Cold Climate Heat Pumps

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ASHRAE Northern Nevada

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Cold Climate Heat Pumps

Specifying & Resources

Design Considerations

Market Updates


U.S
MAIL

Cold Climate Heat Pumps

Why cold climate heat pumps?

They are designed for cold climates. Standard heat pumps are not.

Reno

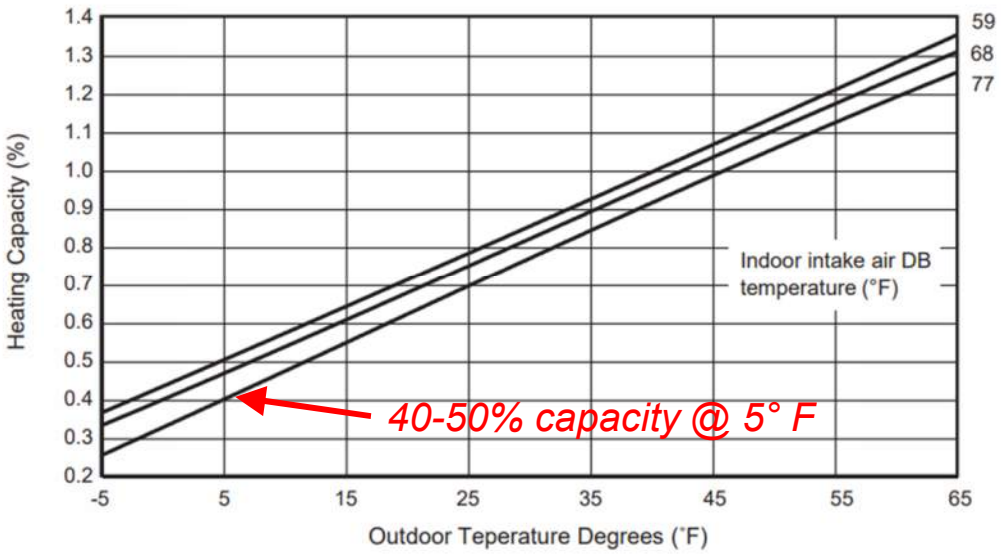
- Design Dry Blub 0.4% 0° F
- Winter Mean of Extremes -10° F

Truckee

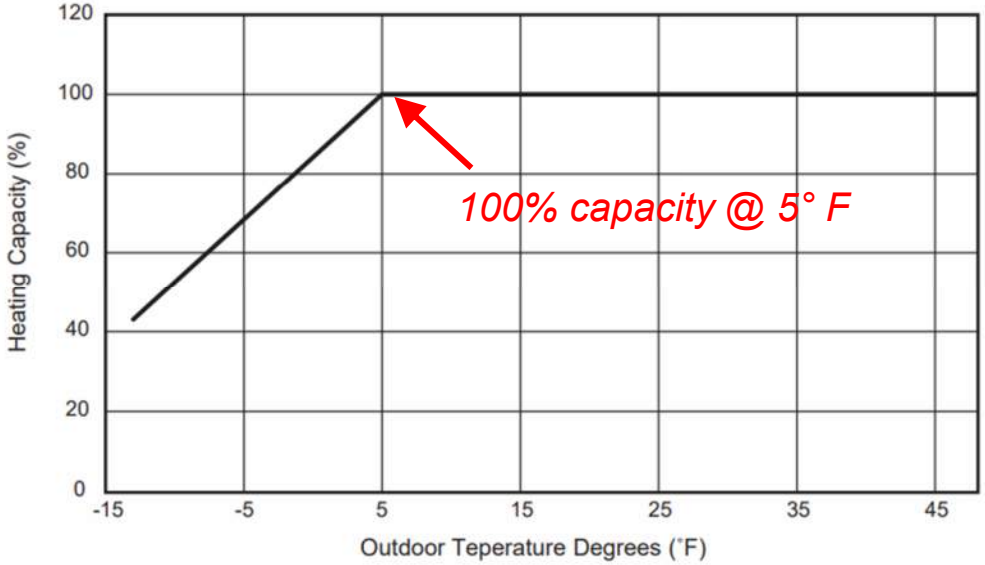
- Design Dry Blub 0.6% 0° F
- Winter Median of Extremes -10° F

Why cold climate heat pumps?

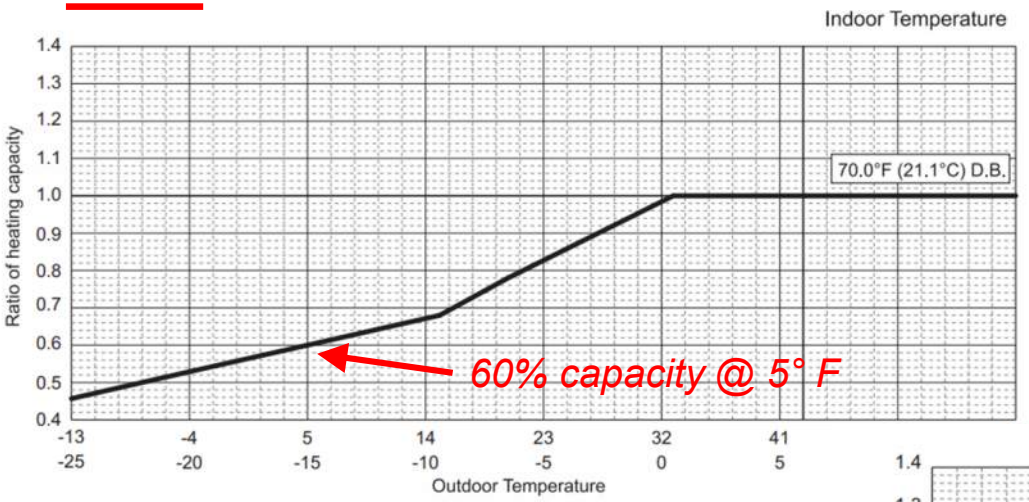
Standard outdoor heat pump



Cold climate outdoor heat pump

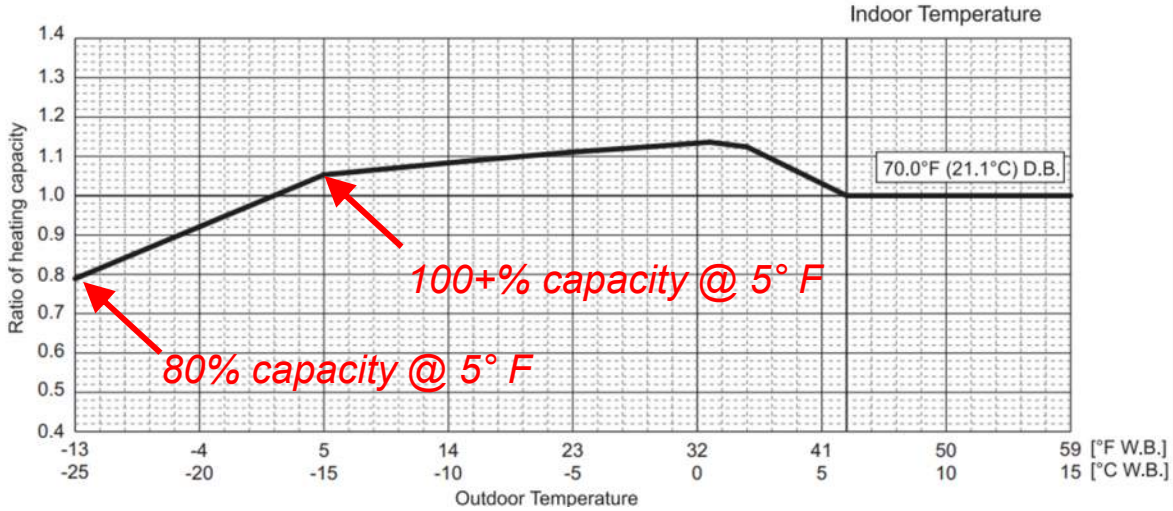


Why cold climate heat pumps?



Standard outdoor heat pump

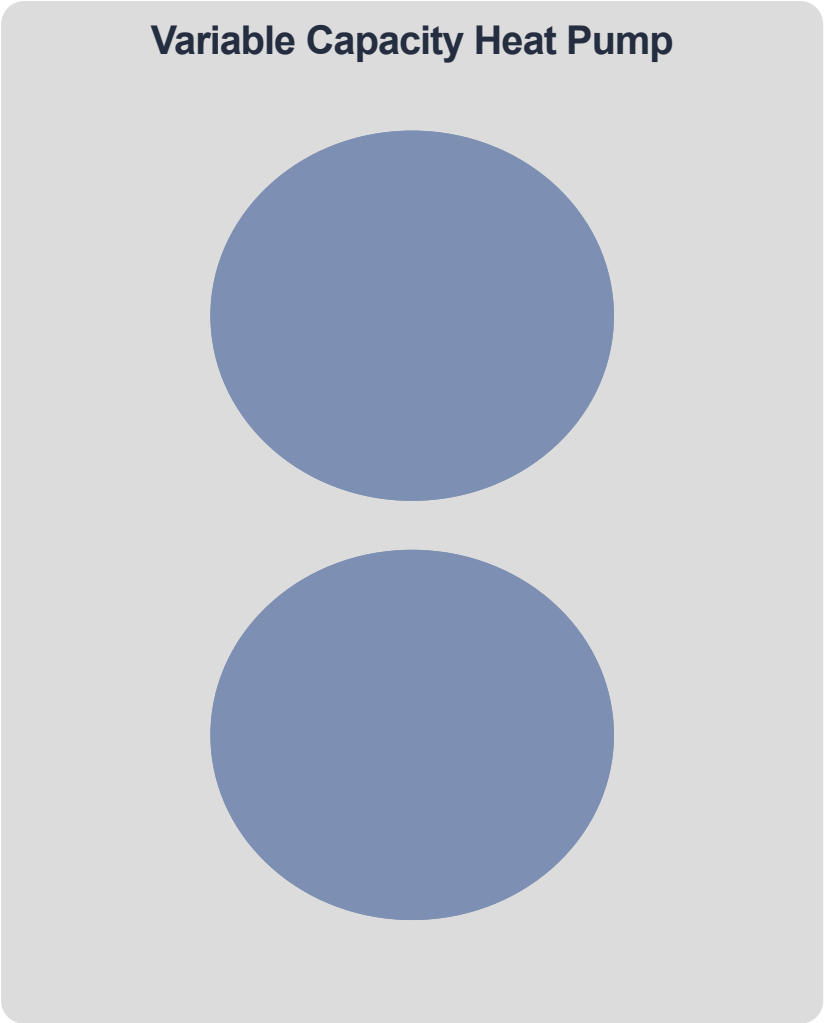
Cold climate outdoor heat pump



Performance expectations, even during extreme events.

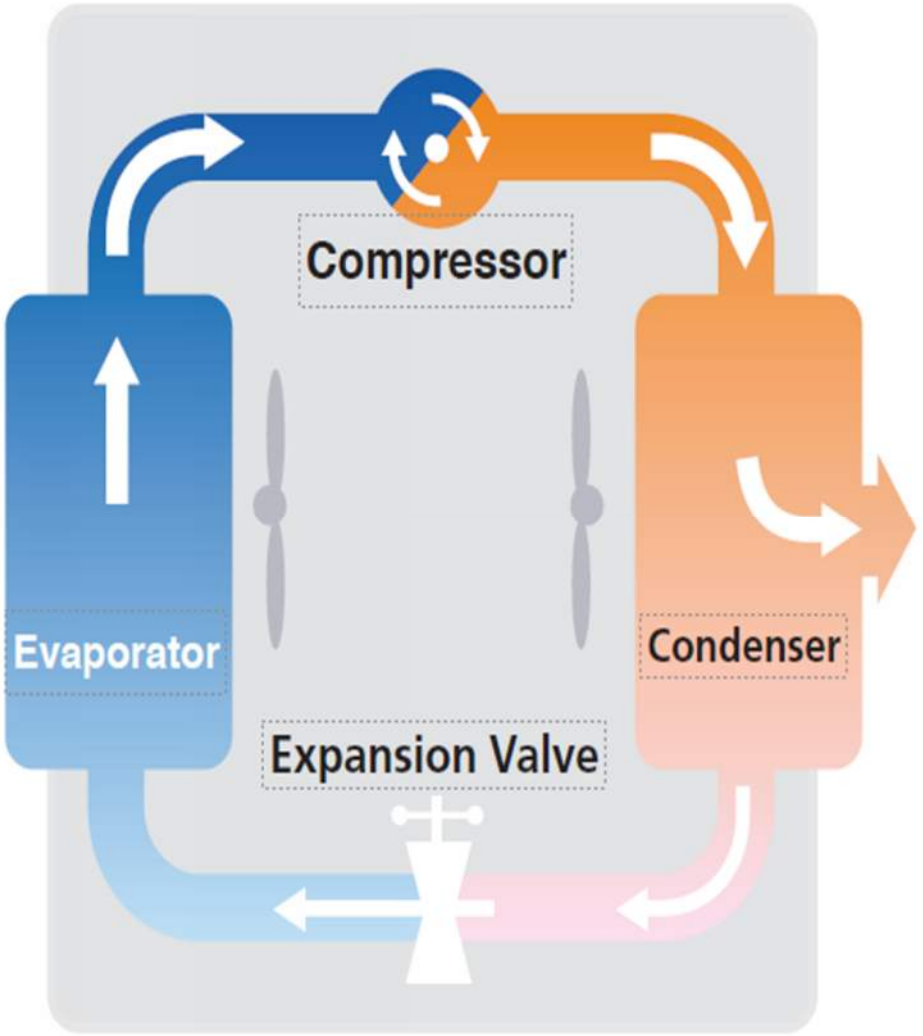
How it works

How it works

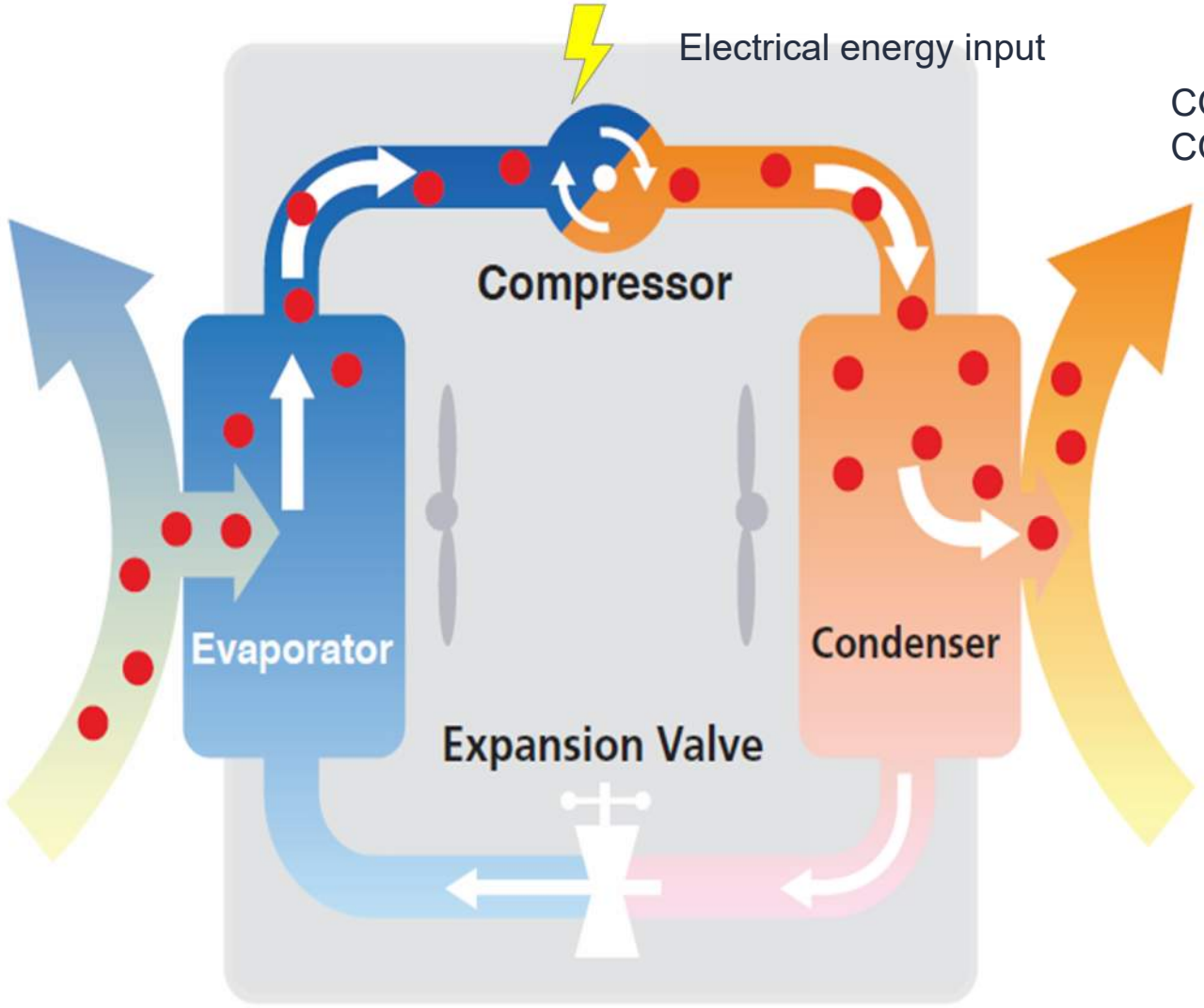


 ©2023 Mitsubishi Trane HVAC US - Confidential

How it works



How it works



COP @ 47° F: 3.85
COP @ 5° F: 2.1

Outdoors

Heat absorbed from air

Indoors

Heat sent to indoor units

Cold climate product innovations

Hot discharge air and “Just right” air flow

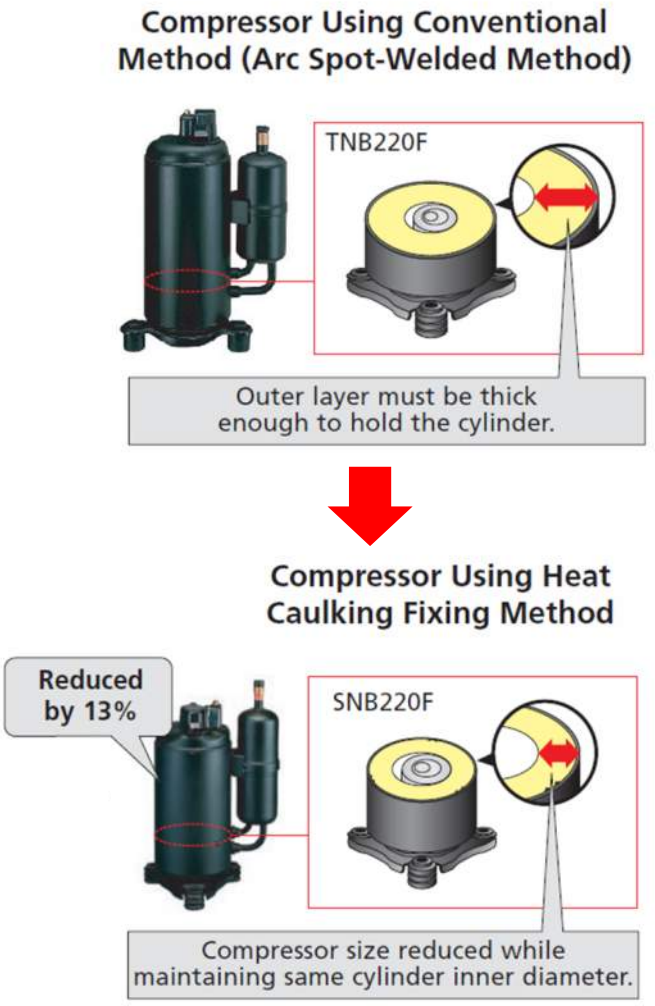
Inverter compressors & advanced motors

Advanced programing for cold climate operations

Intelligent defrost cycles & drain pan de-icing

Optional wind baffles for the outdoor unit

Work with dedicated HVAC designers, contractors & distributors



Specifying

System Sizing

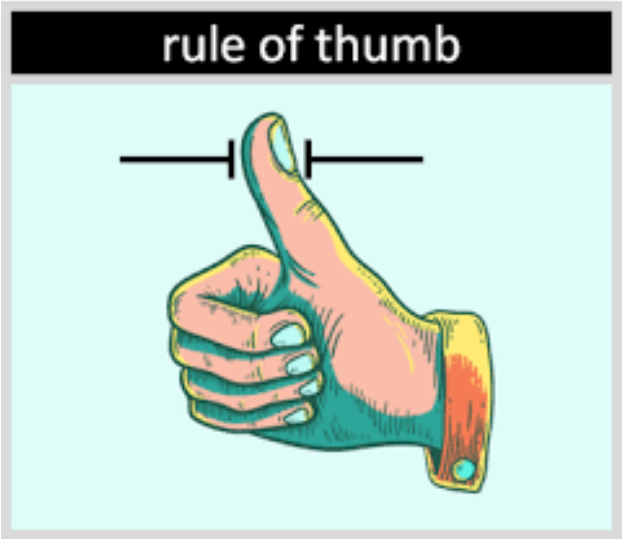
Load calcs for heating and cooling load

Site specific design conditions, including for altitude

Equipment Submittals and Performance Curves

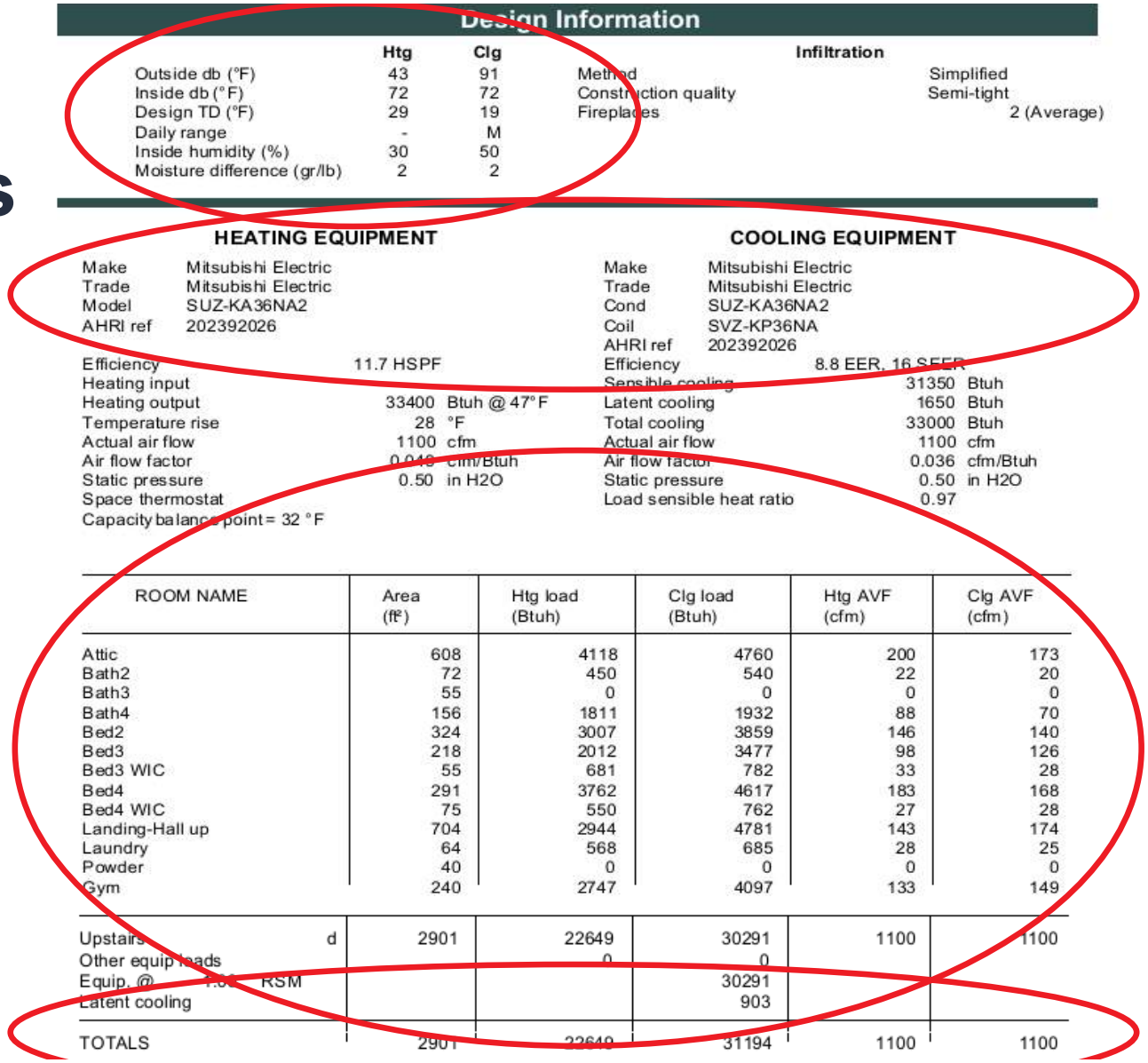
NEEP Cold Climate Performance Charts

System design tools



That's good enough, right?

Manual J Load Calcs



Design Information

	Htg	Clg		
Outside db (°F)	43	91	Infiltration Method	Simplified
Inside db (°F)	72	72	Construction quality	Semi-tight
Design TD (°F)	29	19	Fireplaces	2 (Average)
Daily range	-	M		
Inside humidity (%)	30	50		
Moisture difference (gr/lb)	2	2		

HEATING EQUIPMENT

Make	Mitsubishi Electric
Trade	Mitsubishi Electric
Model	SUZ-KA36NA2
AHRI ref	202392026
Efficiency	11.7 HSPF
Heating input	
Heating output	33400 Btuh @ 47°F
Temperature rise	28 °F
Actual air flow	1100 cfm
Air flow factor	0.046 cfm/Btuh
Static pressure	0.50 in H2O
Space thermostat	

Capacity balance point = 32 °F

COOLING EQUIPMENT

Make	Mitsubishi Electric
Trade	Mitsubishi Electric
Cond	SUZ-KA36NA2
Coil	SVZ-KP36NA
AHRI ref	202392026
Efficiency	8.8 EER, 16 SEER
Sensible cooling	31350 Btuh
Latent cooling	1650 Btuh
Total cooling	33000 Btuh
Actual air flow	1100 cfm
Air flow factor	0.036 cfm/Btuh
Static pressure	0.50 in H2O
Load sensible heat ratio	0.97

ROOM NAME	Area (ft²)	Htg load (Btuh)	Clg load (Btuh)	Htg AVF (cfm)	Clg AVF (cfm)
Attic	608	4118	4760	200	173
Bath2	72	450	540	22	20
Bath3	55	0	0	0	0
Bath4	156	1811	1932	88	70
Bed2	324	3007	3859	146	140
Bed3	218	2012	3477	98	126
Bed3 WIC	55	681	782	33	28
Bed4	291	3762	4617	183	168
Bed4 WIC	75	550	762	27	28
Landing-Hall up	704	2944	4781	143	174
Laundry	64	568	685	28	25
Powder	40	0	0	0	0
Gym	240	2747	4097	133	149
Upstairs d	2901	22649	30291	1100	1100
Other equip loads		0	0		
Equip. @ 1.0 RSM			30291		
Latent cooling			903		
TOTALS	2901	22649	31194	1100	1100

Design Temps

City	Climate Zone	Latitude	Elevation (ft)	Longitude	Cooling											Heating			
					0.10%		0.50%		1.00%		2.00%		Design Wetbulb 0.1%	Design Wetbulb 0.5%	Outdoor Daily Range	Winter Median of Extremes	Design Drybulb (0.2%)	Design Drybulb (0.6%)	HDD*
					DB	MCWB	DB	MCWB	DB	MCWB	DB	MCWB							
Tehachapi	16	35.1	3975	118.5	97	66	93	65	92	65	89	64	69	67	33	13	20	24	4494
Tejon Rancho	16	35	1425	118.8	107	71	103	70	102	70	99	68	74	72	27	24	29	32	2602
Temecula	10	33.5	1006	117.2	101	69	96	68	95	68	91	67	73	71	34	24	29	32	
Temple City	9	34.1	403	118.1	101	70	95	69	93	69	89	68	73	71	27	30	35	37	
Termo	16	40.9	5300	120.5	95	60	92	59	91	59	87	57	64	62	37	-17	-11	-4	
Thermal AP	15	33.6	-112	116.1	114	74	110	74	109	74	106	74	80	79	29	26	31	35	1154
Thermalito	11	37.9	25	121.6	106	71	104	70	102	70	98	69	74	72	37	25	30	33	
Thousand Oaks	9	34.2	810	118.8	98	69	93	68	92	68	88	67	72	70	30	27	32	35	
Three Rivers PH 1	13	36.5	1140	118.9	105	70	102	69	101	69	98	67	73	71	38	24	30	32	2642
Tiburon	3	37.9	90	122.5	85	66	80	65	78	65	73	63	67	65	12	30	34	36	
Tiger Creek PH	16	38.5	2355	120.5	100	66	96	65	95	65	92	63	69	67	36	20	26	29	3795
Torrance	6	33.8	110	118.3	93	69	86	68	84	68	80	66	71	69	18	32	37	39	1859
Tracy Carbona	12	37.7	140	121.4	102	70	97	68	95	68	90	67	72	70	38	24	29	32	2704
Tracy Pumps	12	37.8	61	121.4	104	71	99	69	97	69	92	68	73	71	39	23	28	31	
Travis AFB	12	38.3	72	121.9	103	71	98	69	96	68	91	66	73	70	35	24	29	32	2725
Trinity Dam	16	40.8	2500	122.8	99	65	94	64	92	64	88	62	68	66	37	17	24	28	
Trona	14	35.8	1695	117.4	113	72	109	70	108	70	105	68	76	73	35	18	24	27	2415
Truckee RS	16	39.3	5995	120.2	90	58	87	57	86	57	82	55	62	60	40	-10	-4	0	8230

Altitude corrections

Heat pumps installed at altitude operate in decreased air density.

Equipment size may need to be increased.

Look up correction factors that apply for both heating and cooling operation.

Indoor & outdoor unit sizing needs to account for capacity reductions.

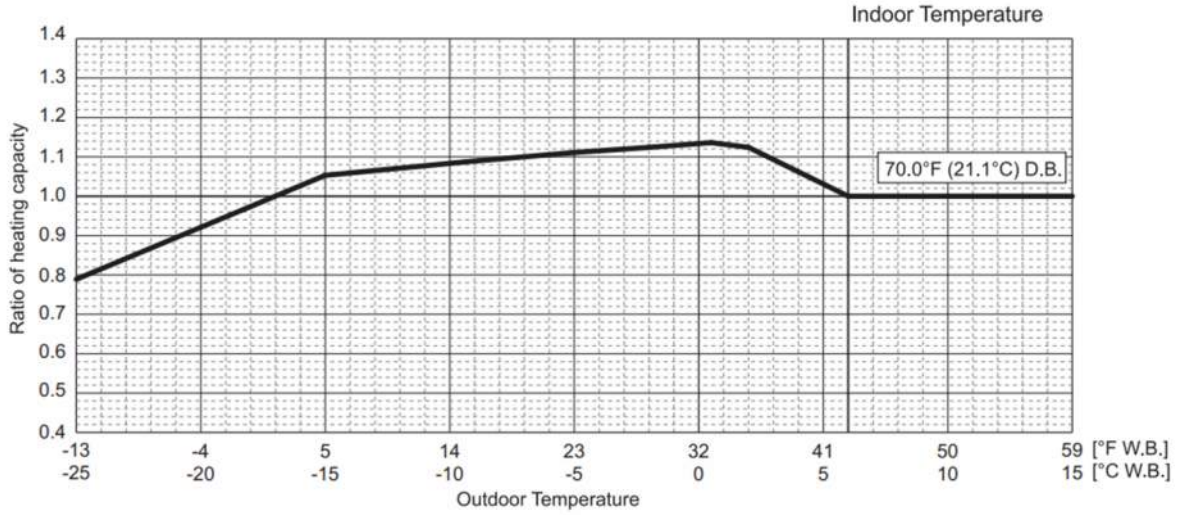
Mitsubishi M&P Series Altitude Corrections

Altitude [feet above sea level]	Indoor Unit	Outdoor Unit
0	1.00	1.00
1,000	0.96	0.99
2,000	0.93	0.98
3,000	0.90	0.98
4,000	0.86	0.97
5,000	0.83	0.96
6,000	0.80	0.95
7,000	0.77	0.94
8,000	0.74	0.94
9,000	0.71	0.93
10,000	0.69	0.92

Technical Documentation

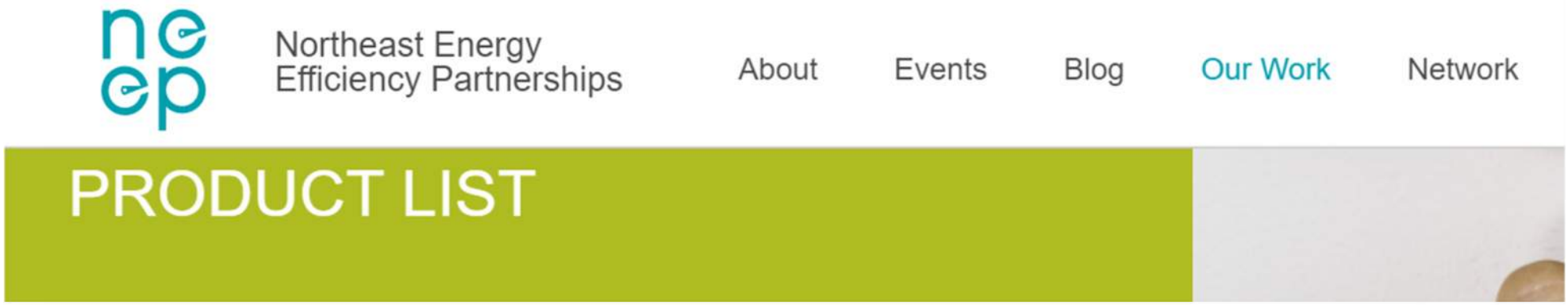
Submittals

Engineering data



Cooling[1] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	36,000 // 36,000 // 36,000
	Rated Capacity	BTU/H	36,000 // 36,000 // 36,000
	Minimum Capacity	BTU/H	15,500 // 15,500 // 15,500
	Maximum Power Input	W	2,400 // 2,610 // 2,855
	Rated Power Input	W	2,400 // 2,610 // 2,855
	Power Factor (208V, 230V)	%	98.5, 98.5 // 98.5, 98.5 // 98.5, 98.5
Heating at 47°F[2] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	42,000 // 42,000 // 42,000
	Rated Capacity	BTU/H	42,000 // 42,000 // 42,000
	Minimum Capacity	BTU/H	22,500 // 22,500 // 22,500
	Maximum Power Input	W	3,080 // 3,200 // 3,325
	Rated Power Input	W	3,080 // 3,200 // 3,325
	Power Factor (208V, 230V)	%	98.5, 98.5 // 98.5, 98.5 // 98.5, 98.5
Heating at 17°F[3] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	49,000 // 49,000 // 49,000
	Rated Capacity	BTU/H	33,000 // 33,000 // 33,000
	Maximum Power Input	W	5,730 // 6,050 // 6,350
	Rated Power Input	W	3,450 // 3,600 // 3,750
Heating at 5°F[4] (Non-Ducted // Mix // Ducted)	Maximum Capacity	BTU/H	42,000 // 42,000 // 42,000
	Maximum Power Input	W	6,155 // 6,315 // 6,480

NEEP Cold Climate Heat Pumps



Click here to access

NEEP'S COLD CLIMATE AIR SOURCE
Heat Pump List

Information Tables

Brand	MITSUBISHI ELECTRIC
Series	M-Series
Ducting Configuration	Singlezone Ducted, Compact Ducted
AHRI Certificate #	202392028
Outdoor Unit Model #	SUZ-KA12NA2
Indoor Model #	SEZ-KD12NA
Indoor Unit Type	
Furnace Model #	
EER	12.9
SEER	20.5
HSPF (Region IV)	12.4
EER2	
SEER2	
HSPF2 (Region IV)	
HSPF2 (Region V)	
ENERGY STAR	✓
ENERGY STAR Cold Climate	
Capacity Maintenance (Rated 17°F/Rated 47°F)	66%

Performance Specs

Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Cooling	95°F	80°F	Btu/h	4,000	12,000	12,000
			kW	0.24	0.93	0.93
			COP	4.88	3.78	3.78
Cooling	82°F	80°F	Btu/h	4,200	-	13,100
			kW	0.2	-	0.85
			COP	6.15	-	4.52
Heating	47°F	70°F	Btu/h	4,800	15,000	16,800
			kW	0.26	1.33	1.69
			COP	5.41	3.31	2.91
Heating	17°F	70°F	Btu/h	2,900	10,000	10,000
			kW	0.19	1.18	1.18
			COP	4.47	2.48	2.48
Heating	5°F	70°F	Btu/h	2,200	-	7,900
			kW	0.15	-	0.97
			COP	4.3	-	2.39

Information Tables

Brand	MITSUBISHI ELECTRIC
Series	M-Series H2i
Ducting Configuration	Singlezone Ducted, Compact Ducted
AHRI Certificate #	204627020
Outdoor Unit Model #	SUZ-KA12NAHZ
Indoor Model #	SEZ-KD12NA4
Indoor Unit Type	Mini-Splits
Furnace Model #	
EER	13
SEER	19
HSPF (Region IV)	10.2
EER2	
SEER2	
HSPF2 (Region IV)	
HSPF2 (Region V)	

Performance Specs

Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Cooling	95°F	80°F	Btu/h	5,210	12,000	12,000
			kW	0.32	0.92	0.92
			COP	4.77	3.82	3.82
Cooling	82°F	80°F	Btu/h	5,600	-	12,800
			kW	0.25	-	0.78
			COP	6.56	-	4.81
Heating	47°F	70°F	Btu/h	7,700	15,000	18,000
			kW	0.54	1.12	1.57
			COP	4.18	3.93	3.36
Heating	17°F	70°F	Btu/h	4,100	9,000	15,000
			kW	0.49	1.03	1.72
			COP	2.45	2.56	2.56
Heating	5°F	70°F	Btu/h	3,500	-	15,000
			kW	0.4	-	2
			COP	2.56	-	2.2

Information Tables

Brand	MITSUBISHI ELECTRIC
Series	Smart Multi
Ducting Configuration	Multizone All Non-Ducted
AHRI Certificate #	207517150
Outdoor Unit Model #	MXZ-SM36NAM
Indoor Model #	
Indoor Unit Type	Non-Ducted Indoor Units
Furnace Model #	
EER	15
SEER	23
HSPF (Region IV)	12.5
EER2	
SEER2	
HSPF2 (Region IV)	
HSPF2 (Region V)	
ENERGY STAR	✓

Performance Specs

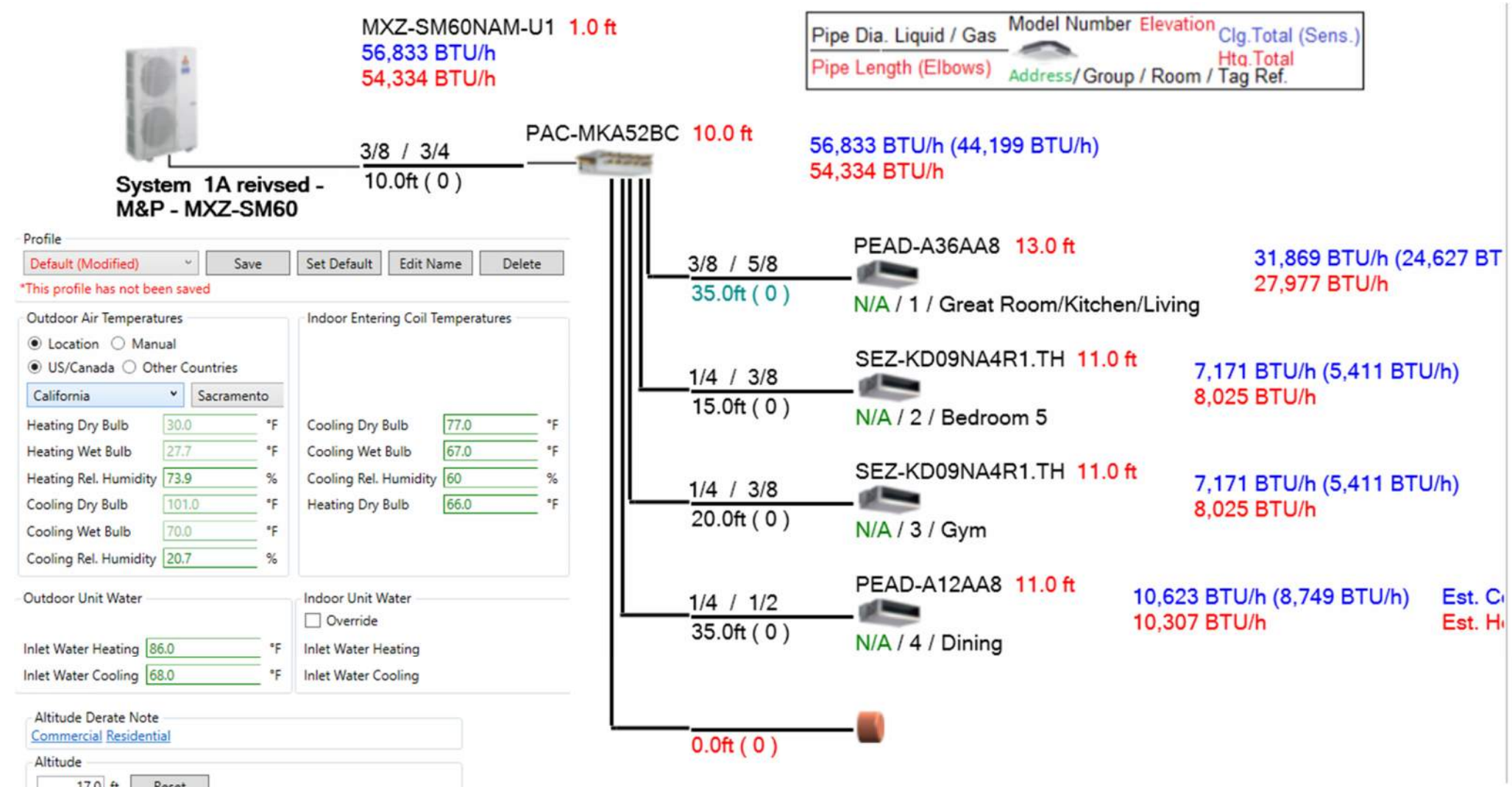
Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Cooling	95°F	80°F	Btu/h	15,500	36,000	36,000
			kW	1.05	2.4	2.4
			COP	4.33	4.4	4.4
Cooling	82°F	80°F	Btu/h	9,508	-	36,000
			kW	0.48	-	2.26
			COP	5.81	-	4.67
Heating	47°F	70°F	Btu/h	22,500	42,000	42,000
			kW	1.09	3.08	3.08
			COP	6.05	4	4
Heating	17°F	70°F	Btu/h	8,500	26,400	29,400
			kW	0.67	2.76	3.91
			COP	3.72	2.8	2.2
Heating	5°F	70°F	Btu/h	5,857	-	25,200
			kW	0.5	-	3.36
			COP	3.43	-	2.2
Heating	-13°F	70°F	Btu/h	2,378	-	18,131
			kW	0.24	-	1.03
			COP	2.9	-	5.16

Information Tables

Brand	MITSUBISHI ELECTRIC
Series	Smart Multi
Ducting Configuration	Multizone All Non-Ducted
AHRI Certificate #	207517152
Outdoor Unit Model #	MXZ-SM36NAMHZ
Indoor Model #	
Indoor Unit Type	Non-Ducted Indoor Units
Furnace Model #	
EER	15
SEER	23
HSPF (Region IV)	12.5
EER2	
SEER2	
HSPF2 (Region IV)	
HSPF2 (Region V)	
ENERGY STAR	✓

Performance Specs

Heating / Cooling	Outdoor Dry Bulb	Indoor Dry Bulb	Unit	Min	Rated	Max
Cooling	95°F	80°F	Btu/h	15,500	36,000	36,000
			kW	1.05	2.4	2.4
			COP	4.33	4.4	4.4
Cooling	82°F	80°F	Btu/h	9,508	-	36,000
			kW	0.48	-	2.26
			COP	5.81	-	4.67
Heating	47°F	70°F	Btu/h	22,500	42,000	42,000
			kW	1.09	3.08	3.08
			COP	6.05	4	4
Heating	17°F	70°F	Btu/h	8,500	33,000	42,000
			kW	0.67	3.45	5.73
			COP	3.72	2.8	2.15
Heating	5°F	70°F	Btu/h	6,687	-	42,000
			kW	0.58	-	6.16
			COP	3.38	-	2
Heating	-13°F	70°F	Btu/h	2,716	-	35,526
			kW	0.28	-	4.68
			COP	2.84	-	2.22

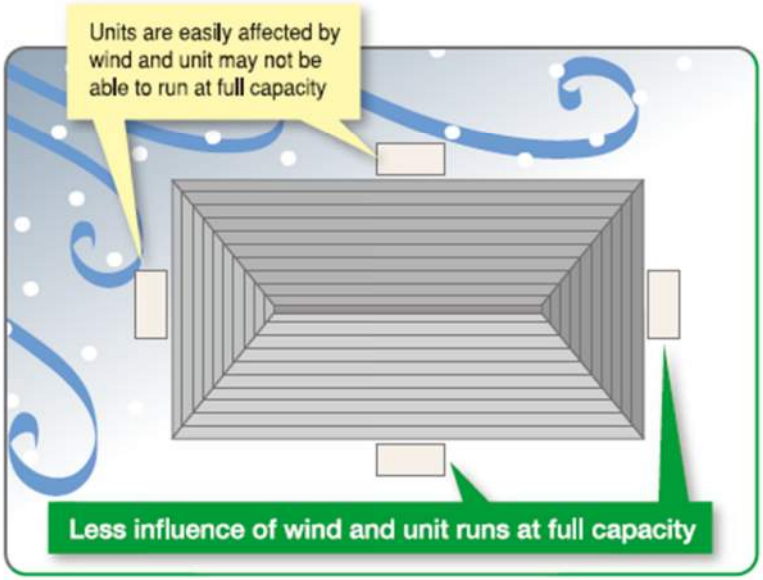

MXZ-SM60NAM-U1 1.0 ft
56,833 BTU/h
54,334 BTU/h
Pipe Dia. Liquid / Gas
Model Number
Elevation
Clg.Total (Sens.)
Pipe Length (Elbows)
Htg.Total
Address/ Group / Room / Tag Ref.
PAC-MKA52BC 10.0 ft
3/8 / 3/4
10.0ft (0)
56,833 BTU/h (44,199 BTU/h)
54,334 BTU/h
System 1A reivsed - M&P - MXZ-SM60
Profile
Default (Modified)
Save
Set Default
Edit Name
Delete
*This profile has not been saved
Outdoor Air Temperatures
Location
Manual
US/Canada
Other Countries
California
Sacramento
Heating Dry Bulb 30.0 °F
Heating Wet Bulb 27.7 °F
Heating Rel. Humidity 73.9 %
Cooling Dry Bulb 101.0 °F
Cooling Wet Bulb 70.0 °F
Cooling Rel. Humidity 20.7 %
Indoor Entering Coil Temperatures
Cooling Dry Bulb 77.0 °F
Cooling Wet Bulb 67.0 °F
Cooling Rel. Humidity 60 %
Heating Dry Bulb 66.0 °F
Outdoor Unit Water
Inlet Water Heating 86.0 °F
Inlet Water Cooling 68.0 °F
Indoor Unit Water
Override
Inlet Water Heating
Inlet Water Cooling
Altitude Derate Note
Commercial Residential
Altitude
17.0 ft
Reset
Source
Air
Water
Unit
Outdoor
Indoor
Outdoor*
Indoor
Derate
1.00
1.00
1.00
1.00
*Water source units and PWFY indoor units are excluded from this altitude derate.
3/8 / 5/8
35.0ft (0)
PEAD-A36AA8 13.0 ft
31,869 BTU/h (24,627 BT
27,977 BTU/h
N/A / 1 / Great Room/Kitchen/Living
1/4 / 3/8
15.0ft (0)
SEZ-KD09NA4R1.TH 11.0 ft
7,171 BTU/h (5,411 BTU/h)
8,025 BTU/h
N/A / 2 / Bedroom 5
1/4 / 3/8
20.0ft (0)
SEZ-KD09NA4R1.TH 11.0 ft
7,171 BTU/h (5,411 BTU/h)
8,025 BTU/h
N/A / 3 / Gym
1/4 / 1/2
35.0ft (0)
PEAD-A12AA8 11.0 ft
10,623 BTU/h (8,749 BTU/h)
10,307 BTU/h
N/A / 4 / Dining
0.0ft (0)

If you do it right

Design Considerations

1 Installation location

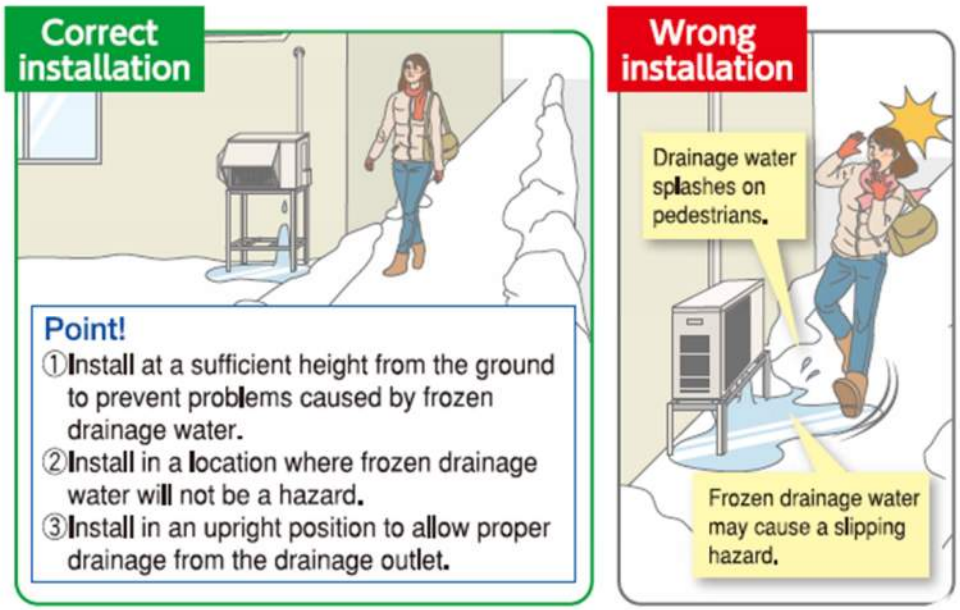
Be aware of the prevailing wind direction in winter and install the outdoor unit where it is sheltered from the wind when possible. When not possible, it is recommended to use an accessory wind baffle



2 Measures for drainage of water

Case 1 : Unit installed near walkway

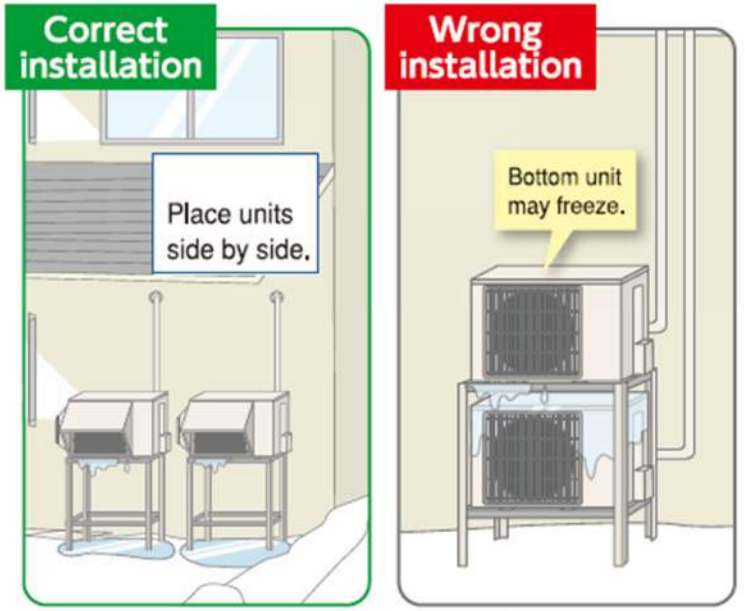
Do not install the unit near a walkway as the drainage water can freeze causing a slip hazard



2 Measures for drainage of water

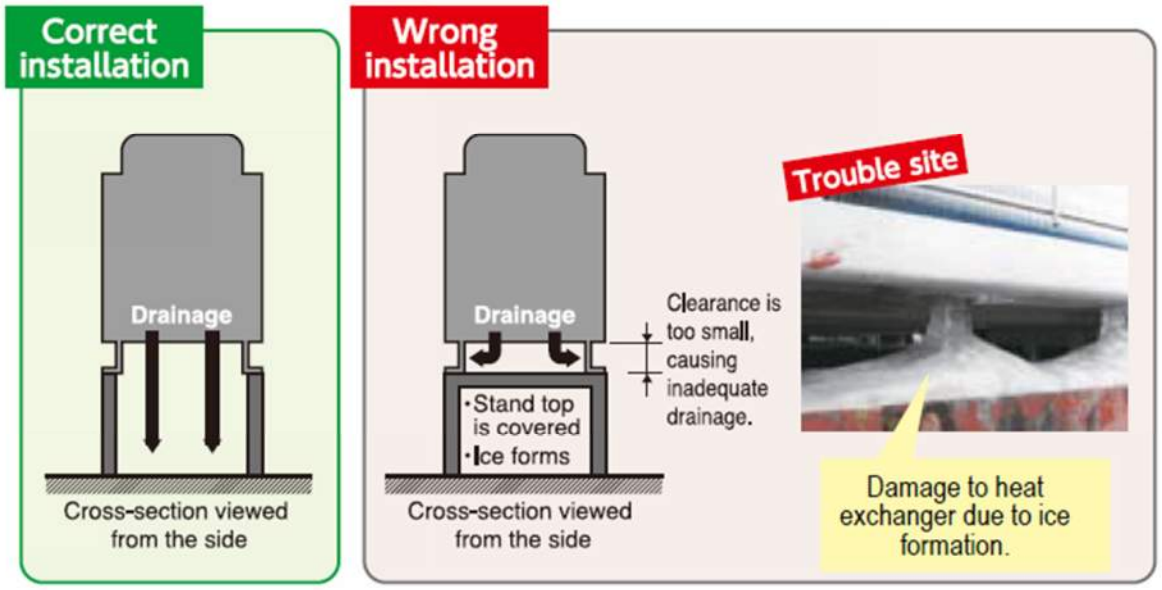
Case 2 : Multiple units are installed

Do not install units on top of one another as it may cause frozen drainage water on the bottom unit.



2 Measures for drainage of water

Use a stand with a steel framework that allows water to drain properly.
The width of the stand's base must not exceed the width of the unit.



QSMS1201M
12" Tall Single Fan Stand

QSMS1801M
18" Tall Single Fan Stand

QSMS2401M
24" Tall Single Fan Stand

3 Measures for snow

M&P Series

Unit is installed on the ground

To avoid the adverse effects of snow, ice and defrosting issues, install the unit on a stand to ensure a sufficient height from the ground

Correct installation

Point!

①Install at a position/height to prevent the unit being buried in snow *1 and the adverse effects of frozen drainage water.*2

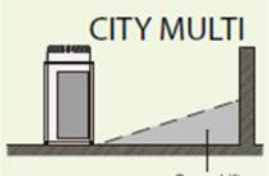
②Install so as to avoid the effects of snow or snowdrift.

③Install so as to avoid the damage from falling snow or icicles.

*1 Install at a height above the highest snowfall depth.

*2 Even for correct installations, dripping drainage water may form an icicle which needs to be cleared away regularly to prevent a blocked drainage outlet.

Correct installation



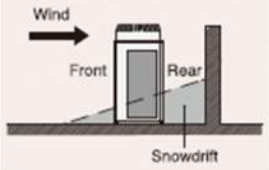
Wrong installation

Unit may become buried in snow due to heavy snowfall, snow sliding off the roof or snowdrift.

Wrong installation

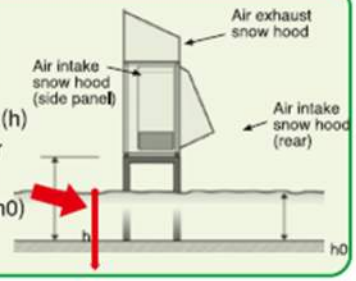
Unit may be damaged due to snowfall or icicles.

Wrong installation



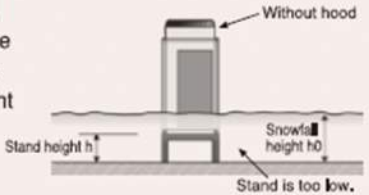
Use a stand to add sufficient height to protect the unit's heat exchanger from snow and prevent icicles forming during defrost operation.

Correct installation



Wrong installation

Unit may become covered in snow if the stand height is insufficient.



3 Measures for snow

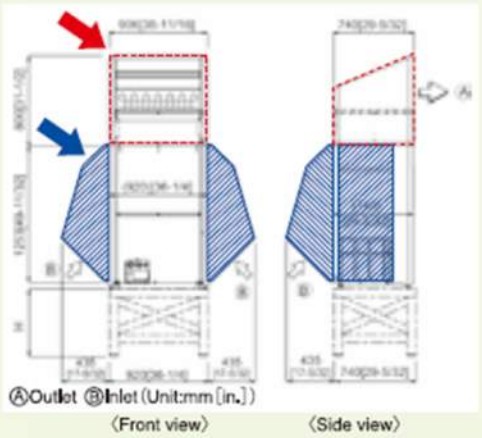
Install snow protection hood as necessary

[City Multi]

Correct installation

The top hood prevents snow from coming in, accumulating inside the unit and covering the heat exchanger.

The side and rear hood prevents snow from covering the heat exchanger.



When installing units side by side, install a filler plate between the fan guard and the outlet-side snow hood.

Wrong

Market Updates

Efficiency Metrics

Energy Efficiency Ratio (EER) [Btu/Wh]

$$\frac{\text{Full Load Cooling Output}}{\text{Total Energy Usage}} = \textbf{EER Rating}$$

Seasonal Energy Efficiency Ratio (SEER) [Btu/Wh]

$$\frac{\text{Cooling Output Over a Typical Cooling Season}}{\text{Energy it Uses over the Season}} = \textbf{SEER Rating}$$

Heating Seasonal Performance Factor (HSPF) [Btu/Wh]

$$\frac{\text{Heating Output Over a Typical Heating Season}}{\text{Energy it Uses over the Season}} = \textbf{HSPF Rating}$$

EER2, SEER2 and HSPF2

- Represents the equipment efficiency with the new testing and calculation procedures that will take effect in 2023

Efficiency Metrics

SEER2
EER2
HSPF2

New procedures

Minimum efficiency increase of ~7%

SEER / HSPF → SEER2 / HSPF2

Product Class	Current Efficiencies (Old Procedure "M")		2023 Efficiencies (Old Procedure "M")		2023 Efficiencies (New Procedure "M1")	
	SEER	HSPF	SEER	HSPF	SEER2	HSPF2
Split-system HP	14	8.2	15	8.8	14.3	7.5

SEER / HSPF / EER → SEER2 / HSPF2 / EER2

Product Class	Current Efficiencies (Old Procedure "M")				2023 Efficiencies (Old Procedure "M")				2023 Efficiencies (New Procedure "M1")			
	National	SE	SW		National	SE	SW		National	SE	SW	
	SEER	SEER	SEER	EER	SEER	SEER	SEER	EER	SEER2	SEER2	SEER2	EER2
Split AC <45 kBtu/h	13	14	14	12.2	14	15	15	12.2/10.2[a]	13.4	14.3	14.3	11.7/9.8[a]
Split AC ≥45 kBtu/h	13	14	14	11.7	14	14.5	14.5	11.7/10.2[a]	13.4	13.8	13.8	11.2/9.8[a]

Note a: The lower EER requirement is for equipment at or above 16.0 SEER using the M test method (or 15.2 SEER2 using the M1 test method).

Inflation Reduction Act

Largest climate investment in American history

Brings energy bill relief to U.S. households

Incentivizes adoption of more efficient, all-electric appliances

Projected to reduce GHG emissions 31-44% below 2005 levels by 2030

Energy Efficient Home Improvement (25C) Tax Credit	New Energy Efficient Home Tax Credit (45L) New Construction	Energy-Efficient Commercial Building Deduction (179D)

Effective for 2023

Energy Efficient Home Improvement (25C) Tax Credit	New Energy Efficient Home Tax Credit (45L) New Construction	Energy-Efficient Commercial Building Deduction (179D)
AVAILABLE for purchases starting Jan. 1 Can claim annually through 2032 Up to $2,000 per system/year CEE-qualified systems	**Contractors** building/selling homes **Single Family**: $2,500 if ENERGY STAR; $5,000 if zero energy ready. **Multifamily**: $500 per unit if ENERGY STAR ($2,500 if prevailing); $1,000 per unit if zero energy ready ($5,000 if prevailing).	Energy reduction of 25% (was 50%) Eligible deduction up to $1.00/sq ft Building owners; designers for: ○ *Government entities* ○ *Not-for-profit organizations* ○ *Churches/religious organizations* ○ *Trival organizations* ○ *Not-for-profit schools/universities*

NVEnergy powershift incentives

Residential New Construction

- Single-family homes
- Multifamily up to four units per foundation
- Must achieve ENERGYSTAR® certification
- Built 10% above code or better*

Rebates increase by $20 per 1% improvement

- 10%–14% Improvement: $200–$280
- 15%–19% Improvement: $300–$380
- 20%–24% Improvement: $400–$480
- 25% Improvement: $500

ENERGYSTAR Certified Smart Thermostat Rebates: $20

Discussion and questions

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