Winterize Maine

Winterize Maine provides free information for the 623,000 Mainers that heat with a very expensive fuel source and want to lower their heating bills.

As long as it's not a fossil fuel, we're technology agnostic our goal is to help homeowners reduce their heating bill. But we're also practical. We know that we can't switch off oil quickly.

Cold Climate Heat Pump Buyers Guide

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About Winterize Maine

Get an Instant Online Heat Pump Cost and Savings Quote --> http://www.winterizemaine.com/

If you want to get a heat pump installed in your home and are curious how much you can save, we can provide quick cost and savings report together for you. If you want, we can put you in touch with a best in class installers in your area.

Go here to get an online heat pump quote --> http://www.winterizemaine.com/

Learning Objectives

After reading this guide, here's what you'll understand. If you have any questions, we've created a private forum where you ask us questions free of charge. This forum is only open to homeowners that have downloaded the cold climate heat pump buyers guide, so it's free of any spam. Here's the private forum: http://www.winterizemaine.com/thank-you.html#/

1. Understand how cold climate heat pumps work
2. Understand the best major brands and the efficiency of each brand's ductless heat pump line
3. Understand the differences between ductless and ducted heat pump systems
4. Understand what types of homes and homeowners are best suited for ductless heat pumps and which home are not well suited for heat pumps
5. Understand exactly how much it costs (equipment, labor, time, profit) for a contractor to install a ductless heat pump
6. Understand the 7 questions you need to ask every ductless heat pump contractors so you don't get ripped off.

How Do Cold Climate Heat Pump Work?

This article will address many of the questions we get from homeowners about how heat pumps works, what a ductless heat pump is and some of the pros and cons of these units from a technical perspective.

There's been a lot of press about heat pumps in Maine lately, from the governor's love of the technology, to new legislation that will increase adoption of the technology, but there's still confusion about how they work.

Most of the information written about this technology is written by engineers and contractors for each other. While this information is amazing, we've found it's not written in a way that's useful to homeowners that want to utilize the technology to lower their heating bills.

This article was written for homeowners that are researching heat pumps as a way to provide very low cost heat to their homes.

By the end of this article, you will learn:

1. What a heat pump is
2. What a ductless heat pump is
3. The pros and cons of a ductless heat pump
4. How a heat pump moves heat between places
5. What a cold climate heat pump is and how it's different than a normal heat pump
6. Heat pump reviews. The manufactures that make the highest quality cold climate heat pumps
7. How effective air source heat pumps are at heating in cold Maine winters

If you have any questions about the content please put it in the comments and we'll respond with an answer very quickly.

Let's get started.

What is a heat pump?

A heat pump uses electricity and a refrigerant to move heat between two places. Most often, this is between a the inside of a building to the outside of a building and vice versa. A heat pump does this by manipulating pressure and temperature of the refrigerant between two places. The most common forms of heat pumps in every day life are freezers, refrigerators, and air conditioning in your car or home. In all of these examples, heat is being removed from one place (the inside of your car or fridge) and put into another place.

While both air conditioning and heat pumps both use the same principles, the difference between air conditioning and a heat pump is just one thing, a heat pump can work in both directions. If your refrigerator could also heat the inside of itself, it would be a heat pump.

In the picture at the top of the article, a condenser is installed outside and an evaporator is installed inside. The condenser extracts heat from the outside air and transfers it to the inside of the room. It's important to note that in this picture, it's showing the heat pump in cooling mode. Cold climate heat pumps can also run in heating mode, where they're extracting heat from the outside of the building and putting it into the inside of the building.

What is a ductless heat pump?

A ductless heat pump, or a mini-split heat pump, is simply a heat pump that doesn't use any duct to distribute the conditioned air inside of the home. In a ductless system, the outside unit is connected to the inside unit only with refrigerant lines. These lines are connected through a 3 inch whole.

This contrasts with a ducted heat pump system that uses duct to distribute air around a conditioned space.

There are many benefits of a ductless heating system from a technical, economics, comfort, and aesthetic perspective.

1. It can integrated with any existing heating system in any home. This is particularly amazing for Maine, which tends to have many types of old heating systems that would be impossible to integrate with for other types of heating system. This is because the set point of the heat pump is independent of other heating controls. This gives you the flexibility to set it to the temperature that you want on the unit itself.
2. The installation is fast. This means less construction and and less time spent for homeowners dealing with installation crews. Also, because there is no complex duct work, it's a very simple installation with no evasive construction.
3. High efficiency. Duct can be used to distribute heat to more places, but there's a lot energy loss in the fans it takes to move the air and within the duct itself. Eliminating the ducts means that more heat is delivered for a lower cost.
4. More even heat in areas with a ductless system. Ductless systems perform better in distributing warm or cool air to a home, making living areas more comfortable. A single indoor unit can heat and cool a large living space, making these systems especially well suited to homes with open floor plans.
5. Year round comfort. By installing a ductless system, you can enjoy year round comfort. Ductless systems come standard with air conditioning, offering you an energy efficient cooling solution.

Point Source Distribution vs Central Distribution

There is one downside to ductless heat pumps, but many don't even see it as a downside.

The inside unit can only distribute hot or cool air from a single place. This is called "point source distribution". Thus, it must be installed in a central location to maximize the ability of it to generate hot or cold air within the space. The central location should also be one of the most heavily used places in the home, so the heat pump can offset the largest portion of fossil fuel use that's possible and maximize comfort.

The reason that some people don't even see this as a downside is simple. In most cases, we don't need an entire home to be a "hot" to be comfortable because 80% of the time, we're only using a small section of the home. Older heating systems need to heat the entire home in order to warm the one place that you want to be warmer. A ductless system only heats the area that you want to heat, so you don't waste energy heating rooms that don't need to be heated.

You can see an example of a ducted heating system on the right. Below to the right, can you see a picture of a ductless system. A ductless systems needs to have the inside unit installed in a centrally located space so the air can be transferred to the largest portion of the home.

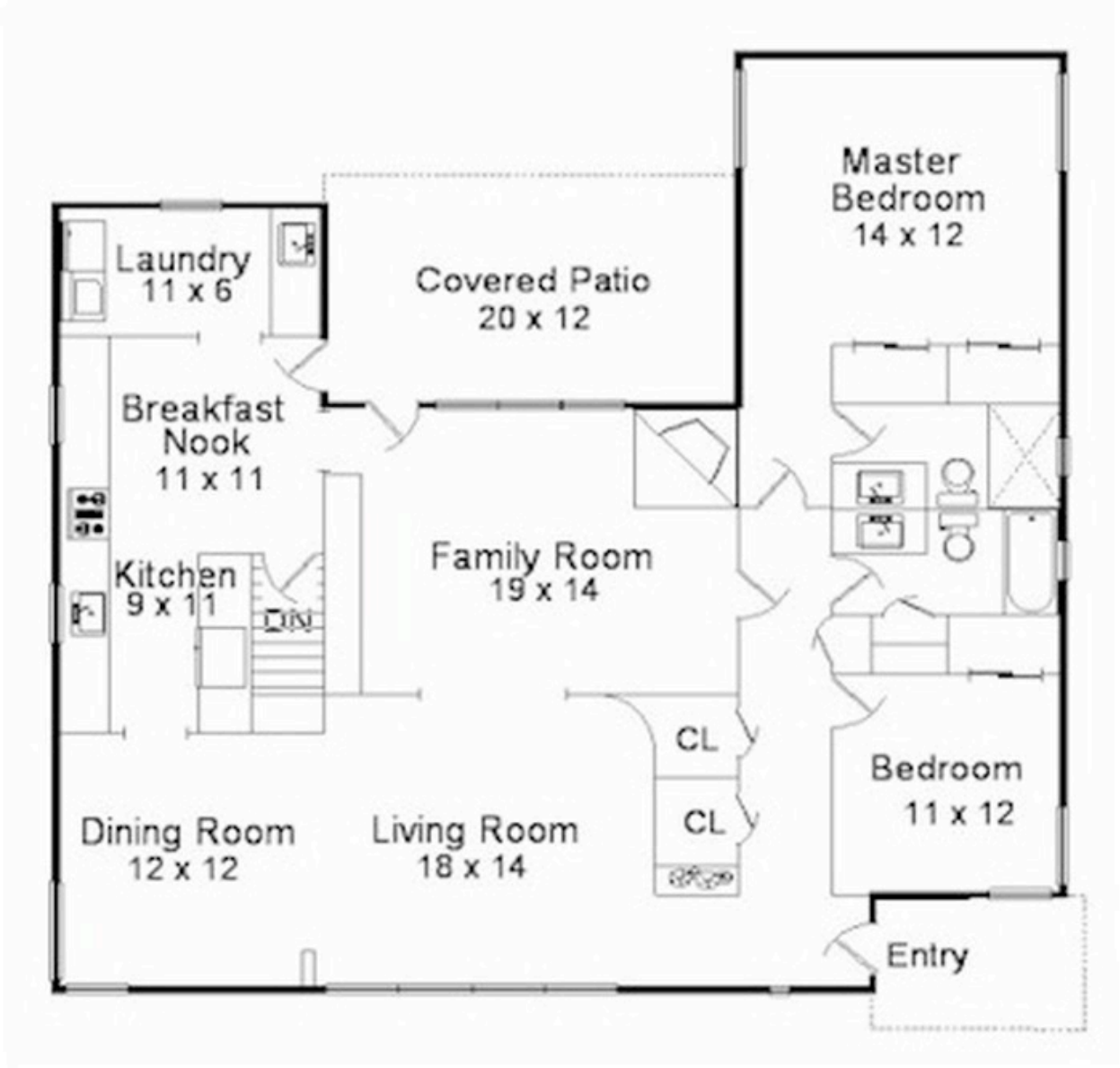
Ductless Heat Pump

Ducted Heat Pump Distribution

Installing the Cold Climate Heat Pump in a Central Location

To give you a specific example, below an example of a floor plan in a home. In most cases, we would want to install the heat pump in the family room, dining room or the living room.

This is a critical piece to understand and something you should discus with any contractor that you might work with to install a heat pump.



How does an air source heat pump work?

This is a question that we get a lot. How do heat pumps work?

Let me try to explain the most complex part in the simplest way because I know that it can be hard to understand we can heat our homes with outside air during the winter.

- **Here's the fundamental thing you need to understand: There is heat in air that we perceive to be cold.** Even though air at 5F seems very cold to us, the reality is that there is heat in this air and we can utilize this heat.
- Air at 5F still has enough energy to change the state of matter for some compounds from a liquid to a gas at lower temperature. We call this compounds refrigerants. In a heat pump, we push a refrigerant through an outside air exchanger that puts the 5F air in direct contact with the refrigerant. It evaporates the refrigerant, which then turns into a gas.
- There's a direct relationship between pressure and temperature. As temperature increases, all else equal, pressure increases. Similarly, if pressure increases in a system so too will temperature.
- Once the compound is in gas state, we increase the pressure to increase the temperature. Within the heat pump, the "compressor" is the piece of equipment that increases the pressure.
- The compressor runs on electricity. The compressor increases the pressure of the gas to increase it's temperature. This is the most important part of the heat pump in heating mode.
- The pressurized, and thus hot, gas is then moved inside of the home and distributed in the evaporator.
- Once a gas is 100F or higher, it becomes easy to move it across a heat exchanger to our homes that are at 60F and bring them to 70F.

This explanation is a very simple explanation of only half of the refrigeration cycle, but one that is the most confusing. This process outlines only how the heat pump is moving heat from outside of a home to the inside during heating mode. You can find more technical explanations of how the refrigeration cycle works in Part 1 The Magic of Air Conditioning and Part Two here.

What is a Cold Climate Heat Pump?

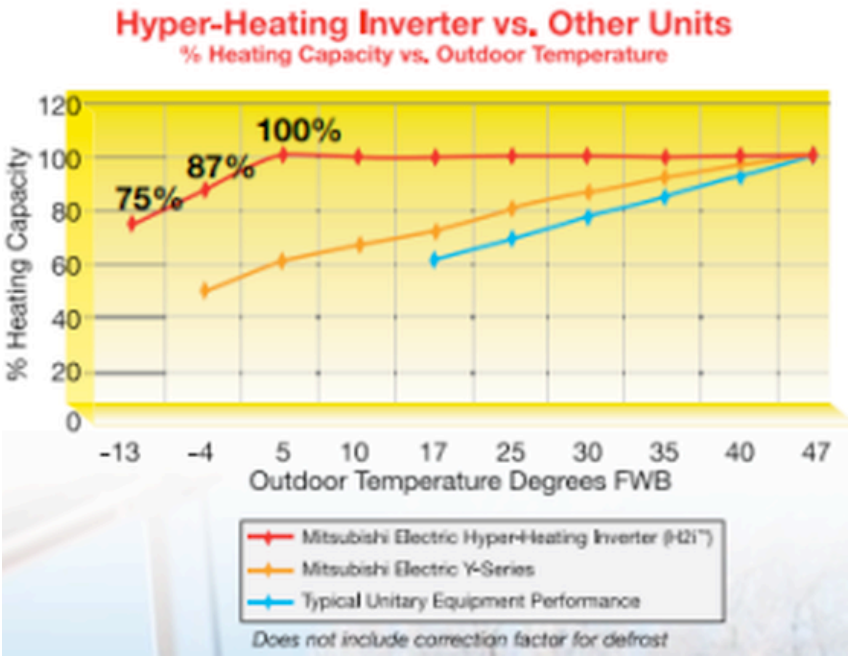
A cold climate heat pump are heat pumps that are able to heat effectively at lower outside temperatures, like the temperatures that we have in Maine.

Traditionally, heat pumps were used for cooling only and on the heating side they were only able to extract heat from the outside air down to 30F. This meant that most heat pumps were only used for very mild heating in regions like the mid-atlantic.

About a decade ago, massive amounts of research started to get commercialized around improved compressor technology. As compressors improved in strength while still being energy efficient, it became possible to extract heat from lower and lower outdoor air temperatures. Also, manufactures started to adopt larger heat exchangers on the outside condenser units to allow for more heat to be exchanged faster with the refrigerant.

You can see the difference in performance from normal heat pumps and cold climate heat pumps in the below graph from Mitsubishi. This graph shows the rated output of three types of heat pumps based on the outdoor temperature.

- The redline is a cold climate heat pump. You can see it maintains 100% output down to 5F outside and to -13F it still has 75% of it's output.
- The yellow and blue lines are examples of traditional heat pumps. This units heating capacity starts to decease at around 45F. By the time it's 20F outside, they've lost a substantial amount of heating capacity.



Cold Climate Heat Pump vs Normal Heat Pump - Heating Output at Various Outdoor Air Temperatures

Heat Pumps in Maine: How Effective are Cold Climate Heat Pumps in Cold Maine Winters?

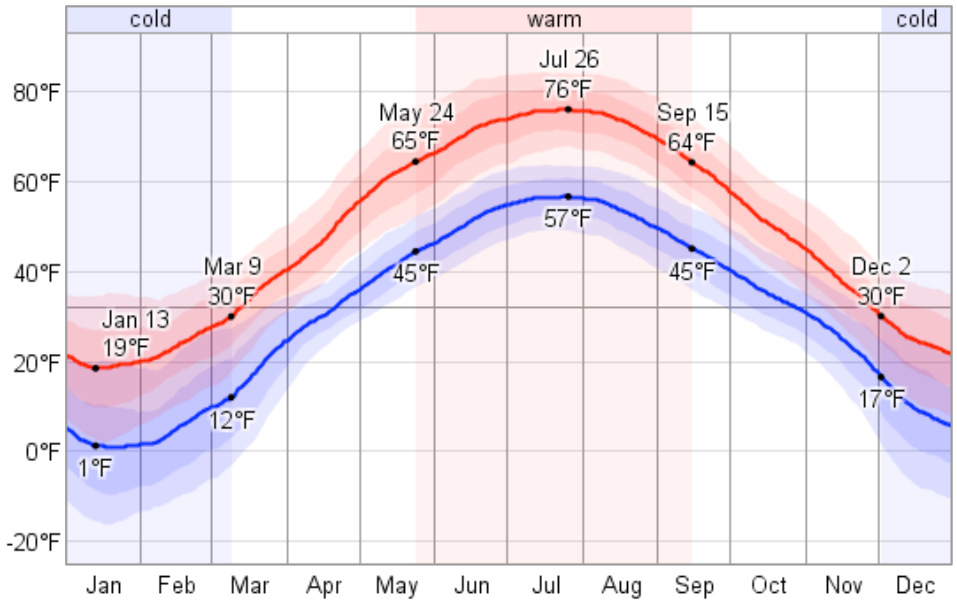
Many people will ask, but can they handle cold Maine winters? Can they still be efficient when it's so cold out? Will they still save money in Maine? It's so cold here!

The reality is that if you look at the average temperatures in Maine, there's only a very small amount of time that the outside air temperature is regularly under 5F.

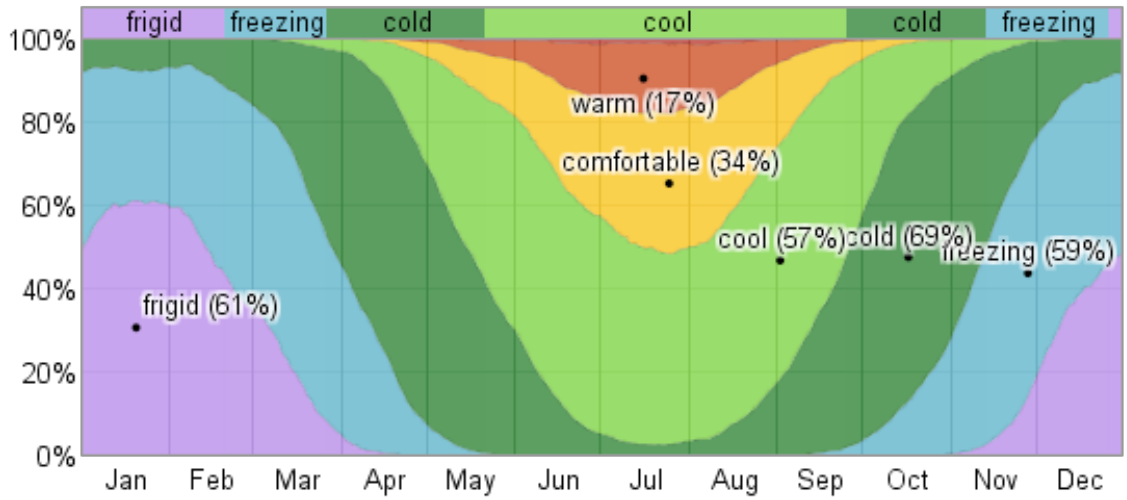
You can find information on the average temperatures in Caribou Maine here.

You can see in the below graph the average daily high and low temperature in Caribou, Maine. Caribou is one of the coldest places in Maine, so we can expect that most regions will be at least slightly warmer.

Average Daily Temperatures - Caribou Maine



Percentage of Time Spent in Various Temperature Bans in Caribou Maine



Above is the the average fraction of time spent in various temperature bands: frigid (below 15°F), freezing (15°Fto 32°F), cold (32°F to 50°F), cool (50°F to 65°F), comfortable (65°F to 75°F), warm (75°F to 85°F), hot (85°F to 100°F) and sweltering (above 100°F).

As you can see from above graph, even in January in Caribou, only about 60% of the time is spent below 15F.

For this reason, cold climate heat pumps can provide a substantial savings for Maine homeowners on their heating bills, even in our harsh winters. We'll talk about the economics of heat pumps in more depth in later articles.

Cold Climate Heat Pump Manufacturers Review

Cold climate heat pumps are heat pumps that can heat in very cold climate climates, like Maine.

Cold Climate Heat Pump Review Introduction

In this article, our goal is to share with you how we've identified the best rated heat pump systems for heating Maine. We will provide a deeper dive into the key characteristics that determine the best rated cold climate heat pump systems for use in heating in Maine.

Here's what we'll cover.

1. A review of the Heating Seasonal Performance Factor (HSPF) and why this is critical to understand when thinking about heat pumps. We'll the definition of HSPF and explain how it impacts how much electricity is used to deliver heat. The most efficient heat pumps use the lease amount of electricity to deliver the most amount of heat.
2. The top 5 manufactures that are producing cold climate heat pumps. We'll focus on the fujitsu mini split, the daikin heat pump and the mitsubishi heat pump. We'll provide a table that covers a heat pump rating review and the rating that are used to measure heat pump efficiency.
3. Other heat pump considerations. We'll discuss other typical heat pump considerations that homeowners ask about like ducted heat pumps; split systems, and larger units.
4. Warranty information details.
5. Heat Pump aesthetics and size. This is simply a review of what different systems look like on the inside and outside of the building
6. Heat pump coverage. How much can a single unit heat?

This is going to be fun. Let's dive in.

If you have any questions about any of this material, please ask it in our homeowner forum: http://www.winterizemaine.com/thank-you.html#/

Heating Seasonal Performance Factor. How to Measure Heat Pump Efficiency

Before we discuss the manufactures of heat pumps and compare specific units, we need to understand how heat pumps are compared from an efficiency perspective.

Heat pumps are rated by Heating Seasonal Performance Factor or HSPF.

HSPF is very simple metric. It is a ratio of the number of BTUs delivered and the amount of watt-hours is required to deliver those BTUs. BTUs are a measure of heat, more more about that here. This number is calculated by running a heat pump over a specific amount of time and considering the amount of electricity that is required to deliver a specific amount of heat over a range of outside air temperatures.

To provide a very specific example, a heat pump that can provide 100 BTUs while using 100 watts would be twice as efficient as a heat pump that provides 50 BTUs using 100 watts.

There are other considerations when selecting a heat pump, but most of the time, we want to use heat pumps that have the highest HSPF rating because these units provide the most amount of heat using the least electricity.

To review, here's the equation to calculate HSPF over a period of time:

- HSPF = BTUs delivered / watt-hours consumed.

Here's a more real example.

- A heat pump with a HSPF of 10 can provide 40,000,000 BTUs (40 million BTUs) by consuming 4,000 kWhs (4 million watt-hours) of electricity.
- Here's the equation. 10 = 40,000,000 BTUs / 4,000,000 watt-hours

Top 5 Heat Pump Manufactures and Heat Pump Rating Review

There are a growing number of manufactures that manufactures cold climate heat pumps. We've narrowed our cold climate heat pump reviews to 5 major manufactures. There are some knock off units but we wanted to focus on the best.

We made this decision based on a few factors

1. The length of time manufacturing cold climate heat pumps. We want to focus on the manufactures that have been doing this the longest.
2. Size and name recognition of the business. We wanted to focus on name brand businesses with large balance sheets. We can trust that these businesses will be around in 20 years to maintain their warranties.
3. Energy star rated.

The manufactures that we reviewed include.

1. Fujitus mini splits
2. Mitsubishi heat pumps
3. Daikin heat pumps
4. LG heat pumps
5. Sanyo heat pumps.

Here are the HSPF rating for each manufacture. We focused on the smallest ductless mini-split system units. These are the most efficient, and we'll explain that in the "other configurations" section below.

Here are the results.

HSPF Rating Based on Manufacture and System Size

HSPF	9,000 BTU	12,000 BTU	15,000 BTU	18,000 BTU
Fujitsu	12.5	12	12	n/a
Mitsubishi	10	10	10	n/a
Daikin	12.5	12.5	11.6	n/a
LG	11	11	n/a	9.7
Sanyo	12.5	9.3	n/a	10

Here are citations for where I found the information for each of the manufactures efficiency ratings. Feel free to do the research yourself. If you have any questions, please leave them in the comment section.

- Fujitsu Ductless Heat Pumps
- Mitsubishi Minisplit Product Catalog
- LG Single Zone Ductless Heat Pumps
- Sanyo Heat Pumps
- Daikin Heat Pump Product Literature.

How do they system efficiencies translate into different amounts of electricity used to provide a specific amount of heat?

Let's assume we're trying to deliver 30,000,000 BTUs to a homeowner over an annual period. Here's the difference in electricity it would take for each unit to deliver this amount of heating capacity.

Electric Use in kWh to Deliver 30MM BTU

HSPF	9,000 BTU	12,000 BTU	15,000 BTU	18,000 BTU
Fujitsu	2400	2500	2500	n/a
Mitsubishi	3000	3000	3000	n/a
Daikin	2400	2400	2586	n/a
LG	2727	2727	n/a	3125
Sanyo	2400	3225	n/a	3000

Let's look at the cost. If we assume electricity costs $.17kWh, you can see the cost difference below.

Cost to Deliver 30MMBTU
Assuming $.17kWh Electric Costs

HSPF	9,000 BTU	12,000 BTU	15,000 BTU	18,000 BTU
Fujitsu	$408	$425	$425	n/a
Mitsubishi	$510	$510	$510	n/a
Daikin	$408	$408	$439	n/a
LG	$463	$463	n/a	$531
Sanyo	$408	$548	n/a	$510

This is why in our no money down heat pump program, we almost exclusivity use Fujisi units, because they provide the most amount of heat for the least cost. This saves homeowners the most money.

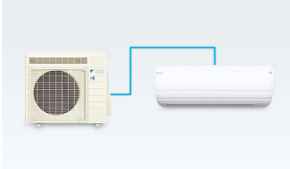
Other System Configurations?

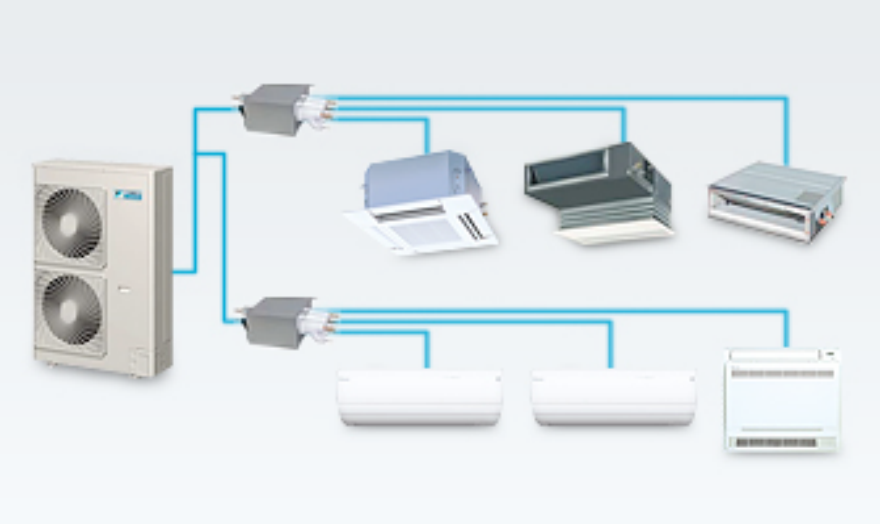
We often get questions about other configurations of cold climate heat pumps. There are many other figurations of heat pumps on the market.

The reason we stay away from other configurations, is that the other configurations have a much lower operating HSPF compared to single ductless heat pump systems.

Here are the other system considerations.

1. Systems with large nominal output. You'll notice in the above table that as the size of the heat pump increases, it's efficiency decreases. For this reason, we stick with smaller units.
2. Ducted systems. In ducted systems, duct is installed to distribute the heat from a central unit around the home. The problem with ducted systems is that a significant amount of energy is lost in duct. The US DOE reports that on average, 20% to 30% of the air is lost while moving through ducts. We need to eliminate in-efficient systems to lower heating costs, so we stay away from ducted systems. The other problem with ducted systems is integrating with existing heating systems. Installing duct takes time.
3. Many outdoor units with single indoor unit. While we don't like duct, it's possible to install multiple indoor units. You can see below that it's possible to have a single outside unit (the compressor on the left in both images) connected with a single indoor unit or multiple indoor units. The issue is that when there are many inside units connected with a single outdoor compressor, the HSPF efficiency drops below 10. We don't like units with low efficiencies for residential applications, so we stay away from this.





We focus exclusively on the units to left because these provide the highest efficiency. This means that produce the most amount of heat with the least amount of electricity.

Warranty Information

With all of these heat pumps, the warranty is essential the same.

- 5 year parts warranty
- 7 year compressor warranty. Read how cold climate heat pumps work to understand what the compressor does
- With all of our systems, we provide 5 year workmanship warranty.

One manufacture, Daikin, has an extended 10 year warranty. The problem is that there are any certified Daikin installers in the state of Maine (at the moment) that provide this service.

Aesthetics and Heat Pump Size.

A heat pump system consists of an inside and outside unit.

Here are some photos of the inside and outside units. You can see that both the internal and outside unit take minimal space.


FUJITSU

Coverage. How much Area Can the Heat Pump Unit Heat?

Heat pumps can provide heating and cooling for an area between 400 and 1,000 square feet. They can provide heating for areas smaller and larger than this, but they are the most efficient in this size.

The specific amount of space they can heat depends on a few key factors.

1. The layout of your home. Because ductless heat pumps distribute a "point source" heat, it's best if they're installed in a central location that is open. An open floor plan means that there are a few rooms that are not separated by doors that are often closed. Most often, kitchens, living rooms, and dining rooms are connected. In older homes, where each individual room is actually it's own room, this can be a problem.
2. The efficiency of your house. How much heat do the walls let in. Heat pumps can heat larger areas in more efficient shells and less area in less efficient shells. When we say "efficient shell", we mean how much heat do your walls let out during the winter.
3. The placement of the unit within the home. This relates to point number one. Heat pumps need to be installed in a central location to heat the maximum amount of space.
4. The size of the heat pump itself. Larger heat pumps can heat larger areas, if the area is sufficiently open for the heat to spread.

Heat Pumps Prices: How Much Do Contractors Charge and Make Installing Ductless Heat Pump in Maine

Item	Units - Hours	Cost	Notes
Heat Pump	1	$1,600	Standard price for a tier 1 manufacture. Don't trust price for heat pump on ebay from no name manufacturer
Heat Pump Accessories	1	$300	This includes line set, brackets and a heating coil. All keys to a high quality installation.
HVAC Labor	4	$160	True for an experienced crew. and simple jobs. Be weary of 6 to 8 hour installations unless there is something difficult about the job. NOTE: This could be more expensive if the installation is difficult.
Electrical Equipment	1	$150	This could be more expensive if the outside unit is very far from the electrical service. NOTE: This will be more expensive if the conduit run is far.
Electrical Labor	4	$160	Again, true for an experience crew. It's not a full day job. NOTE: This will be more expensive if the conduit run is really far or complicated.
Driving	80 miles	$40	This is an average, because you'll have two trucks driving.

We'll explain the above diagram in the article below.

This article will explain with line by line detail how much it costs to install a single ductless heat pump in Maine.

With this article, you should be able to understand heat pump prices and how why some heat pump jobs are more expensive than the average price of a heat pump. It should also provide a heat pump pricing guide so you can understand proposals that different contractors provide.

We'll focus on the costs for a 15,000 BTU cold climate heat pump for a tier one manufacturer. If you want to buy a heat pump no eBay and put it in, please stop reading ;)

Being a contractor is a tough job, especially an HVAC contractor. Not to be too harsh on you the reader (who is likely a homeowner) but you're really hard to deal with. Most homeowners feel that contractors are either completely incompetent, ripping them off, or making tons of money for not doing a lot of work. Or, in most cases, a combination of both.

Once I had someone ask me, "I can get a heat pump on eBay for $700, why does it cost so much to get it installed by a contractor?" To answer of course, is that this particular homeowners is, shall we say, not educated on high quality work and doesn't understand all of the costs of putting in a heat pump that will work for 15+ years.

But it brings up a valid point. People are willing to pay good money for quality work, if they know what the work is and how much it costs.

My solution for this is very simple, let's just tell people exactly what we're doing and how much it costs.

Our goal is to educate Mainers to provide them the best information so that we can eliminate oil use from the state. It's going to take 10 to 20 years, but we finally have the technology and financing to do it, we just need to start.

One of the articles that makes it really difficult for the contractors to sell is that they're not open and transparent about their costs. This decreases the trust of homeowners. By increasing trust, it becomes less risk for a homeowner to invest in the technology, which means more will invest in the technologies.

Heat Pump Pricing Guide

Here are the variables that go into pricing a job. For this, I'm focusing on 15,000 BTU tier 1 manufacturer units. These are ductless units installed as a supplemental heater.

- Heat pump
- Heat pump brackets
- Heat pump coil
- Heat pump accessories
- HVAC labor
- Electrical equipment
- Electrical labor
- Total job costs

Those are the variables that go into a project, here are the other business items that the good contractors keep in mind for every job.

- Gross Profit
- Business overheard
- Pre-tax profit
- Tax
- Post-tax profit

While it doesn't seem like a customer should care about the profitability of the company doing the installation work, there a few reasons you should care.

1. Maintenance. It's best if you get a system installed from a business that will be around for any maintenance issues that come up.
2. Organization is a part of the culture of a business. If organization is present in a aspect of a business, it tends to be present in all aspects. This means that well run and profitable businesses tend to hire the best technicians, have better customer service, respond to the customer faster, etc.

Here are all of the variables explained with ranges for what the price will be for a single job.

- Heat pump. A heat pump from a tier 1 manufactures (Mitsubishi, Fujitsu, Daikin, Sanyo) will cost around $1,500 to $1,700. This is assuming the contractor simply calls the distributor, buys a single unit, and picks it up the morning or day before the job. We'll talk about why this is really inefficient below when we talk about the value of group buying.
- Heat pump brackets - $100 In Maine, a high quality installation will be installed on a bracket on the side of the house. This is for two reasons. First, it guarantees that snow will not build up around the unit and decrease airflow during the winter. Second, during the winter the unit runs in defrost cycle and some of the ice on the coil is turned into water. By elevating the heat pump, the water will run away from the unit. If the water stays around the.
- Heat pump coil - $100. In the bottom pan of the condenser, it makes sense to install an electrical coil. This coil melts any ice that could build up in the condenser. This eliminates the risk of damaging the equipment.
- Heat pump line-set and accessories - $100. To install a heat pump you need to connect the inside and outside unit and this requires a "line-set", plus a line-set cover and a few other odds and ends.
- HVAC labor cost - $160 A well trained individual will be able to install a ductless mini-split in 4 hours. A newer person will work for 8 hours. If we assume the full burdened cost of HVAC labor in Maine is $40 dollars per hour, 4 hours cost $160 dollars.
- Electrical equipment - $150. In order to install a heat pump, an electrician needs a disconnect, 30 to 50 feet of conduit (depending on how far the outside unit is from the electrical service), a breaker and wire. The longer the run, the most expensive, but it averages out to about $150 per job.
- Electrical labor - $160. A good electrician will be able to wire up an heat pump in 4 hours or less. An electrician makes around $40 per hour in Maine.
- Miles to the job - $40. Driving costs money. The IRS costs driving time at around $.50 per mile. This means driving to the job and back costs about $40 on average, 80 miles each way.

- Total direct job costs. $2,300. That's the amount of total direct costs for a single job, on average.

What Will Make a Job More Expensive?

$3,200 is the average price, but not all jobs are this low. Here are a few factors that will make your job more expensive.

- Higher capacity equipment, multi-head equipment or ducted equipment. Heat pumps cost more the larger the units. An 18k or 24k BTU costs more than a 15k unit. The size unit that you need depends on another topic. Also, if you want to get a multi-head unit, one with one outside and many inside units, it will be more expensive.
- Longer and/or more difficult runs. This is true for both the connection between the heat pumps and the electrical equipment
- Service upgrade. If you're electrical service is not large enough to handle a heat pump, you'll need a new electrical service. This can cost between $2,000 and $4,000 and might not be worth it, unless you were planning on getting a new service anyway.
- Inexperience crew. If the crew is new, it will take them a longer time to install the equipment. This cost might be passed on to you.
- Long travel times. If your house is far from the crew, it might cost a little more simple due to longer travel times.

Now, let's get into the business numbers

Back to our original example, let's get into the business numbers.

- Gross Profit. Most companies will mark-up their job related costs by 30% to 33%. Let's assume they mark up the job by $1,000. The final price comes to $3,300.
- Business overheard. Overheard typically makes up 10% of one third of a their gross margin. Calculating overhear is an article by itself, but I can sum it up like this. All of the costs of running a business that are

not associated with a specific job; insurance, software, computers, legal fees, marketing, etc tend to cost about $333 per job.
- Pre-tax profit. This leads a pre-tax profit of $666 per job.
- Taxes. $133. If we assume our business is an LLC, so the profits of the business flow through to the owners, who pay tax on a personal basis. We can assume the tax rate is 20%. $666 times 20% is $133.
- Post-tax profit. This means that for a single job, the business only mades $553, or 16% of the total job cost.

Variable	Cost	Notes
Selling Price	$3,200	Average price for **easiest** 15k BTU retrofit installation
Total direct installation cost	$2,200	This assumes no sales commission
Gross Margin	$1,000	
Overhead	$333	Includes office rent, equipment, etc. Sometimes marketing and account manage could be considered overhead. Larger companies will put this on a per job basis.
Pre-tax profit	$666	
Taxes (33%)	$133	
Post-tax profit per job.	$533	

A few points to add.

Is the gross margin high? No.

Some people will look at the gross margin and say, "wow $1,000 of a $3,200 job is a lot". The answer is because the volume of projects is so low, the gross margins have to be high. This is simply because the volume of projects that any one contractor does is still low.

Most contractors only get jobs when people call them and ask them to bid on projects, they're not actively marketing and selling projects.

While the gross margin looks high, you have to look at the net profit of a single job. A single job only produces around $553 dollars of project, for an extremely efficient crew. Crews that take 6 to 8 hours of time make far less money.

What happens if volume increases? Equipment costs are already as low as possible, only labor and margins can be reduced.

One of the things that's interesting is that the heat pump cost is the single most expensive part of the installation. While you'd think that increasing volume could decrease the equipment cost, it doesn't. The reason is that distributors are selling the equipment in massive volume already (because they're selling the equipment to all of the installers) and they make a very low margin on the product.

What this means is that volume in the number of project sold could decrease labor costs and gross margin but the equipment costs themselves are already the bare minimum.

7 Things to Ask Every Ductless Heat Pump Contractor So You Don’t Get Ripped Off

If you're looking to get a heat pump in Maine installed, don't go with the lowest cost ductless heat pump. If you go with the lowest cost provider, you're likely not getting a good deal but you're getting a bad performing system. The reason for this is simple. While you can understand who makes the best heat pump, the installation can have a large impact on performance than a specific manufacturer.

In this article, we'll discuss the things you need to ask any contractor that is installing a new heat pump system in your home to give you the best chance of getting a high quality installation. There are a few issues that will impact the system right away and these are easier to catch. There are a few common issues that will only impact the performance and durability of the equipment years after it is installed. These are harder to catch. For each issue, we'll provide a "fix", which are questions to ask your installer before the installation is made.

In the past, we discussed the cost of a ductless heat pump in Maine for a contractor to install a unit. This analysis included equipment costs, labor amount and costs, contractor profit, and overhead. Here's the thing, if a contractor goes below this amount, it's not because they're awesome, it's because they're cutting corners or they're not making an acceptable gross margin. Both are indications of a poorly managed firm that is not organized, not a firm that's giving you a great deal.

In case it's not obvious, you don't want to work with a poorly managed firm.

I have this conversation with Vaughan Woodruff from Insource Renewables. Vaughan has inspected hundreds of systems across Maine and I respect his opinion on this.

We talk about items that most commonly go wrong with a heat pump installation and what you need to ask from your installer before the installation so vet them correctly.

The key is getting a system that will operate really well for the next 15 years. Make sure you read this and double check your installation to see that these are done correctly.

Visible Problems that Can Go Wrong

Issue One - Wall Mounting and Unit Placement Within the Home

There are two ways that the units create noise, both of which need to managed correctly. The first is that the fan makes noise. The units make a little less noise than a normal window hung A/C unit. This cannot be eliminated, so it's important to consider this when placing the unit.

The second way that a unit can make noise is bad installation of hanging the unit on the wall. Sometimes installers will not hang the inside unit on the studs within a wall, but simply attach it to the sheathing. This is bad!

THE FIX: Make sure you place the unit in a room where it's okay to have a small amount of noise. This depends on your noise preferences, but it's important to consider.

Also, make sure the unit is being mounted to the structure of the home and not just the sheathing. It needs to hit a minimum of two studs.

Issue Two - Outside Compressor Performance

The second issue that needs to be dealt with is dealing with water, snow, and ice on the outside compressor.

Placement of the compressor is an extremely important aspect of a good performing system. The worst that can happen if a compressor is placed incorrectly is that water gets in, freezes, and destroys "the coil". When this happens, it won't work any longer. The least bad thing that can happen is that snow and ice surround the unit and the performance of the units declines, which stops you from saving money.

You need to make sure that the compressor is installed in a place where it can never have snow around it or where liquid water can get into it. This water will eventually freeze, and this is really bad.

THE FIX: Make sure the outside unit is placed under an eave of the house and/or is installed with a rain cap. This will ensure that a large amount of water can get into the unit.

Second, unless the unit is installed under a porch, make sure it's installed with brackets a few feet above the ground. This will ensure it never is surrounded by snow. Using brackets is more expensive, but it guarantees that the unit will never be surrounded by snow. It's cheap insurance.

Issue 3 - Installing Electric Coil Base-pan Heaters

As a means to reduce ice damage some installers will instal electric coils in the base-pans of the heat pumps. This does provide safety against ice build up but it substantially reduces the operating efficiency of the home. If you install an electric coil in the base-pan your unit WILL NOT be efficient enough to get an Efficiency Maine rebate.

If you're using the heat pump as a supplemental heater (you still will use your existing oil, propane, wood system) don't install an electric coil.

If you're using a heat pump as a primary heating source with no back-up heat (this is most common in net zero or passive house applications) it does make sense to install an electric coil for insurance.

THE FIX: Don't allow a contractor to install an electric coil if you're just installing a heat pump as a supplemental heater.

Issue 4 - Outdoor Unit is Considered a Source of Ignition.

This is a small but important point, but given how many people cook with gas, it's important. The outside unit is considered a point of ignition so it cannot be installed within a 10 feet of a propane tank.

THE FIX: Verify the unit is not with 10 feet of a propane tank.

Non-visible items. Doesn't show up 5 days of an installation but might show up after a year.

These items are difficult to screen for because you won't be there when the installation is happening. If something does go wrong in these instances, it's hard to figure out who was actually responsible (the manufacturer or installers) so you'll end up paying for it.

Most of this items have to do with commissioning the system correctly.

Issue 5 - Integrity of the Refrigeration Line Set

In a previous article, we explained how cold climate heat pumps work by manipulating a refrigerant to move heat from conditioned spaces (like inside a home) to the outside and vice versa. In order to move refrigerant correctly, the refrigeration line needs to be 100% air tight. If they have any leak at all, the system performance and efficiency will decline over time. You won't notice it right away, but it will happen.

There two critical items to correct installation.

First, with ductless heat pumps, only flare fitting should be use in the installation. No brazing. Brazing is a common way of connecting copper together. It's like welding, but for copper.

THE FIX: Verify with the installer that only flare fittings will be used.

Second, an integrating test of the refrigeration line set is key. After a system is installed, it should get a pressure test with nitrogen of at least 400 PSI. Second, an evacuation of the system needs to be done. This creates a vacuum in the line set and removes any moisture. The system should have a vacuum of at least 250 microns and then have a standard vacuum test done by shutting off the value between the pump and unit to see if the vacuum holds.

THE FIX: Ask the installer how they pressure test the system. You want to ask them, after they've connected the refrigeration line, what do they do BEFORE they put refrigerant into the system. If they don’t have a very specific answer, BE AWARE. This will scare off the bad contractors.

Issue 6 - Very Optimistic Savings Numbers

It's very likely the heat pumps will save you money on your heating bill. However, you should be skeptical of contractors that over promise how they performance. The contractor should give you a range of expected savings and not one specific number.

The reason for this is that when estimating savings with HVAC systems, there are many variables that change on a yearly basis that makes it impossible to give a very specific number.

If a contractor provides a range of $500 to $800 per year, this is reason.

If a contractor guarantees that it will save $1,000 per year, but skeptical. You want to work with honest people and there's no way that they can guarantee it will save you that much. However, if they guarantee a much lower number, this could be acceptable.

In order for a supplemental heat pump to get maximum savings, here's the criteria.

1. It needs to be offsetting oil, propane, or electric resistance heating. You won't get much savings if it's replacing natural gas or wood at today's prices.
2. In needs to be placed in central place in the home that is also heavily used! If the unit is placed in a bedroom that is rarely used, you won't get the savings.
3. The homeowner must use the heat pump whenever heating is required. Sometimes people install a heat pump and forget to set the controls properly or use it, if you don't use it, you won't save.

THE FIX: Ask the contractor how much he expect it to save you. If he provides a range of savings but doesn't guarantee anything, this is a good sign! If they guarantee a high amount of savings, it's a bad sign.

Issue 7 - Last Issue Proper Credentials

This isn't an issue around the direct installation per se, but it should be looked it. You want to make sure that you're working with an amazing contractor. In order to do this, there's two things you should do.

1. Check references. Ask for 2 to 3 prior people to speak with. For one, ask the contractor to refer you to someone where the installation didn't go perfectly, so you can learn about how they handled it.

2. Check their certifications. Industry certification verify the the contractors is investing in the proper information to do the job well. There are three certifications to look at

- Manufacture certification. In order to get a manufacturer's warranty, the unit must be installed by an approved contractor. Verify they have this information.
- EPA Refrigeration handling license. In order to handle refrigerant, they need a specific license. Very, they have a EPA refrigeration handling license.

- Electricians license. The electrical side of a heat pump is a huge part of the installation. Verify that there's a licensed electrician working on the job.

Questions?

Thank you for downloading our guide. We hoped you found it useful.

If you have any questions about any of the content, we've created a private forum where you can ask us questions. You can any questions here:
http://www.winterizemaine.com/thank-you.html#/

Also, if you're curious how much you could save by installing a heat pump and would like an instant quote, you can do that here:
http://www.winterizemaine.com/

If you then want to get a quote from a high quality contractor, can refer you to the best contractor in your area.

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