

THE *Definitive* GUIDE TO HEATING YOUR SWIMMING POOL



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AquaCal
SWIMMING POOL/SPA HEAT PUMPS

The Definitive Guide to Heating Your Swimming Pool

Heating Options, Benefits, and Costs

AquaCal AutoPilot, Inc.

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Introduction



This e-book serves as a guide for swimming pool owners, prospective swimming pool owners, and swimming pool professionals as they consider investing in and maintaining swimming pool heating systems.



We first answer a basic question in this e-book: “Why should I heat my swimming pool?” By discussing the advantages a heater provides, we explain how you can benefit from a heated swimming pool from both a recreational standpoint and a health standpoint.



Next, we discuss each available swimming pool heating option in great detail. Many different types of heating systems exist – electric resistance heaters, gas heaters, heat pumps, and solar heaters. Each system has its own set of advantages and disadvantages. Different situations, therefore, call for different systems. You should familiarize yourself with the basics of each system before you make a purchase.



We lastly discuss how energy efficiency relates to the swimming pool industry by providing you with a few steps you can take to make your swimming pool more environmentally-friendly. In addition to reducing your energy waste, these steps can also help you significantly lower your heating costs. Some of these steps are very inexpensive, so everyone can take advantage of them!

Because new heating technology is constantly introduced to the swimming pool industry, and because swimming pool heating is a many-faceted topic, consumers often have difficulty in deciding which heating products to invest in. So, by writing this e-book, we hope to provide you with the knowledge you need in order to make the best purchases for your swimming pool.

If, after reading this e-book, you have any questions about swimming pool heating methods, feel free to contact us at AquaCal at 727-823-5642 or by [clicking here](#). We would love to hear from you!

Why Should I Heat My Swimming Pool?

A swimming pool is one of the largest investments you will make, as a swimming pool costs anywhere above \$20,000 to purchase and construct. As with any other investment, you want to enjoy the maximum benefit of your swimming pool.

Extended Swimming Season

As one of our customers has said: “Why do I have a swimming pool, but to use it?!”

A heater extends your swimming season.

Without a heater, you may only be able to use your swimming pool during three or four months each year, depending on your location. Heating your swimming pool gives you a higher return on your investment simply by allowing you to swim more often. In fact, some swimming pool owners have doubled or even tripled their swimming seasons by installing heaters.



Comfortable Swimming Season

By heating your swimming pool, you can also enjoy a more comfortable swimming season. Most people enjoy swimming in water that measures between 82° and 84°F. Without a heater, swimming pool water may only reach 75°F in some climates, even during summer months.

Moreover, the temperature of your swimming pool water will naturally fluctuate with the weather. A heater is essential to setting and maintaining comfortable swimming pool water temperatures.

Recreation

One of the most valued benefits by consumers of a heated swimming pool is increased recreational time with family and friends. A heated swimming pool brings together family and friends for relaxation and enjoyment.

Health Benefits

As we discussed above, a heater extends your swimming season. An extended swimming season translates to more swimming, and more swimming translates to more exercise. Swimming is one of the best forms of cardiovascular exercise, as it does not place excess stress on your joints. Swimming is particularly beneficial to elderly people, who cannot run or jog, and to people who suffer from arthritis and muscular diseases.

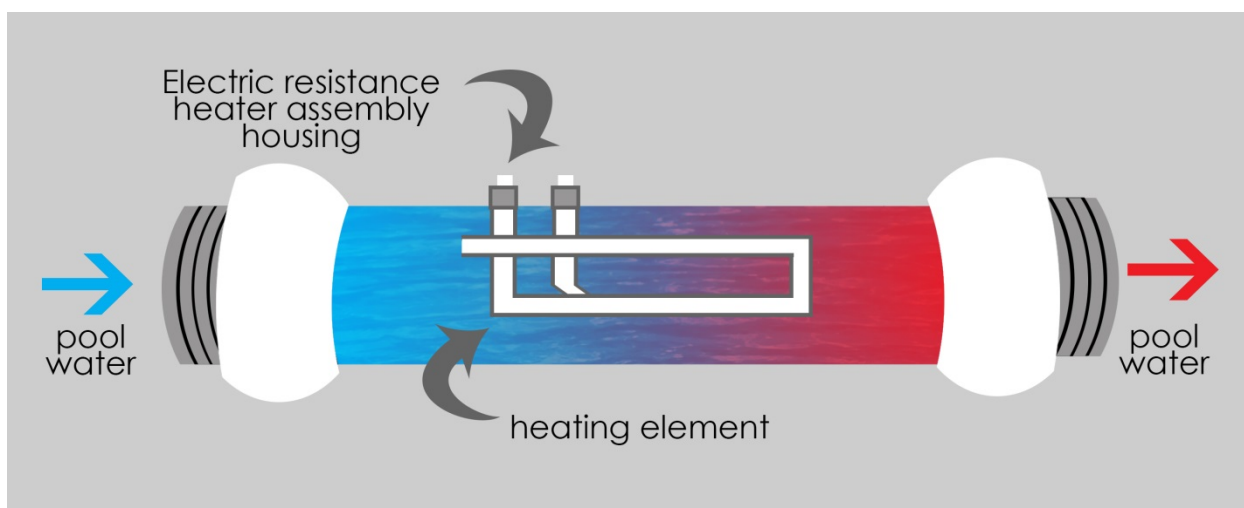
In addition to providing for an excellent method of exercise, a heated swimming pool prevents chilling due to excessive body heat loss. Young children and elderly people are particularly susceptible to respiratory infections due to repeated chilling.

How Can I Heat My Swimming Pool?

Several heating methods are available to you, each with its own advantages and disadvantages. This section discusses electric resistance heaters, gas heaters, heat pumps, and solar heaters. Different methods are best suited for different swimming pools. Therefore, when shopping for a heater, you should consider both the features of the heater itself and the environment in which the heater would operate.

Electric Resistance Heaters

Electric resistance heaters use electric currents to create heat. Because electric resistance heaters consume large amounts of electricity, they are primarily used to heat spas and small therapy pools and are rarely used to heat swimming pools.



An electric resistance heater creates heat by applying an electrical current to a metal resistor, which acts as a heating element. The metal resistor extends throughout the assembly housing inside the unit. The metal resistor heats when a current is applied to it. The spa water enters the assembly housing, washes over the resistor, heats, and exits the assembly housing warm.

Advantages of Electric Resistance Heaters

- With many available for purchase for under \$2,000, electric resistance heaters are relatively inexpensive.
- Electric resistance heaters operate independently of air temperature.
- Because electric resistance heaters emit no air pollution, they are environmentally-friendly.
- Electric resistance heaters occupy very little space, with most occupying less than 12 ft³.

Disadvantages of Electric Resistance Heaters

- Electric resistance heaters are expensive to operate because they require large amounts of electricity.

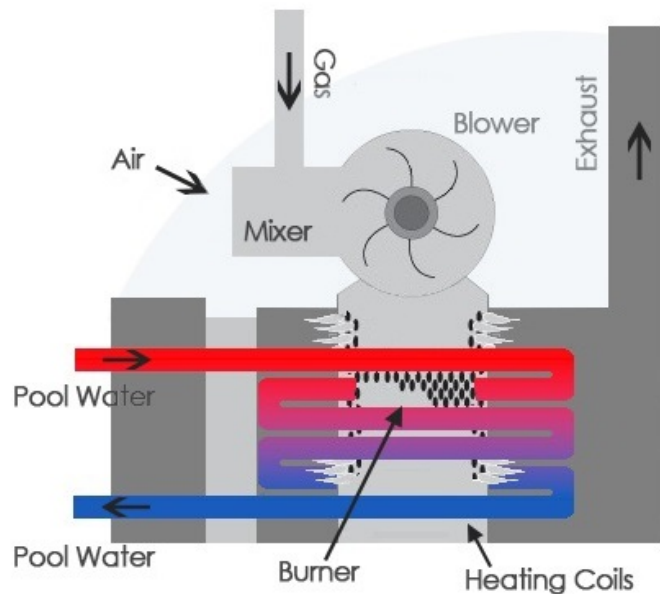
- With a Coefficient of Performance of 1 (See Appendix A), electric resistance heaters are not the most energy-efficient heating system.
- Electric resistance heaters are expensive to install, as they require heavy-duty electrical wiring and large-amperage circuit breakers

Gas Heaters

Gas heaters have been the primary source of swimming pool heating for several decades due to low gas prices. As gas prices have increased, however, consumers have begun searching for more affordable alternatives, and, as a result, other heating methods have increased in popularity. Gas heaters are still very useful, however. They are very effective in cold climates and when used sporadically.

We have found that gas heaters greatly benefit swimming pool owners who live in climates where the air temperature is below 50°F (10°C) and swimming pool owners who only heat their swimming pools a few times each year.

The diagram to the right shows how a gas heater operates. A gas heater burns either natural gas or liquid propane inside a combustion chamber. Copper coils, which contain swimming pool water, run through the combustion chamber. As the gas burns, swimming pool water runs through these copper coils, and returns to the swimming pool warm. Exhaust created by burning the gas leaves the chamber through a flue.



Advantages of Gas Heaters

- With many available for under \$1,500, gas heaters have relatively low purchase costs.
- Gas heaters offer fast heating. To learn more about quickly heating your swimming pool, [click here](#).
- Because gas heaters create energy by burning gas, they operate independently of air temperature.

Disadvantages of Gas Heaters

- Naturally drafted gas heaters have a Coefficient of Performance between 0.80 and 0.85, which makes them the least efficient heating method.
- Due to high gas prices, gas heaters are very expensive to operate.
- The life span of gas heaters is typically five years.
- Because gas heaters emit pollution as they burn gas, they are not environmentally friendly.

Air-Source Heat Pumps

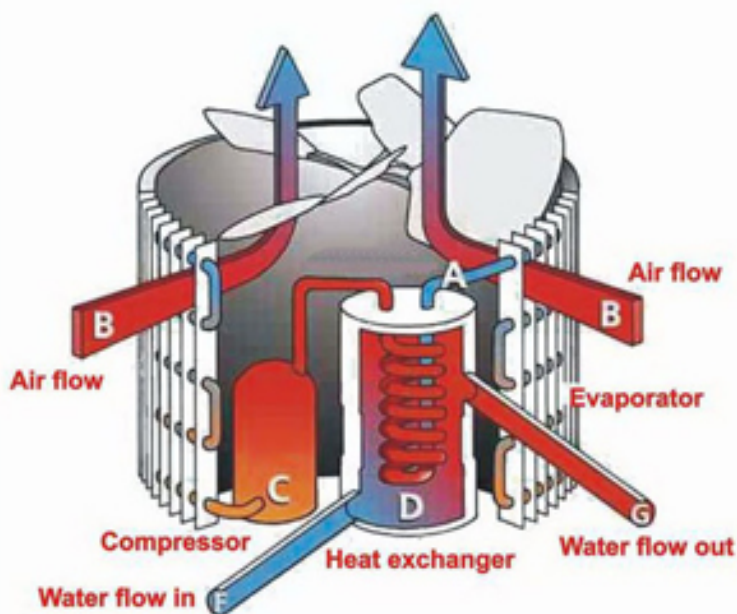
Due to their energy efficiency and low operating costs, air-source heat pumps are rapidly growing in popularity. Heat pumps use electricity to transfer heat from the air to your swimming pool. They are most effective in warmer climates and when used regularly. We have found that air-source heat pumps greatly benefit consumers in all types of climates, including consumers who use their swimming pools year-round.

Air-source heat pumps transfer heat from the air to swimming pool water.

The diagram to the right shows how an air-source heat pump works. Air is drawn into the heat pump and over an evaporator coil, which contains a very cold liquid refrigerant, sometimes referred to as “Freon.” As air passes over the evaporator coil, the refrigerant heats to become warm Freon gas. The warm Freon gas passes through a compressor, which compresses it to a hot Freon gas.

Inside the compressor, large amounts of pressure are placed on the warm Freon gas until it becomes hot Freon gas. Then, the hot Freon gas passes through a condenser, which is where the swimming pool water enters and exits the heat pump. The swimming pool water enters the condenser, washes over the condenser coil, heats, and exits the condenser.

As the swimming pool water heats, the hot Freon gas cools and becomes a warm liquid. Then, the warm liquid passes through a metering device. Inside the metering device, pressure is reduced on the warm liquid until it once again becomes very cold.



Advantages of Air-Source Heat Pumps

- With their Coefficient of Performance measuring between 5 and 6, heat pumps offer very efficient heating.
- Because of their high Coefficient of Performance, heat pumps have very low operating costs. Specifically, heat pumps typically cost between \$50 and \$150 per month to operate.
- The life span of heat pumps is typically ten years.
- Because heat pumps only use electricity to transfer energy and emit no pollution, they are very environmentally-friendly
- Some air-source heat pumps can be used to both heat **and** cool your swimming pool.

Disadvantages of Air-Source Heat Pumps

- Heat pumps have high upfront costs, with many available for purchase from \$2,000 and up.
- Heat pumps offer slower heating than gas heaters.

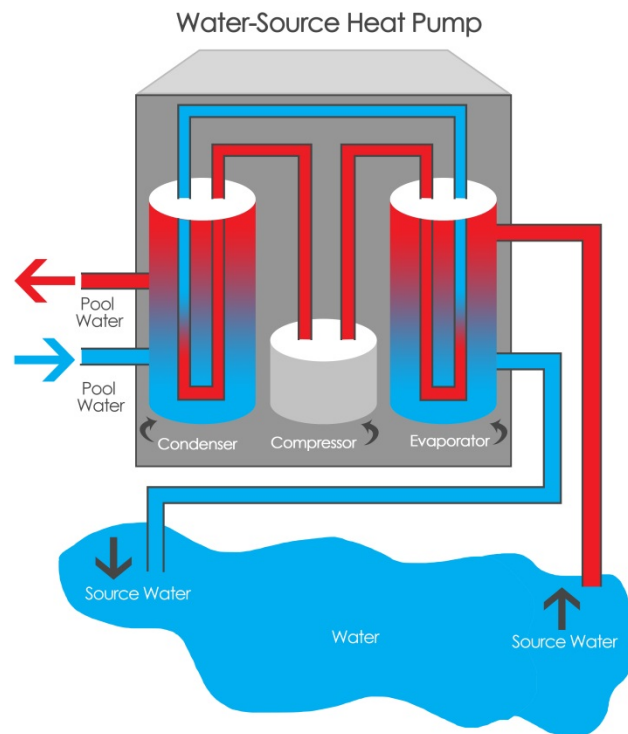
- Air-source heat pumps operate less efficiently in lower temperatures.

Water-Source Heat Pumps

Water-source heat pumps embrace newer technology, and therefore are not as widely-used as other types of heating systems. They are, however, growing in popularity, as they have high efficiency and low operating costs. We have found that water-source heat pumps greatly benefit consumers who live in climates where the average air temperature is below 50°F (10°C) and consumers who use their swimming pools year-round.

A water-source swimming pool heat pump, also referred to as a geothermal heat pump, transfers heat from a water-source to your swimming pool water. Source water enters the unit and passes over an evaporator coil, which contains a cold liquid refrigerant, often referred to as “Freon.” As the source water passes over the coil, the refrigerant heats to become warm Freon gas. The source water cools, exits the evaporator, and travels back to the water source. The warm Freon gas passes through a compressor, which compresses it to hot Freon gas. Then, this hot Freon gas passes through a condenser, which is where the swimming pool water enters and exits the unit.

The swimming pool water washes over the coil, heats, and leaves the unit warm. As heat transfers from the coil to the swimming pool water, the hot Freon gas cools to once again become cold refrigerant, and the process starts again.



Water-Source Systems

Because many types of bodies of water exist, many types of water-source heat pumps exist. Some common water-source systems are explained below.

An **open loop**, also known as a deep ground well, consists of two deep wells: one that supplies water to the heat pump and one that returns water back to the ground. How can you tell if your well is deep enough? The bottoms of deep wells should be within porous rock-based soil. By contrast, the bottoms of shallow wells are typically within sandy soil. A shallow well is subject to rapid draw down and clogging from loose soil.

A **closed loop**, also known as a ground loop, uses the ground as the heat source, rather than the water itself. In this system, plastic tubing is placed underground. A mixture of water and glycol (an antifreeze) circulates through the tubing and collects heat from the ground. The heated mixture returns to the heat

pump to heat the evaporator coil. A closed loop system can be either shallow and wide (called a horizontal closed group) or deep and narrow (called a vertical closed group).

A **surface water system** is a type of open loop system. This system draws water from an open body of water. Keep in mind, however, that higher maintenance is required to keep the water-to-refrigerant heat exchangers free of fouling from organic materials. Either fresh water-sources or salt-based water-sources can be used. We do not recommend salt-based water-sources because barnacles and sea mussels can clog the plumbing system and cause a need for equipment replacement.

A **mechanical loop** is part of a large system that uses water to remove heat from a commercial air conditioning system. As the air conditioning system removes “waste” heat from indoors, it transfers it into a water loop. This loop is then cooled using a rooftop cooling tower. A water-source heat pump helps the air conditioning system operate more efficiently by tapping into this loop and removing this “waste” heat from the air conditioning system.

A **pool/spa loop** transfers heat from unheated swimming pools to spas. Because of the large size of a swimming pool, you can transfer enough heat from a swimming pool to warm a spa without noticeable decreasing the swimming pool’s temperature. Specifically, you can use a 50°F (10°C) swimming pool warm a spa to 104°F (40°C).

Advantages of Water-Source Heat Pumps

- With their Coefficient of Performance measuring between 5 and 6, heat pumps offer very efficient heating.
- Because of their high Coefficient of Performance, heat pumps have very low operating costs. Specifically, heat pumps typically cost between \$50 and \$150 per month to operate.
- Water-source heat pumps operate independently of air temperature.
- The life span of heat pumps is typically ten years.
- Because heat pumps only use electricity to transfer energy and emit no pollution, they are very environmentally-friendly

Disadvantages of Water-Source Heat Pumps

- Heat pumps have high upfront costs, with many available for purchase from \$4,500 and up.
- Heat pumps offer slower heating than gas heaters.

Solar Heaters

Within the swimming pool industry, solar energy plays a dominant role in environmentally-friendly products. Solar swimming pool heating systems obtain their heat from the sun. Because solar heaters depend on the sun to heat swimming pools, they mostly benefit consumers who live in very sunny areas.

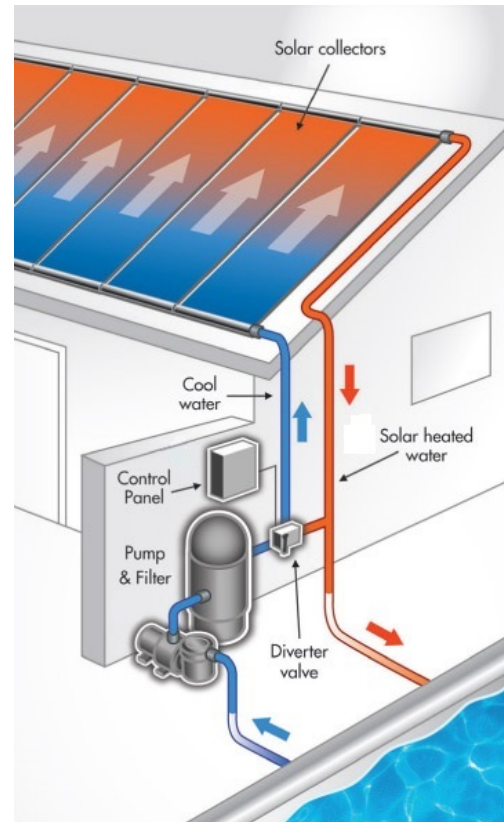
The diagram to the right shows how a solar heater works. When the swimming pool circulation pump operates, swimming pool water travels through solar collectors, which are usually located on the consumer's roof or in the consumer's yard. As the swimming pool water travels through the solar collectors, it heats. The swimming pool water exits the solar collectors warm and returns to the pool.

Advantages of Solar Heaters

- Because solar heaters operate with the swimming pool circulation pump, they have no additional operating costs.
- Solar energy systems are environmentally friendly: they use a clean energy source and they emit no pollutants.
- The typical life span of a solar heater is about 25 years.
- Solar energy systems are energy-efficient, as they require no additional electricity to operate.

Disadvantages of Solar Heaters

- While solar energy is free, a solar heater is the most expensive heating system to purchase, with many available from \$4,000 and up.
- A solar heater's efficiency depends upon the amount of sunlight that reaches its solar collectors. Moreover, a solar heater cannot heat a swimming pool during the night. An auxiliary heater is necessary to heat a swimming pool during nights and cloudy days.
- Solar heaters offer slower heating than electric resistance heaters and gas heaters.
- The solar panels of a solar heater occupy a lot of space. Specifically, the surface area of the solar panels will equal the surface area of the swimming pool.
- Solar panels often need roof penetrations for a secure installation.



How Can I Heat My Swimming Pool Efficiently?

Energy efficiency, as it relates to the swimming pool industry, has rapidly grown in importance due to increases in costs and environmental awareness. Manufacturers have begun to focus their attention on developing and improving products in order to provide energy-efficient options to consumers. In this section, we discuss a few of these energy-efficient options.

Take Advantage of Floor Return Lines

Floor return lines return swimming pool water to the floor of the swimming pool after it has circulated through the swimming pool heater. They differ from regular return lines, which return water to the surface of the swimming pool. Floor return lines provide energy-efficient heating by taking advantage of the fact that heat rises.



Regular return lines expel water to the warmest part of a swimming pool – the surface. When heat is expelled to the surface of the swimming pool, it remains there. Regular return lines, therefore, only effectively heat the surface of a swimming pool. In contrast, when heat is expelled to the bottom (and coldest part) of a swimming pool, it rises. As it rises, some heat is transferred to the surrounding cold water. Floor return lines, therefore, heat a swimming pool more effectively than regular return lines with the same amount of heat.

Purchase a Solar Cover

Solar covers contribute to energy efficiency by minimizing swimming pool heat loss. 75% of a swimming pool's heat loss is due to evaporation. By acting as a barrier between the air and the swimming pool water, a solar cover minimizes evaporation and therefore reduces heat waste.

You should utilize a solar cover whenever your swimming pool is not in use, particularly at night. With a solar cover, your swimming pool will only lose around 20% of its heat overnight, while without a solar cover, it will lose around 50%.

You can easily choose a solar cover that fits your budget and needs because many different kinds are available to you. Solar covers vary in color, thickness, shape, and size. Many solar covers are available for purchase for between \$50 and \$300 and last for up to three years, though many consumers replace them more frequently.

Utilize a Solar Heater

Solar heaters use solar panels to collect heat from the sun to warm your swimming pool. They are very energy-efficient, as they heat your swimming pool with transferred heat, not created heat. Moreover, they require minimal energy input, as they operate with your swimming pool pump.

Because they use a totally renewable, non-polluting energy source, solar heaters are essential to creating a “green” swimming pool.

Utilize a Heat Pump

Yes, you can use **two** heaters to heat your swimming pool! Without sunshine, a solar heater cannot collect sufficient heat to warm your swimming pool. You need to purchase an auxiliary heater to warm your swimming pool at night and during cloudy days. A heat pump is a very energy-efficient heating option, as it transfers heat, rather than creates heat, to warm your swimming pool. In fact, a heat pump is six times more efficient than a gas heater.

Because heat pumps collect heat from the air, they work most efficiently in warmer air temperatures. You should therefore run your heat pump during the hottest times of the day in order to most benefit from it.

Lower Your Water Temperature

You can save energy and lower your swimming pool heating costs simply by adjusting the temperature of your swimming pool. Maintain appropriate water temperatures when your pool is in use – 78° to 80°F (26° to 27°C) for active swimming and 80° to 82°F (27° to 28°C) for recreational swimming. Lower the water temperature when your pool is not in use.



Conclusion

There has never been a better time to purchase a heating system for your swimming pool. With the recent technological advances in the swimming pool industry, you can heat your swimming pool more efficiently and for less cost than ever before.

To help you decide on a heating system, we encourage you to conduct research. A heater is, after all, a fairly large investment. Ask questions to both swimming pool providers and swimming pool heating



system manufacturers. Look at manufacturers' brochures. Use the internet to look up reviews for specific heaters. Talk to your friends. Each source will provide you with valuable information to consider, which will make choosing a heating system much easier.

With that being said, we at AquaCal have found that heat pumps coupled with solar covers greatly benefit swimming pool owners living in all areas. Together, they easily maintain swimming pool water temperatures, even at night. Heat pump also offer high returns on investment, as they utilize free heat, which results in low operating costs. And, heat pumps have very small environmental footprint, as they use electricity to only transfer heat, not to create it. Ultimately, heat pumps, with solar covers, can provide great value to any swimming pool owner.

If you would like further information on swimming pool heating methods or have any general questions regarding swimming pool heating, please feel free to contact us at AquaCal by calling 727-823-5642 or by [clicking here](#).

About AquaCal

Since 1981, we at AquaCal have been providing quality products, services, and repairs to our customers all over the world. Each of our heat pumps is tested by our CPO-certified and HVAC-licensed factory technicians to ensure optimal performance and reliability.

We at AquaCal know that each of our customers is unique. Our heat pumps are available in a variety of sizes with an assortment of features in order to accommodate every customer. From our economically-priced [TropiCal](#) unit to our commercial-sized [Great Big Bopper](#) unit and from our geothermal [Water Source](#) unit to our reverse-cycle [HeatWave IceBreaker](#) unit, our heat pumps tailor to every need and every budget.



Overall, we at AquaCal strive to provide you with the greatest possible benefit. We are passionate about the swimming pool industry, and are committed to communicating that passion by offering you superior products and services. It is our sincere belief that we can only succeed by continually providing you with quality.

Working together. Growing together. Winning together.

Appendix A: Coefficient of Performance

A Coefficient of Performance is used to determine the energy efficiency of air conditioners, space heaters, swimming pool heaters, and other heating and cooling devices. It measures the ratio of energy output to the energy input. The higher the Coefficient of Performance, the higher the energy efficiency of the device.

The equation to find the Coefficient of Performance of a device is:

$$COP = \frac{E_o}{E_i}$$

where COP is Coefficient of Performance, E_o is energy output, and E_i is energy input.