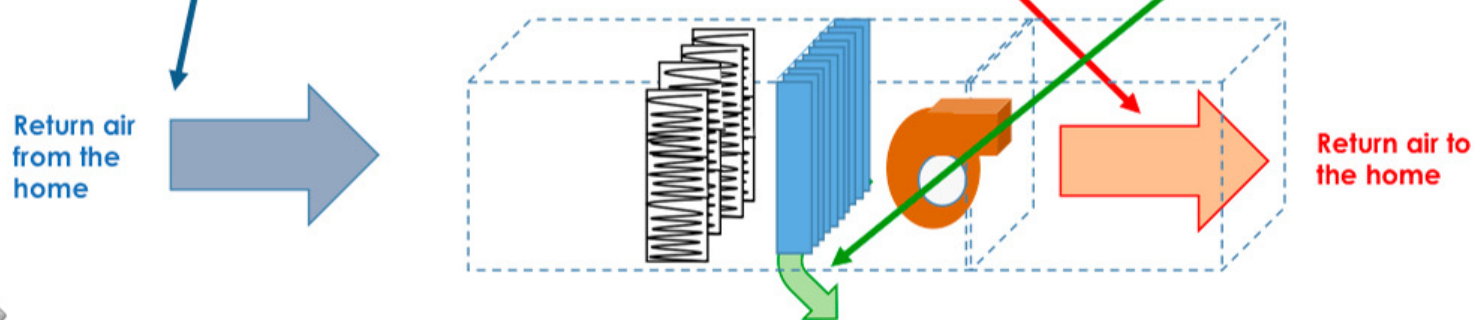
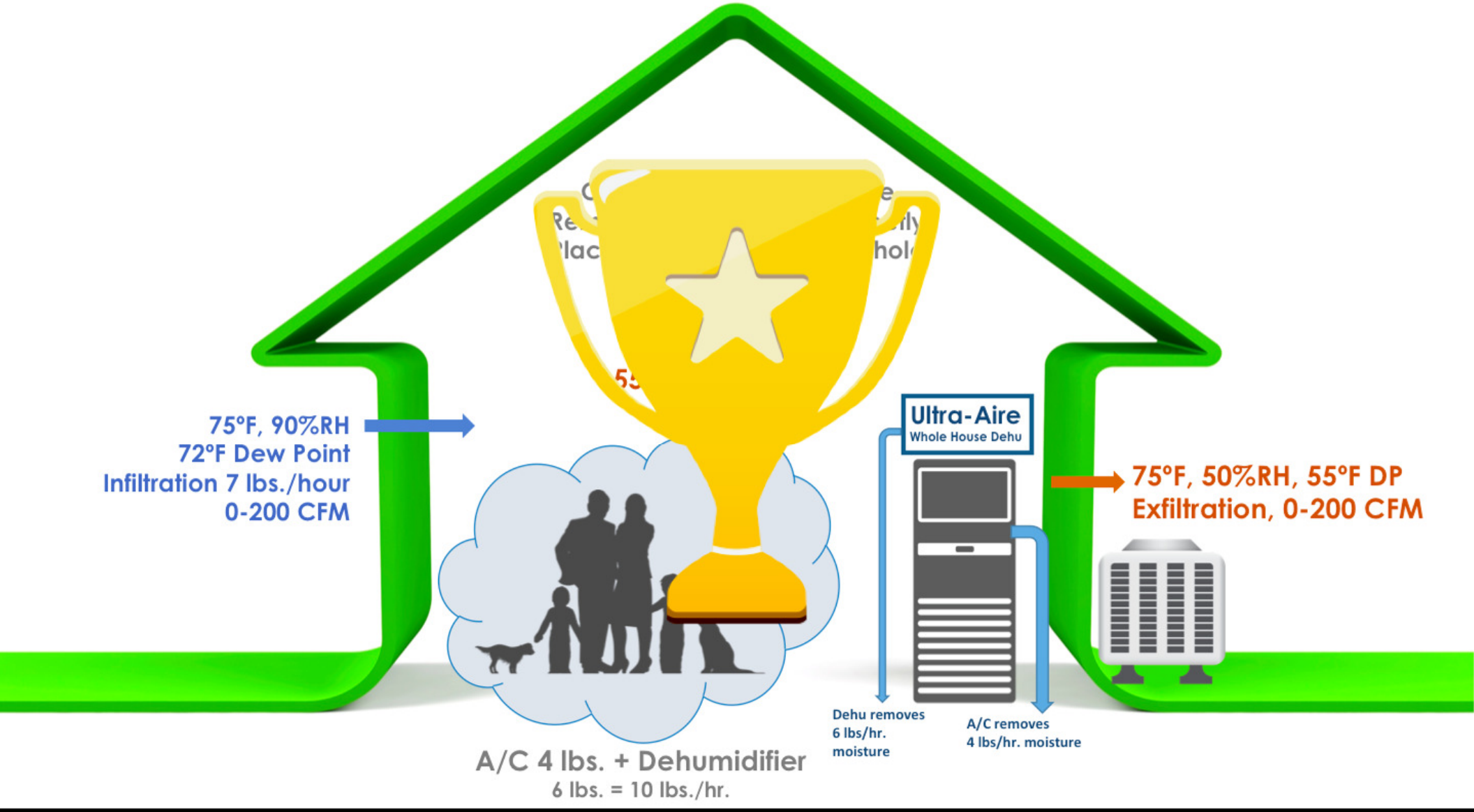
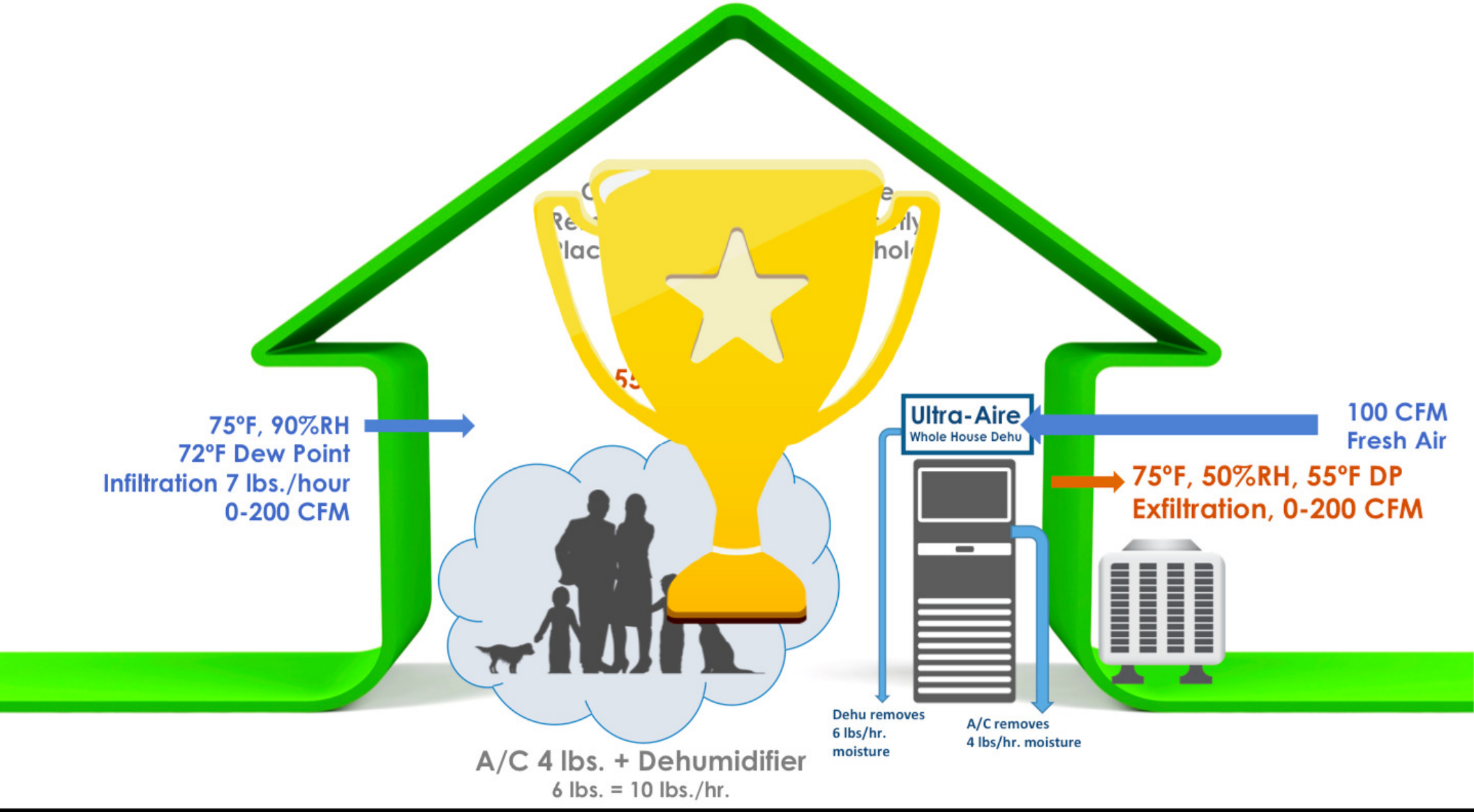


GOLD STANDARD

IDEAL MOISTURE CONTROL

In The Home | 50%RH…Rain or Shine and Fresh Air When Occupied!


75°F, 90%RH
72°F Dew Point
Infiltration 7 lbs./hour
0-200 CFM
Ultra-Aire
Whole House Dehu
75°F, 50%RH, 55°F DP
Exfiltration, 0-200 CFM
Dehu removes
6 lbs/hr.
moisture
A/C removes
4 lbs/hr. moisture
A/C 4 lbs. + Dehumidifier
6 lbs. = 10 lbs./hr.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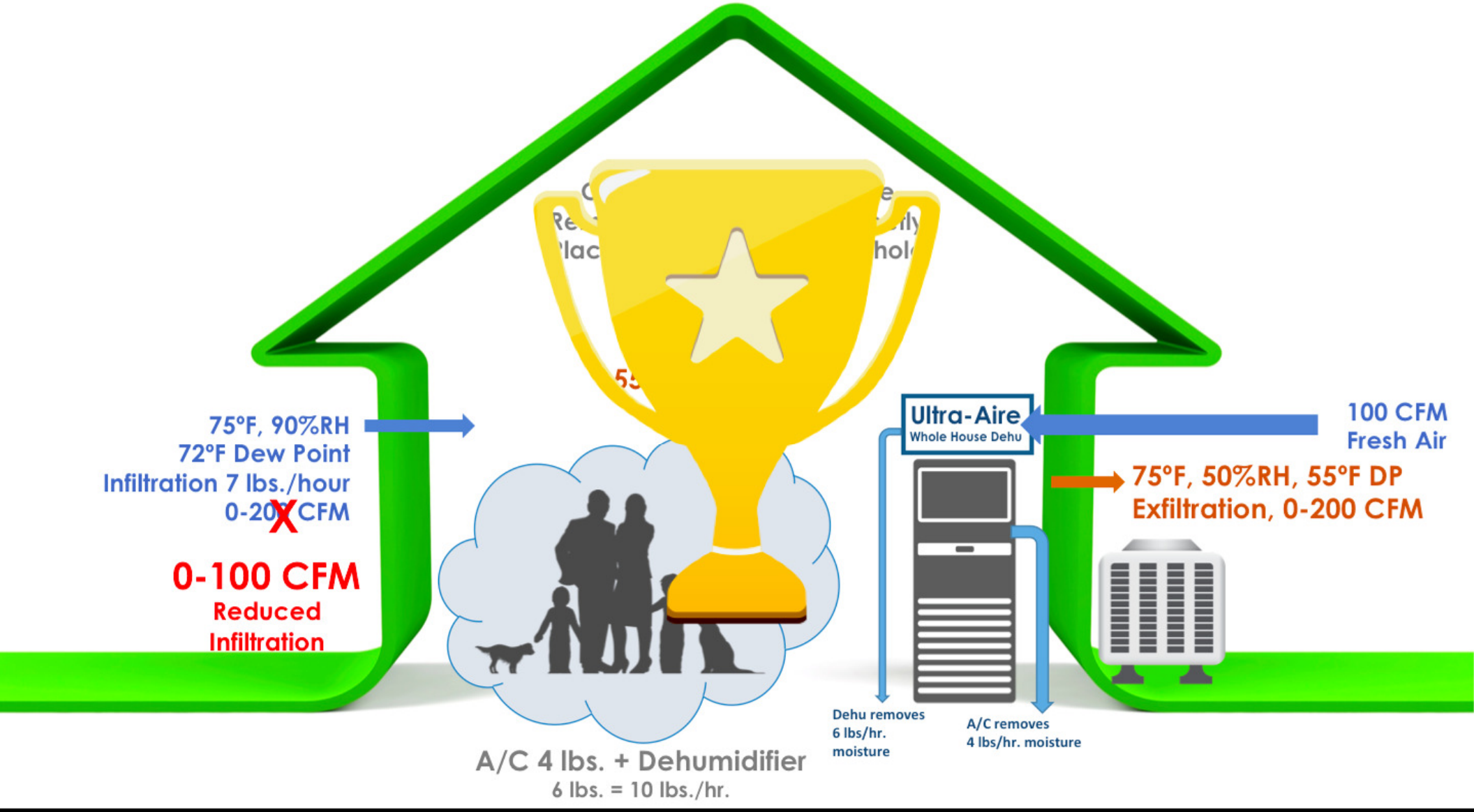
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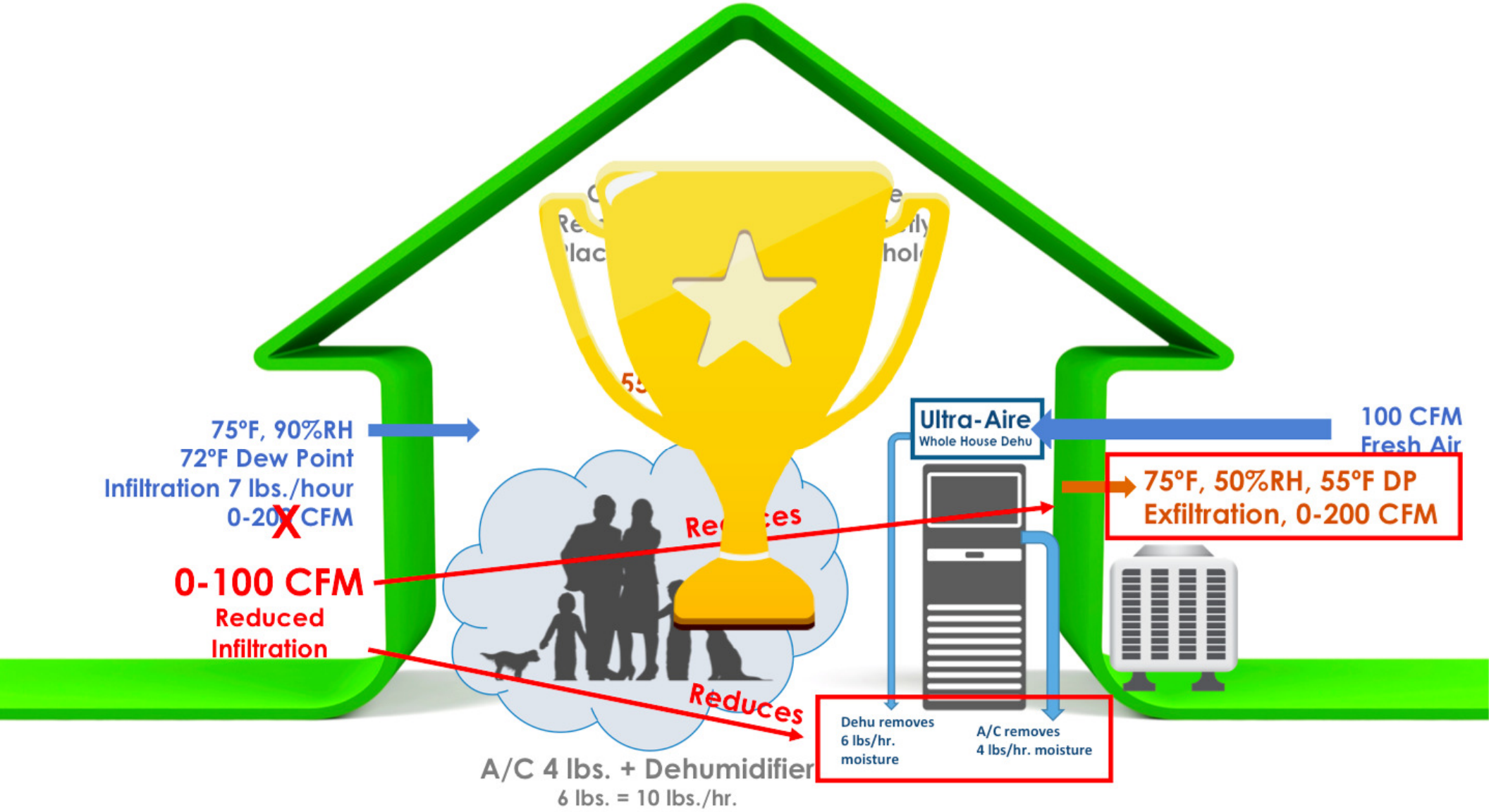
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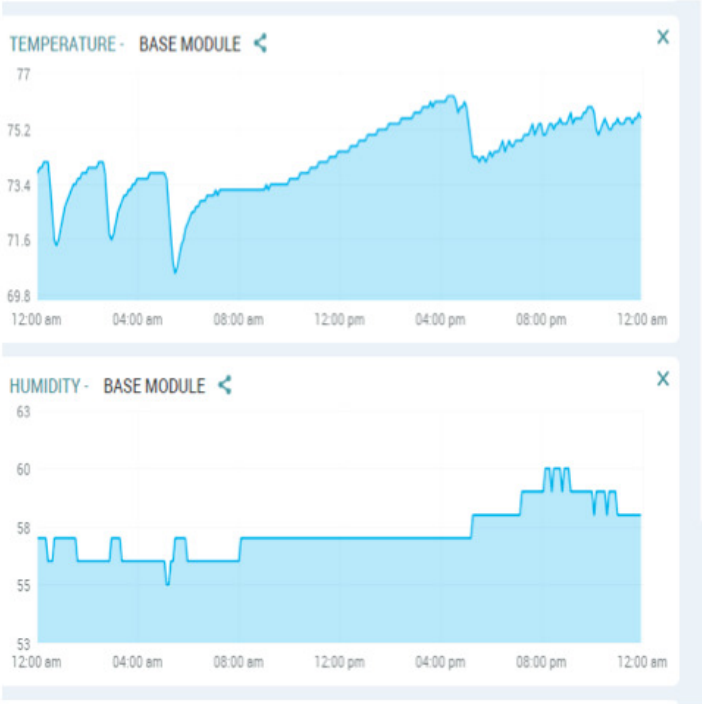
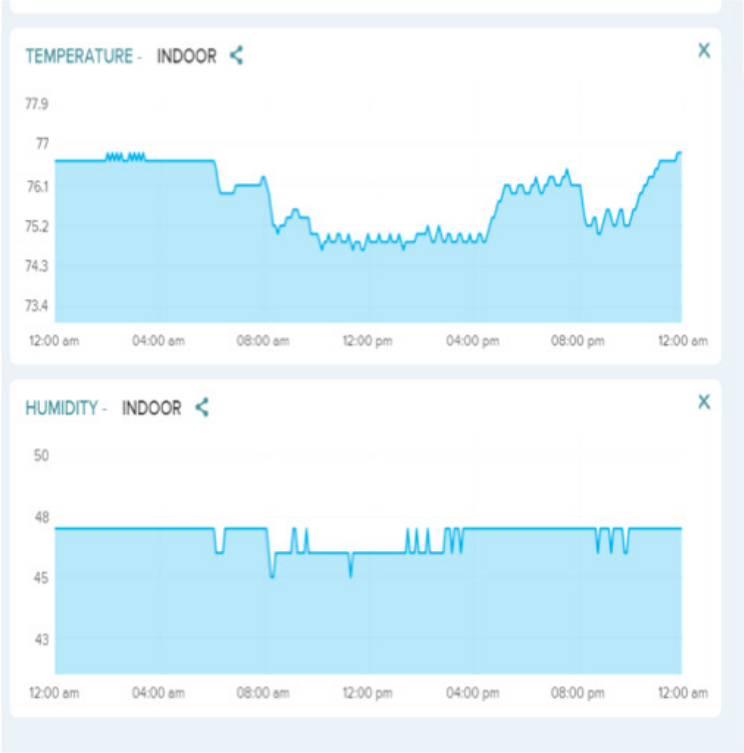
Proof of the Analysis? Fixed Home in TX

Before



After



BEN FRANKLIN

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Benjamin Franklin (18 Century)

Source: Indoor Environment Engineering. 2000

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- Install a whole house dehumidifier to handle low/no load conditions (70F and rainy) and to guarantee comfort in partial load situations