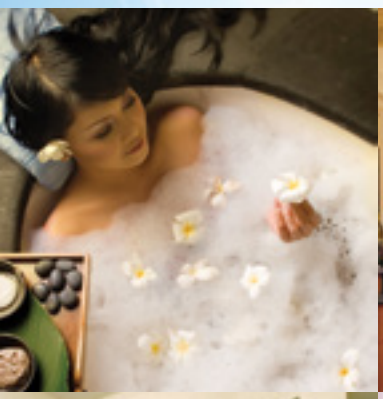
TANKLESS PRODUCT GUIDE

SEISCO








"The Perfect Solution for Residential and Commercial Water Heating"

ADVANCED TANKLESS WATER HEATING TECHNOLOGIES

Welcome to the SEISCO International Limited tankless electric water heating family. I'm David Seitz, the Chief Executive Officer of SEISCO International Limited. The SEISCO award winning tankless electric water heating product line incorporates superior technology that has earned five U.S. and many more foreign patents. The SEISCO was introduced as the industry's first "whole house" tankless electric water heater in 1986 at the ASHRAE show in conjunction with DuPont.

Whole house tankless water heating is the fastest growing segment of the water heating industry today. Homeowners everywhere are discovering the benefits of endless hot water, space savings, and lower energy bills.

On December 31, 2007, the entire SEISCO product line was acquired by SEISCO INTERNATIONAL LIMITED, INC. and the vision of a complete line of all types of tankless water heaters was launched.

SEISCO models are unique and incorporate many features unmatched by the competition. I invite you to explore the advantages of SEISCO tankless electric water heaters.

This Water Heating Product Guide is the industry's most exhaustive reference on whole house tankless electric water heating. Residential sizing guidelines include three methods of sizing tankless electric water heaters to cover every residential application. As you will see, SEISCO can even be combined with a storage tank or residential tank water heater to meet the most demanding applications such as body showers with multiple spray heads and fast filling Roman tubs. Piping diagrams facilitate the installation of SEISCO tankless electric water heating systems.

This guide also includes a commercial sizing section for multi-dwellings. SEISCO commercial models include all the features of residential models plus higher temperature capabilities .

Other sections include an extensive electrical requirements section, a brief installation section that outlines critical installation issues, and an appendix that contains a simple cost comparison method, and a competitive cross reference.

Most importantly, you have my personal commitment that SEISCO International Limited will provide unmatched customer service with outstanding literature, internet, email, fax, and telephone support for all application, sizing, service, and warranty issues.

I speak for the entire SEISCO International Limited team when I say that "we appreciate your business!"

~ David Seitz

SEISCO

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RESIDENTIAL


Four Chamber


Two Chamber


Single Chamber

Whole-House	Point of Use	Booster	Space Heating
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RA-14,16	RA-14,16	RA-14,16	SH-5,7,9,11
SC-11.5,14	POU24-120,30-120, 35-120 POU35,45,55, 70,80,90	POU70,80,90 * (Supercharger Model)	SH-35,45,55,70

COMMERCIAL


Four Chamber


Two Chamber


Single Chamber


Mini Tank


Three Phase

Multi-Family	Point of Use	Eye/Face Wash-Shower
RA-18,22,28,32	CA-18,22,28,32	CA-18,22,28,32
RA-14,16	CA-14,16	CA-14,16
SC-11.5,14	POU24-120, 30-120,35-120 POU35,45,55,70,80,90	POU24-120,30-120,35-120 POU35,45,55,70,80,90
	SMT-2.5,4,6	
		3P180,230,360,468,720,930-208 3P180,240,270,480-277 3P180,240,270,360,480,540-480 3P720,960,1080-480

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REFERENCES & WHAT OTHERS ARE SAYING

TV - The Discovery Channel-The Discovery Channel's "Your New House" initially filmed in August, 1999, included the SEISCO heater in a segment of their show. A new segment featuring the Seisco was filmed in 2000 and is currently airing.

Manufactured Housing Industry-SEISCO was first introduced to the manufactured housing industry in November, 1998. After over three years of very difficult work, Seisco was granted several special use provision exceptions under HUD's Manufactured Housing Construction and Safety Standard. These accomplishments provided recognition to a tankless water heater as a viable whole house water heater for HUD manufactured housing. The most recent provision was granted August, 2000.

Trade Magazines & Articles-Miracles of Science: Seisco was included in DuPont Magazine, "Miracles of Science" issue in June, 1999. SEISCO has been featured in articles in "Appliance Magazine," "Appliance Manufacturer's Magazine," "DuPont Magazine," Edison Electric Institute's "Marketing Electricity Today." And many more from 1997 to the present.

EXTRACTS FROM INDUSTRY PUBLICATIONS

Design New Magazine, p 43, April 7, 1997-Flow detection drives tankless water heater "Conroe, TX — A new patented tankless water heater only heats water when someone turns on a faucet."

EEI-Marketing Electricity Today, V3, No. 4, April 97-Texas firm offers new type of tankless water heater "Analysts who've tested the SEISCO® tankless water heater say it can lower energy use significantly compared to conventional gas or electric water heaters employing storage tanks."

Appliance Manufacturer, November 1996-A water heater for the wall "Abundant, continuous hot water is achieved through advanced mechanical and electrical design circuitry. One hundred-plus showers may be taken in a row. … Temperature control is very precise, within a + or – degree."

Designfax, April 1997-Parts and space reduction provided by use of nylon resin... "In addition to providing an unlimited supply of hot water to meet peak needs, lower energy costs and space savings, the on-demand heater mounts on the wall in a small cabinet."

Technologies for Energy Management™ January 1997, p 11-Instantaneous electric water heater serves whole house "…a patented control system provides for continuous hot water, with variable energy input using only the energy required to heat the water to the desired temperature."

Appliance, March 1997, p 78-No tanks necessary "…the new unit underwent rigorous testing [by Bradley Consulting Group] before its release…conditions employed in the tests were much more severe than those encountered in normal operations… The result: surface erosion of the components… was less than the thickness of two typical human hairs…mineral buildup was negligible and there was no corrosion."

Heating & Ventilating Review [U.K.], April 1997, p 29-Water heater made in plastic. "The SEISCO heater has been designed…to overcome capacity problems and has a highly responsive electronic controller with dual backups for key heat control functions."

MH/RV Builders News, March/April 1997-Yes/no water heater: unlimited hot water but no storage tank, "The Seisco heater…uses a patented flow-sensing and variable power-sharing technology to avoid capacity limitations, minimum flow and pressure requirements, overheating of water and burnout of heating elements at low flow rates or shutdown."

Energy Design Update®, May 1997-Seisco tankless electric water heater sets new standard "…the Seisco control offers three additional advantages. First, it uses electronic sensors to control the elements rather than in-line flow switches and/or pressure diaphragms, which have a notorious history of failing... Second, there are no minimum pressure or flow requirements… Finally, the Seisco control contains a separate (redundant) high-temperature shutdown circuit that's inherent in the control's design."

PLASTICS NEWS, April 28, 1997-Zytel nylon finds use in heating chamber "DuPont Co. polymers stand the heat in on-demand water heaters made by SEISCO®… The SEISCO heater electrically heats water when needed, eliminating the need for a bulky storage tank. It also cuts down on heat losses from a tank while it is not in use."

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Why is The Seisco Tankless Electric Water Heater The Perfect Residential and Commercial Water Heating Solution ...?

...Because Everyone Loves Endless, Inexpensive Hot Water!

Endless Hot Water

The fastest growing segment of the water heating industry is tankless water heaters. Why? ***Home and business owners are discovering the benefits and convenience of endless hot water.***

Energy Water Savings

Natural and propane gas prices are at an all time low but renewable electric energy sources including wind and solar are increasing by over 15% annually and are expecting to continue to increase as a major part of our energy resources. When used for" point of use" Seisco can save over 50% of total water normally used

Low Installed Cost With Savings

Electric rates are generally lower with the rate of increase much less than previous years. In many traditionally gas water heating areas particularly rural, the operating cost of electric water heaters is equal to or less than their gas counterparts. When the installation cost and other factors such as losses through vents and the use of preconditioned combustion air are considered, the benefits of electric water heating are undeniable.

Now with the new Seisco Supercharger models, every homeowner with a storage tank water heater can **Supercharge** their tank and enjoy the benefits of endless hot water for thousands less.

Extra Space Customers Deserve

The cost of precious space is rising...why waste it? Tankless electric water heaters can be installed almost anywhere. Give customers the extra space they deserve!

Decide Now!

Give your customers what they want....the SEISCO Advantage!

Using This Product Guide

1. Model Selection-Residential including hydronic space heating, extenders, boosters solar, geothermal and commercial sizing guides are provided in this Product Guide. For more information consult our website or our technical support team at technical@seisco.com or toll free at 888-296-9293.

2. Electrical Service-For proper operation, Seisco must have adequate power. The Electrical Requirements section of this manual will assist you in ensuring that an adequate power supply is available. In most cases, residences with a 150-200 amp service panel will easily handle the largest Seisco models and provide endless hot water for most homes. Consult an electrician to review the available power supply and ensure that all installations are according to local and national codes.

3. Location-Home and business owners can save thousands of gallons of wasted water per year by locating the water heater closer to the fixtures. Studies show that the average home wastes 6-10 thousand gallons of water every year waiting for hot water to arrive at the fixture. This guide provides application information, piping diagrams, and a section on installation to help ensure an efficient, low cost, installation that will guarantee customer satisfaction and an endless supply of hot water.

SEISCO IS SUPERIOR

New technologies offer incredible solutions for everyone to enjoy endless hot water while saving money through significant energy and water savings.

PowerShare™: Seisco is the only tankless electric water heater with PowerShare, a patented power-sharing distribution method for activating the heating elements. PowerShare control technology utilizes computer algorithms and electronic triacs to pulse power on and off to all heating elements resulting in uniform temperature modulation between 1-100% of the element's range. This allows Seisco to use only the power necessary to heat the water demanded by the flow rate through the Seisco. Most of the time, Seisco's amperage draw will be far below the maximum of the water heater. Most hot water usage by number of occurrences originate from lavatories and kitchen sinks. PowerShare along with constantly flowing water across heating elements ensure that heating elements operate at the lowest possible sheath temperature. Low sheath temperature prevents boiling minerals out of the water causing buildup on the heating elements, prolonging element life.

Eliminates Flicker: When properly installed, PowerShare technology prevents disturbances (flicker) in lighting circuits. This is very important since the proper temperature control for tankless electric water heaters depends on modulating or instantaneously varying the power to high-wattage heating elements. Without Seisco's patented control, lights may flicker in the same modulating manner as if someone were turning the air conditioner or electric heating off and on very rapidly.

Unique Microcomputer control, standard water heater elements, Ease of Service and Self-diagnostics: Seisco's microprocessor control is programmed with Seisco's patented control technology not only to provide uniquely precise temperature control but also self-diagnostics. If a service issue occurs, the control emits a visual or optional audible code. The user can interpret the code from a code sheet or have a service technician do it remotely over the phone using audible beeps emitted by the control's speaker. In addition, if necessary, convenient cleanout plates below the heating chambers allow the user to remove any build-up, sand ,or grit inside the heating chambers. Modular construction and standard off-the-shelf heating elements help make Seisco quick, easy, and inexpensive to service.

Demand and Energy Consumption: Years ago, when the double oven was first marketed, there was a concern that electrical services to homes would not handle the increased amp load. Electric utilities believed that their worst nightmare was about to occur by allowing ovens with twice the amp draw. The diversity of such systems had not been properly considered and the perceived problem was no problem at all. Ovens heat up, then only periodically cycle to maintain the heat over the long cooking periods, and people don't all cook at the same time, even during the Holidays.

The same diversity principle applies with the Seisco on-demand water heater. First, water heating is typically at mid- to off-peak periods, occurring mostly in the early morning or evening, times of the day when the power company generally has more available generating capacity. Second, the same amount of total hot water used for all homes will be identical regardless of how it is heated, with a tankless electric water heater or a tank type electric water heater. The difference is in wasted energy.

During any 15-minute sampling period of the day, more tank type water heaters will be simultaneously heating water than Seisco. The reason is longer recovery time, as long as 45 minutes after the water usage stops. The Seisco only heats water on demand. In standby, Seisco does not continue heating water to recover a lost reserve of hot water, unlike tank water heaters. Even though the Seisco will require more power (kW) or pull more current (amps) during use, there will be a significantly less number of Seisco heaters actually operating at the same time. The resulting electrical load (kW or amps) for simultaneously operating Seisco heaters will also be diversified.

It must be noted that tank water heaters will turn on and off all day long due to standby heat loss. **Electric tank water heaters lose up to 2% of their stored energy *every hour*.** To periodically restore lost energy, they turn on and reheat water inside the storage tank. Even with no water usage at all, a certain number of electric tank water heaters will always be on.

Given these facts, it should be obvious why the Seisco type heater is much more efficient than a tank heater.

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GENERAL INFORMATION

Seisco Signature Series models are manufactured in two basic sizes, a four-chamber unit (15x15x6") and a two-chamber unit (15x15x6"). The same advanced microprocessor technology and construction are used in all models. In fact, many of the parts are interchangeable.

RA/CA-18, 22, 28 & 32 models have four-chambers and are designed for domestic water heating for the whole house and a backup to tank-type water heaters, including solar and geothermal water heating systems. Models SH 14,18, 22, and 28 are designed for hydronic space heating. Models CA-5, 7, 9, 11, & RA/CA-14 are two-chamber models designed specifically for booster and point-of-use applications. Models SH-5, 7,9 and 11 are the hydronic models.

Seisco Flagship Series single chamber models are available in point of use, supercharger/recirculating and hydronic space heating models in 120, 208, 240 and 277 volts. The also serve as the building block for our multi-chamber three phase commercial models. Seisco also offers point of use mini-tanks. Consult written specification sheets for model specific information. There are no moving parts or flow restricting devices used in Seisco tankless heaters. Seisco uses electronic temperature sensors, called thermistors, for unique patented flow/ no flow activation and detection. Flow/no flow is detected when there is a change as small as 0.15 GPM in the gradient. The advanced microprocessor control turns power on through a set of relays and ensures the power is off when flow stops.

Construction: Seisco heating chambers are modular for ease of repair and molded of lightweight thermoplastic materials. The chamber is specifically engineered for durability in harsh water heating environments and capable of withstanding extreme temperature swings and pressure changes. Heating elements, sensors and detection devices that come in contact with the water are made of stainless steel, brass, or copper to resist corrosion. Standard 1 ½ inch, screw-type heating elements are utilized which are interchangeable with heating elements available from virtually any plumbing distributor.

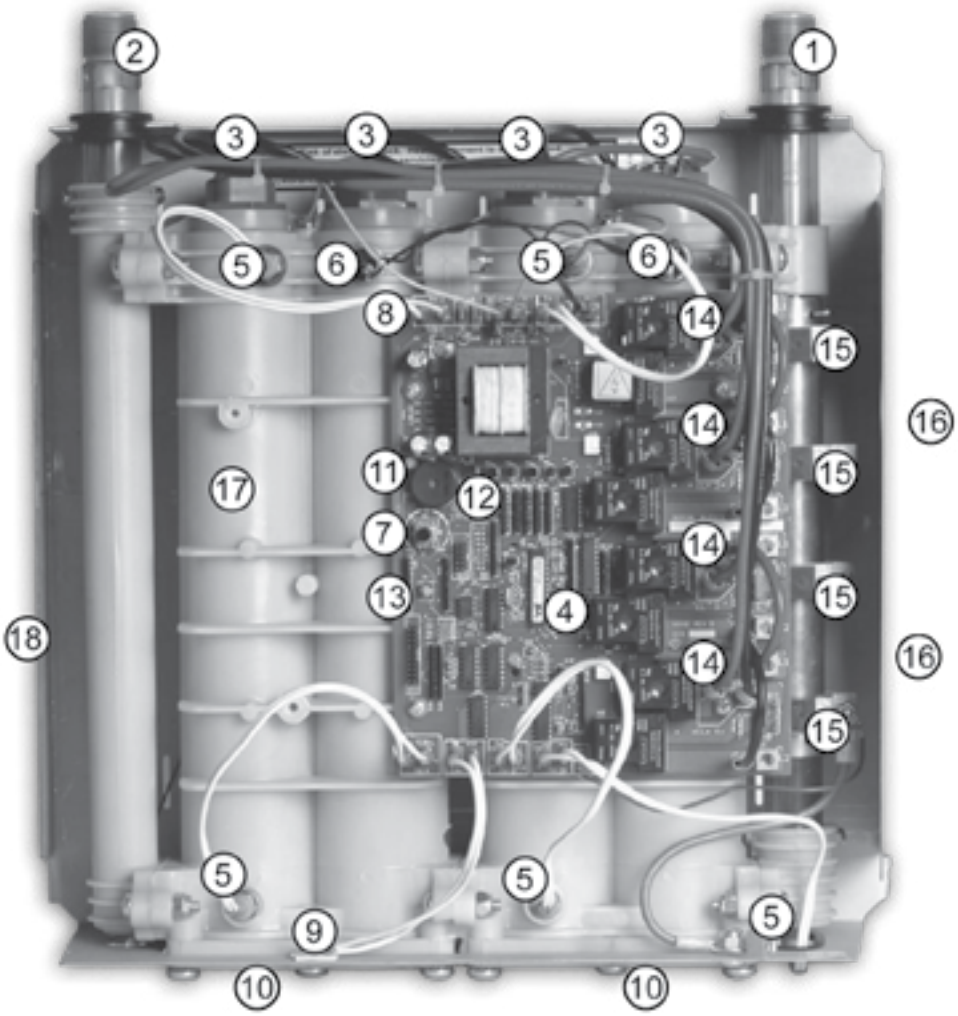
Safety and NO DRY FIRE: Seisco has a complete array of dependable safety features to prevent harm to the user and the heater, including redundant high temperature limit switches on independent circuitry. Control of the water heater is 100% based on temperature control, no flow switches required, making it the perfect solution for use with potable water. Water level sensors are used to prevent dry firing of the heating elements in all tankless models. Water chambers are designed with a patented air venting system that continuously vents gasses that release from the water during the heating process. A leak detector is mounted on the casing that sounds an alarm and automatically shuts off the power to the heating elements in case a water leak occurs. The control board is protected against electrical surges. Additional heater protection is achieved due to relays that are open during periods of standby, providing no path for electrical surges to the heating elements.

Power Rating: Four-chamber models contain four electric heating elements whose combined wattage is the total power rating of the heater. For instance, standard RA/CA-28 models contain four 7000-watt elements for a total of 28,000 watts, or 28 kilowatts (kW). Two-chamber models, RA/CA-14, contain only two 7000 watt elements for a total power rating of 14,000 watts, or 14kW. POU-70 models contain a single 7000-watt heating element for a total of 7kW. Refer to Seisco product specification sheets for KW ratings by model.

Heat Input: Since the SEISCO has been shown to have a 99% thermal efficiency the total heat input of Seisco models is simply the total kilowatt power rating of the combined heating elements converted to BTUs using 3,413 BTU per kW. For instance, RA/CA-28 models have a total power rating of 28 kW or 95,564 BTUs of heat input. Refer to Seisco specification sheet for heat input by model.

Voltage Ratings: Most Seisco heaters are manufactured with common 240 volt (AC) heating elements designed for optimum operation on a standard residential 240-volt (AC) electric service. These models will also operate at 208-volt (AC), a typical commercial voltage, however, the power rating and the heat output are reduced to 75%. POU models are also available in 120V and 277V (AC). Three phase models are available in 208, 277 and 480V.

Maximum Amperage Rating: Each Seisco model has a maximum electrical current rating (or amp rating) equivalent to the sum of the heating element ratings. For example, a four-chamber model, RA-28, operating at 240 VAC has four heating elements, each with a maximum rating of 29 amps. The maximum current rating or total current rating of the RA-28 is therefore 116 amps. However, the actual current measured during low flow rates and/or under low temperature rise conditions will be much less than the maximum rating of the heater. Refer to the maximum amp rating in the electrical requirements section of this publication.to the maximum amp rating in the electrical requirements section of this publication.



Four Chamber Design-Inside View

1	Cold Water Inlet	10	Cleanout Plates
2	Hot Water Outlet	11	LED Indicator Light
3	Heating Elements	12	Speaker
4	Microprocessor	13	Service Button
5	Thermistor Temperature Sensors	14	Power Lugs
6	Safety Cutoff Switches	15	Triacs
7	Temperature Control Knob	16	3/4" Conduit Connections
8	Off Peak Control Connection	17	Non-Ferrous Water Passages
9	Water Leak Detector	18	Heavy Gauge Steel Mounting Panel

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Electrical Capacity: Whether considering retrofit or new construction, the initial consideration for use of a Seisco is the electrical design. The Seisco represents only a part of the overall electrical requirements. When a reference is made to electric service, it means the rating of the building's primary electric service. Typically, in an existing building the electrical service rating can be determined by looking at the number written on the main breaker (i.e. 125, 150, 200 amperes or more). Some buildings will have two electrical panels that combine to provide the total service.

Today, most new homes have a 200 amp electric service. However, homes that utilize gas for space heating, water heating, and cooking may have 100 or 150 amp electric service. In most cases, an all-electric home of 3000 square feet or less with a 200 amp whole house electric service will have the electrical capacity for one Seisco RA-32, sufficient to provide all the normal hot water requirements for a home of this size containing 2-½ or 3 baths with standard flow rate fixtures. However a qualified electrician must calculate the electrical loads in the home or building with the load of the selected Seisco model(s). Load calculations should be done according to the National Electric Code (NEC), 220-82 and 220-83, Optional Calculation. Refer to the electrical requirements section of this publication.

Temperature Rise: The required temperature rise must be known in order to choose the appropriate Seisco model. Rise can be determined by subtracting the cold water inlet temperature from the desired outlet water temperature of the water heater. Seisco's outlet temperature is factory set to 120°F. Therefore, if the cold water inlet temperature is 65°F, then the temperature rise is 55°F (120°-65°=55°F). If the desired outlet temperature is 125°F, then the temperature rise would be 60°. With the temperature rise determined, the product specification sheet can be used to determine the correct model for the desired flow rate. An example of a performance table for RA models based on temperature rise and flow rate by model is provided on the next page.

Measuring the inlet temperature can be determined with a cooking or baking thermometer. Turn on the cold water for three minutes and then place the thermometer into the flow. This procedure purges ambient temperature water out of the cold water supply piping.

Inlet water temperatures can vary depending on geographical location, season of the year, and the type of water system. Water temperatures from most well water systems (except in mountainous areas) generally remain constant at 50 to 55°F year round.

Peak Flow Rate: The flow rate for each model is given on the product specification sheet. **The temperature rise at various flow rates are provided in the product specification sheet. (**See page 13**) Deviations from normal fixtures i.e. body spas & roman tubs have flow rate requirements that must be considered as separate from the norm.** Normal hot water flow requirements rarely exceed 2.5 GPM. For example, in a home with three showers, it is highly unlikely that all three showers need to run simultaneously. After all, the average length of time for a shower is about 7 minutes. In homes with 40- or 50-gallon electric tank water heaters and teenagers, families quickly adapt to the inability of the water heater during cold months to provide adequate hot water for three showers in a row by spacing shower times in order to give the water heater time to reheat the tank. With Seisco, as many people who want to can shower one right after the other. Which is ultimately better, two showers and a long wait for the third, or three showers one right after the other?

If the desired life style in the home actually requires running multiple faucets at the same time, then the flow rates must be added together to determine the peak flow demand. Depending on the plumbing arrangement, it may be necessary to select more than one Seisco to match the peak flow rate or use a Seisco/storage tank system.

Typical Fixture Flow Rates (gallons/minute)

Fixture Type	Lavatory	Bathtub	Shower	Kitchen Sink	Pantry Sink	Laundry Sink	Dish-washer	Washing Machine
Flow Rate	.5 - 1.5	2.0 - 6.0	1.5 - 3.0	1.0 - 1.5	1.5 - 2.5	2.5 - 3.0	1.5 - 3.0	1.0 - 3.0

Introduction

Designer fixtures and faucets may have unusually high flow rates. For instance, large custom body spa showers, whirlpool and Jacuzzi tubs may have faucets with flow rates ranging from 6 gpm to 18 gpm. A combination of multiple Seisco heaters (plumbed in a parallel configuration) can be installed to match these higher flow rates. The same peak design approach would be necessary for the anticipated life style of multiple flow rates occurring at the same time. Use the table below to help with selecting the Seisco model(s) for the peak flow application. Measuring flow rate of a fixture can be done by using a one-gallon milk jug. The approximate flow rate can be determined by turning on hot water at full flow, and timing how long it takes to fill the one gallon jug. To determine the gallons per minute (gpm) flow rate of the fixture, divide 60 seconds (which is one minute) by the number of seconds it takes to fill the one gallon milk jug. For example, if the one gallon jug is filled in 20 seconds, the flow rate is 3 gpm (60/20).

Gallons/Minute and First Hour Recovery (gpm & 1st Hour) @ Temperature Rise (F)

kW	Recovery	65	60	55	50	45	40	35	30	25	20	15
2.4	GPM	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.7	0.8	1.1
	GPH	15.1	16.4	17.9	19.7	21.9	24.6	28.1	32.8	39.3	49.2	65.6
3.0	GPM	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.4
	GPH	18.9	20.5	22.3	24.6	27.3	30.7	35.1	41.0	49.2	61.5	81.9
3.5	GPM	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.8	1.0	1.2	1.6
	GPH	22.1	23.9	26.1	28.7	31.9	35.9	41.0	47.8	57.4	71.7	95.6
4.0	GPM	0.4	0.5	0.5	0.5	0.6	0.7	0.8	0.9	1.1	1.4	1.8
	GPH	25.2	27.3	29.8	32.8	36.4	41.0	46.8	54.6	65.6	81.9	109.3
4.5	GPM	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0
	GPH	28.4	30.7	33.5	36.9	41.0	46.1	52.7	61.5	73.8	92.2	122.9
5.0	GPM	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.1	1.4	1.7	2.3
	GPH	31.5	34.1	37.2	41.0	45.5	51.2	58.5	68.3	81.9	102.4	136.6
5.5	GPM	0.6	0.6	0.7	0.8	0.8	0.9	1.1	1.3	1.5	1.9	2.5
	GPH	34.7	37.6	41.0	45.1	50.1	56.3	64.4	75.1	90.1	112.7	150.2
6.0	GPM	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.4	1.6	2.0	2.7
	GPH	37.8	41.0	44.7	49.2	54.6	61.5	70.2	81.9	98.3	122.9	163.9
7.0	GPM	0.7	0.8	0.9	1.0	1.1	1.2	1.4	1.6	1.9	2.4	3.2
	GPH	44.1	47.8	52.1	57.4	63.7	71.7	81.9	95.6	114.7	143.4	191.2
7.3	GPM	0.8	0.8	0.9	1.0	1.1	1.2	1.4	1.7	2.0	2.5	3.3
	GPH	46.0	49.8	54.4	59.8	66.5	74.8	85.5	99.7	119.6	149.5	199.4
8.0	GPM	0.8	0.9	1.0	1.1	1.2	1.4	1.6	1.8	2.2	2.7	3.6
	GPH	50.4	54.6	59.6	65.6	72.8	81.9	93.7	109.3	131.1	163.9	218.5
7.8	GPM	0.8	0.9	1.0	1.1	1.2	1.3	1.5	1.8	2.1	2.7	3.6
	GPH	49.2	53.3	58.1	63.9	71.0	79.9	91.3	106.5	127.8	159.8	213.1
9.0	GPM	0.9	1.0	1.1	1.2	1.4	1.5	1.8	2.0	2.5	3.1	4.1
	GPH	56.7	61.5	67.0	73.8	81.9	92.2	105.4	122.9	147.5	184.4	245.8
11.0	GPM	1.2	1.3	1.4	1.5	1.7	1.9	2.1	2.5	3.0	3.8	5.0
	GPH	69.3	75.1	81.9	90.1	100.2	112.7	128.8	150.2	180.3	225.3	300.5

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kW	Recovery	65	60	55	50	45	40	35	30	25	20	15
14.0	GPM	1.5	1.6	1.7	1.9	2.1	2.4	2.7	3.2	3.8	4.8	6.4
	GPH	88.2	95.6	104.3	114.7	127.5	143.4	163.9	191.2	229.4	286.8	382.4
16.0	GPM	1.7	1.8	2.0	2.2	2.4	2.7	3.1	3.6	4.4	5.5	7.3
	GPH	100.9	109.3	119.2	131.1	145.7	163.9	187.3	218.5	262.2	327.8	437.0
18.0	GPM	1.9	2.0	2.2	2.5	2.7	3.1	3.5	4.1	4.9	6.1	8.2
	GPH	113.5	122.9	134.1	147.5	163.9	184.4	210.7	245.8	295.0	368.8	491.7
18.0	GPM	1.9	2.0	2.2	2.5	2.7	3.1	3.5	4.1	4.9	6.1	8.2
	GPH	113.5	122.9	134.1	147.5	163.9	184.4	210.7	245.8	295.0	368.8	491.7
22.0	GPM	2.3	2.5	2.7	3.0	3.3	3.8	4.3	5.0	6.0	7.5	10.0
	GPH	138.7	150.2	163.9	180.3	200.3	225.3	257.5	300.5	360.6	450.7	600.9
23.0	GPM	2.4	2.6	2.9	3.1	3.5	3.9	4.5	5.2	6.3	7.9	10.5
	GPH	145.0	157.1	171.3	188.5	209.4	235.6	269.2	314.1	376.9	471.2	628.2
24.0	GPM	2.5	2.7	3.0	3.3	3.6	4.1	4.7	5.5	6.6	8.2	10.9
	GPH	151.3	163.9	178.8	196.7	218.5	245.8	281.0	327.8	393.3	491.7	655.6
24.0	GPM	2.5	2.7	3.0	3.3	3.6	4.1	4.7	5.5	6.6	8.2	10.9
	GPH	151.3	163.9	178.8	196.7	218.5	245.8	281.0	327.8	393.3	491.7	655.6
27.0	GPM	2.8	3.1	3.4	3.7	4.1	4.6	5.3	6.1	7.4	9.2	12.3
	GPH	170.2	184.4	201.1	221.3	245.8	276.6	316.1	368.8	442.5	553.1	737.5
28.0	GPM	2.9	3.2	3.5	3.8	4.2	4.8	5.5	6.4	7.6	9.6	12.7
	GPH	176.5	191.2	208.6	229.4	254.9	286.8	327.8	382.4	458.9	573.6	764.8
32.0	GPM	3.4	3.6	4.0	4.4	4.9	5.5	6.2	7.3	8.7	10.9	14.6
	GPH	201.7	218.5	238.4	262.2	291.4	327.8	374.6	437.0	524.4	655.6	874.1
36.0	GPM	3.8	4.1	4.5	4.9	5.5	6.1	7.0	8.2	9.8	12.3	16.4
	GPH	226.9	245.8	268.2	295.0	327.8	368.8	421.4	491.7	590.0	737.5	983.3
46.8	GPM	4.9	5.3	5.8	6.4	7.1	8.0	9.1	10.7	12.8	16.0	21.3
	GPH	295.0	319.6	348.6	383.5	426.1	479.4	547.9	639.2	767.0	958.8	1278.3
48.0	GPM	5.0	5.5	6.0	6.6	7.3	8.2	9.4	10.9	13.1	16.4	21.9
	GPH	302.6	327.8	357.6	393.3	437.0	491.7	561.9	655.6	786.7	983.3	1311.1
54.0	GPM	5.7	6.1	6.7	7.4	8.2	9.2	10.5	12.3	14.8	18.4	24.6
	GPH	340.4	368.8	402.3	442.5	491.7	553.1	632.1	737.5	885.0	1106.3	1475.0
72.0	GPM	7.6	8.2	8.9	9.8	10.9	12.3	14.0	16.4	19.7	24.6	32.8
	GPH	453.8	491.7	536.4	590.0	655.6	737.5	842.9	983.3	1180.0	1475.0	1966.7
93.0	GPM	9.8	10.6	11.5	12.7	14.1	15.9	18.1	21.2	25.4	31.8	42.3
	GPH	586.2	635.1	692.8	762.1	846.8	952.6	1088.7	1270.1	1524.2	1905.2	2540.3
96.0	GPM	10.1	10.9	11.9	13.1	14.6	16.4	18.7	21.9	26.2	32.8	43.7
	GPH	605.1	655.6	715.2	786.7	874.1	983.3	1123.8	1311.1	1573.3	1966.7	2622.2
108.0	GPM	11.3	12.3	13.4	14.8	16.4	18.4	21.1	24.6	29.5	36.9	49.2
	GPH	680.8	737.5	804.5	885.0	983.3	1106.3	1264.3	1475.0	1770.0	2212.5	2950.0

Residential Model Selection

Selecting The Proper Size: Seisco offers several options for sizing hot water systems. The selection process for the proper Seisco model is dependent on four issues: electrical service, home classification (high flow or low flow), consumer preferences, and special needs within the home.

Electrical Service

Initially, model selection may depend on the home's electrical service. In replacement situations, if sufficient electrical service is not available for a whole house model(s), a smaller Seisco model or a Seisco/storage tank design are perfect choices for providing/extending hot water capacity. Undersized electrical capacity is generally the case in older homes designed to primarily use gas or oil for heating. Typically, a Seisco "extender" consists of a RA-14 or RA-18. If sufficient electrical capacity is available, any Seisco RA model can be used as an "extender" in conjunction with any existing tank type water heater. There are some people who wish to keep a tank water heater as a pre-heater or for an emergency backup unit for power outages.

When building homes, apartments and condominiums, installation cost of a slightly larger power panel and wiring are minimal in the new construction phase.

Home Classification

In April 2003, the National Association of Home Builders Research Center published a study of hot water usage profiles based on data developed through previous testing supported by the National Renewable Energy Laboratories (NREL). This study found that homes typically fall in two categories, low flow and high flow. Low flow homes have a typical peak hot water usage rate of 3 gpm or less. High flow homes have a peak hot water usage of 5 gpm or less. Sizing tables on the next page for homes with more than one bath follow the criteria of peak flow rate outlined in the NAHB study.

Consumer Preferences

In typical installations, a single Seisco RA-28 or 32 will provide all the hot water normally required without running out. **However, endless hot water does not mean limitless hot water.** For example, model RA-28 will provide 3 gpm (180 gph) of water at a 63°F rise indefinitely. If the flow rate is increased to 5.5 gpm, the temperature rise will fall to 35°F. A typical example of high flow rate is the fill rate of a bathtub. Tub faucets can be designed with high flow rates, up to 18 gpm. With a tank water heater, the maximum flow rate can be obtained for a short period of time before the water turns cold. Before refilling the tub, the homeowner must then wait for the tank to reheat, a process that takes over an hour with a tank electric water heater. However, with a Seisco, it may take slightly longer (5 minutes) to fill the tub at a lower flow rate, but more hot water to keep the tub warm is available for as long as desired. This is known as the short wait (fill time) that avoids the long (out of hot water) wait.

Because Seisco provides endless hot water, the tub can be filled with water that is just the right temperature. This means that the homeowner can get in the tub immediately. Best of all, after bathing, endless hot water allows for more showers and continuing with dish washing, etc.

The final selection often depends on personal lifestyle preferences of the home owner. For example, although seldom do five showers run simultaneously in a home, some consumers want the ability to do so. The system must be sized accordingly. Gallon capacity and recovery rate of residential water heaters are usually calculated using various code requirements such

SIZING RULES OF THUMB

IN AREAS WITHOUT VERY COLD GROUND WATER

Families of 4 or less: Minimum RA-22
(Spa tub or higher flow options: RA-28 or 32, two RA-18 in parallel or one RA-18 in master bath plumbed in series* with primary Seisco or tank heater.)

Families of 5 and larger: Minimum RA-28 or 32
(Spa tub higher flow options: two RA-18 in parallel or one RA-18 in master bath plumbed in series* with primary Seisco or tank heater.)

IN AREAS WITH VERY COLD GROUND WATER SUCH AS THE ROCKY MOUNTAINS

Families of 4 or less: Minimum RA-32
(Spa tub or higher flow options: two RA-18 in parallel or one RA-18 in master bath plumbed in series* with primary Seisco or tank heater.)

Families of 5 and larger: Minimum Two RA-18 in parallel.
(Spa tub higher flow options: two RA-22 in parallel or one RA-22 in master bath plumbed in series with primary Seisco or tank heater.)

* The Seisco RA-18 will provide sufficient hot water for the single shower and sinks in the master bath but must be plumbed in series with the primary water heater as it requires the additional pre-heated water for the tub for simultaneous use.

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as the International Plumbing Code. In general, written codes for residential water heater sizing are based on the storage capacities of tank type water heaters. Since residential tank type water heaters usually have low BTU (KW) input capabilities, the time to reheat the tank can be extensive. Tankless water heaters allow the homeowner an endless flow of hot water at a limited rate with operating cost savings.

For low and high flow homes, shower head flow rate and number of simultaneously running showers is the best sizing method for tankless water heaters. Families adapt to miscellaneous hot water usage based on the system's capabilities, just as they do for tank type water heaters.

Table 1 represents the majority of homes in the United States. In fact the National Association of Home Builders (NAHB) Research Center report based on actual flow data confirmed that with 40°F inlet water "The maximum portion of time in any month in which a demand of 28 kW is exceeded...is less than .02% for the year." Low flow homes usually have 2.5 gpm shower flow rates, a washing machine, a dishwasher, and standard bath tubs. Table 1 should be used to determine which Seisco model(s) should be installed in most homes.

Table 2 for high flow homes represents the same basic construction as low flow homes but may have a jetted tub, teenagers living at home or a large number of occupants. The NAHB Research Center report also found, "The maximum portion of time for any month in which a demand of 28 kW is exceeded in the high-use home is less than 1% for the year." Table 2 should be used when the homeowner wants to ensure extra hot water availability.

Residential Sizing - Low Flow and High Flow Homes

Table 1-Low Flow Home

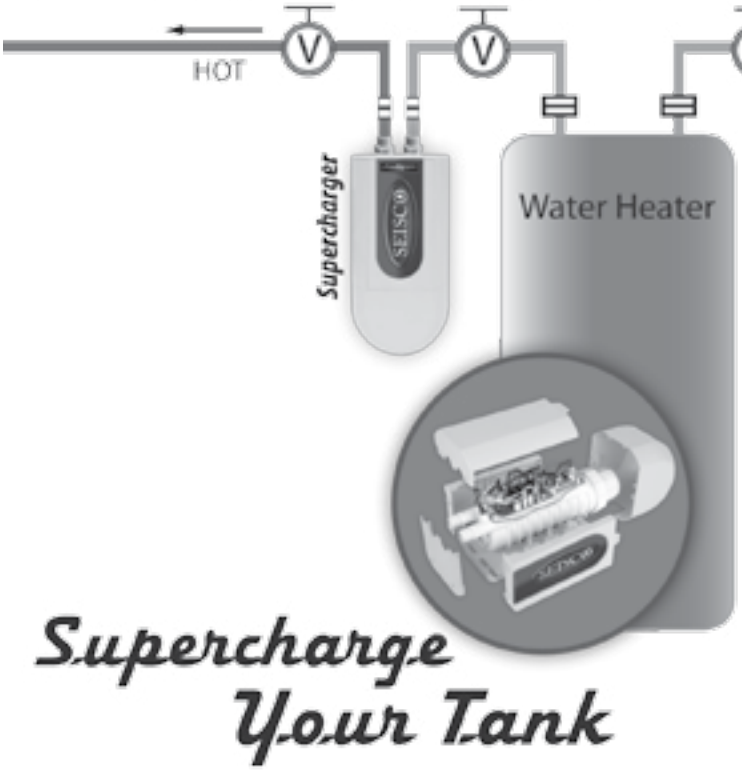
Number Bathrooms	40°F Inlet Water	45°F Inlet Water	50°F Inlet Water	55°F Inlet Water	60°F Inlet Water	65°F Inlet Water	70°F Inlet Water	Number Showers Running Concurrently	Maximum Showers Per Hour
1	RA-32	RA-28	RA-28	RA-22	RA-22	RA-22	RA-22	1	4-6
2	RA-32	RA-32	RA-28	RA-28	RA-28	RA-28	RA-28	1-2	4-6
3	2 RA-28	2 RA-22	2 RA-22	2 RA-18	2 RA-18	RA-32	RA-28	2	8-12
4	2 RA-32	2 RA-28	2 RA-28	2 RA-22	2 RA-22	2 RA-18	RA-32	2	8-12
5	3 RA-28	3 RA-28	3 RA-28	2 RA-32	2 RA-28	2 RA-28	2 RA-22	3	12-18

Table 2 -High Flow Home

Number Bathrooms	40°F Inlet Water	45°F Inlet Water	50°F Inlet Water	55°F Inlet Water	60°F Inlet Water	65°F Inlet Water	70°F Inlet Water	Number Showers Running Concurrently	Maximum Showers Per Hour
1	RA-32	RA-28	RA-28	RA-28	RA-28	RA-28	RA-28	1	4-6
2	2 RA-28	2 RA-28	2 RA-28	2 RA-22	2 RA-22	2 RA-18	RA-32	2	8-12
3	2 RA-28	2 RA-28	2 RA-28	2 RA-22	2 RA-22	2 RA-18	RA-32	2	8-12
4	3 RA-28	3 RA-28	3 RA-28	3 RA-22	2 RA-22	2 RA-18	RA-32	3	12-18
5	3 RA-32	3 RA-32	3 RA-32	3 RA-28	3 RA-28	3 RA-22	2 RA-28	3	12-18

Notes for Tables 1 & 2: Table 1 is based on 2.5 GPM shower heads and an average of 1.5 showers/hour/bathroom. Table 2 is based on 3 GPM shower heads and an average of 3 showers/hour/bathroom. Also, consider using Table 2 for homes with two or more teenagers. When reading these tables, do not add 1/2 baths when calculating the number of bathrooms. These tables cover over 99% of all homes with standard showers, tubs and other common appliances such as washing machines and dishwashers. If the home has multi-head showers, also called body showers, or a large jetted/garden tub, calculate the total desired flow rate and use multiple Seisco models plumbed in parallel or consider using Table 3, "Residential Sizing - Seisco With A Storage Water Heater or Storage Tank."

Never Take A Cold Shower Again



Supercharge Your Tank

The Seisco ***Supercharger*** is a new technology designed to connect to a hot water tank regardless of its primary heating source (gas, electric, solar, heat pump, geothermal, heat recovery). (Patent Pending)

The ***Supercharger*** is designed to avoid scald potential by not heating water that is already hot and only incrementally adding the precise amount of heat to maintain the desired set point. It can recognize very small temperature changes so as the water in the tank drops below its pre-set **desired** temperature, the ***Supercharger*** increments the heat required to maintain the constant desired set point within 1.5 degrees.

When evaluating the performance of the complete hybrid heating system, one must consider not only the Seisco *Supercharger* but also the heating capability of the tank.

The following chart demonstrates the expected performance. The GPM* below shows the flow rates for hot water deliverable at 115°F, based on the water temperature in the tank, and the combined heating capacity of the primary heating source PLUS the *Supercharger*. The performance chart demonstrates, as the water temperature in the tank declines, the combined capacity to provide hot water flow also declines but remains more than sufficient to provide that hot water needed to allow for a tempered 105°F hot shower "Endlessly"

***GPM at Tank Temperature to 115°F**

Model	Tank	SC BTU	Tank BTU**	TTL BTU	90°	80°	70°	60°
SC70	Electric	23,652	15,051	38,703	3.1	2.2	1.7	1.4
SC90	Electric	30,410	15,051	45,461	3.6	2.6	2.0	1.7
SC70	Gas	23,652	31,200	54,852	4.4	3.1	2.4	2.0
SC90	Gas	30,410	31,200	61,610	4.9	3.5	2.7	2.2

* *Assumes 40,000 BTU Gas Tank @ 78% and 4500 Watt Electric Tank @ 98% efficiency in use

Supercharger Models	Voltage	KW	Breaker Amps	Wire AWG	UPC	Overall Length
SC70	240	7.0	30	10	838034002901	15"
SC90	240	9.0	40	8	838034002918	15"

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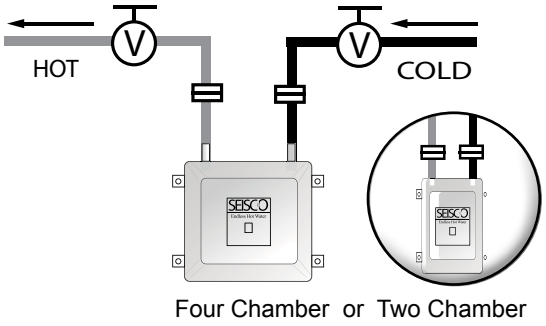
RESIDENTIAL PIPING DIAGRAMS

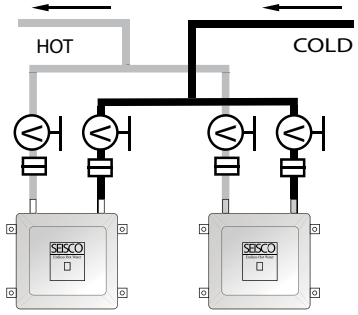


Singe Unit Installation

This is the standard piping diagram for a single Seisco in a whole house application sized using Table 1 or Table 2.

Symbol Legend For All Piping Diagrams

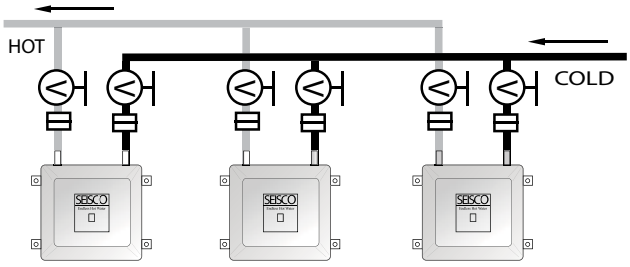
P Pump
FV Flow Adjustment Valve
CV Check Valve
V Shut off Valve
Union



Dual Unit Installation

This is the standard piping diagram for two Seisco units plumbed in parallel in a whole house application sized using Table 1 or Table 2. For parallel installations, both Seisco heaters should be the same model.

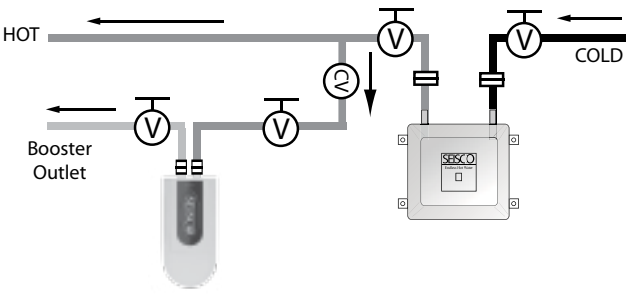
The thermostat setting of both heaters should be in the same position in order to balance the power of both heaters and maximize efficiency. This can be checked by measuring the amp flow through the heating element wires using an amp meter.



Triple Unit Installation

This is the standard piping diagram for three Seisco units plumbed in parallel in a whole house application sized using Table 1 or Table 2. The reverse return piping method is required.

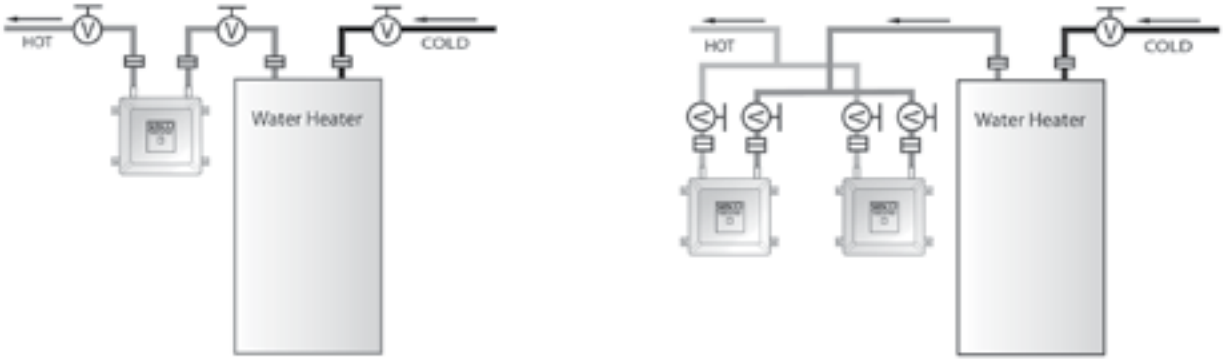
The thermostat setting of all heaters should be in the same position in order to balance the power of all heaters and maximize efficiency. This can be checked by measuring the amp flow through the heating element wires using an amp meter.



Primary Whole House Unit With Booster For Master Bath

This is the standard piping diagram for a single Seisco in a whole house application sized using Table 1 or Table 2 combined with a Seisco booster heater for high flow tubs or supplying an additional bathroom. The booster heater can be any Seisco model that provides the additional heating capacity required by the maximum flow rate.

Seisco Model(s) As An "Extender" For The Whole House With A Storage Water Heater



These are piping diagrams for Seisco units plumbed as "extenders" for a whole house or special needs application sized using Table 3. As a "extender," the Seisco will not turn on until the temperature of the storage tank heater has dropped below the temperature setting of the Seisco. While the storage tank is recovering, the Seisco will turn on and continue to provide hot water. For parallel installations, both Seisco heaters should be the same model. The thermostat setting of both heaters should be in the same position to balance the power of both heaters and maximize efficiency. This can be checked by measuring the amp flow through the heating element wires using an amp meter. Pipe the temperature and pressure relief valve on the tank type water heater to an open drain in accordance with code. Water lines to the tankless water heaters should be 3/4".

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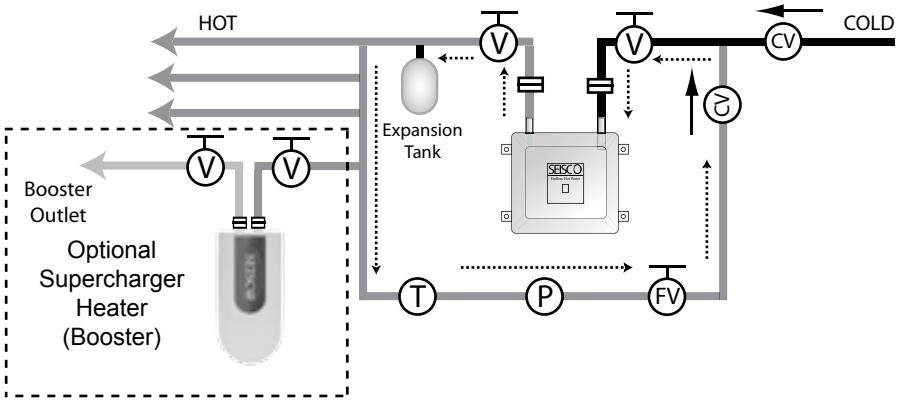
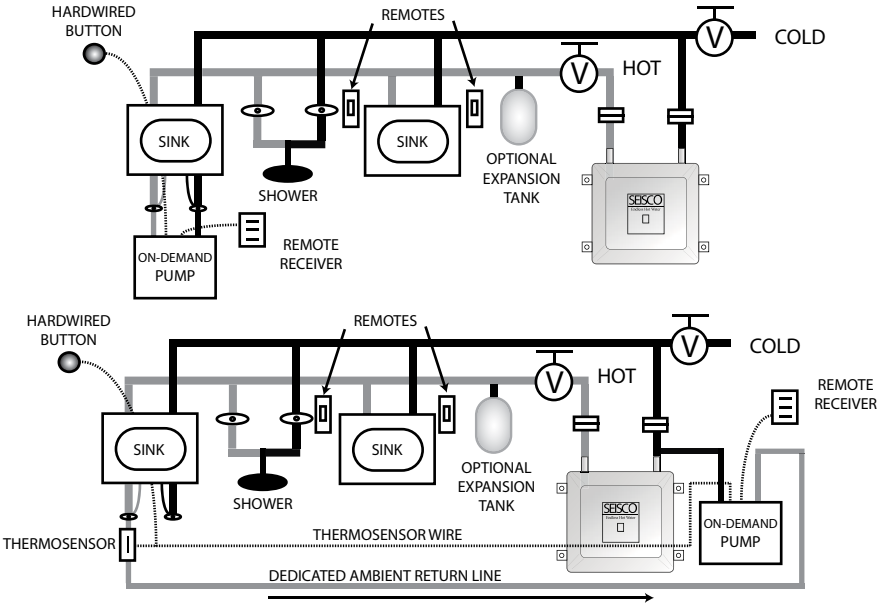
HOT WATER CIRCULATING SYSTEMS

Traditional Circulating System With Optional Booster Heater



Some homes have a hot water circulating or re-circulating system (loop) designed to maintain hot water in the plumbing system throughout the house making hot water instantly available at every outlet. In most cases, circulating systems maintain the water temperature between 90 and 125°F with an auxiliary thermostat connected to a circulating pump. When the water temperature in the circulating loop drops below the loop thermostat's set point, the pump is turned on to circulate water through the water heater and around the circulating loop. Seisco's control works independently in this type of system and does not require wiring to the pump or the auxiliary thermostat. Seisco automatically reheats the water as if flows through the water heater.

Instant Hot Water On-Demand System



An average home wastes between 6,000 and 10,000 gallons of water per year waiting on hot water. More and more, consumers are insisting on instantly available hot water, eliminating the wait and wasted water.

As an alternative to a standard recirculating loop design, manufacturers have developed and introduced non-traditional methods of making hot water instantly available.

The on-demand system is designed to move hot water from the water heater to the most remote fixture within seconds, saving water. The system is activated at the push of a button or via remote motion sensors. The system is installed either under the most remote sink or next to the water heater. When installed under the sink, upon activation, the pump quickly pulls hot water to the fixture from the water heater while pushing the cold water back to the water heater through the cold water line. A sensor on the pump immediately shuts down the pump as soon as hot water reaches the pump's inlet, preventing hot water from entering the cold water line. The second option, locating the pump next to the water heater, requires a dedicated ambient water return line. Several different pumps are offered based on the distance between the water heater and the most remote fixture. For more information about the on-demand system shown above, visit www.gothotwater.com.

Residential Application

Plumbing: For years, in many areas of the country, hot water distribution lines from the water heater have been uninsulated. Regardless of whether a tank water heater or a Seisco tankless water heater is used, the best investment for saving energy and optimizing the hot water system is properly insulated hot water lines. In many areas of the country, highly heat conductive copper hot water lines are actually run uninsulated beneath concrete slabs. Heat loss during transportation from the heater to the fixture can be 10 to 15º F. This loss does not help anyone and can be as much as 25% of the cost of water heating.

Explore other new technologies such as structured plumbing designs. (www.aim4sustainability.com) The use of PEX tubing and best recirculating loop designs offer an affordable and unique means of moving hot water directly to the fixture in use.

Location: In new construction, avoid zoning a home in such a manner that requires multiple Seisco's of nearly the same power rating for the purpose of providing hot water to separate areas of use (i.e. bathrooms). Try to place Seisco water heaters at the heart of the home, centrally located between the master bath and kitchen areas.

Because of Seisco's compact size, it can be located in closets and under staircases so that it is central to areas of major hot water usage. If necessary, a multiple heater system can even fit where most storage tank heaters cannot. These benefits are important to the user, as they help conserve water, reduce the wait for hot water, and reduce energy costs. ***Most water damage is caused by faulty or failed water connections***. A suitable drain (pan) ***must*** be installed in such locations.

Multiple units should be installed in parallel, equalizing the demand from each while maximizing the system's capacity. If the house is particularly long, a good option is to place the primary Seisco slightly closer to remote bathrooms and kitchen areas and install an extender/ booster unit in the master bath. This booster/extender unit should never be smaller than the Seisco SC-70 and must be plumbed in series with the primary Seisco.

Typical one-story and two-story floor plans are provided to help illustrate the possibilities for locating Seisco heaters to achieve maximum benefits. The optional multiple heater configuration, as well as the single heater configuration, is shown. For instance, a single RA-28, or 32, can effectively provide hot water for the whole house. However, if peak flow demands of the master bath exceed the flow rate capacity of the RA-28, or 32, i.e. multiple shower heads, then a booster unit, an RA-22, can be located downstream and closer to the master bath. This arrangement significantly reduces the wait for hot water in the master bath as well. With the Seisco utilized as a booster or backup water heater downstream from the storage tank heater, it is still possible for a large family to enjoy ***endless hot water***.

In homes with a basement, there may be additional flexibility to locate the heater in the basement in a central location directly below the fixtures on the first and second floors. Instead of locating the booster in the master bath closet, it could also be located in the basement. Also, there may be a need for hot water to serve fixtures in the basement, such as the washing machine and future baths that may be installed when the basement is finished for living space.

In homes with an attached garage, the garage may be one of the most convenient locations for the Seisco heater, but not necessarily the most central location to faucets in the home. If the garage is on one end of the house, and the master bath is on the opposite end, probably a long distance from the water heater, the result may be relatively long delays (2 minutes or more) for the hot water to reach the master bath fixtures. This arrangement is generally not acceptable by most homeowners unless a Seisco booster heater is installed within the vicinity of the master bath in combination with the heater in the garage. It may be necessary to avoid installing the Seisco heater in the garage altogether due to possible exposure to high humidity and freezing conditions. If possible, locate the Seisco heater in the adjacent utility room or other room in conditioned air space.

Most water damage is caused by faulty or failed water connections therefore... (*DRAIN IS REQUIRED*)

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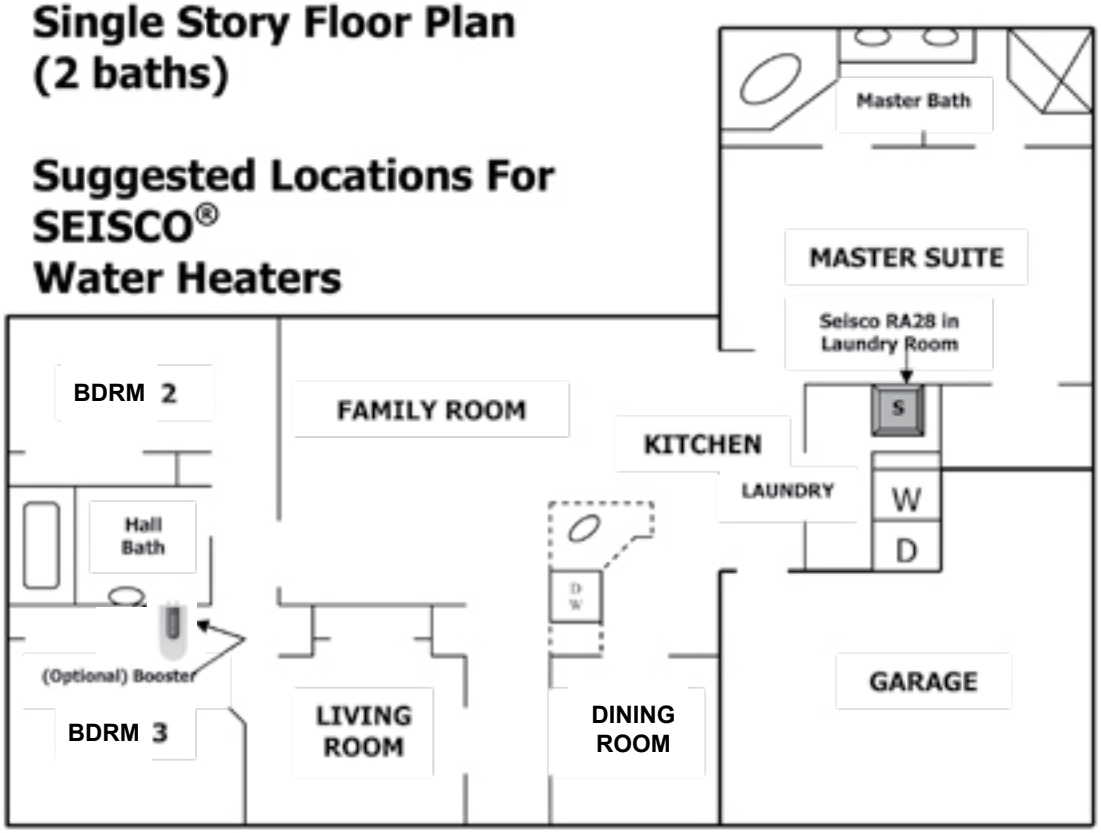
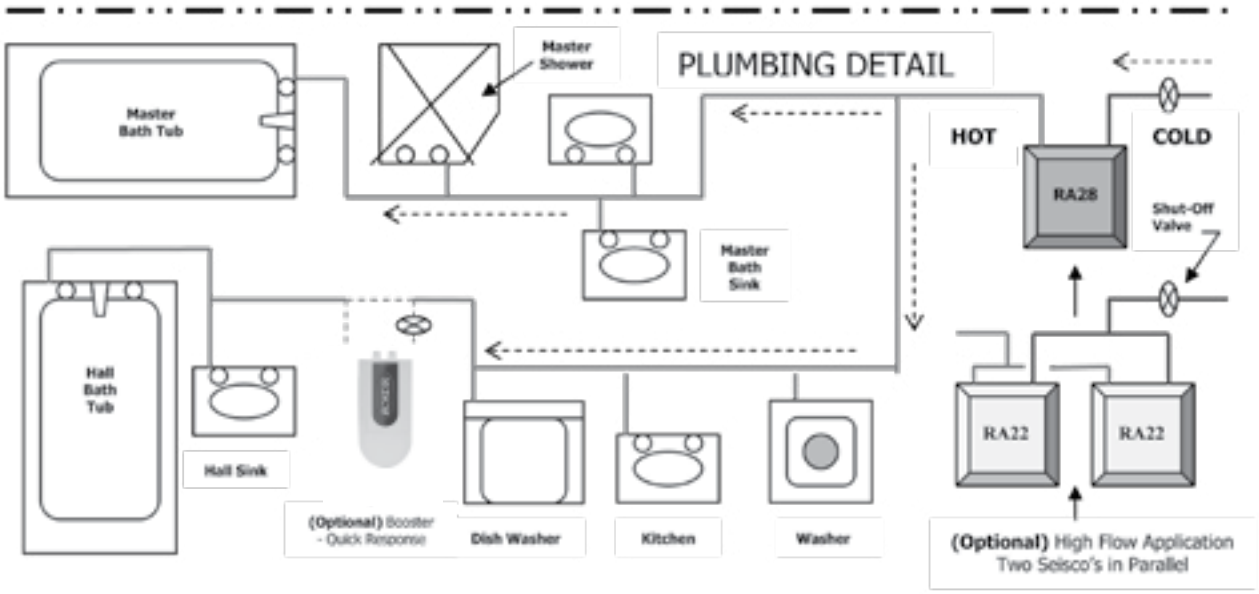
Single Story Floor Plan (2 baths)

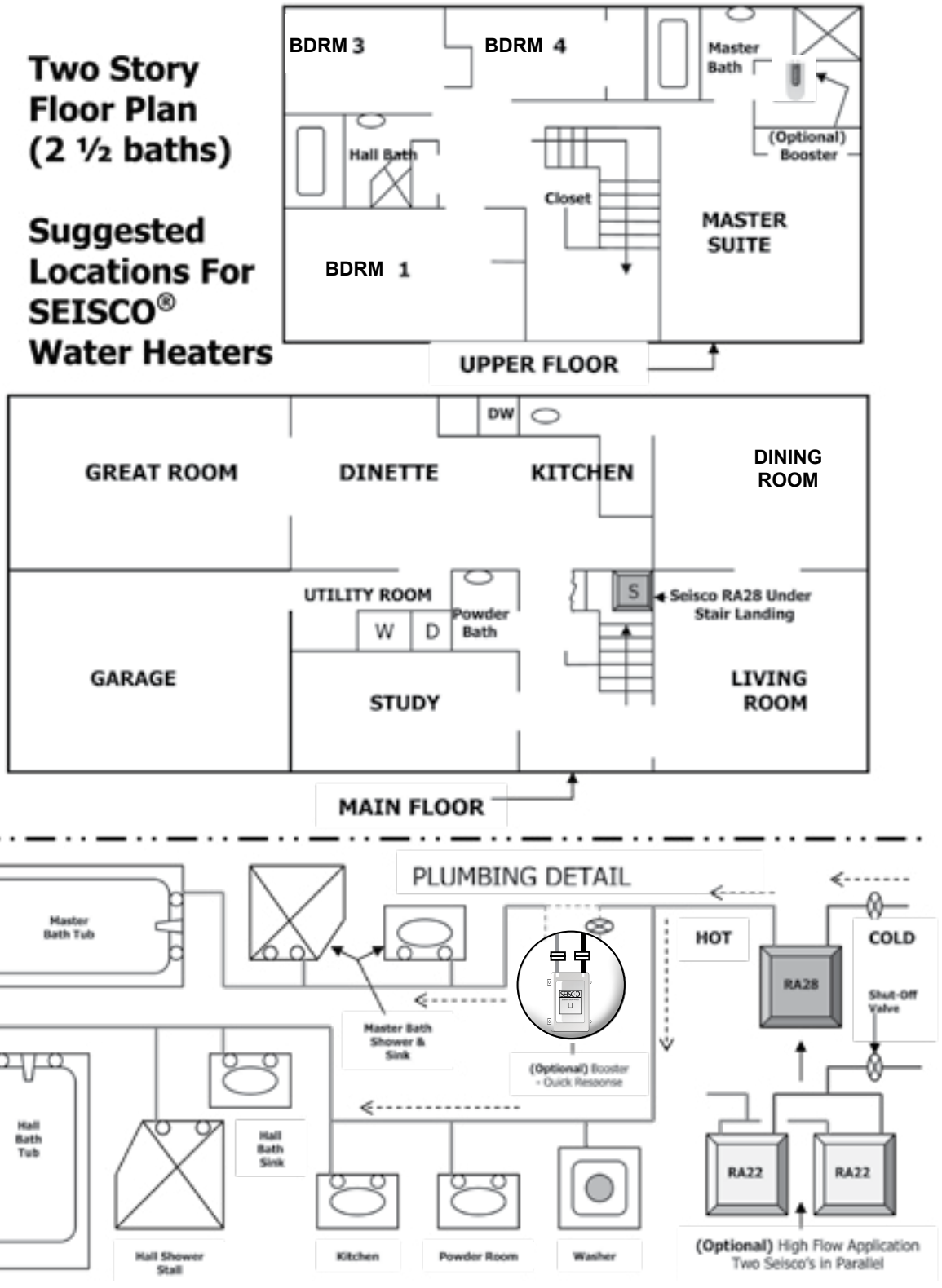
Suggested Locations For SEISCO® Water Heaters





Note: RA-28, RA-22, RA-18 models shown. In areas with inlet water temperature below 50°F, consider model RA-32 with optional RA-28s for high flow applications and RA-22 for the optional booster. For electrical requirements of all models (amp draw and number of circuit breakers required), refer to the Electrical Requirements section of this manual.

Residential Application



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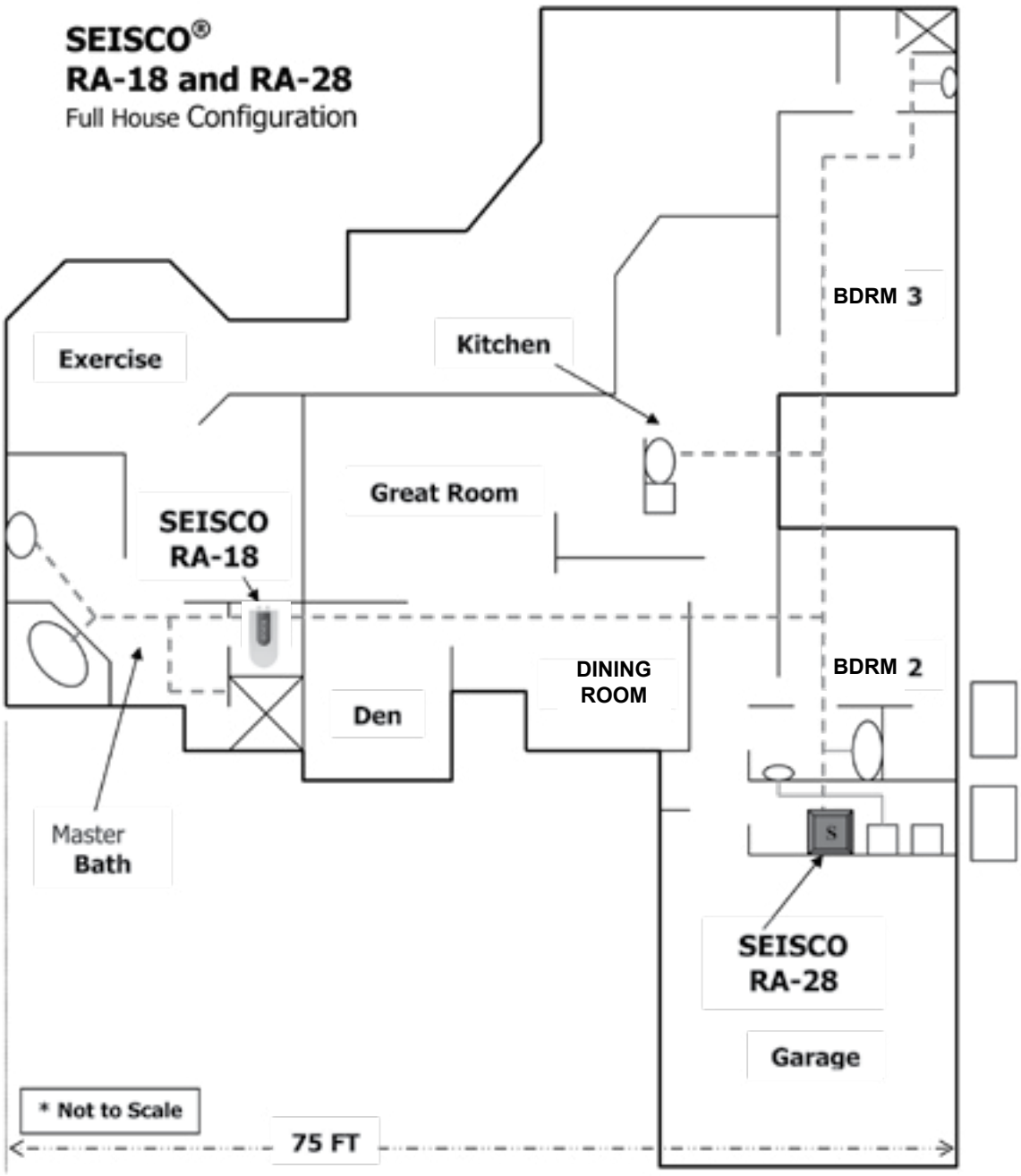
Florida Style Home – Single Story Floor Plan*

(SEISCO Full House Model With Booster in the Master Bath for Quicker Response)



HEAT PUMP APPLICATIONS WITH SEISCO TANKLESS WATER HEATERS

Heat pump technology has been around for many years. Heat pumps operate by moving or transferring heat from one location to another.

A heat pump compresses a vapor refrigerant which lowers its temperature and then expands the vapor which raises its temperature. When the vapor is pumped in one direction, it can be used for cooling. Reversing the flow allows the same unit to be used for heating.

Air Source Heat Pumps

During the summer, heat is captured inside the home by circulating warm air in the home across a coil through which cold compressed refrigerant is pumped. As warm air travels across the coil, heat is absorbed by the cold refrigerant. The net effect is that cold air then returns to the home while heated refrigerant is returned to the compressor to be recompressed. During the return trip to the compressor, heat in the expanded vapor is absorbed by air surrounding the outdoor condensing unit.

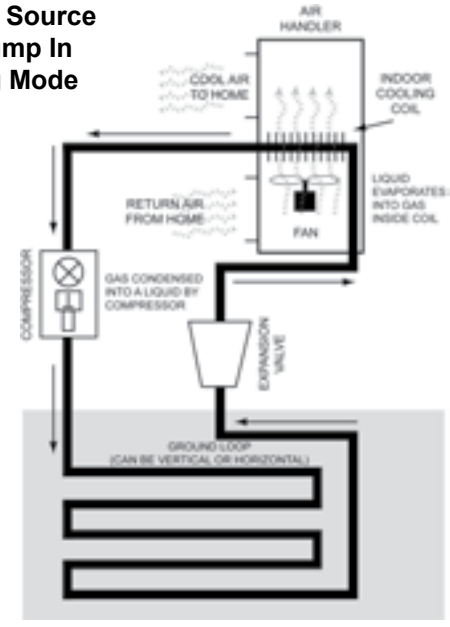
During winter, the process is reversed. Expanded vapor travels through the condensing coil outside the home and absorbs heat from the surrounding air. The liquid is then pumped through the coil inside the home where air passing over the indoor coil absorbs the heat and carries it through ducts into the home.

Geothermal Heat Pumps

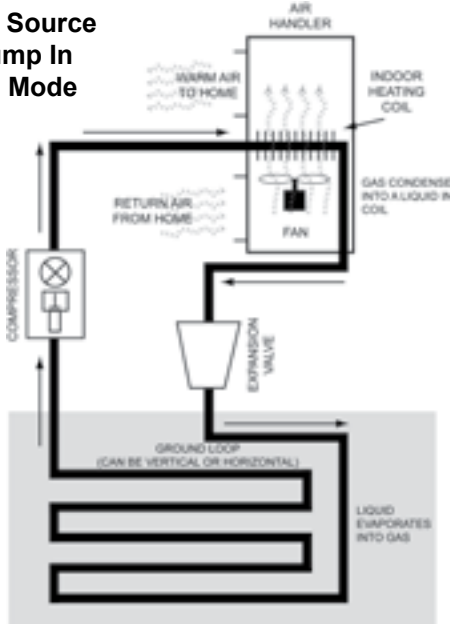
Geotherrmal heat pumps operate on the same exact principles as atmospheric heat pumps. However, there is one huge difference. The temperature of the earth below the frost line remains very constant all year. For heat exchange, a geothermal heat pump uses refrigerant lines buried in the ground. Two basic methods of burying lines in the ground have emerged. The first method is to bury refrigerant lines horizontally below the frost line. The second method is to drill deep vertically oriented slanted holes and install the lines at a small angle.

As with an air source heat pump, during the summer, heat is captured inside the home by circulating warm air in the home across a coil through with cold compressed refrigerant is pumped. As the warm air travels across the coil, heat is absorbed by the cold refrigerant. The net effect is that cold air then returns to the home while heated refrigerant is returned to the compressor to be recompressed. However, in the case of geothermal heat pumps, heat is absorbed by the earth as the refrigerant is circulated through the lines buried in the ground. Since ground temperatures remain constant, the efficiency of geothermal heat pumps is higher than the efficiency of air source heat pumps and varies very little throughout the year.

Ground Source Heat Pump In Cooling Mode



Ground Source Heat Pump In Heating Mode



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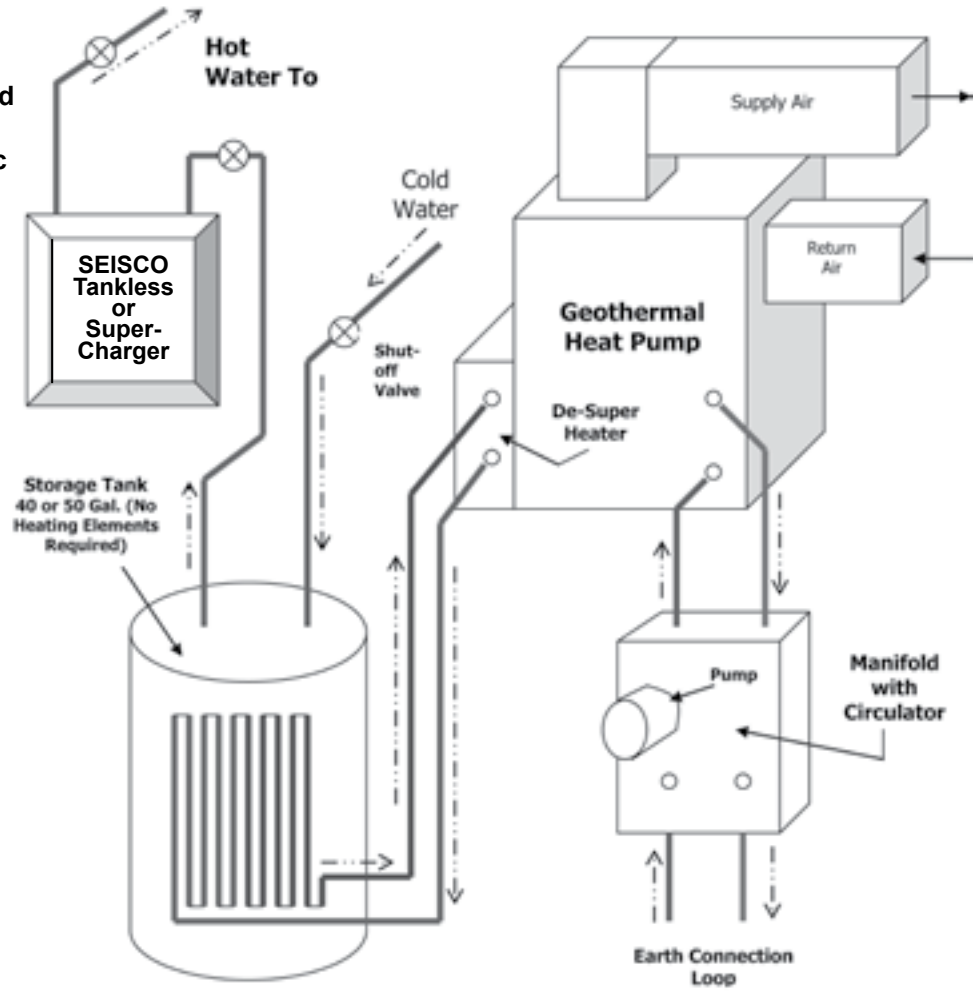
PRE-HEATED WATER APPLICATIONS WITH SEISCO TANKLESS WATER HEATERS-CONT.

Heating Water With Heat Pumps and Seisco Tankless Water Heaters

As stated previously, during the heating and cooling process heat is exchanged or "pumped" from one location to another. In order to heat water with a heat pump, heated refrigerant is diverted through a coil inside a storage tank. The water inside the storage tank absorbs heat from the refrigerant. The hot water can then be used for domestic purposes such as showering, washing dishes, washing clothes, etc.

Seisco tankless electric water heaters are an important component in the water heating system when heat pumps are used to heat water. Heating water with heat pumps designed for space heating and air conditioning raises the overall efficiency of the heat pump. More heat is scrubbed out of the refrigerant vapor as it passes through a de-super heater, also called a heat exchanger coil, in the water tank. However, at times, sufficient heat may not be present to adequately heat the water in the tank. Seisco takes over when the consumer draws water out of the storage tank that is not up to 120°F. Since the Seisco operates on temperature, it will turn on automatically to boost the water temperature to 120°F. **When the heat pump is adequately heating the water, the Seisco does not turn on!** Only the exact amount of energy required to boost the water temperature to 120°F is used by the Seisco. Should the consumer draw more hot water than the tank can hold, the Seisco provides an endless supply of hot water up to its maximum flow rate. Seisco tankless water heaters used as a back up for heat pump applications should be sized to cover the entire water heating requirement as if the heat pump were not available. This gives the consumer the most efficient water heating system and the convenience of endless hot water!

Ground Source Heat Pump With Hot Water Storage Tank Backed Up By Seisco Tankless Electric Water Heater

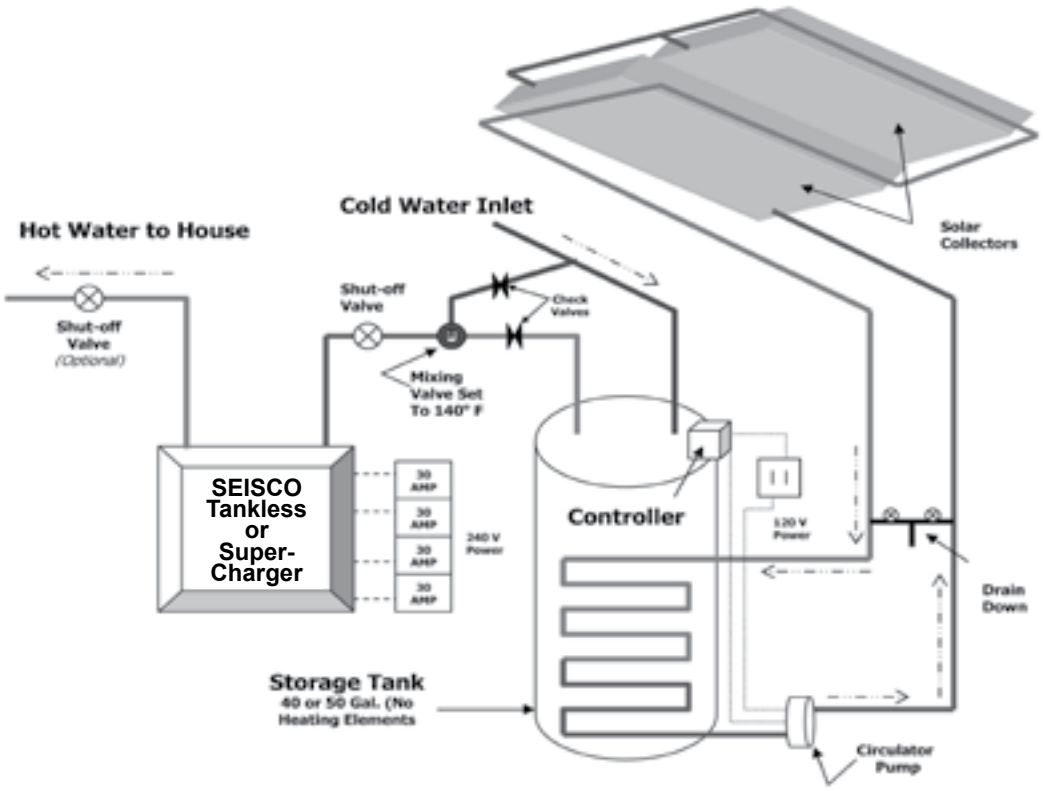


Residential Solar Water Heating

Auxiliary Heat Source for Solar-Heating water with solar collectors in certain geographic regions is one of the most efficient systems. When enough sunlight is not available, Seisco provides the perfect back-up. As a back-up heater, Seisco allows the solar water heating system do what it was designed to do, recover on it's own. **Solar heating systems are vulnerable to running out of hot water during the evening and early morning hours, especially if the tank only holds 40 or 50 gallons.** Two or three baths or showers taken during this period can completely deplete the storage tank of hot water. **Seisco models will only turn on and provide hot water when it senses the temperature from the storage tank is lower than Seisco's set point, making it the perfect back-up.** In addition, the Seisco will only use the energy necessary to raise the temperature it senses to the set point, typically 120°F.

Refer to the diagram below. A mixing valve must be used between the storage tank and the Seisco. Temperatures generated by solar collectors can exceed 160°F, too hot for domestic use. Also, Seisco is equipped with a 180°F high temperature safety shut down switch. So temperatures of 180°F or greater will disable the Seisco heater requiring a manual reset. Because there will be periods when the solar collectors are not heating the water and the storage of hot water can be depleted, the Seisco heater should be sized to heat the water as if there were no solar heating system.

SEISCO Backup Water Heating Application With Storage Tank and Closed-Loop Heat Exchanger using a SEISCO Booster SuperCharger



Temperatures from the Solar Heated Storage Tank can reach 160°F, thus requiring a mixing valve ahead of the Seisco to prevent the high temperature switch from tripping and disabling the Seisco.

Suitable booster models include the single chamber Supercharger models through the full RA product line. Generally the booster is sized to sufficiently heat water on the day of the year with the least sun at the coolest temperature unless the homeowner is willing to make lifestyle adjustments based on weather.

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INTRODUCTION

Multi-dwelling applications for hot water covered in this Water Heating Product Guide include apartments, dormitories, and hotels/motels. If the total theoretical flow rate and gallons per use were calculated for sizing water heaters and storage, the resulting systems would be grossly oversized. For example, in an apartment complex with 100 apartments, the probability of every shower running simultaneously is extremely low, almost zero. The same example applies to dormitories and hotels/motels. Studies have been done to identify diversity factors that can be applied to the number of units or occupants under consideration. This is one explanation why sizing tables are not just a calculation of maximum theoretical gallon per minute (gpm) flow.

In addition to the number of units or occupants under consideration, the time of day that people use hot water is important. For example, if a hotel/motel is located next to a convention center, most of the occupants will arise early in the morning to shower before attending their first seminar. This situation creates a one hour peak demand for hot water just prior to occupants attending their first seminar. On the other hand, if an identical hotel is located in a vacation/resort area, the maximum demand of hot water flow is spread over three or more hours. Apartments are considered a three hour peak demand application. Hotels/motels are usually considered as two hour peak applications, other than those located on a busy interstate highway or near a convention center in a busy business district. Dormitories are considered a one hour peak demand.

The basic principle of sizing is that storage plus recovery must equal or exceed demand. Storage capacity is included in the sizing tables where appropriate. Total recovery based on the peak demand period is also provided. Customarily, storage and recovery are based on 140°F water. When 140°F outlet water is utilized from the water heater or storage tank, a mixing valve should be used to reduce the water temperature to 120°F or less to domestic water fixtures. The best solution to reduce the risk of scald injuries is to store water at temperatures of 120°F. Extra gallon capacity is required when storing water at 120°F versus 140°F.

While the user of this Water Heating Product Guide can use the sizing tables for selecting the proper Seisco model(s), other sizing methods may be applicable to your situation. The U.S. Department of Housing and Urban Development (HUD) specifies that design criteria for HUD approved water heating systems must follow the American Society of Heating, Refrigeration, and Air Conditioning Engineers' (ASHRAE) requirements. Building codes and local housing authorities must be followed.

Sizing tables for multiple dwelling applications in the Water Heating Product Guide are based on 3 gpm and 2.5 gpm shower flow rates. To account for the differences in inlet water temperature, water usage of the appropriate demand period is calculated for 40°F and 60°F inlet water.

APARTMENTS-SEISCO MODEL SELECTION

Today virtually all new multi-family projects are individually metered and have their own individual source of hot water. Much older projects used boilers and any retrofit must comply with these requirements. Thus Apartments may be sized using two methods, the first method uses standard residential home sizing when apartments are individually metered. The designations of low flow, high flow and special needs apply to apartments as well as homes. That is addressed by the chart below. Consult the Residential Sizing section of this guide when sizing individually metered apartments.

The second method treats the water heating system as a single system with one or more water heaters and one or more storage tanks for multiple units. If each apartment building has its own water heating system, the table below should be used when sizing each building. The table below assumes an average occupancy rate of 2 1/2 persons per apartment and a three hour hot water demand period. Demand for separate laundry facilities is not included. For separate laundry facilities, add to storage and recovery according to the requirements of the laundry.

To use this table:

1. Determine the number of apartments from column one in the table.
2. Determine the number of occupants from column two in the table.
3. If the number of occupants is greater than 2 1/2 per apartment, use the number of occupants for determining the size of the water heater(s) and storage tank. Otherwise use the number of apartments.
4. Use the appropriate columns for shower flow rate, inlet water temperature, and storage tank temperature to determine the appropriate Seisco model(s) and storage tank capacity.

		1.5 GPM Shower Heads		2.5 GPM Shower Heads			
Number of Apartments	**Number of Occupants**	**40°F Incoming Water**	**60°F Incoming Water**	**40°F Incoming Water**	**60°F Incoming Water**	**Storage Tank Capacity (140°F)**	**Storage Tank Capacity (120°F)**
1-3	7	CA-18	CA-18	CA-18	CA-18	80	100
4	10	CA-18	CA-18	CA-18	CA-18	80	100
5-6	15	CA-18	CA-18	CA-18	CA-18	120	100
7-8	20	CA-18	CA-18	CA-18	CA-18	120	150
9-10	25	CA-18	CA-18	CA-22	CA-22	120	150
11-15	37	CA-28	CA-22	CA-32	CA-28	120	150
16-20	50	CA-32	CA-28	2 CA-22	2 CA-18	150	200
21-25	62	2 CA-22	CA-32	2 CA-28	2 CA-22	150	200
26-30	75	2 CA-22	2 CA-22	2 CA-32	2 CA-28	160	200
31-35	87	2 CA-28	2 CA-22	3 CA-28	2 CA-32	200	250
36-40	100	2 CA-32	2 CA-28	3 CA-28	3 CA-28	200	250
41-45	112	2 CA-32	2 CA-28	3 CA-32	3 CA-28	200	250
46-50	125	4 CA-22	2 CA-28	3 CA-32	3 CA-28	200	250
51-75	187	4 CA-28	4 CA-22	5 CA-28	4 CA-28	255	350
76-100	250	4 CA-32	4 CA-28	6 CA-28	5 CA-28	300	400

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HOTEL - MOTEL-SEISCO MODEL SELECTION

The table below assumes a two hour demand period and an average occupancy rate of 1 1/2 persons per unit. Demand for separate laundry facilities is not included. For separate laundry facilities, add to storage and recovery according to the requirements of the laundry.

To use this table:

1. Determine the number of hotel/motel rooms from column one in the table.
2. Determine the number of occupants from column two in the table.
3. If the number of occupants is greater than 1 1/2 per room, use the number of occupants for determining the size of the water heater(s) and storage tank. Otherwise use the number of rooms.
4. Use the appropriate columns for shower flow rate, inlet water temperature, and storage tank temperature to determine the appropriate Seisco model(s) and storage tank capacity.

		1.5 GPM Showers		2.5 GPM Showers			
Number of Units (Rooms)	Number of Occupants	40°F Incoming Water	60°F Incoming Water	40°F Incoming Water	60°F Incoming Water	Storage Tank Capacity (140°F)	Storage Tank Capacity (120°F)
1-3	4	CA-18	CA-18	CA-18	CA-18	50	80
4	6	CA-18	CA-18	CA-18	CA-18	80	100
5-6	9	CA-18	CA-18	CA-18	CA-18	80	100
7-8	12	CA-18	CA-18	CA-18	CA-18	120	150
9-10	15	CA-18	CA-18	CA-18	CA-18	120	150
11-15	22	CA-18	CA-18	CA-28	CA-22	120	150
16-20	30	CA-22	CA-18	CA-32	CA-28	150	200
21-25	37	CA-28	CA-22	2 CA-22	CA-32	150	200
26-30	45	CA-28	CA-28	2 CA-28	2 CA-18	200	250
31-35	52	CA-32	CA-28	2 CA-28	2 CA-22	200	250
36-40	60	2 CA-22	CA-28	2 CA-28	2 CA-28	200	250
41-45	67	2 CA-22	CA-32	2 CA-32	2 CA-28	200	250
46-50	75	2 CA-22	CA-32	2 CA-32	2 CA-28	200	250
51-75	112	2 CA-28	2 CA-22	3 CA-32	3 CA-28	250	350
76-100	150	2 CA-32	2 CA-28	4 CA-32	3 CA-32	300	400
101-125	187	3 CA-22	2 CA-32	4 CA-32	4 CA-28	350	450
126-150	225	3 CA-22	3 CA-22	5 CA-28	4 CA-28	350	450
151-175	262	3 CA-32	3 CA-28	6 CA-28	5 CA-28	400	500
176-200	300	4 CA-28	3 CA-32	6 CA-32	6 CA-28	400	500
301-250	375	5 CA-28	4 CA-32	8 CA-28	6 CA-32	500	600
251-300	450	5 CA-32	5 CA-28	9 CA-32	8 CA-32	600	750
301-350	525	6 CA-32	5 CA-32	10 CA-32	9 CA-32	700	900

Note: Hotels/motels can be broken down into individual rooms or groups of rooms and sized for maximum fixture flow without using storage tanks.

DORMITORIES-SEISCO MODEL SELECTION

Today virtually all new multi-family projects are individually metered and have their own individual source of hot water. Much older projects used boilers and any retrofit must comply with these requirements
The table below assumes a one hour demand and 5 gallons of hot water per person.

To use this table:

1. Look up the number of occupants in column one on the table.
2. Determine the model(s) required from columns 2-5 based on shower head flow rate and incoming water temperature.
3. Determine storage tank capacity from the last two columns based on stored water temperature.

	1.5 GPM Shower Heads		2.5 GPM Shower Heads			
Number Occupants	40°F Incoming Water	60°F Incoming Water	40°F Incoming Water	60°F Incoming Water	Storage Tank Capacity (140°F)	Storage Tank Capacity (120°F)
1-10	CA-22	CA-18	CA-28	CA-22	120	150
11-15	CA-28	CA-18	2 CA-18	CA-32	150	200
16-20	CA-32	CA-28	2 CA-28	2 CA-22	200	250
21-25	CA-32	CA-28	2 CA-28	2 CA-22	250	300
26-30	2 CA-22	CA-28	2 CA-32	2 CA-28	300	400
31-40	2 CA-22	CA-32	2 CA-32	2 CA-28	300	400
41-50	2 CA-22	CA-32	3 CA-28	2 CA-28	350	500
51-75	2 CA-28	2 CA-22	4 CA-22	2 CA-32	400	500
76-100	2 CA-32	2 CA-28	4 CA-28	3 CA-28	500	750
101-125	3 CA-28	2 CA-32	4 CA-32	4 CA-32	500	750
126-150	3 CA-32	3 CA-28	5 CA-32	4 CA-32	500	750
151-175	4 CA-28	3 CA-28	6 CA-32	5 CA-28	500	750
176-200	4 CA-32	3 CA-32	7 CA-32	5 CA-32	750	1000
201-250	5 CA-32	4 CA-32	8 CA-32	6 CA-32	750	1000
251-300	6 CA-32	5 CA-28	10 CA-32	8 CA-28	750	1000

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GENERAL APPLICATION-SEISCO MODEL SELECTION

Hot water requirements for every commercial application can be broken down into two components, recovery rate and gallons of stored water required. Typically, hot water demand is stated in terms of continuous, one-, two-, or three-hour demand.

If demand is continuous, recovery rate must match flow rate. Storage volume is not used in calculating hot water availability although it may be used for other purposes such as a safety net for temporary spikes in demand above the installed recovery rate of the system.

No matter whose sizing charts are used for determining demand, Seisco models can be applied. This section includes hot water availability tables for one-, two-, and three-hour demand periods for one to ten Seisco models plumbed in parallel. Yoke manifolds are used for two units plumbed in parallel. Reverse return manifolds are used when three or more models are piped in parallel.

If a continuous demand flow rate has been calculated for the application, convert it to gph and use the One-Hour Availability table on page 26.

To calculate total available hot water based on one-, two- or three-hour demand with a storage tank, add 80% of the storage tank volume to the value in the appropriate table from page 26.

For example, if six CA-28 Seisco water heaters are plumbed in conjunction with a 500 gallon storage tank, the total three hour availability of hot water is 2065 gallons from recovery (see Three-Hour Availability table on page 26), and 400 gallons from the storage tank, or 2465 gallons total.

For your convenience, use the table below to determine the total kW and amp draw when multiple Seisco units are plumbed in parallel.

Total KW Input and amp draw for Multiple Seisco Models (240 Volt, Single Phase)

		Number of Units								
Model	kW / Amps	2	3	4	5	6	7	8	9	10
CA-5	5	10	15	20	25	30	35	40	45	50
	21	42	63	83	104	125	146	167	188	208
CA-7	7	14	21	28	35	42	49	56	63	70
	29	58	88	117	146	175	204	233	263	292
CA-9	9	18	27	36	45	54	63	72	81	90
	38	75	113	150	188	225	263	300	338	375
CA-11	11	22	33	44	55	66	77	88	99	110
	46	92	138	183	229	275	321	367	413	458
CA-14	14	28	42	56	70	84	98	112	126	140
	58	117	175	233	292	350	408	467	525	583
CA-18	18	36	54	72	90	108	126	144	162	180
	75	150	225	300	375	450	525	600	675	750
CA-22	22	44	66	88	110	132	154	176	198	220
	92	183	275	367	458	550	642	733	825	917
CA-28	28	56	84	112	140	168	196	224	252	280
	117	233	350	467	583	700	817	933	1050	1167
CA-32	32	64	96	128	160	192	224	256	288	320
	133	267	400	533	667	800	933	1087	1200	1333

HOT WATER AVAILABILITY TABLES

(Based on 140°F Hot Water with 40°F Cold Inlet Water)

One-Hour Availability (Recovery) for stored water

	Number of Units									
kW Each	1	2	3	4	5	6	7	8	9	10
5	20	41	61	82	102	123	143	164	184	205
7	29	57	86	115	143	172	201	229	258	287
9	37	74	111	148	184	221	258	295	332	369
11	45	90	135	180	225	270	315	361	406	451
14	57	115	172	229	287	344	402	459	516	574
18	74	148	221	295	369	443	516	590	664	738
22	90	180	270	361	451	541	631	721	811	901
28	115	229	344	459	574	688	803	918	1033	1147
32	131	262	393	524	656	787	918	1049	1180	1311

Two-Hour Availability (Recovery) for stored water

	Number of Units									
kW Each	1	2	3	4	5	6	7	8	9	10
5	41	82	123	164	205	246	287	328	369	410
7	57	115	172	229	287	344	402	459	516	574
9	74	148	221	295	369	443	516	590	664	738
11	90	180	270	361	451	541	631	721	811	901
14	115	229	344	459	574	688	803	918	1033	1147
18	148	295	443	590	738	885	1033	1180	1328	1475
22	180	361	541	721	901	1082	1262	1442	1623	1803
28	229	459	688	918	1147	1377	1606	1836	2065	2294
32	262	524	787	1049	1311	1573	1836	2098	2360	2622

Three-Hour Availability (Recovery) for stored water

	Number of Units									
kW Each	1	2	3	4	5	6	7	8	9	10
5	61	123	184	246	307	369	430	492	553	615
7	86	172	258	344	430	516	602	688	774	860
9	111	221	332	443	553	664	774	885	996	1106
11	135	270	406	541	676	811	946	1082	1217	1352
14	172	344	516	688	860	1033	1205	1377	1549	1721
18	221	443	664	885	1106	1328	1549	1770	1991	2213
22	270	541	811	1082	1352	1623	1893	2163	2434	2704
28	344	688	1033	1377	1721	2065	2409	2753	3098	3442
32	393	787	1180	1573	1967	2360	2753	3147	3540	3933

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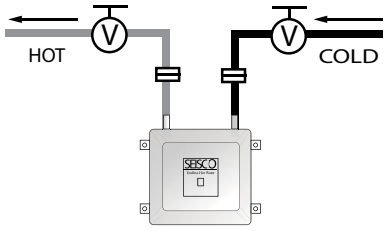
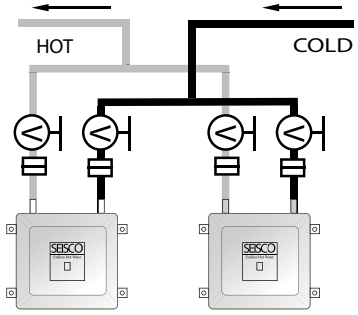
SINGLE OR MULTIPLE SEISCO MODELS WITH OR WITHOUT A BOOSTER HEATER



Singe Unit Installation

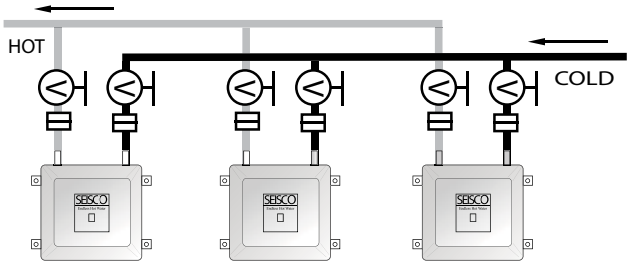
This is the standard piping diagram for a single Seisco in a commercial application.



Dual Unit Installation

This is the standard piping diagram for two Seisco units plumbed in parallel. For parallel installations, both Seisco heaters should be the same model.

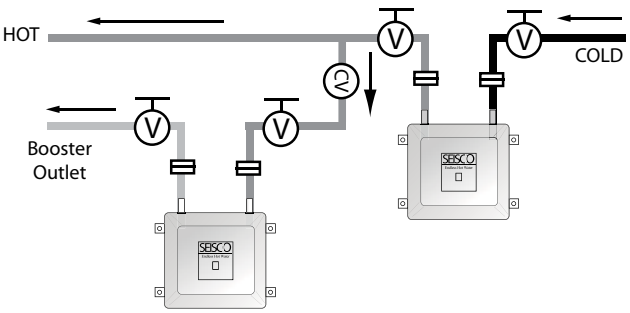
The thermostat setting of both heaters should be in the same position in order to balance the power of both heaters and maximize efficiency. This can be checked by measuring the amp flow through the heating element wires using an amp meter.



More Than Two Units

This is the standard piping diagram for three Seisco units plumbed in parallel. The reverse return piping method is required when three or more units are piped in parallel.

The thermostat setting of all heaters should be in the same position in order to balance the power of all heaters and maximize efficiency. This can be checked by measuring the amp flow through the heating element wires using an amp meter.



Primary Heater With Booster Heater

This is the standard piping diagram for a single Seisco and booster heater for high flow or two temperature applications. The flow rate of the primary heater must meet or exceed the maximum expected combined flow rates of all fixtures for both heaters. The booster heater must meet or exceed the maximum expected combined flow rate of fixtures connected to the booster heater. The booster heater can be any Seisco model that provides the additional heating capacity required by the maximum flow rate. Multiple heaters can be used as the primary or booster heater as long as they are plumbed in parallel.

BASIC RADIANT SPACE HEATING DESIGN CONSIDERATIONS

This Radiant Space Heating Product Guide is designed to help you understand how to apply Hydronic Heater™ in radiant space heating applications. It is not designed as an in-depth technical manual on designing hydronic space heating systems. To design a hydronic space heating system, SEISCO highly recommends that you contact a mechanical contractor or engineer trained in hydronic space heating design. This section of the Space Heating Product Guide is designed to give the user a brief overview of some of the issues that should be considered when using Hydronic Heaters in a space heating system.

SYSTEM TYPES

Five basic hydronic heating systems are common; radiant floor, radiant ceiling, fin tube baseboard, wall radiators, and forced air with a hydronic heating coil. Each system has its unique advantages and disadvantages. The current trend in the hydronic space heating market is toward radiant floor for space heating. Over the last 15-20 years, a market has developed using forced air with a hydronic heating coil located in the duct or right in the air handler itself. As consumers across the country have discovered the benefits and efficiency of hydronic heat, the popularity of hydronic radiant space heating has flourished, particularly the radiant floor version. Acceptance of flexible plastic tubing (PEX) in space heating applications for potable water has also grown.

COMPONENTS

The two main ingredients of every hydronic system are the heat source (gas, oil or electric) and the method of putting the heat into the living space or occupied zone. The occupied zone is the area in which we live, floor level to approximately 6 ½ feet above the floor.

The heat source in our case is one or more electric Hydronic Heaters. Since the maximum temperature of the heating fluid from the Hydronic Heater is 90°F to 145°F, this is a major design consideration. Radiant space heating using PEX tubing as the radiator generally requires a much lower heating fluid temperature than systems using wall and/or baseboard radiators. The length of the tubing as well as the spacing determines how much heat is radiated through the surrounding environment. Since PEX tubing lengths can be up to 300 ft for ½", the amount of surface area is high. With a high surface area for radiating heat, the temperature of the heating fluid can be lowered. However, in joist heating applications, the temperature may be higher 145°F.

The industry has rapidly reached a consensus that radiant floor space heating is the most comfortable method of heating a home, and it is more efficient than conventional forced air methods, **usually by more than 25%.** Many homes, particularly in the northeast, have used hydronic heating for years, usually with high temperature (above 170F°) systems. High temperature radiators have been around for many years, many of which use as the heating fluid. Using high temperature steam helps minimize the size of the radiator that must be installed in each room. These systems are infamous for making noise especially with prolonged usage over the years.

Finned tube baseboard radiators are very similar to wall radiators. The critical detail to remember is that the lower the heating fluid temperature, the more baseboard radiation surface will be required. With wall and baseboard radiators, burn hazards are always a concern due to accidentally rubbing against the radiator surface. Most products are now manufactured to minimize the hazard with the installation of radiation shields.

Forced air hydronic heating has gained more acceptance in southern climates than in northern climates. The downside is that some customers feel that the air exiting the grilles and registers (air outlets) is not hot enough. In reality, it contains adequate heat to heat the space but feels cool to the customer.

Heat transfer fluid is also a design consideration. hydronic heating systems may use 100% water or a water propylene glycol mixture, commonly 20-30% but as high as 50%. Composition of the heat transfer fluid affects pressure drop throughout the system. Systems utilizing 100% water as the heat transfer fluid may be potable or non-potable. While hybrid potable/space heating systems have grown in popularity over the last several years, they are still relatively new and may be

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BASIC RADIANT SPACE HEATING DESIGN CONSIDERATIONS - CONTINUED

rejected by some code jurisdictions and inspectors. However, this problem is slowly disappearing. Once again, as acceptance grows within the mechanical contractor community and more installers use hybrid systems, this niche market will continue to grow.

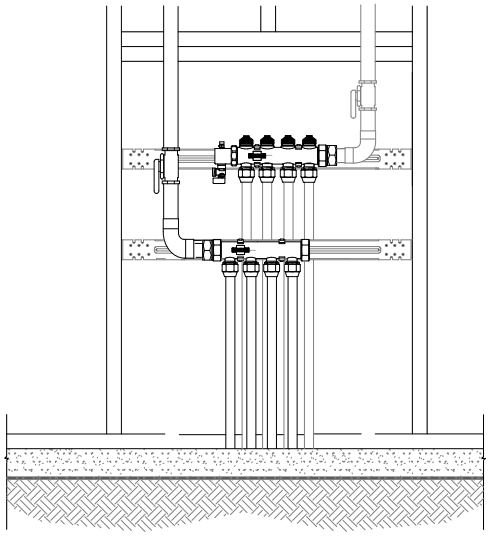
The size and type of PEX tubing used is also a consideration. PEX tubing is manufactured in many sizes. The smaller the tube diameter, the lower the flow rate and the higher the pressure drop throughout the system. Pressure drop and flow rate determine pump size. Tubing is also manufactured with a barrier to prevent oxygen diffusion. Oxygen diffusion is a process whereby dissolved oxygen permeates the walls of the tubing and enters the heating fluid. The oxygen then causes corrosion to components in the rest of the heating system, eventually causing component failures. The standard method of eliminating oxygen diffusion is to prevent oxygen from entering the system or to isolate system components that can corrode. The addition of corrosion inhibitors into heating systems has been a common practice for years.

Hydronic piping systems commonly use headers or manifolds as connections for supply and return lines. Headers allow a large amount of heating fluid to be pumped to a common location and then distributed throughout branches or loops of tubing. The ease of making tubing connections and flow control features of headers is a consideration. Flow control allows the installing contractor to accurately direct the flow of heat transfer fluid to various zones.

Zone control valves allow control of on and off flow of heating fluid to individual zones. A zone is a defined area that a single temperature controller regulates by turning on and off the flow of water. A zone may consist of one of more runs of tubing.

Temperature control components include thermostats that turn zones on and off as well as other electronic controls such as outdoor reset controls and computer controlled logic boards that monitor the entire heating system. Electronic control of the entire system is beyond the scope of this publication. As a matter of information, the Hydronic Heater controls temperature of the heating fluid (90°F -145°F) independently of the rest of the system. Since the Hydronic Heater modulates from 1-100% of full input, the set point of the Hydronic Heater automatically determines the outlet temperature on the Hydronic Heater. The heating system controls utilize the heat from the Hydronic Heater through pumping the heating fluid through various parts of the system as required by the heating system's main control board.

Other components of the system include air purgers, air separators, pump(s), fitting, pressure and temperature gauges, mixing and pressure relief valves, expansion tanks, valves for filling and draining the system, and more.



Sample Uponor Manifold Setup
(4 Loops)

Eliminating air is critical in hydronic space heating systems. Air and oxygen cause corrosion, improper flow of heating fluid throughout the system and a host of other problems. The main goal of air purgers or air separators is to trap and eliminate air. Pressure and temperature gauges allow the installer and user a way to monitor the system's operation.

BASIC RADIANT SPACE HEATING DESIGN CONSIDERATIONS - CONTINUED

Mixing valves, although rarely requried with hydronic heating models, serve two purposes. When used on the space heating side of the system, they reduce water temperature to the zone(s) they serve. When used in a potable water system, they reduce the temperature of water routed to domestic fixtures.

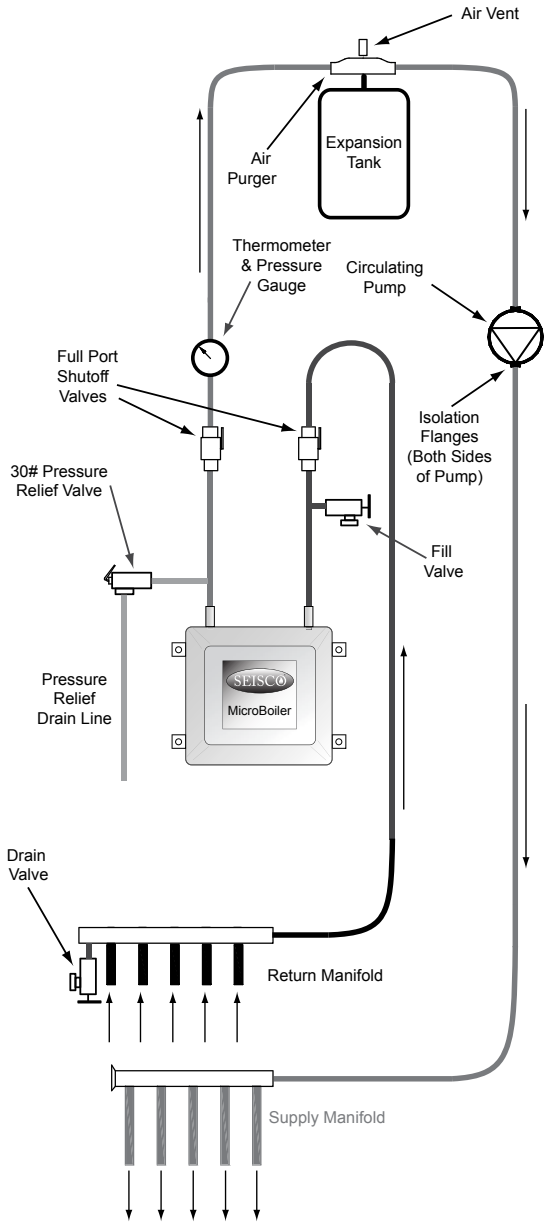
Expansion tanks are used to eliminate excessive pressure buildup in the system as the heating fluid expands and contracts due to heating cycles. Heating fluid expands when it is heated. Given no means for accommodating the expansion or relieving the pressure associated with expansion, the system pressure will quickly exceed the capability of the components to withstand the pressure causing a break in the weakest link of the system. The size of the expansion tank is based on the amount of fluid the system holds and the temperature rise of the heating fluid.

Pressure relief valves, not included with MicroBoilers, serve to protect the system should an overpressure situation occur. They are not designed as a control valve to constantly relieve pressure.

Consult with component suppliers for proper application of system components.

CONSTRUCTION METHODS

Installation of a hydronic heating system varies with the construction method of the structure and the timing of the installation. For example, if a home is constructed using slab on grade, the time to install the tubing for a floor system is during the construction of the slab. An insulating barrier and the tubing can be installed before the concrete is poured. If the home is already built and the owner wants to install a radiant floor heating system, the tubing can be installed on top of the slab with a thin layer of underlayment poured over the tubing. The finished floor is then installed over the underlayment. Other methods of installing radiant heating systems over an existing floor are also used.



Manufacturers provide various methods of installing tubing. The preferred method is poured in concrete or underlayment. This gives the system a very large thermal mass for storing, conducting, and radiating heat more uniformly throughout the structure.

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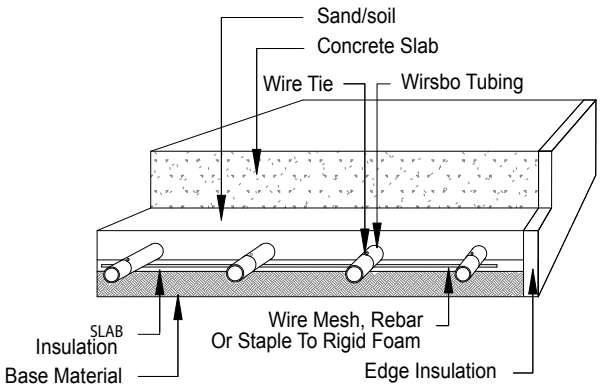
BASIC RADIANT SPACE HEATING DESIGN CONSIDERATIONS - CONTINUED

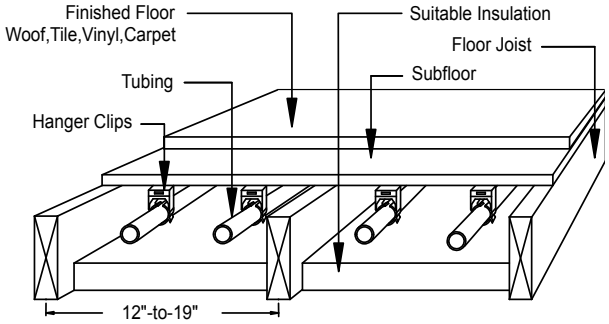
For other than ground floor applications (i.e. joist) and/or pier and beam installations, manufacturers offer a variety of hangers with or without metallic heat transfer/mounting plates. Tubing is installed in a channel in the plate and laid on the subfloor or attached to the subfloor from below. The heat transfer plates are used to conduct the heat away from the tubing and distribute it more evenly through the floor into the occupied zone.

Baseboard and wall radiator installations are similar. However, wall radiators are frequently attached to the wall, but may be attached to the floor. Finned tube baseboard radiators always run along the wall at the bottom. The drawback to baseboard radiators is that they tend to collect dust and dirt and can be difficult to clean. However, they can readily be hidden behind furniture, although not a recommended practice. Wall radiators are much more difficult to conceal but are easier to maintain. The merits of the comfort level provided by either are beyond the scope of this guide.

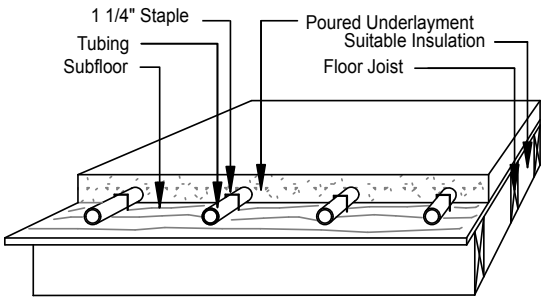
Although radiant ceiling systems are available, their popularity is low. In some instances, the temperature at head level is warmer than that at floor level, just the opposite of the most desirable situation. When the feet feel warm in a relatively warm to somewhat cool environment, the whole body feels more comfortable.



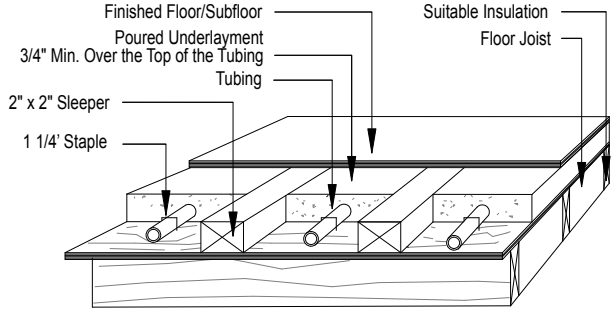
Slab On Or Below Grade Over a Sand Bed



Radiant Floor - Joist Using PEX Hanger Clips



Radiant Floor Heating - Poured Floor Underlayment on Suspended Wood Floor



Radiant Floor Heating - Poured Floor Underlayment Over a Suspended Wood Floor With Sleepers

Illustrations on this page represent several methods of installing radiant floor heating systems. Courtesy of Uponor.

BASIC RADIANT SPACE HEATING DESIGN CONSIDERATIONS - CONTINUED

HEAT LOSS CALCULATIONS

The single most difficult part of system design is the process of calculating the heat load (loss) on the structure. Because of the difficulty in manually calculating the heat loss of a structure, computer programs have been developed to help the system designer avoid errors of overlooking critical heat loss issues and to automatically calculate heat loss based on electronic forms that are designed for input of all the critical variables. Even with computers, every structure is different and a good working knowledge of heat flux and hydronic systems is necessary.

At a simplified level, heat loss occurs in three basic forms: downward into the surrounding earth, outward from the walls and upward through the roof. Another consideration is infiltration of external air. The number of windows, doors and other wall and ceiling penetrations affect heat loss. Other critical variables are the temperature of the surrounding environment as well as the insulating value of barriers designed to reduce heat loss such as foam insulated walls, etc.

MAXIMUM BTU/FT^2 HEAT LOAD AND BTU/FT^2 INPUT REQUIREMENT

Armed with accurate heat loss calculations, the system designer can then determine the appropriate heat transfer method to achieve the ultimate desired comfort level. For example, the BTU input required to offset the Btu losses determines the size of wall radiators and length of baseboard radiators. Both are also dependent on the temperature of the heating fluid. All manufacturers provide performance charts that clearly guide the system designer to the right product configuration for the heat loss requirement and the design temperature of the heating fluid.

In the case of radiant floor heating, the system designer has the option of adding or subtracting tubing based on the amount of heat required. When more tubing is required in order to increase the amount of heat surface transfer area, the spacing between loops is narrowed. When less tubing is required, the spacing between loops is increased. Common spacing of loops is 6, 9, and 12”, although there is no scientific rule that says it must be this way. The system designer is free to alter the spacing as they see fit based on the calculated heat loss or personal experience. However, some system components are designed for specific tube spacing. The system designer should check for component compatibility before changing the tube spacing outside the norm.

In addition to tube spacing, the designer may concentrate more tubing in high traffic areas or near large heat loss sources such as windows and doors. Tubing layout can vary tremendously. A serpentine layout may follow one wall or two. It could follow a reverse flow or one way flow pattern. The ultimate goal is to provide a tubing layout that puts the most heat near the location of the largest heat losses.

HEATING FLUID FLOW

The system designer not only selects the water temperature, but also the flow rate. The flow rate is normally determined by the desired difference between the temperature of the heating fluid when it leaves the heat source to where it enters the heat source. The temperature difference is call the differential, rise, drop, or change in temperature, depending on the point of reference when referring to temperature differences in the system. Depending on the type of system, it is normally designed for a differential temperature or temperature drop or 10-20°F. In radiant floor heating the differential is usually 10-15°F. In wall and baseboard radiators, it could be over 20°F. In forced air hydronic systems it will be in the 10-40°F degree range. The flow rate of heating fluid throughout the system determines the pressure drop through components in the system, pipes, tubing, valves, etc. Pressure drop and flow rate are the determining factors in selecting pumps for the heating system.

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BASIC RADIANT SPACE HEATING DESIGN CONSIDERATIONS - CONTINUED

BASIC SYSTEM DESIGN

Basic system design consists of the following:

- Determine the basic characteristics of the structure and the desired heating method.
- Perform accurate calculations of the anticipated heat loss (load).
- Evaluate the installation characteristics of the selected heating method. For example, in radiant floor heating, the type of floor, its insulating value (resistance to heat flow), the method of installing tubing, and the desired floor temperature must all be taken into account.
- Use heat loss calculations and the equipment supplier's performance data to determine the correct system design temperature and select the products that perform adequately to do the job. For example, in radiant floor heating, the tube diameter must be selected, the tube spacing, and the heating fluid temperature must be finalized.
- Using the flow requirements of the selected equipment and information from other system components, the pressure drop is calculated and a pump is selected that will overcome the pressure drop at the required flow rate.

The above system design explanation is very simplified and is designed to give users of Hydronic Heater a brief overview of how systems are designed. Other factors will be considered by the system designer, such as the required pumping methodology. Many systems only require one pump. However, some systems require multiple pumps, arranged in a primary/secondary piping system as shown on page 26.

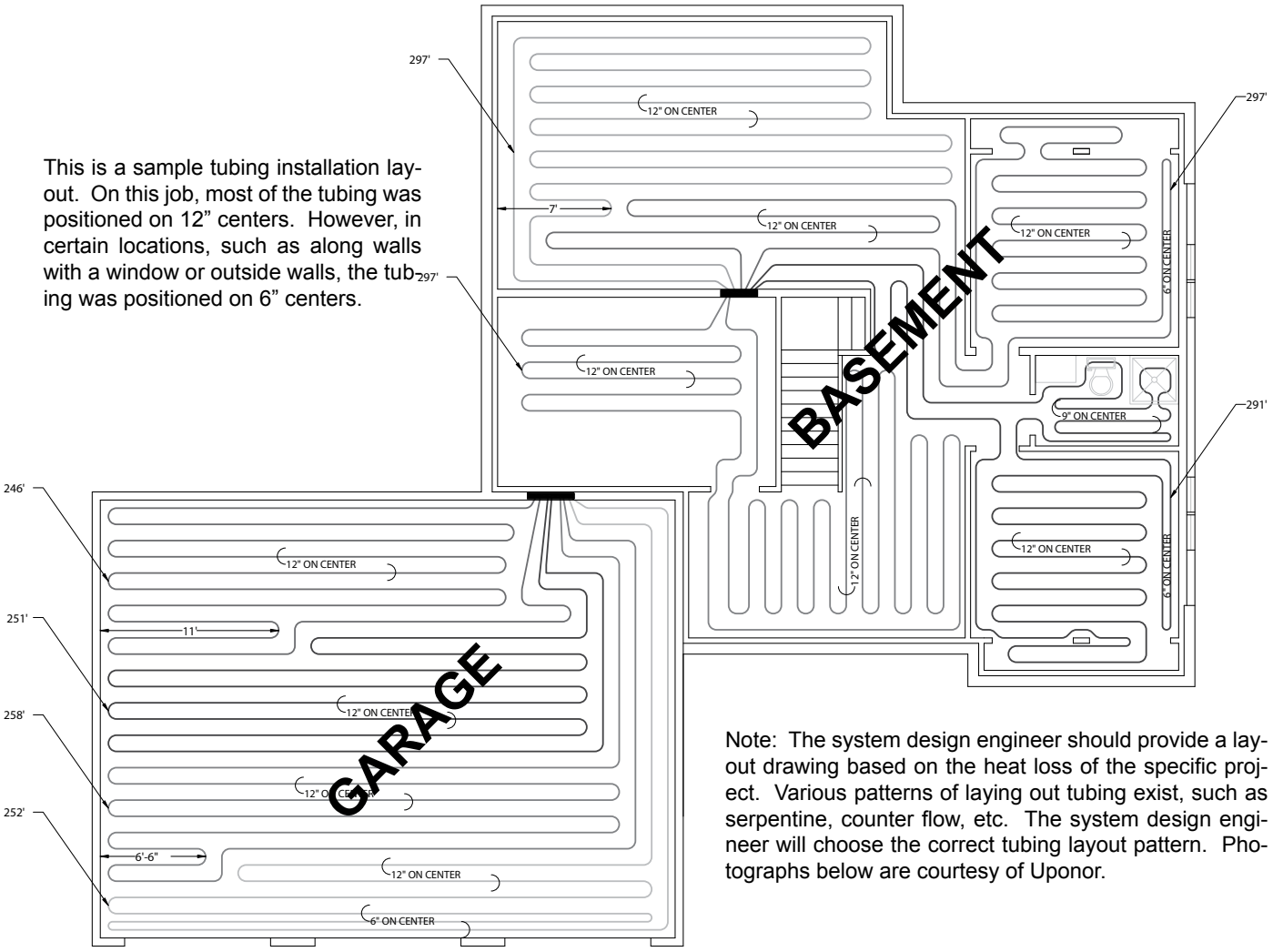
APPLICATION OF HYDRONIC HEATERS

Determining which Hydronic Heater fits the application requires three considerations:

- What is the heat input requirement? Heat input and output are considered the same for Hydronic Heaters. Heat produced by the heating elements is transferred to the hydronic system's heating fluid. When the heat input requirement exceeds the capability of one Hydronic Heater, multiple units can be installed. Multiple units can also be installed in primary/secondary piping or for use in different zones of the heating system.
- What is the design temperature of the system's heating fluid? Hydronic Heaters are designed for use in systems with maximum temperatures of 145°F.
- What is the flow rate through the Hydronic Heater? If the flow rate exceeds the Hydronic Heater's ability, several Hydronic Heaters can be used in a primary/secondary piping configuration to reduce the individual flow rate through each unit. Generally speaking, as long as the flow rate is below 10 gpm, the pressure drop will be less than 2.5 psi or 6 ft of head.

SAMPLE TUBING LAYOUT FOR A RADIANT FLOOR SPACE HEATING PROJECT

This is a sample tubing installation layout. On this job, most of the tubing was positioned on 12" centers. However, in certain locations, such as along walls with a window or outside walls, the tubing was positioned on 6" centers.



Note: The system design engineer should provide a layout drawing based on the heat loss of the specific project. Various patterns of laying out tubing exist, such as serpentine, counter flow, etc. The system design engineer will choose the correct tubing layout pattern. Photographs below are courtesy of Uponor.

Photography on this page courtesy of Watts Radiant.

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HOW TO SELECT THE RIGHT MODEL HYDRONIC HEATER FOR YOUR PROJECT

Using Tables To Select Hydronic Heaters

The scope of this Space Heating Application Guide does not allow for every system configuration to be tabulated. However, the tables that follow allow the user to determine the correct Hydronic Heater and pump for many applications that use 1/2" ID PEX tubing. This is the most popular size tubing used for radiant space heating due to its cost and performance characteristics as well as its ease of installation.

To use the tables on pages 18-23, you must know:

1. The size of the project in square feet.
2. The tables are based on tubing spaced on 12" centers
3. The water temperature differential, 10 or 20°F.
4. The heat load/ft^2: 10, 15, 20, 25, or 30°F.

Note: When calculating input, SEISCO, Inc. adds 20% to the actual calculated heat load. This allows the Hydronic Heater to operate at less than full input almost 100% of the time. It does not increase the amount of electricity used in the heating process. This also assists the system with a heat boost on cold start up.

To use the tables:

1. Locate the table that use the system's design temperature differential. Table 1 uses 10°F while Table 2 uses 20°F.
2. Locate the portion of the table that uses the correct BTU/ft^2 heat load.
3. Use the first column to locate the project's total square feet of heated area.
4. Read across the table and identify theSEISCO model and the pump model required.
5. If the tube spacing is 9" on center, multiply the project square feet by 1.5 and use the newly calculated square footage as the Project Square Feet in column 1. Repeat steps 3-4.
6. If the tube spacing is 6" on center, multiply the project square feet by 2 and use the newly calculated square footage as the Project Square Feet in column 1. Repeat step 3-4 to select the SEISCO and pump.
7. When the square footage value exceeds the maximum Project Square Feet in column one, you must manually size and design the entire radiant floor space heating job and use the procedure for selecting the Hydronic Heater that follows.

Manually Selecting Hydronic Heaters

As explained earlier in this Space Heating Product Guide, application of Hydronic Heaters is simply a function of heat input/output required for the structure and the pumping requirements of the system.

Therefore, after the system designer has determined the required heat input/output, the Hydronic Heater is selected as follows:

1. Convert total BTUs requirements to KW if necessary, (BTU/3413)=KW.
2. Multiply the required input/output by 1.20
3. Select the Hydronic Heater that has an input equal to or greater than the KW calculated in step 2.
4. Identify the pump rate in gallons/minute that must be pumped through the Hydronic Heater and refer to the pressure drop charts on page nine to determine the pressure loss through the Hydronic Heater at the system's designed pump rate.
5. If the pressure drop is too high, divide the total KW calculated in step 2 by 2.
6. Select a Hydronic Heater that has an input equal to or greater than the KW calculated in step 5. Two units will be required for the job preferrably using primary/secondary pumping.*
7. Divide the pump rate in gallons/minute found in step 4 by 2, and look up the new pressure drop for the model selected in step 6.
8. Select the pump that best fits the gpm and pressure requirements

Note: Hydronic Heaters are designed for a maximum temperature of 145°F. Always make sure the heating fluid temperature designed for the system is equal to or less than 145°F. If the pump rate is below 10 gpm, the pressure drop will be less than 2.5 psi or 6 feet of head, a rate that is usually negligible.

*In multi SEISCO installations, if each SEISCO is not supplied by its own circulating pump, a flow regulating plug cock should be installed with a bypass line to adjust equal flow through each SEISCO. The flow through each SEISCO can be checked while the system is in operation by measuring the amp draw of the heating elements while the SEISCO operates. The amperage should be the same for all SEISCO's. If not, adjust the flow through each SEISCO until the amperage readings are equal, thus assuring equal flow through all Hydronic Heaters.

RADIANT FLOOR SYSTEM SIZING TABLES

Table 1-10°F. Temperature Differential, 120°F. Water Temperature, 1/2" Tubing, 12" On Center, 100% Water

Project Square Feet	Number of Loops	Loop Length*	BTU Heat Load	Heater Min** kW Rating	Total Feet of Head	Grundfos Pump Model	Armstrong Pump Model	Taco Pump Model
10 BTU/Ft² (.61 gpm flow through each loop)								
275	1	300	3300	1.0	7.13	UPS15-58F	Astor 30	005-F2
550	2	600	6600	2.0	7.13	UPS15-58F	Astor 30	005-F2
825	3	900	9900	3.0	7.13	UPS15-58F	Astor 30	005-F2
1100	4	1200	13200	3.9	7.13	UPS15-58F	Astor 30	005-F2
1375	5	1500	16500	4.9	7.13	UPS15-58F	Astor 30	005-F2
1650	6	1800	19800	5.9	7.13	UPS15-58F	Astor 30	005-F2
1925	7	2100	23100	6.8	7.13	UPS15-58F	Astor 30	005-F2
2200	8	2400	26400	7.8	7.13	UPS15-58F	Astor 30	005-F2
2475	9	2700	29700	8.8	7.13	UPS15-58F	Astor 30	005-F2
2750	10	3000	33000	9.7	7.13	UPS15-58F	Astor 30	005-F2
15 BTU/Ft² (.91gpm flow through each loop)								
275	1	300	4950	1.5	11.5	UPS15-58F	Astor 30	0010-F3
550	2	600	9900	3.0	11.5	UPS15-58F	Astor 30	0010-F3
825	3	900	14850	4.4	11.5	UPS15-58F	Astor 30	0010-F3
1100	4	1200	19800	5.9	11.5	UPS15-58F	Astor 30	0010-F3
1375	5	1500	24750	7.3	11.5	UPS15-58F	Astor 30	0010-F3
1650	6	1800	29700	8.8	11.5	UPS15-58F	Astor 30	0010-F3
1925	7	2100	34650	10.2	11.5	UPS15-58F	Astor 30	0010-F3
2200	8	2400	39600	11.7	11.8	UPS15-58F	Astor 50	0010-F3
2475	9	2700	44550	13.1	12.2	UPS15-58F	Astor 50	0010-F3
2750	10	3000	49500	14.4	11.7	UPS15-58F	Astor 50	0010-F3
20 BTU/Ft² (1.2 gpm flow through each loop)								
275	1	300	6600	2.0	17.3	UP26-64F	Astor 50	0014-F1
550	2	600	13200	3.9	17.3	UP26-64F	Astor 50	0014-F1
825	3	900	19800	5.9	17.3	UP26-64F	Astor 50	0014-F1
1100	4	1200	26400	7.8	17.3	UP26-64F	Astor 50	0014-F1
1375	5	1500	33000	9.7	17.3	UP26-64F	Astor 30	0014-F1
1650	6	1800	39600	11.7	17.5	UP26-64F	Astor 30	0014-F1
1925	7	2100	46200	13.6	18.1	UP26-64F	Astor 30	0014-F1
2200	8	2400	52800	15.5	18.3	UP26-64F	Astor 30	0014-F1
2475	9	2700	59400	17.5	21.0	UP26-64F	E13	0014-F1
2750	10	3000	66000	19.4	24.5	UP26-96F	E13	0014-F1

*Loop length includes floor loop length plus supply/return leader
**Select Seisco Radiant Model of specified size or larger. Radiant models available in single, two and four chamber

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RADIANT FLOOR SYSTEM SIZING TABLES

Table 1 Continued-10°F. Temperature Differential, 120°F. Water Temperature, 1/2" Tubing, 12" On Center, 100% Water

Project Square Feet	Number of Loops	Loop Length*	BTU Heat Load	Heater Min** kW Rating	Total Feet of Head	Grundfos Pump Model	Armstrong Pump Model	Taco Pump Model
25 BTU/Ft² (1.52 gpm flow through each loop)								
275	1	300	8250	2.5	24.3	UP26-99F	E11	0011-F4
550	2	600	16500	4.9	24.3	UP26-99F	E11	0011-F4
825	3	900	24750	7.3	24.3	UP26-99F	E11	0011-F4
1100	4	1200	33000	9.7	24.3	UP26-99F	E11	0011-F4
1375	5	1500	41250	12.1	24.7	UP26-99F	E11	0011-F4
1650	6	1800	49500	14.6	24.5	UP26-99F	E11	0013-F3
1925	7	2100	57750	17.0	27.6	UP26-99F	E11	0013-F3
2200	8	2400	66000	19.4	32.0	P/S	E9	P/S
2475	9	2700	74250	21.8	38.0	P/S	E12	P/S
2750	10	3000	82500	24.2	45.5	P/S	E12	P/S
30 BTU/Ft² (1.82 gpm flow through each loop)								
275	1	300	9900	3.0	32.5	P/S	E9	0013-F3
550	2	600	19800	5.39	32.5	P/S	E9	0013-F3
825	3	900	29700	8.8	32.5	P/S	E9	0013-F3
1100	4	1200	39600	11.7	32.7	P/S	E9	P/S
1375	5	1500	49500	4.9	32.7	P/S	E9	P/S
1650	6	1800	59400		36.5	P/S	E9	P/S
1925	7	2100	69300		42.3	P/S	E12	P/S
2200	8	2400	79200		50.4	P/S	P/S	P/S
2475	9	2700	89100		60.5	P/S	P/S	P/S
2750	10	3000	82500		64.6	P/S	P/S	P/S

Table 1 Notes: Maximum loop length is 300'. Head includes tubing loss as well as loss through the Hydronic Heater. P/S = Use primary/secondary pump arrangement.

*Loop length includes floor loop length plus supply/return leader.

** Select Seisco Radiant Model of specified size or larger. Radiant models available in single, two and four chamber. For requirements greater than 25kW, use two heaters of equal size.

RADIANT FLOOR SYSTEM SIZING TABLES

Table 2 Continued-20°F. Temperature Differential, 120°F. Water Temperature, 1/2" Tubing, 12" On Center, 100% Water

Project Square Feet	Number of Loops	Loop Length*	BTU Heat Load	Heater Min** kW Rating	Total Feet of Head	Grundfos Pump Model	Armstrong Pump Model	Taco Pump Model
35 BTU/Ft² (1.06 gpm flow through each loop)								
275	1	300	11550	3.4	13.6	UPS15-58F	Astor 30	008-F6
550	2	600	23100	6.8	13.6	UPS15-58F	Astor 30	008-F6
825	3	900	34650	10.2	13.6	UPS15-58F	Astor 30	008-F6
1100	4	1200	46200	13.6	13.6	UPS15-58F	Astor 30	008-F6
1375	5	1500	57750	16.9	12.5	UPS15-58F	Astor 30	008-F6
1650	6	1800	69300	20.4	11.9	UPS15-58F	Astor 30	008-F6
1925	7	2100	80850	23.7	11.9	UPS15-58F	Astor 30	008-F6
2200	8	2400	92400	27.1	12.7	UP26-64F	Astor 70	008-F6
2475	9	2700	103950	30.5	14.2	P/S	P/S	P/S
2750	10	3000	115500	33.9	16.5	P/S	P/S	P/S
40 BTU/Ft² (1.21 gpm flow through each loop)								
275	1	300	13200	3.9	17.3	UP26-64F	Astro 50	0014-F1
550	2	600	26400	7.8	17.3	UP26-64F	Astro 50	0014-F1
825	3	900	39600	11.7	17.3	UP26-64F	Astro 50	0014-F1
1100	4	1200	52800	15.5	15.9	UP26-64F	Astro 50	0014-F1
1375	5	1500	66000	19.4	15.9	UP26-64F	Astro 50	0014-F1
1650	6	1800	79200	23.3	15.9	UP26-64F	Astro 50	0014-F1
1925	7	2100	92400	27.1	16.7	UP26-64F	Astro 50	0014-F1
2200	8	2400	105600	31.0	18.5	P/S	P/S	P/S
2475	9	2700	118800	34.9	21.2	P/S	P/S	P/S
2750	10	3000	132000	38.7	24.8	P/S	P/S	P/S

Table 1 Notes: Maximum loop length is 300'. Head includes tubing loss as well as loss through the Hydronic Heater. P/S = Use primary/secondary pump arrangement.

*Loop length includes floor loop length plus supply/return leader.

**Select Seisco Radiant Model of specified size or larger. Radiant models available in single, two and four chamber

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RADIANT FLOOR SYSTEM SIZING TABLES

Table 2 Continued-20°F. Temperature Differential, 120°F. Water Temperature, 1/2" Tubing, 12" On Center, 100% Water

Project Square Feet	Number of Loops	Loop Length*	BTU Heat Load	Heater Min** kW Rating	Total Feet of Head	Grundfos Pump Model	Armstrong Pump Model	Taco Pump Model
45 BTU/Ft² (1.36 gpm flow through each loop)								
275	1	300	14850	4.4	20.7	UP26-64F	Astor 50	0014-F1
550	2	600	29700	8.8	20.7	UP26-64F	Astor 50	0014-F1
825	3	900	44550	13.1	20.7	UP26-64F	Astor 50	0014-F1
1100	4	1200	59400	17.5	19.2	UP26-64F	Astor 70	0014-F1
1375	5	1500	74250	21.8	19.2	UP26-64F	Astor 70	0011-F4
1650	6	1800	89100	26.2	19.8	UP26-96F	E7	0011-F4
1925	7	2100	103950	30.5	21.6	P/S	P/S	P/S
2200	8	2400	118800	34.9	24.6	P/S	P/S	P/S
2475	9	2700	133650	39.2	28.7	P/S	P/S	P/S
2750	10	3000	148500	43.6	34.1	P/S	P/S	P/S
50 BTU/Ft² (1.52 gpm flow through each loop)								
275	1	300	16500	4.9	24.3	UP26-96F	Astor 70	0011-F4
550	2	600	33000	9.7	24.3	UP26-96F	Astor 70	0011-F4
825	3	900	49500	14.6	24.4	UP26-96F	Astor 70	0011-F4
1100	4	1200	66000	19.4	23.0	UP26-96F	E7	0011-F4
1375	5	1500	82500	24.2	23.0	UP26-96F	E7	0011-F4
1650	6	1800	99000	29.1	24.5	P/S	P/S	P/S
1925	7	2100	115500	33.9	27.6	P/S	P/S	P/S
2200	8	2400	132000	38.7	32.0	P/S	P/S	P/S
2475	9	2700	148500	43.6	38.0	P/S	P/S	P/S
2750	10	3000	165000	48.4	45.5	P/S	P/S	P/S

Table 1 Notes: Maximum loop length is 300'. Head includes tubing loss as well as loss through the Hydronic Heater. P/S = Use primary/secondary pump arrangement.

*Loop length includes floor loop length plus supply/return leader.

** Select Seisco Radiant Model of specified size or larger. Radiant models available in single, two and four chamber.

INTRODUCTION TO PIPING DIAGRAMS

Location: The best practice is to locate the Hydronic Heater in a central location that minimizes tubing runs between manifold headers and the Hydronic Heater. Location for easy access for servicing and setup during the installation process is also desirable.

Piping/Pumping Methods: For most jobs, the Hydronic Heater will be piped in a standard configuration using one circulating pump for moving heating fluid throughout the entire radiant heating system. This works well up to 10 gpm as the pressure drop through the Hydronic Heater is low. Pumping the entire flow of the heating system through the Hydronic Heater is not a problem as long as the pressure drop does not become an issue. This piping application is shown on page 25.

However, when flow rates increase above a desirable pressure drop, two or more Hydronic Heaters may be used in parallel. This effectively divides the flow rate by the number of Hydronic Heaters.

As an alternative, a primary/secondary pumping method may be used. In a primary/secondary system, the pumps that circulate heating fluid through the radiant heating system do not circulate the heating fluid through the Hydronic Heater(s). The system circulating pumps route return water through a main system header that travels past the Hydronic Heater(s). A separate pump draws

heating fluid from the main header and routes it through the Hydronic Heater(s) where it is heated and immediately returned to the main header, mixing with the balance of the bypassed water.

The piping diagram on page 26 is a typical primary/secondary pumping application. In the example diagram, six separate pumps are used in the system. Each of three zones has its own circulating pump. Each Hydronic Heater also has its own circulating pump.

Many other applications and piping arrangements are available that are not shown in this Space Heating Product Guide. Refer to your local profession radiant system designer for specifics involving your project.

Hydro-heat System or Radiant Heating System With Plate Heat Exchanger: When sizing the pump for a hydro-heat system the pressure loss through the coil, all system components and the Hydronic Heater are added together. The flow rate is established by the requirements of the heating coil. When a plate heat exchanger is used as shown on page 28, at least two pumps are always used, one to circulate hot water between the Hydronic Heater and the plate heat exchanger and one to circulate non-potable heating fluid throughout the radiant heating system. The requirements for each pump are determined separately.

Left photo courtesy of Watts Radiant, right photo courtesy of Uponor.

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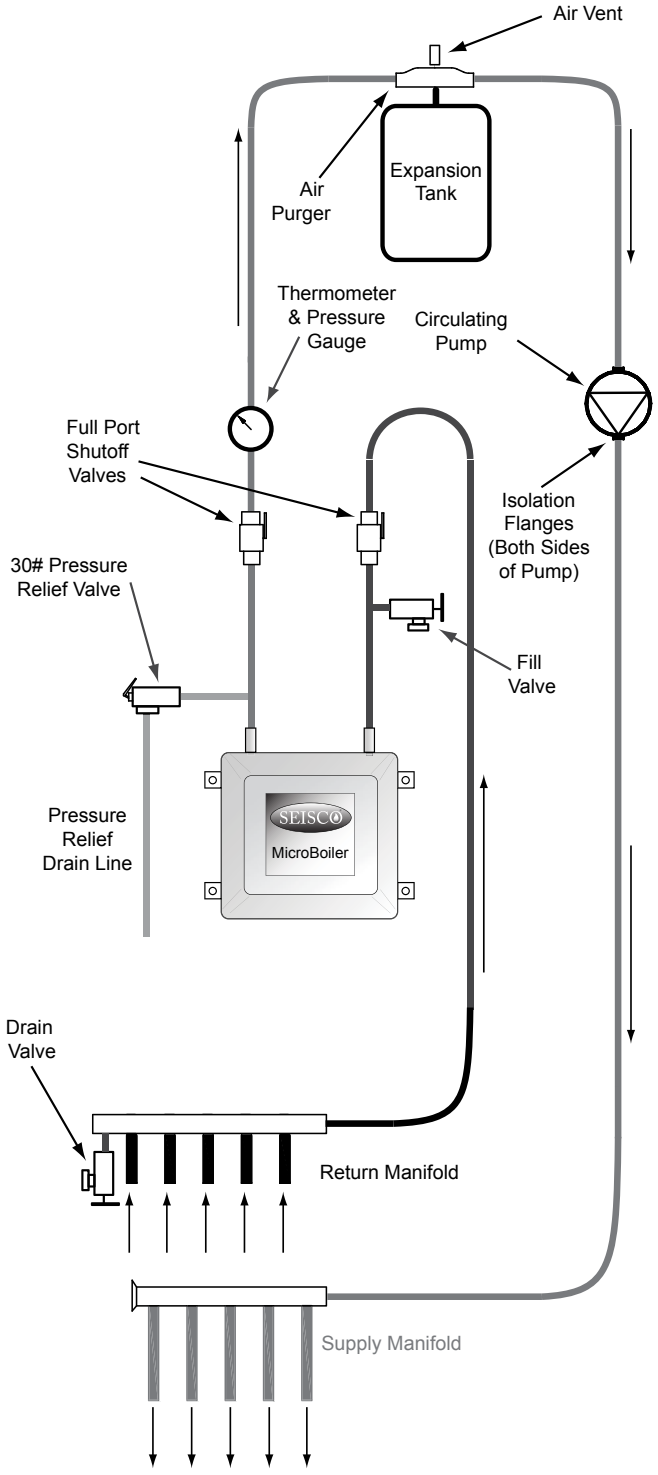
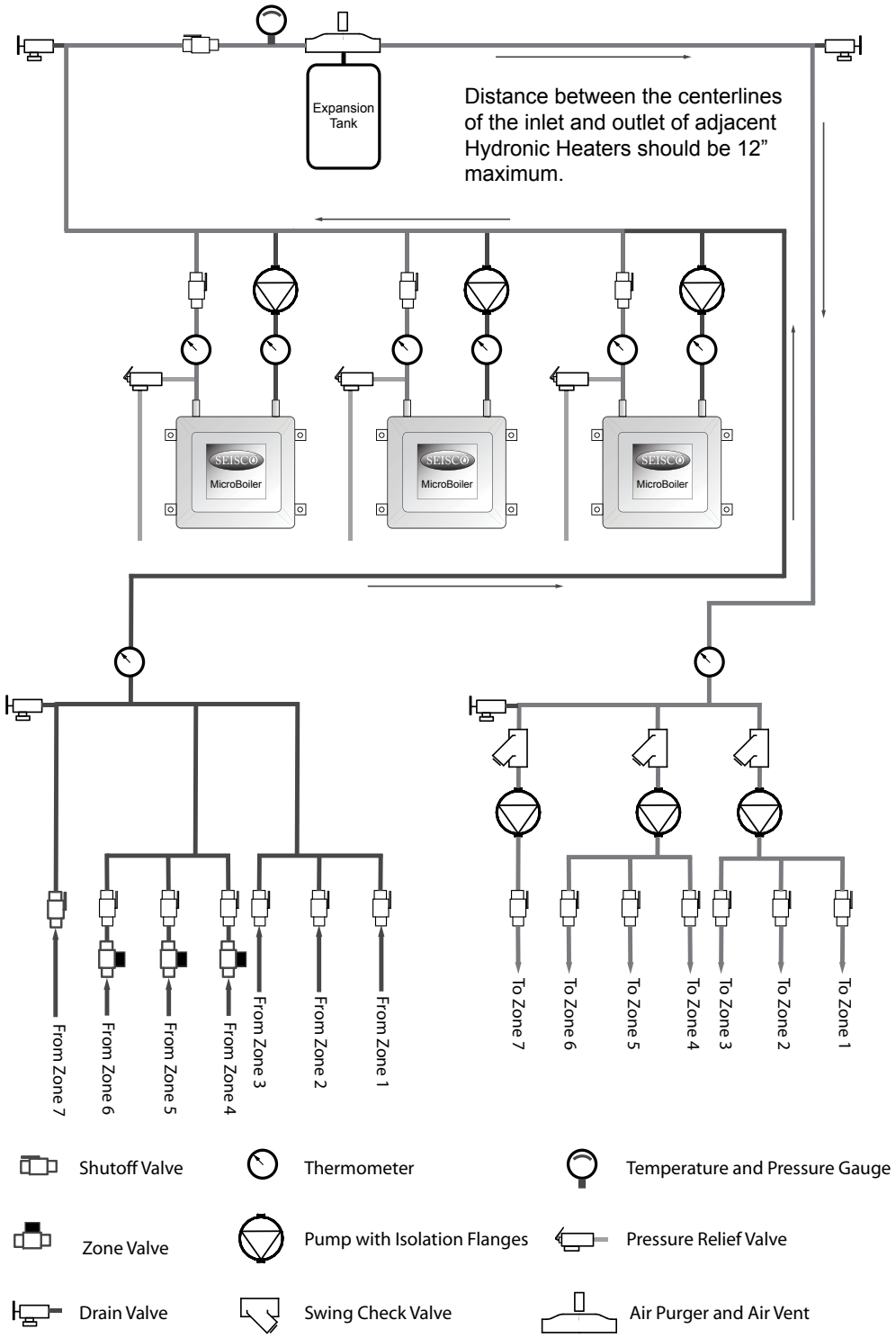
HYDRONIC HEATER PIPED FOR RADIANT FLOOR SPACE HEATING USING PRIMARY PUMPING SYSTEM



Note: All heating fluid is circulated through the Hydronic Heater. See Model Selection tables for limitations of this piping application.

MULTIPLE HYDRONIC HEATERS PIPED FOR RADIANT FLOOR SPACE HEATING USING PRIMARY/SECONDARY PUMPING SYSTEM



Note: Each Hydronic Heater has its own circulating pump. All heating fluid is not circulated through each Hydronic Heater. See Model Selection tables for using this piping application.

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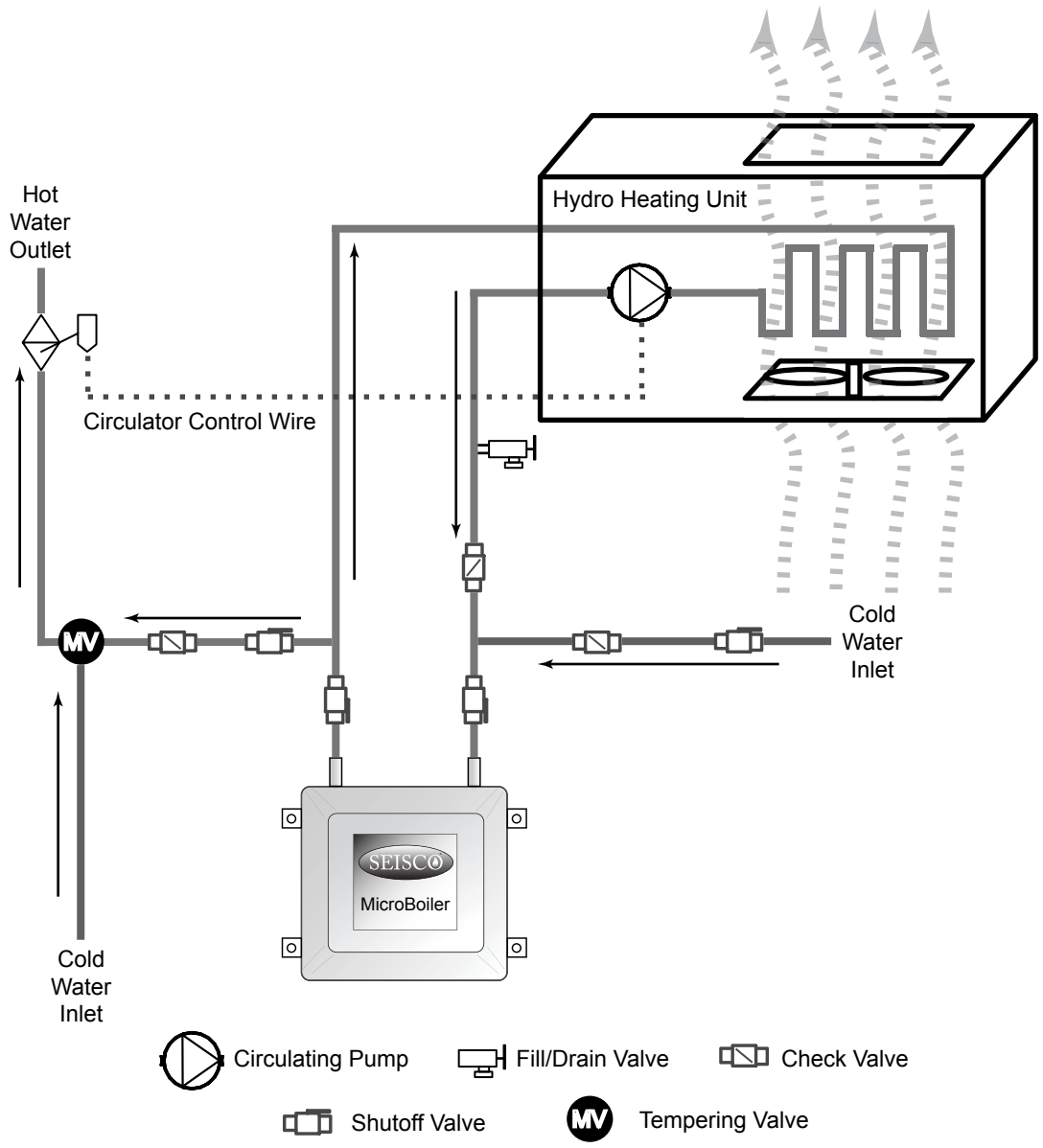
COMBINED DOMESTIC HOT WATER AND HYDRO-HEAT

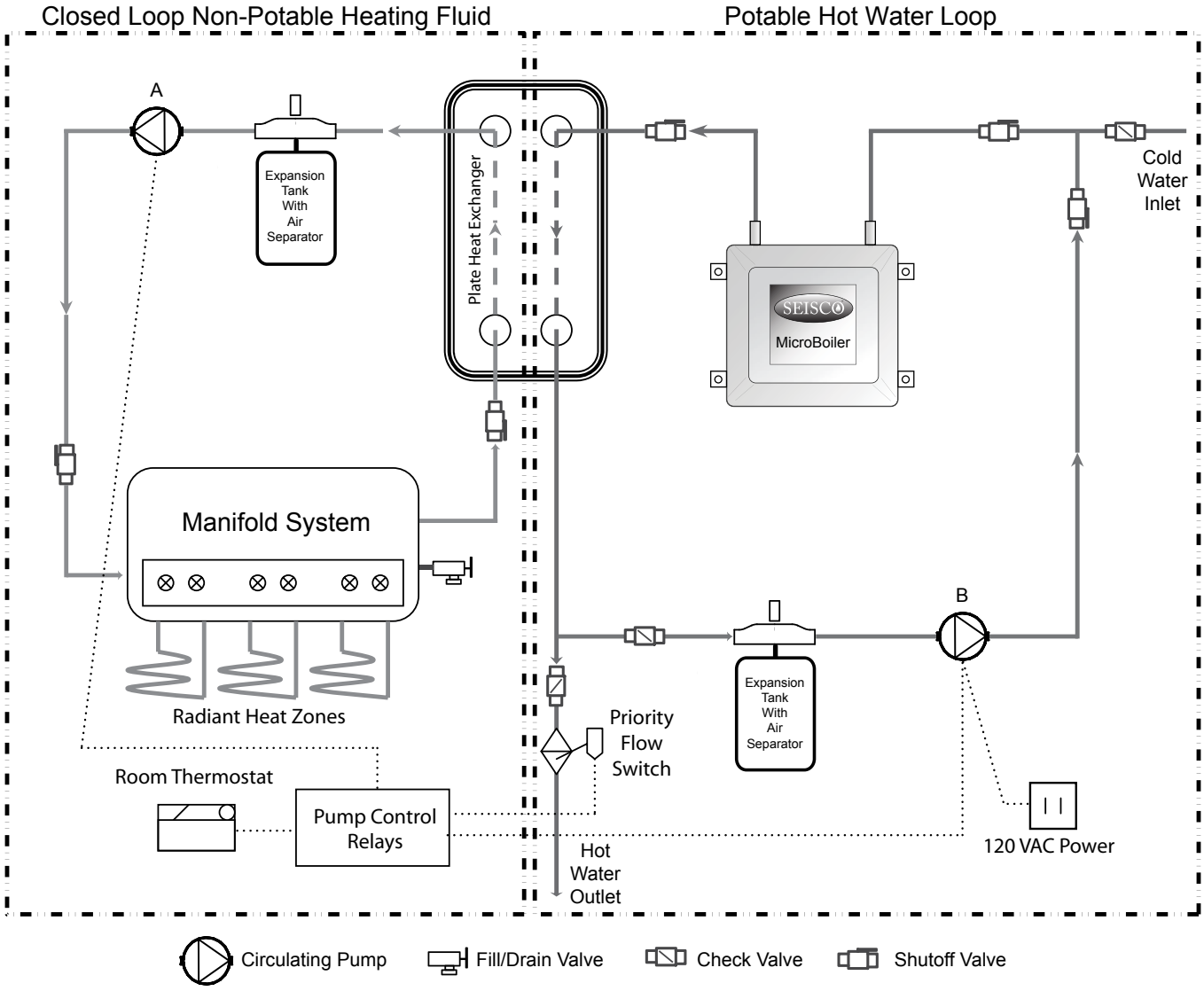


Hydro-heat systems are generally used for apartments and condominiums throughout the central and southern regions of the United States. Typically, the BTU ratings for these systems range from approximately 27,000 to 40,000 BTU. Hydronic Heater Model SH-28 is rated for over 96,000 BTU output.

For the Hydro-heat system to obtain it's maximum BTU rating, the Hydronic Heater temperature setting should be set between 125° and 135°F.

The priority flow switch can be replaced with a surface mounted thermostat. Either one serves the same function of turning off both circulating pumps when domestic hot water flow is sensed, giving domestic hot water priority over space heating.

COMBINED DOMESTIC HOT WATER AND RADIANT HEAT WITH SEISCO PRIORITY SYSTEM USING NON-POTABLE HEATING FLUID



SPACE HEATING OPERATION: When the room thermostat calls for heat, both circulating pumps 'A' & 'B' will turn on. Pump 'B' circulates water through the Hydronic Heater creating heated water that flows through the plate heat exchanger. Heat is transferred to the closed loop radiant floor heating system and circulated by pump 'A' until the thermostat is satisfied. When satisfied, the room thermostat will signal both pumps to turn off.

DOMESTIC HOT WATER OPERATION: The priority flow switch will sense flow while domestic hot water is being used and prevent pumps 'A' & 'B' from turning on. The circulating pumps will not turn on until the demand for domestic hot water stops, even if the room thermostat calls for heat.

The priority flow switch can be replaced with a surface mounted thermostat. Either one serves the same function of turning off both circulating pumps when domestic hot water flow is sensed, giving domestic hot water priority over space heating.

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GENERAL ELECTRICAL INFORMATION

Electrical Service-Like most electric storage tank water heaters, Seisco requires a supply circuit voltage nominally rated for 220- 240 volts (VAC) (or 208 VAC). Some models require multiple double pole circuits and breakers (see the chart below for 240 volt electrical ratings and requirements). Models rated for 208 volt service are available. Refer to the appendix in this publication and consult the factory before ordering 208 volt models.

In the U.S., Seisco residential water heaters are considered a non-continuous heating appliance according to the National Electric Code, sections 410 and 411. An appliance load that is not continuous for 3 hours or more is considered non-continuous. Due to the diversity of hot water usage in the home, the load (amps) contribution of the Seisco to the overall service load of the home can be calculated using the optional methods from the National Electrical Code, sections NEC 220.82 or 220.83. The methods and rules for calculating these loads can be found in the *Electrical Requirements* section of this product guide.

For new residential dwellings, the service load should be calculated using NEC 220.82. For existing residential dwellings, the service load should be calculated using NEC 220.83. By both calculation methods, the Seisco load is added to the service load at 40% of it's maximum nameplate rating. For example, the maximum current (amp) rating of the Seisco Model RA-28 is 116 amps, 40% of which is about 47 amps., the amount added to the overall service load of the dwelling when using the optional calculation methods as described in NEC 220.82 and 220.83. As a result, the Seisco Model RA-28 will fit in most homes up to 3500 square feet that have a 150-200 amp electrical service.

Sub-panels-Electrical sub-panels, containing circuit breakers, may be used with appliances such as the Seisco water heater in residential and commercial applications. Particularly for the models requiring multiple circuits, (see chart on this page).

In new residential construction, there are usually enough spaces for additional breakers in the main electrical panel to accommodate multiple circuit breakers for Seisco. However, in existing homes, the main electrical panel may be nearly full with circuit breakers serving existing loads. In these cases, a single large breaker, rated for the entire load of the Seisco heater, can be installed at the main panel.

From the main panel, a single circuit or sub-feed is then installed to a sub-panel where the appropriate number of circuit breakers can be installed for the Seisco heater. Refer to the electrical wiring & breaker diagrams in this section for options that can be used to serve various Seisco models requiring multiple circuits.

Branch Circuits and Breakers-Water Heaters: SEISCO Water Heaters ("RA" Models) are considered a non-continuous heating appliance. The branch circuit wires and breakers protecting the appliance must be sized to 100% (percent) of maximum amperage rating. It is recommended that the wire and breakers of the branch circuits and sub-feeds be rated for at least 75°C. This is particularly important to avoid over heating of the wires at the connections to the breakers. Over heating at the breaker connections may cause nuisance or premature breaker trips. Refer to D. National Electrical Code Rules – Branch Circuit Protection in this section for further detail and explanation.

NATIONAL ELECTRIC CODE-LOAD CALCULATIONS

Optional Calculations for Computing Feeder and Service Loads 220.82. Optional Calculation — New Dwelling Unit

(a) Feeder and Service Load-For a dwelling unit having the total connected load served by a single 3-wire, 120/240-volt or 208Y/120-volt set of service-entrance or feeder conductors with an ampacity of 100 or greater, it shall be permissible to compute the feeder and service loads in accordance with this NEC section. The calculated load shall be the result of adding the loads from (b) and (c). Feeder and service-entrance conductors whose demand load is determined by this optional calculation shall be permitted to have the neutral load determined by Section 220.61.

(b) General Loads.The general calculated load shall be not less than 100 percent of the first 10 kVA plus 40 percent of the remainder of the following loads:

1. 1500 volt-amperes for each 2 wire, 20-ampere small-appliance branch circuit and each laundry branch circuit specified in Section 220.52.
2. 3 volt-amperes per square foot (0.093 m2) for general lighting and general-use receptacles
3. The nameplate rating of all appliances that are fastened in place, permanently connected, or located to be on a specific circuit, ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and **water heaters**
4. The nameplate ampere or kVA rating of all motors and of all low-power-factor loads

(c) Heating and Air-Conditioning Load. Include the largest of the following six selections (load in kVA).

1. 100 percent of the nameplate rating(s) of the air conditioning and cooling.
2. 100 percent of the nameplate rating(s) of the heating when a heat pump is used without any supplemental electric heating.
3. 100 percent of the nameplate ratings of electric thermal storage and other heating systems where the usual load is expected to be continuous at the full nameplate value. Systems qualifying under this selection shall not be calculated under any other selection in (c).
4. 100 percent of the nameplate rating(s) of the heat pump compressor and 65 percent of the supplemental electric heating for central space heating. If the compressor cannot operate at the same time as the supplemental heating, the central space heating load is based on 65 percent of the supplemental heating load.
5. 65 percent of the nameplate rating(s) of electric space heating if less than four separately controlled units.
6. 40 percent of the nameplate rating(s) of electric space heating if four or more separately controlled units.

220.83. Optional Calculation for Additional Loads in Existing Dwelling Unit

For an existing dwelling unit presently being served by an existing 120/240-volt or 208Y/120-volt, 3 wire service, it shall be permissible to compute load calculations as follows:

Load (kVa)	Percent of Load
First 8 kVA of load at	100
Remainder of load at	40

Load calculations shall include lighting at 3 volt-amperes/ft^2 (0.093 m2); 1500 volt-amperes for each 2 wire, small-appliance branch circuit and each laundry branch circuit as specified in Section 220.52; range or wall-mounted oven and counter-mounted cooking unit; other appliances that are permanently connected or fastened in place, at nameplate rating.

If air-conditioning equipment or electric space-heating equipment is to be installed, the following formula shall be applied to determine if the existing service is of sufficient size.

Air-conditioning equipment*	100%
Central electric space heating*	100%
Less than four separately controlled space heating units*	100%
First 8 kVA of all other loads	100%
Remainder of all other loads	40%

*Use larger connected load of air conditioning and space heating, but not both.

Other loads shall include the following:

1. 1500 volt-amperes for each 20 ampere appliance circuit
2. Lighting and portable appliances at 3 volt-amperes/ft^2 (0.093 m2)
3. Household range or wall-mounted oven and counter-mounted cooking unit
4. All other appliances fastened in place, including four or more separately controlled space-heating units, at nameplate rating

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Electrical Requirements

Homes of various square footages in the following sample calculations are all electric with Seisco model RA-28, an electric range (12kW), a dishwasher (1.2kVA), electric clothes dryer (5kW), and one or two 3.5 ton air conditioners with air handler(s) (21.2 amp draw for combination of one air conditioner and one air handler). Electric strip heat is added to examples 2, 4, 6, and 8.

Note that only 40% of the Seisco Model RA-28 (28kW) is included in the overall Demand Factor. For example, in example one, the lighting, appliance, and laundry loads are added to the "Total Other Load (VA)." The total is 61,200 VA, not shown. Under Demand Factor, the first 10,000 VA is automatically required per the code. This reduces the remaining VA to 51,200, 40% of which is added to the 10,000 VA or 20,480 VA, or (51,200 VA X .4). As can be seen from the examples in Table 1, adding strip heat significantly increases the electrical demand, whereas the Seisco does not. Refer to Table 2 for calculations using the same criteria as Table 1, but substituting various Seisco models in lieu of the RA-28.

Table 1-Sample Residential Load Calculations	**Example**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Seisco Model	**RA-28**	**RA-28**	**RA-28**	**RA-28**	**RA-28**	**RA-28**	**RA-28**	**RA-28**
	Sqr. Ft.	**3,500**	**3,500**	**2,500**	**2,500**	**2,000**	**2,000**	**1,500**	**1,500**
Lighting	3 VA/ft2 X dwelling area	10,500	10,500	7,500	7,500	6,000	6,000	4,500	4,500
Appliance	2 X 1500 VA	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Laundry	1500 VA	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
	Subtotal (VA)	**15,000**	**15,000**	**12,000**	**12,000**	**10,500**	**10,500**	**9,000**	**9,000**
Range	12 kW	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
Water Heater	28 kW	28,000	28,000	28,000	28,000	28,000	28,000	28,000	28,000
Dishwasher	1.2 VA	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Dryer	5 kW	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
	Total Other Load (VA)	**46,200**	**46,200**	**46,200**	**46,200**	**46,200**	**46,200**	**46,200**	**46,200**
Demand Factors	10 kW X 100%	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
	Remainder X 40%	20,480	20,480	19,280	19,280	18,680	18,680	18,080	18,080
3.5 Ton A/C*	AC 240V X 21.2Amps	5,088	5,088	5,088	5,088	5,088	5,088	5,088	5,088
3.5 Ton A/C*	AC 240V X 21.2Amps	5,088	5,088	5,088	5,088	0	0	0	0
Strip Heat	(Watts=kW X 1000)	0	18,000	0	18,000	0	10,000	0	10,000
	Service Load (VA)	**40,656**	**58,656**	**39,456**	**57,456**	**33,768**	**43,768**	**33,168**	**43,168**
	Service Load/240V=Current (Amps)	**169**	**244**	**164**	**239**	**141**	**182**	**138**	**180**
	Service Panel (Amps) with RA-28 (28 kW)	**200**	**250**	**200**	**250**	**150**	**200**	**150**	**200**

***21.1A includes 3.3 amp draw air handler.**

Table 2 is an extension of Table 1. Various Seisco models are substituted for the RA-28 in Table 1. For example, in example 1, if three Seisco model RA-28s were installed in the same home as shown in Table 1, Example 1, the electrical service required would be 300 Amps. If the home already had a 200 Amp panel, the maximum total kW that could be installed would be 44, 2 Seisco RA-22 models.

Table 2-Service Panel Required For Various Seisco Models	**Example**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
	Sqr. Ft.	**3,500**	**3,500**	**2,500**	**2,500**	**2,000**	**2,000**	**1,500**	**1,500**
Service Panel (Amps) with 3-RA-28 (84 kW)		300	350	300	350	250	300	250	300
Service Panel (Amps) with 2-RA-32 (64 kW)		250	350	250	300	250	250	200	250
Service Panel (Amps) with 2-RA-28 (56 kW)		250	300	250	300	200	250	200	250
Service Panel (Amps) with 2-RA-22 (44 kW)		200	300	200	300	200	250	200	250
Service Panel (Amps) with 2-RA-18 (36 kW)		200	300	200	300	200	200	200	200
Service Panel (Amps) with RA-32 (32 kW)		200	300	200	250	150	200	150	200
Service Panel (Amps) with RA-22 (22 kW)		200	250	200	250	150	200	150	200
Service Panel (Amps) with RA-18 (18 kW)		200	250	150	250	150	200	150	200

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CALCULATION FORM FOR ADDING SEISCO TO EXISTING DWELLING

Use this form to calculate the maximum total kW Seisco Model(s) that may be installed in an existing home using the home's existing service panel. This form assumes that additional breaker slots are available for the Seisco(s) selected. If not, installation of an additional subpanel may be required. The sample calculation on this page is based on the same home configuration used on Example 1 on the preceding page with the exception that a standard 4.5 kW tank type water heater is assumed already installed as shown on row H below.

			Sample Calculation	Your Information
A	Lighting	Dwelling _____ sq. ft. X 3 VA	10,500	
B	Appliance Loads	1500 VA X _____ circuits	3,000	
C	Laundry	1500 VA X _____ circuits	1,500	
D		Subtotal VA (add rows A through C)	15,000	
E	Range VA	kW X 1000 X _____circuits	12,000	
F	Cook top VA	kW X 1000 X _____circuits	0	
G	Oven (s) VA	kW X 1000 X _____circuits	0	
H	Existing Water Heater VA	kW X 1000 X _____circuits	4,500	
I	Dishwasher VA	1200 VA	1,200	
J	Dryer VA	kW X 1000 X _____circuits	5,000	
K	Disposal VA		0	
L	Microwave Oven VA		0	
M	Built-in Vacuum VA		0	
N	Spa Bathtub VA		0	
O	Other VA		0	
P	Total Other Load VA (add rows E through O)		22,700	
Q	Subtotal VA (add rows D and P)		37,700	
R	Demand Factors	Subtract 10,0000	27,700	
S		Multiply Row R by .4	11,080	
T		Add 10,000 to Row S	21,080	
U	Air Conditioner #1 VA	AC 240V X _____ Amps	5,088	
V	Air Conditioner #2 VA	AC 240V X _____ Amps	5,088	
W	Strip Heat VA	kW X 1000 X _____circuits	0	
X	Total Service Load VA (Add Rows T through W)		31,256	
Y	Panel Usage in Amps (Divide row W by 240)		130.23	
Z	Current Service Panel (Amps)		200	
AA	Available Amps For Seisco (Subtract Row Y from Row Z)		69.76	
BB	Available VA Capacity	Multiply Row AA by 240	16,744	
CC	Available kW Capacity	Divide Row BB by 1000	16.74	
DD	Max kW of Seisco*	Divide Row CC by .4	41.86	
EE	Max kW of Seisco**	Add old water heater KW to Row DD	46.36	
FF	Choose Seisco Model with kW Input Equal to or Less Than Row DD or EE		2RA-22=44 kW	

***Use this line if the tank type water heater will remain in the home. **Use this line if the tank type water heater will be eliminated.**

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BRANCH CIRCUIT PROTECTION

NATIONAL ELECTRIC CODE RULES- BRANCH CIRCUIT PROTECTION

422-10. Branch-Circuit Rating

This section specifies the ratings of branch circuits capable of carrying appliance current without overheating under the conditions specified.

(a) Individual Circuits. According to NEC 422.10, the rating of an individual branch circuit shall not be less than the marked rating of the appliance or the marked rating of an appliance having combined loads as provided in Section 422-62.

The rating of an individual branch-circuit for motor-operated appliances not having a marked rating shall be in accordance with Part B of Article 430.

The branch-circuit rating for an appliance that is continuously loaded, other than a motor-operated appliance, shall not be less than 125 percent of the marked rating; or not less than 100 percent of the marked rating if the branch-circuit device and its assembly are listed for continuous loading at 100 percent of its rating.

NOTE: Seisco models are not considered a continuous load!

Continuous Load- A load for which the maximum current is expected to continue for 3 hours or more.

NEC 422-11. Overcurrent Protection
Appliances shall be protected against overcurrent in accordance with (a) through (g) and Section 422-10.

(a) Branch-Circuit Overcurrent Protection. Branch circuits shall be protected in accordance with Section 240-3.

If a protective device rating is marked on an appliance, the branch-circuit overcurrent device rating shall not exceed the protective device rating marked on the appliance.

NEC 422-11(f), (3): (2005 Edition) Water Heaters and Steam Boilers

Water heaters and steam boilers employing resistance-type immersion electric heating elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes.

For example; the RA-28 with four 7000-Watt elements can each draw 29 amperes at 240 volts. Thus, under NEC 422-11(f), (3) above, and as listed with U.L., the RA-28 Water Heating Model can be supplied with two (2) - 60 ampere circuits and the SH-28 Space Heating Model can be supplied with two (2) – 75 ampere circuits. Likewise, the RA-14 model can be supplied with one (1) – 60 ampere circuit and the SH-14 model with one (1) – 75 ampere circuit.

422-47. Water Heater Controls
All storage or instantaneous-type water heaters shall be equipped with a temperature-limiting means in addition to its control thermostat to disconnect all ungrounded conductors. Such means shall be as follows:

1. Installed to sense maximum water temperature; and
2. Either a trip-free, manually reset type or a type having a replacement element. Such water heaters shall be marked to require the installation of a temperature and pressure relief valve

Exception No. 1: Storage water heaters that are identified as being suitable for use with supply water temperature of 82ºC (180ºF) or above and a capacity of 60 kW or above, or

Exception No. 2: Instantaneous-type water heaters that are identified as being suitable for such use, with a capacity of 1 gal (3.785 L) or less.

See ANSI Z21.22-1999/CSA 4.4-M99, Relief Valves for Hot Water Systems.

NOTE: No pressure relief valve required according to the NEC

Table 310-16. Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts, 60ºC Through 90ºC (140ºF Through 194ºF) Not More than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30ºC (86ºF).

	Temperature Rating of Conductors					
AMPS	**60°C**	**75°C**	**90°C**	**60°C**	**75°C**	**90°C**
Wire Size	**Copper**			**Aluminum**		
18			14			
16			18			
14	20	20	25			
12	25	25	30	20	20	25
10	**30**	**35**	**40**	**25**	**30**	**35**
8	40	50	55	30	40	45
6	55	65	75	40	50	60
4	70	85	95	55	65	75
3	85	100	110	65	75	85
2	95	115	130	75	90	100
1	110	130	150	85	100	115
1/0	125	150	170	100	120	135
2/0	145	175	195	115	135	150
3/0	165	200	225	130	155	175
4/0	195	230	260	150	180	205

Wire Types:

60°C TW, UF

75°C FEPW, RH,RHW,THHW, THW,THWN,XHHW,USE,ZW

90°C TBS,SA,SIS,FEP,FEPB,MI,RHH,RHW-2,THHN,THHW,THW-2,THWN-2,USE-2,XHH,XHHW,XHHW-2,ZW-2

Source: Table 310-16: Allowable Ampacities for Insulated Conductors Rated 0 Through 2000 Volts, 60°C Through 90°C Not More than Three Current-Carrying Conductors in Raceway, Cable or Earth (Directly Buried), Based on Ambient Temperature of 30°C. FOR REFERENCE ONLY. CONSULT LOCAL AND NATIONAL CODES.

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Very Important

Under the 2005 Edition of the National Electric Code (NEC), article 422.11(f)(3), Water heaters and steam boilers employing resistance-type immersion electric heating elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes.

As a result, U.L. has given authorization to SEISCO®, under U.L. Standard 499, to use their U.L. marking on the SEISCO® model heater for connections to one (1) 60 Amp branch circuit instead of the two (2) 30 Amp branch circuits, as was previously required.

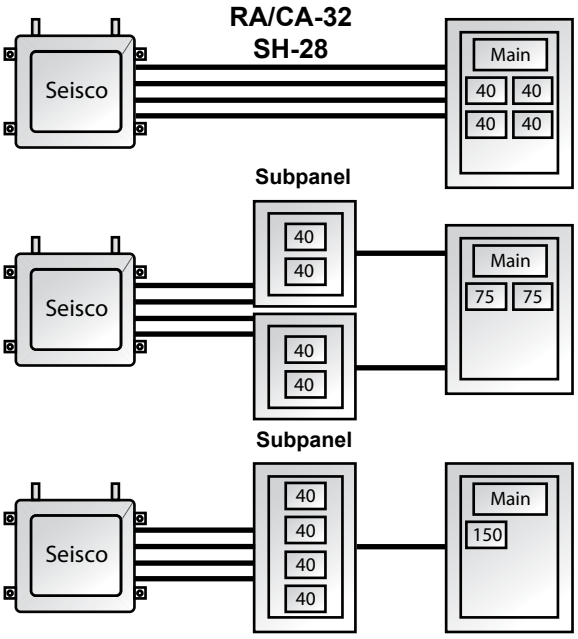
The wiring guide below illustrates the new wiring option for the RA-14. In accordance with NEC 422.11(f)(3), one 60 Amp branch circuit is shown connected to the heater directly from the Main Service Panel in the diagram below.

- - - CAUTION - - -

Before using this one circuit option for RA-14 and RA-16 models, check with the Manufacturer to make sure that the jumpers have been installed on the control board at the factory or they have been ordered or shipped with the unit. There should be two jumpers, 4 inches in length, 1 red and 1 black.

WIRE AND BREAKER SIZING

Signature Series (RA, CA, SH)



Main panel requires 8 spaces or four (4) double-pole, 40 amp, 240 volt breaker positions. Breaker lugs must have a 75°C rating. A 200 AMP MAIN SERVICE IS RECOMMENDED. Four pairs of #8 Cu AWG with ground are required between the heater and the main panel.

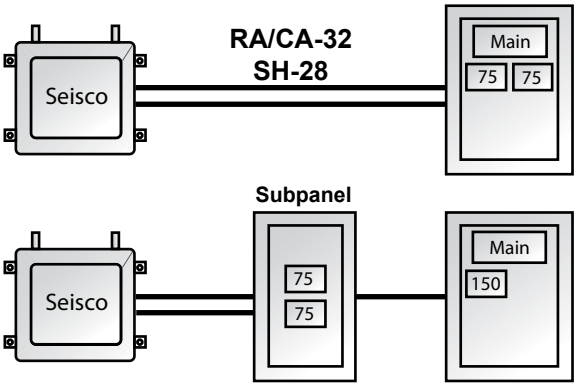
Main panel requires 4 spaces or two (2) double-pole, 75 amp, 240 volt breaker positions. Breaker lugs must have 75°C rating to feed sub-feed, from main panel. A 200 AMP MAIN SERVICE IS RECOMMENDED. Four pairs of #8 Cu AWG with ground are required between heater and subpanel. Two pairs of #*AWG with ground are required between the subpanels and the main panel.

Main panel requires 2 spaces or one (1) double-pole, 150 amp, 240 volt breaker position. Breaker lugs must have 75°C rating to feed sub-feed, from main panel. A 200 AMP MAIN SERVICE IS RECOMMENDED. Four pairs of #8 Cu AWG with ground are required between heater and subpanel. One pair of #1 Cu AWG with ground or one pair #2/0 AL with ground is required between the subpanel and the main panel.

The wiring guide below illustrates two new wiring options for the heater. In accordance with NEC 422.11(f)(3), two 75 Amp branch circuits are shown connected to the heater directly from the Main Service Panel in the Option A diagram below. In Option B, two 75 Amp branch circuits are shown connected to the heater directly from a sub-panel downstream from the Main Service Panel.

- - - CAUTION - - -

Before using this two circuit option for the heater Model, check with the Manufacturer to make sure that either the jumpers have been installed on the control board at the factory or they have been ordered or shipped with the unit. There should be four jumpers, 4 inches in length, 2 red and 2 black.



Main panel requires 4 spaces or two (2) double-pole, 75 amp, 240 volt breaker positions. Breaker lugs must have 75°C rating from main panel. A 200 AMP MAIN SERVICE IS RECOMMENDED. Two pairs of #*AWG with ground are required between the heater and the main panel.

Main panel requires 2 spaces or one (1) double-pole, 150 amp, 240 volt breaker position. Breaker lugs must have 75°C rating to feed sub-feed, from main panel. A 200 AMP MAIN SERVICE IS RECOMMENDED. Two pairs of #*AWG with ground are required between the heater and the subpanel. One pair of #1 Cu AWG with ground or one pair of #2/0 AL with ground is required between the subpanel and the main panel.

**NOTE: #6 Wire MUST be temperature rated for 75C. See chart on page 55. DO NOT USE #4 WIRE, it is too large for the lugs.*

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WIRE AND BREAKER SIZING

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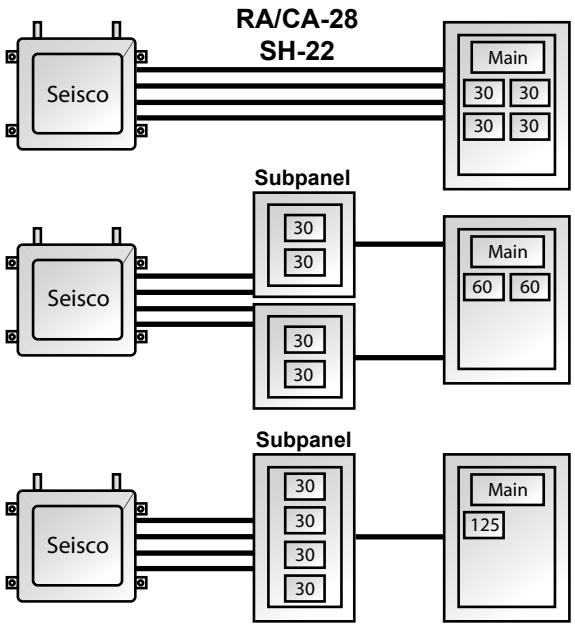
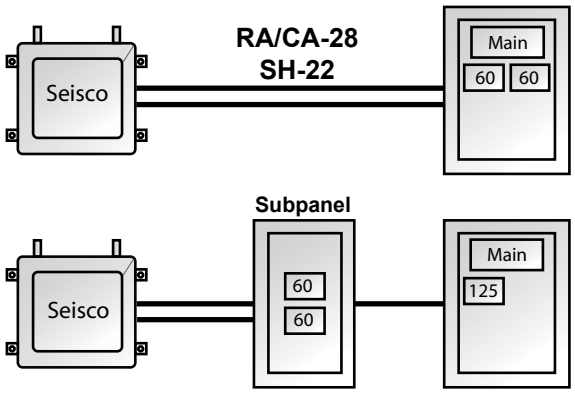


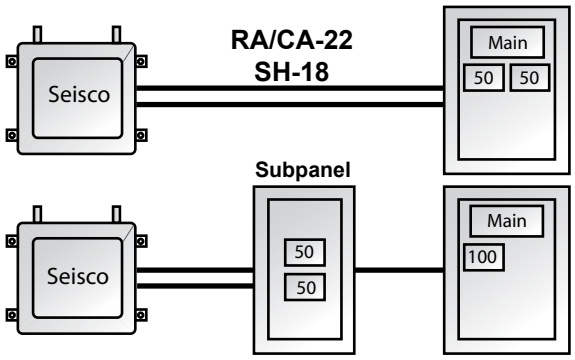
Main panel requires 8 spaces or four (4) double-pole, 30 amp, 240 volt breaker positions. Breaker lugs must have a 75°C rating. A 200 AMP MAIN SERVICE IS RECOMMENDED. Four pairs of #8 Cu AWG with ground are required between the heater and the main panel.

Main panel requires 2 spaces or one (1) double-pole, 125 amp, 240 volt breaker position. Breaker lugs must have 75°C rating to feed sub-feed, from main panel. A 200 AMP MAIN SERVICE IS RECOMMENDED. Four pairs of #8 Cu AWG with ground are required between heater and subpanel. One pair of #1 Cu AWG with ground or one pair #2/0 AL with ground is required between the sub-panel and the main panel.



Main panel requires 4 spaces or two (2) double-pole, 60 amp, 240 volt breaker positions. Breaker lugs must have 75°C rating from main panel. A 200 AMP MAIN SERVICE IS RECOMMENDED. Two pairs of #6 Cu AWG with ground are required between the heater and the main panel.

WIRE AND BREAKER SIZING
Signature Series (RA, CA, SH)

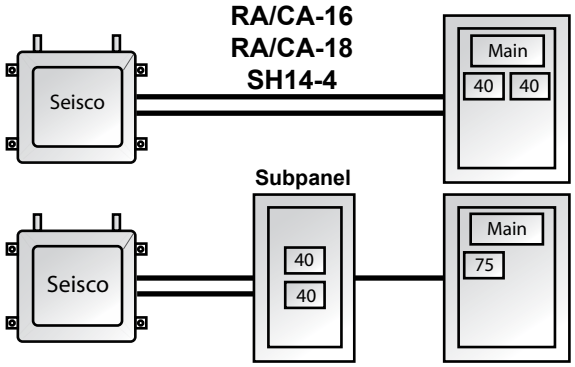


Option A

Main panel requires 4 spaces or two (2) double-pole, 50 amp, 240 volt breaker positions. Two pairs of #6 Cu AWG are required between the heater and the main panel.

Option B

Main panel requires 2 spaces or one (1) double-pole, 100 amp, 240 volt breaker position. Two pairs of #6 Cu AWG with ground are required between the heater and the sub-panel. One pair of #3 Cu AWG with ground or one pair of #1 AL with ground is required between the subpanel and the main panel.

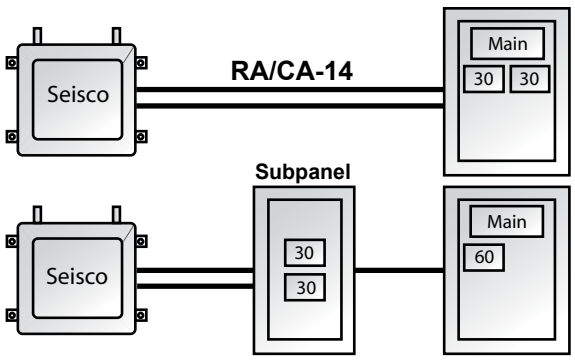


Option A

Main panel requires 4 spaces or two (2) double-pole, 40 amp, 240 volt breaker positions. Two pairs of #8 Cu AWG are required between the heater and the main panel.

Option B

Main panel requires 2 spaces or one (1) double-pole, 75 amp, 240 volt breaker position. Two pairs of #8 Cu AWG with ground are required between the heater and the sub-panel. One pair of #4 Cu AWG with ground or one pair of #2 AL with ground is required between the subpanel and the main panel.



Option A

Main panel requires 4 spaces or two (2) double-pole, 30 amp, 240 volt breaker positions. Two pairs of #8 Cu AWG are required between the heater and the main panel.

Option B

Main panel requires 2 spaces or one (1) double-pole, 60 amp, 240 volt breaker position. Two pairs of #8 Cu AWG with ground are required between the heater and the sub-panel. One pair of #6 Cu AWG with ground or one pair of #4 AL with ground is required between the subpanel and the main panel.

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WIRE AND BREAKER SIZING

Signature Series (RA, CA, SH)

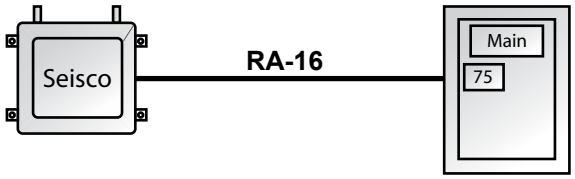
Under the 2005 Edition of the National Electric Code (NEC), article 422.11(f)(3), Water heaters and steam boilers employing resistance-type immersion electric heating elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into circuits not exceeding 120 amperes and protected at not more than 150 amperes.

As a result, U.L. has given authorization to SEISCO®, under U.L. Standard 499, to use their U.L. marking on the SEISCO® model heater for connections to one (1) 60 Amp branch circuit instead of the two (2) 30 Amp branch circuits, as was previously required.

The wiring guide below illustrates the new wiring option for the RA-14. In accordance with NEC 422.11(f)(3), one 60 Amp branch circuit is shown connected to the heater directly from the Main Service Panel in the diagram below.

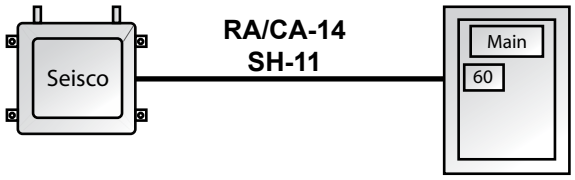
- - - CAUTION - - -

Before using this one circuit option for RA-14 and RA-16 models, check with the Manufacturer to make sure that the jumpers have been installed on the control board at the factory or they have been ordered or shipped with the unit. There should be two jumpers, 4 inches in length, 1 red and 1 black.



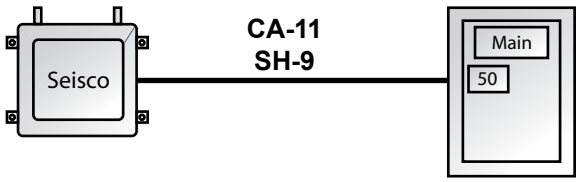
Optional One Circuit Method

Main panel requires 2 spaces or one (1) double-pole, 75 amp, 240 volt breaker positions. One pair of #4 Cu AWG with ground is required between the heater and the main panel.



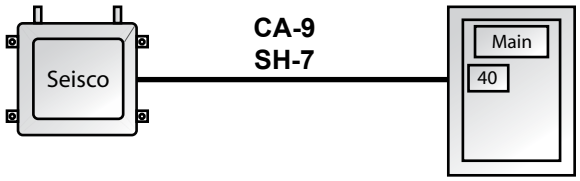
Optional One Circuit Method

Main panel requires 2 spaces or one (1) double-pole, 60 amp, 240 volt breaker positions. One pair of #6 Cu AWG with ground is required between the heater and the main panel. OPTIONAL FOR RA/CA, STD FOR SH



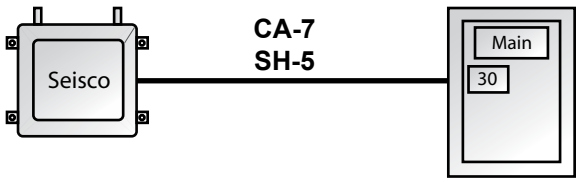
Only Option

Main panel requires 2 spaces or one (1) double-pole, 50 amp, 240 volt breaker positions. One pair of #6 Cu AWG with ground is required between the heater and the main panel.



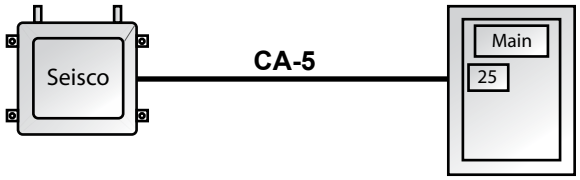
Only Option

Main panel requires 2 spaces or one (1) double-pole, 40 amp, 240 volt breaker positions. One pair of #8 Cu AWG with ground is required between the heater and the main panel.



Only Option

Main panel requires 2 spaces or one (1) double-pole, 30 amp, 240 volt breaker positions. One pair of #10 Cu AWG with ground is required between the heater and the main panel.



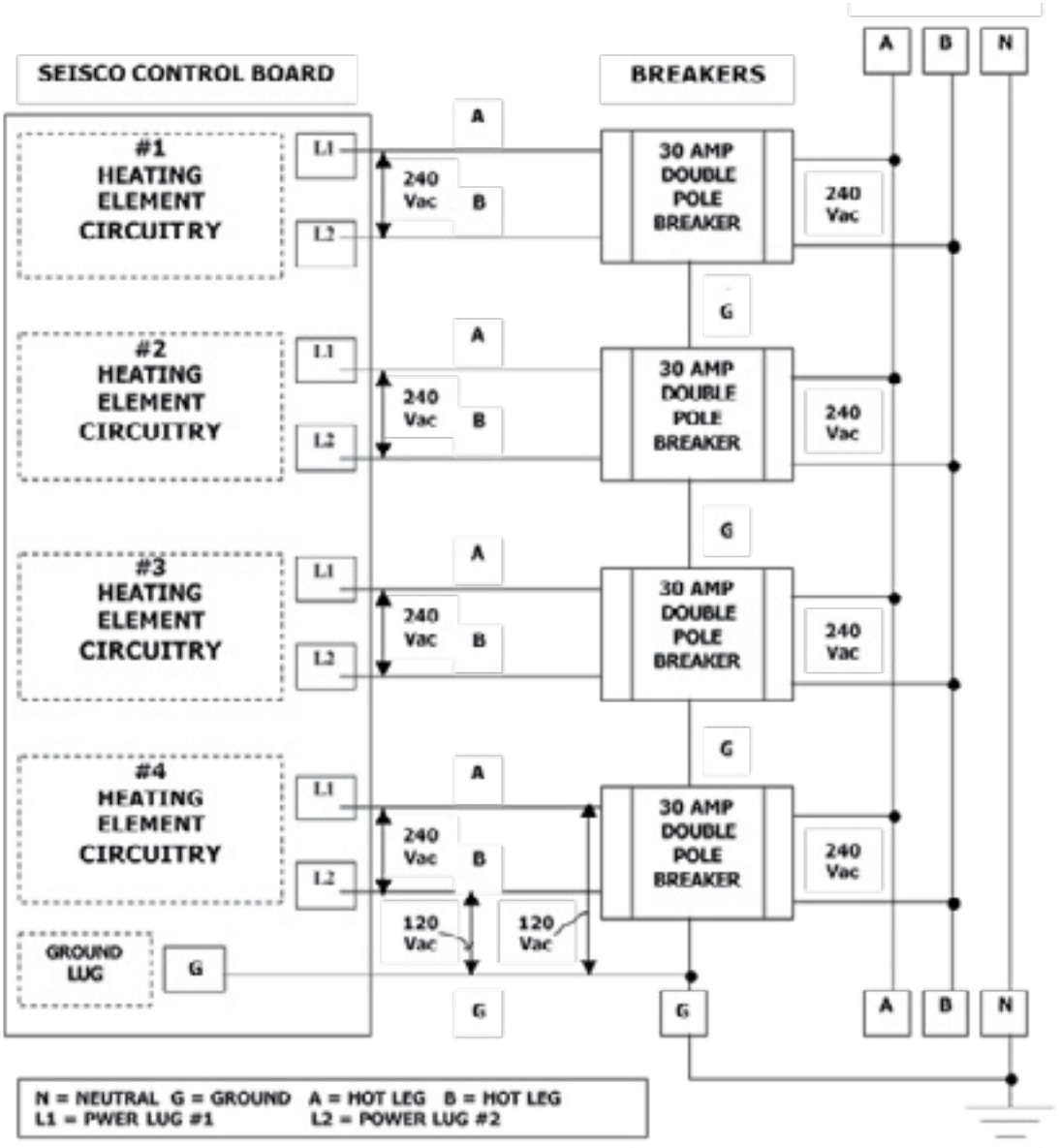
Only Option

Main panel requires 2 spaces or one (1) double-pole, 25 amp, 240 volt breaker positions. One pair of #12 Cu AWG with ground is required between the heater and the main panel.

SINGLE PHASE CONNECTIONS

Single-Phase Connections-The Seisco water heater was designed for single-phase, standard 220/240 VAC operation on residential and light commercial electrical services. When properly connected, the load of the Seisco is automatically balanced across both legs (or poles) of the service. **It doesn't matter how many circuits the Seisco requires, the load will always be balanced on a single-phase service. However, the only way the Seisco will work properly, is with both distinct poles and legs connected to each circuit.** If the legs making up the circuit are from the same side of the service bus, then they will cancel and the resultant voltage will be zero (0) volts instead of 220/240 volts. This is usually referred to as "out-of-phase" or simply having the circuit wires crossed or out of sequence. Refer to the single-phase wiring diagram that illustrates the correct connections to the single-phase service on the next two page of this publication.

Wiring connections to SINGLE PHASE 240 VAC supply: SEISCO® Model RA-28 / 32 (4- Circuit Supply)
(See also Optional 2-Circuit Supply for RA-28)



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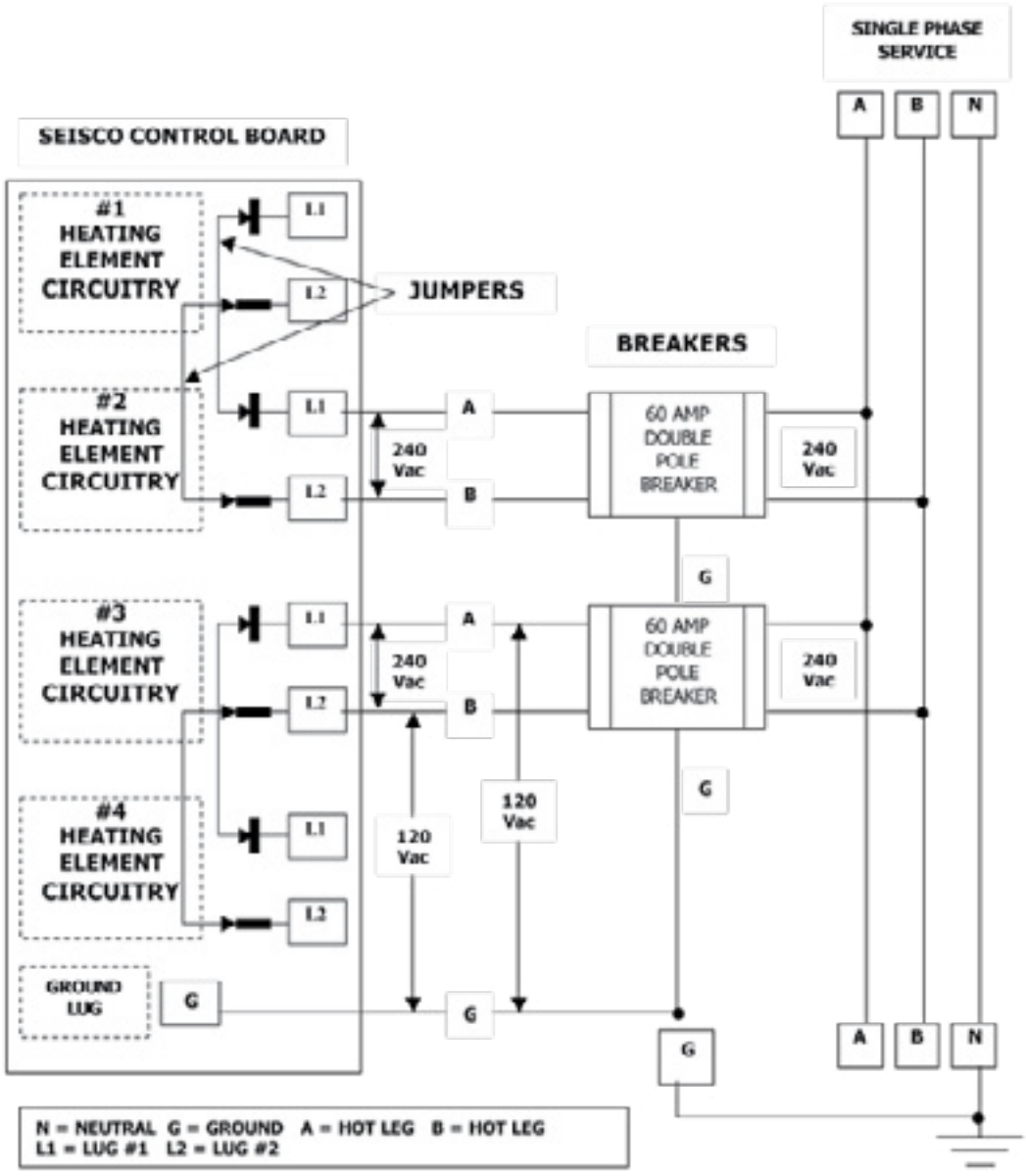
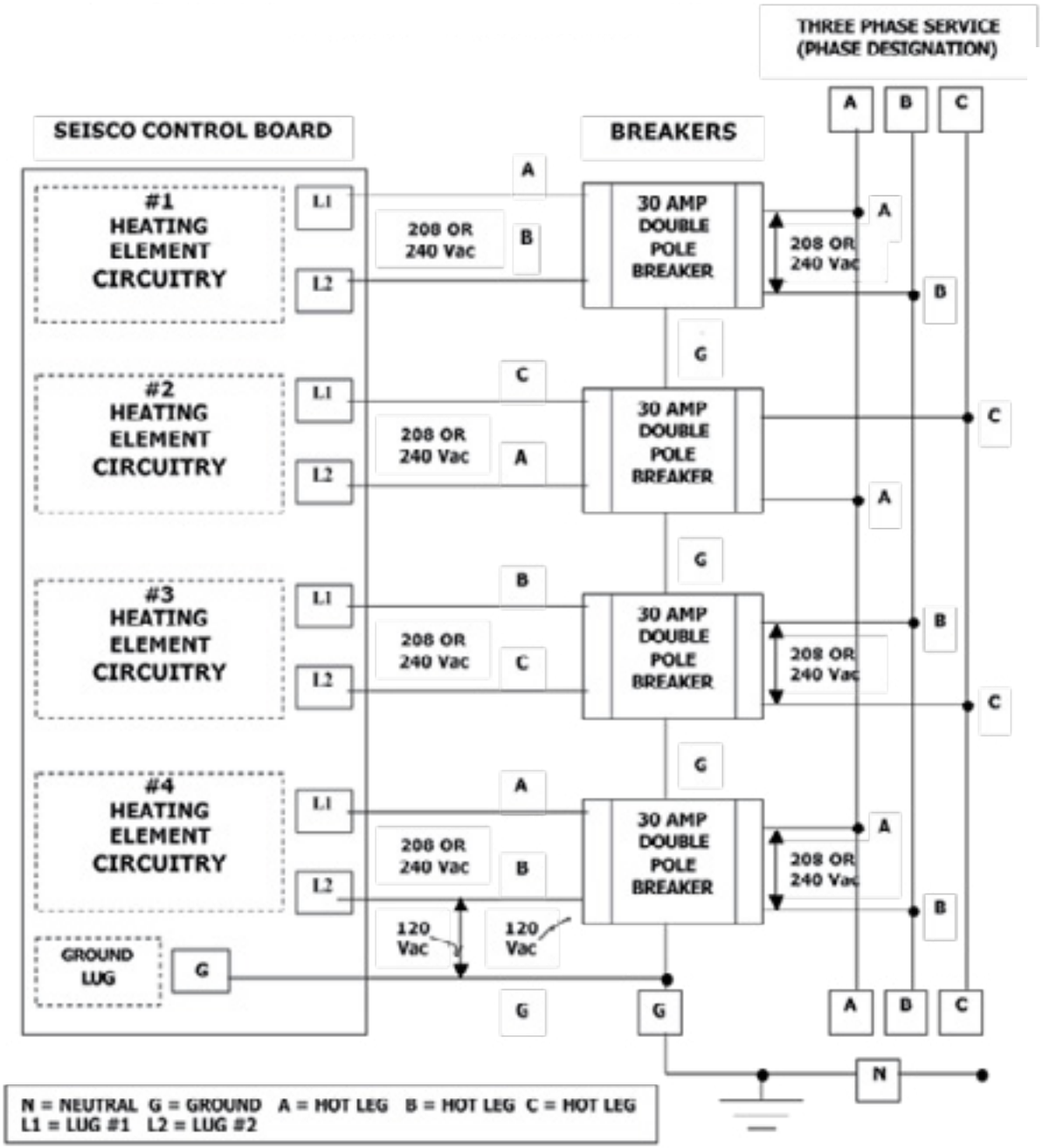
Wiring connections to SINGLE PHASE 240 VAC supply:
SEISCO® Model RA-28 / 32 (4- Circuit Supply)
(Optional 2-Circuit Supply)



Wiring connections to 208 or 240 VAC THREE-PHASE supply:

SEISCO® Model RA-28 / 32 (4 - Circuit Supply)



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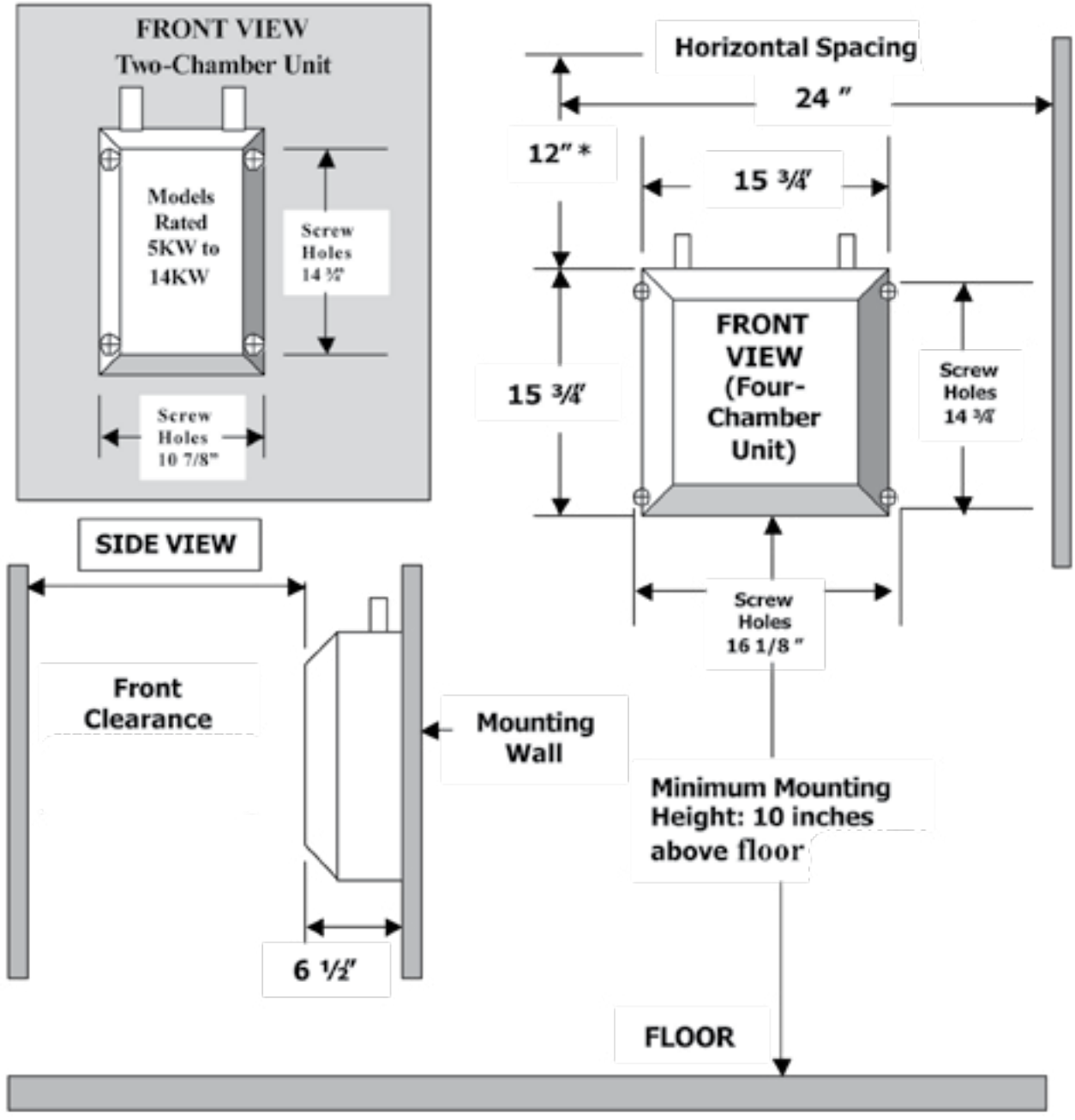
Top Clearance-For removal of heating elements and to provide room for plumbing connections, a minimum of 12 inches is required.

Side Clearance-Allow an overall minimum horizontal space for the heater of 24 inches for removal of protective cover screws and access to electrical wires entering the heater from the side.

Mounting Height-For safety, ease of installation and service, the suggested height above the floor is 42 to 48 inches, (minimum 10 inches). ***Do not install electrical disconnect or sub-panels below heater as this may interfere with access to the clean out plates located under the heater.***

Front Clearance-In the absence of a door or removal access panel in front of the heater, allow 32 to 36 inch clearance in front of the heater for protective cover removal and ease of service.



HUD RULES FOR MANUFACTURED HOUSING

Where to Install-The Seisco water heater should be installed as specified in the Federal Manufactured Housing Construction and Safety Standards. This was further clarified in a letter from HUD, dated Aug. 1, 2000.

In summary, the Seisco water heater can be installed in any room, including closets, alcoves, utility rooms, and storage rooms, in which all walls and ceilings have a flame spread rating of 25 or less. Walls and ceilings consisting of unpainted or painted 5/16 inch or greater gypsum board or 5/16 inch or greater tape/textured gypsum board meet these flame spread ratings. When installed in such a room, the Seisco can be mounted at any convenient location and without any additional enclosure.

If any of the walls or ceilings in a room have vinyl covered gypsum board, 5/16 inch or greater, the room may not meet the flame spread index of 25 or less, for the purpose of installing the Seisco water heater. If one or more of the walls is paneling, the 25 or less flame-spread rating is not met. In these situations, the Seisco water heater can be installed if a surrounding enclosure is constructed of 5/16 inch or greater gypsum. Vinyl covered gypsum board that is labeled with a flame-spread rating of 25 or less is acceptable to use in the water heater compartment without any additional enclosure.

Prevention of Storage-When the Seisco water heater is installed in a closet, storage room or similar room, the area surrounding the appliance should be framed-in or guarded with noncombustible material such that the distance from the appliance to the framing or guarding is not greater than 3 inches. (When clearance required by the listing is greater than 3 inches, the guarding or framing shall not be closer to the appliance than the distance required by the listing).

Clearance spaces surrounding the Seisco water heater are not required to be framed or guarded when:

1. the space is specifically design for a clothes washer or dryer;
2. dimensions surrounding the appliance do not exceed 3 inches; or
3. the home manufacturer affixes either to the side of the storage area or closet containing the appliance, or to the appliance itself, in a clearly visible location, a 3" X 5" adhesive backed plastic laminated label or the equivalent which reads as follows:

"Warning"

This compartment is not to be used as a storage area. Storage of combustible materials or containers on or near any appliance in this compartment may create a fire hazard. Do not store any materials or containers in this compartment.

Temperature and Pressure (T&P) Valves-As of August 1, 2000, there is no longer any requirement to install a T&P Valve with the Seisco water heater. The HUD letter recognizes and accepts the Underwriters Laboratories, Inc. (UL) Standard 499 endorsing the National Electrical Code (NEC) as an appropriate standard to the installation of valves for temperature and pressure relief as mandated by Standard 3280.609(c). Since the Seisco water heater meets the requirements of UL 499 and NEC as a tankless water heater, ***there is no requirement for a T&P Valve*** when the Seisco water heater is installed in a manufactured home.

See also-Water Heater Controls, National Electric Code, NEC, 422-47

NATIONAL ELECTRICAL CODE

422-47. Water Heater Controls-All storage or instantaneous-type water heaters other than:

(a) Storage water heaters that are identified as being suitable for use with supply water temperature of 82ºC (180ºF) or above and a capacity of 60 kW or above, or
(b) Instantaneous-type water heaters that are identified as being suitable for such use, with a capacity of 1 gal (3.785 L) or less shall be equipped with a temperature-limiting means in addition to its control thermostat to disconnect all ungrounded conductors, and such means shall be (1) installed to sense maximum water temperature and (2) be either a trip-free, manually reset type or a type having a replacement element. Such water heaters shall be marked to require the installation of a temperature and pressure relief valve.

FPN: See Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems, ANSI Z21.22-1986.

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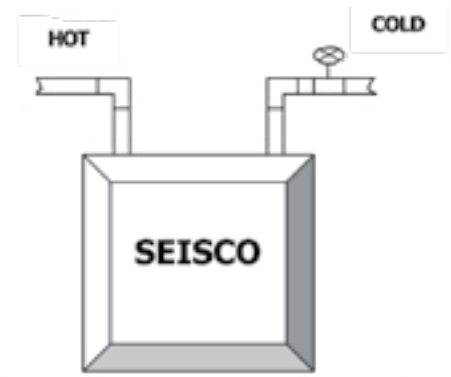


Above diagram shows approved plumbing connections without T&P Valve (T&P NOT REQUIRED BY MANUFACTURERER).

PLUMBING INSTALLATION

NOTE: This heater must be installed to meet the current National Electric Code, and any applicable Local Plumbing, Electrical, Heating and Air Conditioning Codes.

General-Unpack the heater from the shipping carton carefully. DO NOT CUT THE SHIPPING CARTON WITH A SHARP INSTRUMENT. Stand the unit upright and remove the plastic wrap. Locate the four (4) mounting holes in the metal back plate. Position the unit against the wall with the two inlet and outlet fitting tubes pointed up toward the ceiling. Refer to *Mounting Clearances* in this section of the manual to ensure compliance with all mounting clearances. Make sure the unit is level and attach to the wall with ¼ inch or larger lag bolts that are at least 1 ½ inches long. If attaching to sheet-rock or paneling, anchors or molly bolts should be used to prevent the screws from pulling through the wall. If the heater is installed on a cinder block or concrete wall, attach a ½ or ¾ inch section of plywood (20" x 20 " square) to the wall first. Then use wood screws to attach the heater to the plywood.

PROPERTY DAMAGE PROTECTION

IF THE WATER HEATER IS INSTALLED IN AN AREA WHERE A WATER LEAK CAN RESULT IN DAMAGE TO THE AREA ADJACENT TO THE WATER HEATER, A SUITABLE DRAIN PAN SHALL BE INSTALLED AND PIPED TO A DRAIN OR TO THE OUTSIDE. THE DRAIN PAN MUST MEET ALL APPLICABLE PLUMBING CODES AND BE AT LEAST 1-1/2" DEEP, EXTENDING AT LEAST 1" BEYOND THE UNIT'S BASE PLATES, MUST PROTECT AN AREA AT LEAST 1-1/2" GREATER THAN THE LOWER EXTERNAL DIMENSIONS OF THE WATER HEATER, AND INCLUDE A SPLASH COVER FOR THE AREA OF ATTACHMENT TO THE WALL.

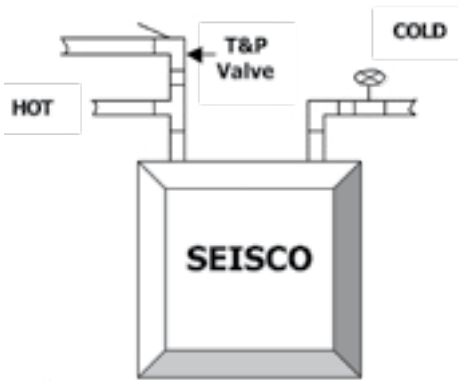
ATTACHING THE WATER SUPPLY

WARNING #1: Always use two wrenches when making any attachments to the water supply. Hold the heater's inlet and outlet fittings secure while attaching the cold water and hot water lines. Never attempt to attach water lines to the heater's fittings without using a second wrench to hold the fittings secure. The heater's inlet and outlet fittings are designed to turn freely.

WARNING #2: Never solder water supply lines to the heater's fittings. Heat from the soldering may damage the heat exchanger.

WARNING #3: Do not use plumber's putty or PVC/CPVC primer and glue on the threads of the heater's inlet and outlet fittings. Some of the putty compounds on the market are very aggressive and could potentially dissolve the threads on the heater's fittings. PVC/CPVC primer and glue will also dissolve the threads on the heater's fittings. Teflon tape is the only sealer that should be used on the threads of the inlet and outlet fittings.

Installation Considerations



Above diagram shows plumbing connections with a T&P Valve if required by local codes.

Temperature & Pressure Relief Valve-SINCE THE SEISCO HEATER DOES NOT UTILIZE A STORAGE TANK, THE USE OF A T&P RELIEF VALVE IS NOT REQUIRED BY MANY NATIONAL STANDARDS, INCLUDING UL STANDARD 499. Seisco heaters are designed with control logic as well as electromechanical high limit thermostat switches for over-temperature protection. With these built-in safety features, the use of a T&P Relief Valve is not required.

A temperature and pressure relief valve (T&P Valve) may be required by local code. When a T&P valve is installed (which is not provided by the manufacturer), it should be checked after the water supply to the heater is turned on. With the water supply on, there should be no water flowing from the valve. Operate the valve manually two or three times to purge the trapped air from the top of the heater's chamber. CLOSE VALVE. Water should stop flowing completely prior to connecting the drain piping to the valve.

Drain Pan-If the Seisco heater is installed in an area where water damage can occur to the area adjacent to the heater, a drain pan and pressure relief valve or T&P valve must be installed. The pan must be at least 1 ½ inches deep and large enough to protect the area below the heater (the pan should be at least 1 ½ inches larger than the lower external dimensions of the heater) and must be piped by 1 inch pipe to a suitable drain. A splash cover must be included to protect the area of attachment to the wall.

ELECTRICAL INSTALLATION GUIDE

Connection To Power Supply-

WARNING

INSTALLATION AND SERVICE MUST BE BY QUALIFIED PERSONNEL ONLY!

NOTE: This unit must be installed to meet the current National Electric Code, and any applicable local plumbing, electrical, heating and air conditioning codes.

Install wiring (see wiring diagram) from the unit to the Main Power Circuit Breaker Panel. Connect the wiring to the unit as shown on the wiring diagram attached to the inside of the unit's cover.

WARNING

ALL MODELS LARGER THAN 16KW REQUIRE MULTIPLE DOUBLE POLE CIRCUIT BREAKERS. TWO CHAMBER MODELS CAN BE INSTALLED WITH ONE DOUBLE POLE BREAKER WITH THE JUMPERS INSTALLED ON THE CIRCUIT BOARD, TWO WITHOUT. FOUR CHAMBER MODELS CAN BE INSTALLED WITH TWO DOUBLE POLE BREAKERS WITH THE JUMPERS INSTALLED ON THE CIRCUIT BOARD, FOUR WITHOUT. SINGLE CHAMBER MODELS USE A SINGLE POLE BREAKER WITH A NEUTRAL FOR 120V MODELS, A SINGLE DOUBLE POLE BREAKER FOR ALL OTHER MODELS.

RISK OF ELECTRICAL SHOCK. HEATING ELEMENT IS NOT GROUNDED. SOME UNITS HAVE MULTIPLE POWER SUPPLIES. DISCONNECT ALL POWER SUPPLIES BEFORE SERVICING.

IF USING STRANDED WIRE, MAKE SURE THAT ALL STRANDS ARE IN SECURE PLACEMENT IN THE TERMINAL BLOCK. A LOOSE STRAND IN CONTACT WITH THE CIRCUIT BOARD CAN IMPAIR PERFORMANCE OR DAMAGE THE BOARD.

HEATER SUPPLY SIDE CONNECTION

Each double pole breaker should be connected to the heater with one wire to L1 and the second to L2. For heaters with multiple circuits, this should be repeated for each circuit connecting each circuit pair to L1 and L2 for each circuit. A single ground connection should be made to the ground lug. A neutral is connected to L2 for 120V models only. All other models should not have a neutral.

WHERE REQUIRED BY CODE, USE A DISCONNECT SWITCH ADJACENT TO THE HEATER. WHEN MAKING THIS TYPE OF INSTALLATION, BE SURE THE MAIN FEEDER WIRES USED ARE PROPERLY SIZED.

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Install the proper size circuit breaker (see the section Wire and Breaker Sizing in this publication). Be sure that the power supply circuits are properly connected inside the water heater. For models RA, CA-5 thru 11, the pair of feeders attached to power circuit 1 (CKT 1) should be attached to one 2-pole breaker, and for models RA, CA-14 - 22, the second pair attached to power circuit 2 (CKT 2) should be attached to a second 2-pole breaker such that the total load will be balanced. For models RA, CA-28 and 32, two additional breakers are required for power circuits 3 and 4 (CKT 3 & 4).

*NEC branch circuit rule has changed which allows the option to wire the 14 kW unit with one circuit and the 28 kW unit with two circuits. Refer to pages 37-39, *Wire and Breaker Sizing,* for circuit breaker size by model number. Contact the manufacturer for jumpers that must be installed on the control board before using these wiring options.

PRE-POWER CHECK

1. After all electrical connections have been made, every effort should be made to verify a safe installation. Again check to be sure all connections in the unit disconnect and/or circuit breaker panel are secure. Check to be sure that an adequate ground has been properly connected. Check to be sure that adequate size breakers have been installed properly. Remember that breakers that are too large are more dangerous than breakers that are too small.

2. Run water through the unit until air is purged..

POWER CHECK

Check only after the Pre-Power Check has been completed and the unit filled with water. Turn on the Main Power Circuit Breakers. Verify that the heater's GREEN POWER-ON indicator light is illuminated.

USE EXTREME CAUTION WHEN CHECKING VOLTAGE TO THE UNIT.

Check the voltage available to each active power circuit. SEISCO models CA-5 to CA-32 are designed to operate from a 208V to 240V power supply. Connect a voltmeter at power circuit 1 (CKT 1) between L1 and L2. (For models with multiple power circuits utilized, continue to check voltage at each additional power circuit.)

OPERATIONAL CHECKS

Turn water on MEDIUM-LOW utilizing any sink allowing water to run for a couple of minutes to ensure that all air is purged from the unit. You will hear a "click" as the relays on the circuit board engage. **It is normal to hear a "hissing" or "crackling" noise from the heat exchanger after the unit is initially started. In rare instances you may hear intermittent clicking noise's (relay chatter) this condition generally indicates the presents of air that hasn't been purged. In this event increase the flow rate until the air is fully purged and the chatter goes away.** *(*If chatter continues see page 69)*. With the unit's cover removed, verify with an ammeter that there is ELECTRICAL CURRENT through each heating element circuit. DISREGARD THE WATER TEMPERATURE WHILE DOING THIS TEST.

TURN OFF FAUCETS after completing Operational Check.

Thermostat settings are factory preset for units employing a circuit board potentiometer (thermostat).

THIS INSTALLATION MUST BE DONE BY QUALIFIED AND LICENSED CONTRACTORS. Refer to your local electrical and plumbing codes for additional information.

Functional Checks-After the initial start-up, following the Pre-Power and Operational Checks described on this page, it may be necessary to make adjustments to the system to insure that the heater is functional and providing hot water.

BEEPS & FLASHING LIGHTS

It is normal at start-up or any time the heater is powered-on for the control board to beep and the LED to flash red and then green. Normal status of the heater is for the control to flash all green repeatedly. The initial 2 to 4 red flashes and beeps after power-on are normal, but should not continue.

ON-BOARD SELF DIAGNOSTICS

However, in the event that the LED light continues to flash a red sequence after power-on, then there may be a need for further investigation. The heater's control provides self diagnostics by emitting a red flashing code. The code definitions and possible solutions can be found in the Trouble Shooting section of the Seisco Service Manual.

Some of the most common problems discovered during installation and initial start-up are as follows:

- Circuit breakers are not turned-on (especially, heaters with multiple circuits)
- Incoming power wires to the heater are out-of-phase (heaters with multiple circuits)
- Water supply valve not turned-on, no water in the heater chamber
- Water supply lines are reversed; hot and cold reversed
- Water supply connection(s) are leaking
- T&P Relief Valve (where required by local code) is leaking or stuck open

WATER LEAK DETECTION

Diagnostic codes are designed to tell the installer or user if there is a problem and what the problem might be. Also, the Seisco heater has a built in alarm that will sound if there is water leaking onto the heater, possibly from a leaky water line connection or from a leaky T&P Relief Valve. It is important to turn off all of the circuit breakers to the heater whenever a leak is detected to prevent possible damage to the control board. After the leak is discovered and repaired, it is important to dry any moisture or water accumulation on the heater. This can be done with a standard household hair dryer or dry towels. Any attempts to dry the heater should be done with all the power off to the heater.

SYSTEM MATCH – FAUCETS AND HEATER

When a Seisco heater is selected for the home or building, the faucets should be selected to match the flow rating and temperature rise specifications of the heater. Seisco specifications can be found on specification sheets provided by Sales and Marketing as well as in this manual. Sometimes, this is overlooked and the user discovers that the tub faucets in the home are a higher flow rate than the design of the Seisco model(s) selected. **Never use fixed flow tub/shower valves. You must be able to manually adjust volume of Hot vs. Cold Water**. A table of typical flow rate by fixture type is provide below for reference.

SOLUTIONS FOR HIGH FLOW APPLICATIONS

Another oversight may be the lifestyle of the user. For instance, if the user wants to take two showers at the same time or run the washing machine and the bath tub at the same time, then the flow rate demands of the water heater are increased, sometimes beyond the capability of the Seisco heater. Multiple Seisco heaters are used for higher flow applications, such as for multiple task lifestyles, whirl pool and Jacuzzi tubs and body spa showers as well. Refer to earlier sections on applying Seisco products in this publication for recommended multiple Seisco heater arrangements. **Note: it is important to evaluate the electrical capacity of the home or building when selecting multiple Seisco heaters for a high flow application. Refer to the electrical requirements and load calculations discussed in this manual.**

TEMPERATURE ADJUSTMENT

After the Seisco heater has been installed and the operational checks are completed, the output of the hot water can be measured and adjusted if necessary. The temperature adjusting knob can be found on the left side of the control board. The factory setting is usually between 117 and 120 degrees F. The knob will usually be in the 2 to 3 o'clock position. Turning the knob to the left decreases the temperature and turning it to the right increases the temperature. **Note: it is important to understand the effects of increasing the temperature above the factory setting as follows:**

1. The heater will use more power to heat the water; energy savings are reduced.
2. There will be a greater chance that the heater will produce scaling and sediment build-up.
3. The heater may not have the power to achieve temperatures higher than factory settings.
4. Safety; with higher temperatures, there will be a higher risk of scalding and personal injury.

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TROUBLESHOOTING GUIDE

Symptom	Possible Cause	Corrective Action
Hot water supply is warm but does not get HOT!	Flow is too high*	Reduce flow
	One of the main power breakers may be tripped.	Check power panel and reset breaker if tripped
	Bad heating element	Contact local service contractor**
	Bad temperature sensor	Contact Seisco tech support
Hot water supply is COLD!	Flow is too high*	Reduce flow
	High temperature limit switch may be tripped	Verify if limit switch is tripped and reset if necessary
	One of the main power breakers may be tripped	Check power panel and reset breaker if tripped
	Bad heating element or temperature sensor	Contact local service contractor**
	Circuit board failure	Contact Seisco tech support
Hot water supply temperature fluctuates	Flow is too high*	Reduce flow
	One of the main power breakers may be tripped	Check power panel and reset breaker if tripped
	Bad heating element	Contact local service contractor**
	Bad temperature sensor	Contact Seisco tech support

**** Do not attempt to fill a large bathtub at full faucet flow. Tub faucets are designed to literally dump hot water from a storage tank heater to maximize the useful quantity available. SEISCO® will fill a tub slightly slower, but you will continue to have hot water for as long as you wish to bathe. In space heating, excessive flow can occur with too large of a circulator pump or excessive system pressure or flow in the circulatory loop connected to the Hydronic Heater. It may be necessary to reduce flow or select a model capable of matching the flow and temperature rise required for your heating system.***

** Check listings in your area for local Heating & Plumbing or Appliance Repair companies for labor estimates. Check for Warranty coverage on labor charges. **FOR FURTHER ASSISTANCE, CALL** SEISCO®**. AT 888-296-9293, CENTRAL TIME, DURING REGULAR BUSINESS HOURS FOR AVAILABLE PARTS, DIAGNOSTICS AND REPAIR INFORMATION.**

Seisco Technical Support 1-888-296-9293 technical@seisco.com

* If this chatter doesn't stop within 10 seconds after increasing the flow. Turn off water and power. Call tech support 1-888-296-9293

ADDITIONAL TECHNICAL SPECIFICATIONS AND PERFORMANCE TABLES

208 V Recovery for 240 V Models(gpm & 1st Hour) @ Temperature Rise (F)

kW@ 240V	kW@208V	Recovery	65	60	55	50	45	40	35	30	25	20	15
3.5	**2.6**	**GPM**	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.7	0.9	1.2
		GPH	16.4	17.8	19.4	21.3	23.7	26.6	30.4	35.5	42.6	53.3	71.0
4.5	**3.4**	**GPM**	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.8	0.9	1.2	1.5
		GPH	21.3	23.0	25.1	27.7	30.7	34.6	39.5	46.1	55.3	69.1	92.2
5.0	**3.8**	**GPM**	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.9	1.0	1.3	1.7
		GPH	23.6	25.6	27.9	30.7	34.1	38.4	43.9	51.2	61.5	76.8	102.4
5.5	**4.1**	**GPM**	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.9	1.1	1.4	1.9
		GPH	26.0	28.2	30.7	33.8	37.6	42.3	48.3	56.3	67.6	84.5	112.7
7.0	**5.3**	**GPM**	0.6	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.4	1.8	2.4
		GPH	33.1	35.9	39.1	43.0	47.8	53.8	61.5	71.7	86.0	107.6	143.4
8.0	**6.0**	**GPM**	0.6	0.7	0.7	0.8	0.9	1.0	1.2	1.4	1.6	2.0	2.7
		GPH	37.8	41.0	44.7	49.2	54.6	61.5	70.2	81.9	98.3	122.9	163.9
9.0	**6.8**	**GPM**	0.7	0.8	0.8	0.9	1.0	1.2	1.3	1.5	1.8	2.3	3.1
		GPH	42.5	46.1	50.3	55.3	61.5	69.1	79.0	92.2	110.6	138.3	184.4
11.0	**8.3**	**GPM**	0.9	0.9	1.0	1.1	1.3	1.4	1.6	1.9	2.3	2.8	3.8
		GPH	52.0	56.3	61.5	67.6	75.1	84.5	96.6	112.7	135.2	169.0	225.3
14.0	**10.5**	**GPM**	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.4	2.9	3.6	4.8
		GPH	66.2	71.7	78.2	86.0	95.6	107.6	122.9	143.4	172.1	215.1	286.8
16.0	**12.0**	**GPM**	1.3	1.4	1.5	1.6	1.8	2.0	2.3	2.7	3.3	4.1	5.5
		GPH	75.6	81.9	89.4	98.3	109.3	122.9	140.5	163.9	196.7	245.8	327.8
18.0	**13.5**	**GPM**	1.4	1.5	1.7	1.8	2.0	2.3	2.6	3.1	3.7	4.6	6.1
		GPH	85.1	92.2	100.6	110.6	122.9	138.3	158.0	184.4	221.3	276.6	368.8
22.0	**16.5**	**GPM**	1.7	1.9	2.0	2.3	2.5	2.8	3.2	3.8	4.5	5.6	7.5
		GPH	104.0	112.7	122.9	135.2	150.2	169.0	193.2	225.3	270.4	338.0	450.7
28.0	**21.0**	**GPM**	2.2	2.4	2.6	2.9	3.2	3.6	4.1	4.8	5.7	7.2	9.6
		GPH	132.4	143.4	156.4	172.1	191.2	215.1	245.8	286.8	344.2	430.2	573.6
32.0	**24.0**	**GPM**	2.5	2.7	3.0	3.3	3.6	4.1	4.7	5.5	6.6	8.2	10.9
		GPH	151.3	163.9	178.8	196.7	218.5	245.8	281.0	327.8	393.3	491.7	655.6

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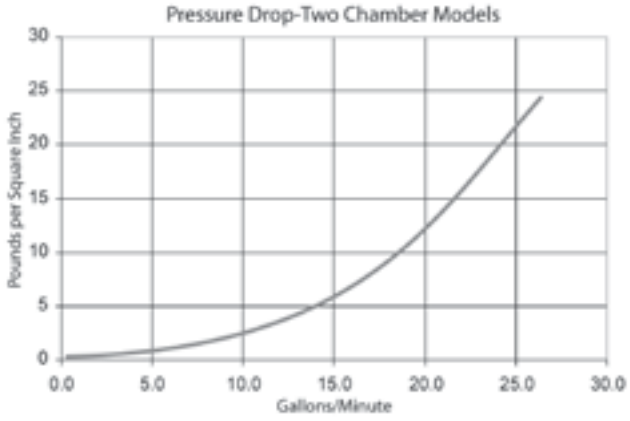
ADDITIONAL TECHNICAL SPECIFICATIONS AND PERFORMANCE TABLES

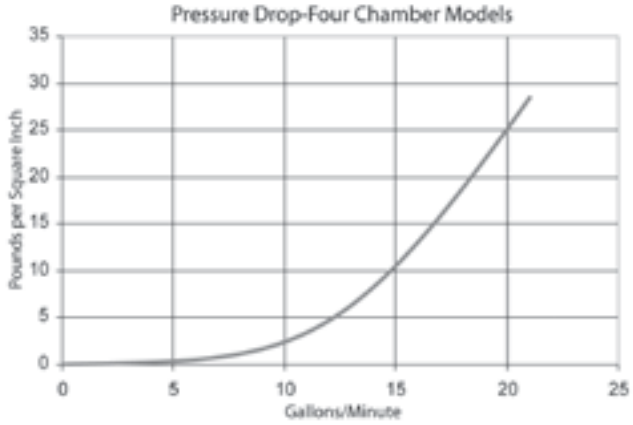
240 Volt Models Connected to 208 Volt Service
Recovery (gpm & 1st Hour) @ Temperature Rise (F)

kW 240V / kW 208V	Recovery	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15
5	gpm	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.8	0.8	1.1	1.3	1.7
3.75	1st Hour	17.1	18.1	19.2	20.5	22.0	23.6	25.6	27.9	30.8	34.1	38.4	43.9	51.2	61.4	76.8	102.5
7	gpm	0.4	0.5	0.5	0.5	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.1	1.2	1.4	1.8	2.4
5.25	1st Hour	23.9	25.3	26.9	28.7	30.8	33.1	35.9	39.1	43.1	47.8	53.8	61.4	71.7	86.0	107.6	143.4
9	gpm	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.1	1.1	1.4	1.5	1.9	2.3	3.1
6.75	1st Hour	30.8	32.6	34.6	36.9	39.5	42.5	46.1	50.3	55.4	61.4	69.2	79.1	92.2	110.6	138.3	184.4
11	gpm	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.1	1.1	1.3	1.4	1.6	1.9	2.3	2.9	3.8
8.25	1st Hour	37.6	39.8	42.2	45.1	48.3	52.0	56.3	61.4	67.6	75.2	84.5	96.6	112.7	135.2	169.0	225.4
14	gpm	0.8	0.8	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.6	1.8	2.0	2.4	2.9	3.6	4.8
10.5	1st Hour	47.8	50.6	53.8	57.4	61.4	66.2	71.7	78.2	86.0	95.6	107.6	122.9	143.4	172.1	215.1	286.8
16	gpm	0.9	.95	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.8	2.0	2.4	2.8	3.25	4.1	5.5
12	1st Hour	54	57	60	66	72	78	81	87	99	105	123	141	165	195	246	330
18	gpm	1.1	1.1	1.1	1.2	1.4	1.4	1.5	1.7	1.9	2.0	2.3	2.6	3.1	3.7	4.6	6.2
13.5	1st Hour	61.4	65.1	69.2	73.7	79.1	85.1	92.2	100.6	110.6	122.9	138.3	158.0	184.4	221.3	276.6	368.8
22	gpm	1.3	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.3	2.5	2.9	3.2	3.8	4.5	5.6	7.5
16.5	1st Hour	75.2	79.5	84.5	90.2	96.6	104.0	112.7	122.9	135.2	150.2	169.0	193.1	225.4	270.5	338.0	450.7
28	gpm	1.6	1.7	1.8	2.0	2.0	2.2	2.4	2.6	2.9	3.2	3.6	4.1	4.8	5.7	7.2	9.5
21	1st Hour	95.6	101.3	107.6	114.8	122.9	132.4	143.4	156.5	172.1	191.2	215.1	245.9	286.8	344.2	430.2	573.6
32	gpm	1.8	1.9	2.0	2.2	2.4	2.6	2.7	2.9	3.3	3.6	4.1	4.7	5.5	6.5	8.2	11.0
24	1st Hour	108	114	120	132	144	156	162	174	198	210	246	282	330	390	492	660

Note: The table above reflects a 25% derating for 240-volt models connected to 208-volt service.

PRESSURE DROP CURVES





SEISCO® Tankless Heaters

Warranty Fact Sheet

(This Fact Sheet is intended only as a Guide and does not supersede the written warranty)

	RESIDENTIAL		COMMERCIAL		
Models	**RA & SC**	**SH**	**CA**	**POU**	**3 Phase**
Warranty Term	10-Year Limited	10-Year Limited	5-Year Limited	5-Year Limited	5-Year Limited
Warranty Activation	Original Purchase Date, Proof of Purchase, Warranty Registration				
Warranty Application Coverage	Residential Water Heating	Residential Radiant Heating & Water Heating	Residential & Commercial Water Heating		Commercial Water Heating
Labor Reimbursement	First Year (Maximum 1 hour)				
Parts Replacement for Defects in Manufacturing or Workmanship	**INITIAL WARRANTY**				
	First 3-Years				
	Chamber Body		Chamber Body, Heating Element		
	First 18 Months				
	Circuit Board		Circuit Board, Electronic Components		
	First 1-Year				
	All Other Components				
	PRORATED WARRANTY				
	Thru year 10		**Thru Year 5**		
	After initial warranty, Chamber Body or Circuit board maximum replacement cost of 25% of the current MSRP of the heater				

Warranty Notes: Reimbursements do not include shipping and handling charges. This fact sheet is intended as a guide only and does not supersede the Original Written Warranty. Consult the written warranty with each model for details.

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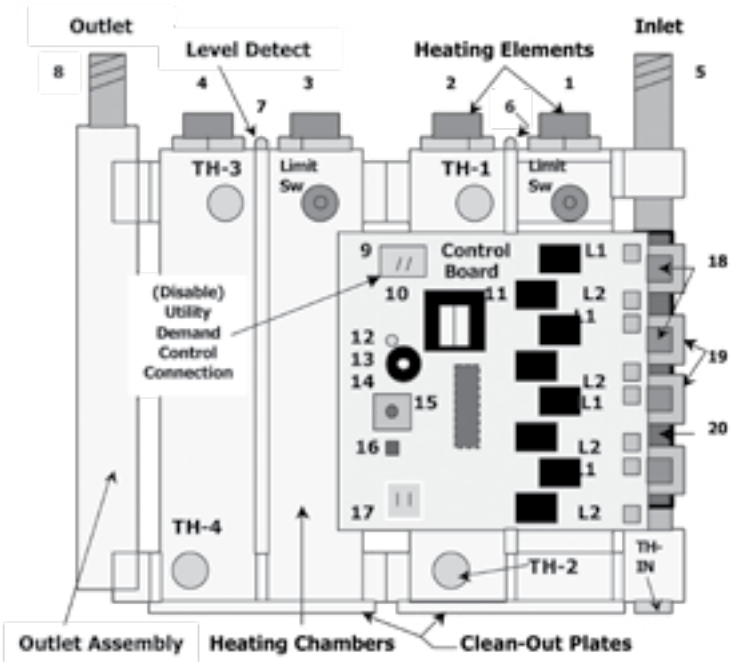
PARTS IDENTIFICATION

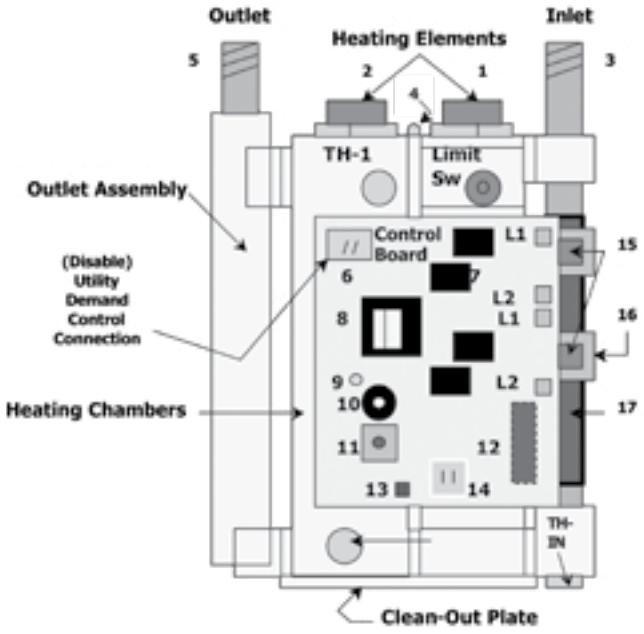
4-CHAMBER MODELS



LEGEND

1 – Heating Element #1
2 – Heating Element #2
3 – Heating Element #3
4 – Heating Element #4
5 – Inlet Water Tube, ¾
6 – Water-Level Detect Screw
7 – Water-Level Detect Screw
8 – Outlet Water Tube, ¾
9 – Disable, Demand Control Switch
10 – Transformer
11 – Heating Element Relays (8 ea.)
12 – LED Light Indicator
13 – Audible Speaker
14 – Output Temperature Control
15 – Microprocessor Control Chip
16 - Blue Button; Manual Audible Activation
17 – Terminal Spades for Leak Detect Wires
18 – Triacs (4 each)
19 – Triac Mounting Blocks to Heat Sink (4 ea
20 – Copper Heat Sink Tube
L1 – Power Connection Lugs (208 – 240 VAC)
L2 – Power Connection Lugs (208 – 240 VAC)
Limit Sw : Over Temperature Limit Switches
TH-IN : Inlet Temperature Sensor
TH-1 : Chamber Temperature Sensor #1
TH-2 : Chamber Temperature Sensor #2
TH-3 : Chamber Temperature Sensor #3
TH-4 : Chamber Temperature Sensor #4

2-CHAMBER MODELS



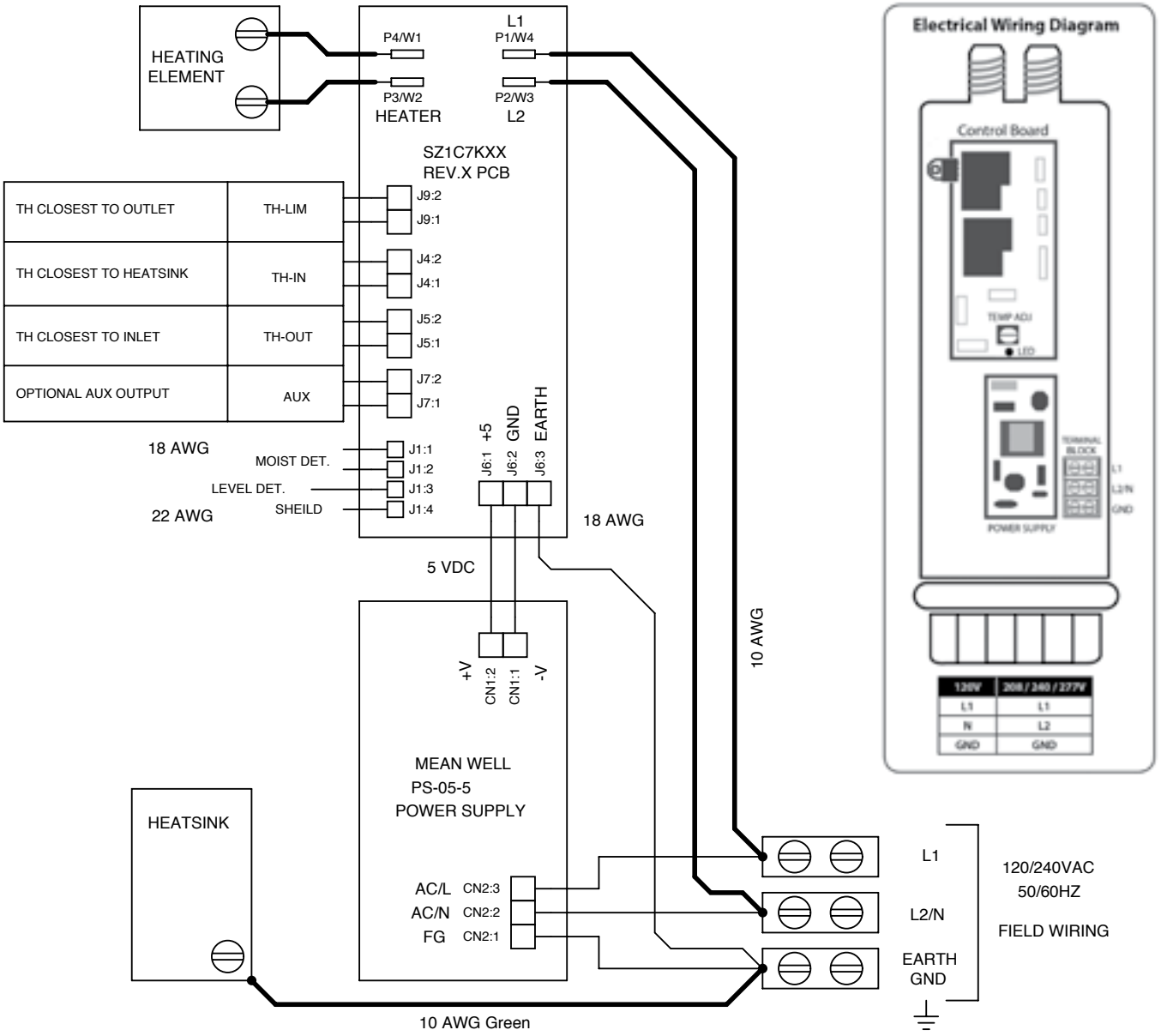
LEGEND

1 – Heating Element #1
2 – Heating Element #2
3 – Inlet Water Tube, ¾
4 – Water-Level Detect Screw
5 – Outlet Water Tube, ¾
6 – Disable, Demand Control Switch
7 – Heating Element Relays (4)
8 – Transformer
9 – LED Light Indicator
10 – Audible Speaker
11 – Output Temperature Control
12 – Microprocessor Control Chip
13 – Blue Button; Manual Audible Activation
14 – Terminal Spades for Leak Detect Wires
15 – Triacs (2)
16 – Triac Mounting Blocks to Heat Sink (2)
17 – Copper Heat Sink Tube

L1 – Power Connection Lugs (208 – 240 VAC)
L2 – Power Connection Lugs (208 – 240 VAC)

Limit Sw : Over Temperature Limit Switch
TH-IN : Inlet Temperature Sensor
TH-1 : Chamber Temperature Sensor #1
TH-2 : Chamber Temperature Sensor #2

PARTS IDENFICATION FOR SEISCO
SINGLE CHAMBER SUPERCHARGER, POU, HYDRONIC HEATERS



Title: SEISCO 1 CHAMBER WIRING DIAGRAM		
Size: A	Number: SZ240G03	Rev: A
Date: OCTOBER 10, 2012		Drawn by: JRH
Filename: SZ240G03.S01		Sheet 1 of 1

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COST COMPARISONS

This section provides estimated cost comparisons for the installation and operation of the Seisco water heater. Conventional electric and gas storage tank heaters have been the standard in new construction until the late 1990s. **Seisco's technology has opened the way for new design options for all water heating applications including space heating. There are a great many other issues that are favorably impacting the acceptance and use of Seisco electric water heating systems including the current deregulation of electric utilities in the U.S. and, rapidly rising energy costs.** The cost increase is particularly significant for heaters using natural gas. The global movement to reduce the burning of fossil fuels is expected to create energy shifts and new technologies. These issues, although very significant, are so broad and complex that they can only be noted at this time.

1. The Average American Home-In the average electrically heated or cooled home, the electric storage tank water heater is the second largest user of electricity, ranging typically from 15 to 20% of total energy use. It is the largest user of electricity in homes with non-electric heat. **SEISCO's energy efficiency and technology gives the homeowner an opportunity to significantly reduce the operating cost and energy use for hot water. In addition, the Seisco heater provides numerous other benefits over storage tank heaters as follows:**

- A Continuous and Endless Supply of Hot Water
- Space Savings
- Safety and Health Benefits
- Smart Technology
- No Maintenance
- Environmental Benefits

2. New Home Versus Existing Home Installation- Designing a new home with new technology can be fun and rewarding. The cost of installing new technology in a new home can also be controlled. The installation cost at the time of construction can be many times lower than the cost of installing the same technology in an existing home. Although this is not necessarily true in all cases, there are a few factors and variables that affect the cost of retrofitting the Seisco heater into an existing home.

Costs of installing a Seisco heater in an existing home can vary greatly. For instance, the possibility of running additional electrical circuits through finished walls and ceilings can be more costly. These additional cost factors are generally eliminated during the construction phase of a home because the equipment and labor costs can be anticipated. Wiring and plumbing for the Seisco heater can be planned ahead to avoid fishing wires and pipes through finished walls and ceilings. Also, a properly sized electrical service, and the appropriate electrical panel can be planned for in advance. The location of the Seisco heater can be selected in any home to allow shorter plumbing runs and thus reduce the cost due to waste water.

COST COMPARISON METHODS

Comparing the cost of various products can become very complicated. On the other hand, a simplified cost comparison can usually provide consumers with enough information to make an intelligent decision. This appendix contains a simplified approach for comparing total cost, installation and operation, of Seisco versus alternative water heaters. The simplified approach is designed to allow a quick, accurate comparison of installing a Seisco versus alternative water heaters. The simplified cost comparison is based on commonly applied cost information standard to any industry.

COST COMPARISON - A SIMPLIFIED APPROACH
(BREAK EVEN AND PAYBACK)

In the simplified cost comparison, purchase price, installation cost, and operating cost are considered. Logically speaking, installing a Seisco will result in one of three outcomes, an overall cost savings, an overall cost increase, or an overall neutral cost position. When a Seisco is installed and the overall installation and operating cost are both less than the alternative under consideration, a cost comparison is not necessary for obvious reasons. If installing a Seisco is both more expensive to install and operate, a cost comparison is not necessary. In this case, consumer preference dictates whether or not a Seisco is used in the application. When either the installed cost or the operating cost of an alternative is less than Seisco, a cost comparison should be used.

When performing a cost comparison, an overall cost savings or an overall cost increase requires a different mind set when analyzed. When the installed cost of the Seisco is less than the alternative but the annual operating cost is more, the question becomes "How long will it take to break even if the alternative water heater is installed in lieu of the Seisco?" For example, if the installed cost of the Seisco is $1,500 less than the alternative, and if the operating cost of the alternative water heater saves $50/year in operating cost, it would take 30 years for the operating cost savings of the alternative water heater to pay for the difference in installation cost. Practically speaking, water heaters do not last 30 years. It is easy to see that the alternative would never pay for itself.

The reverse applies to Seisco models. If the Seisco costs more to install, but has a lower operating cost, how long will it take to make up the difference in installation cost?

The simplified cost analysis that follows is designed to empirically answer these questions without the complications of considering other environmental variables that are more difficult to define and quantify. A more in-depth cost comparison that considers such factors as wasted hot water due to the location of the water heater, lower water temperatures and wasted energy from using conditioned air for combustion in gas water heaters are not considered in this cost comparison method.

The tables that follow are based on the following:

- 64.3 gallons/day average water usage per the DOE test procedure
- 77°F temperature rise for tank type water heater (58°F inlet water with 135°F outlet water based on DOE test procedure)
- 64.5°F temperature rise for Seisco water heater. The standard DOE test procedure utilized draws that allow a 25°F temperature decrease during the draw. The average temperature is therefore (135-25)+(25/2)=122.5°F. 58°F inlet + 64.5°F rise=122.5°F.
- Seisco water heater efficiency of 99.3%
- Operating costs for tank type gas, electric, and tankless gas water heaters are calculated using the same equations provided by GAMA in the February 2006 edition of the Consumer's Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment.
- Example calculations use $1.40/therm for natural gas cost and 8.42 cents/kWh for the cost of electricity.

HOW TO DO COST COMPARISON

1. Determine the purchase price of the Seisco and the alternative model.
2. Determine the installation cost of both alternatives. Include materials and labor.
3. Use Table 1 to determine the annual operating cost for the Seisco model based on the local cost per kWh or use the national average of 8.42 cents if the local cost is unknown.
4. Use Table 1 to determine the annual operating cost for the alternative electric model, Table 2 for natural gas products, or Table 3 for propane products. When using Table 2 or 3, consider that the overall efficiency of the majority of tank type water heaters is usually 50-55%. The overall efficiency of tankless gas water heaters is usually less than 80%. As scale builds up inside gas water heaters, the efficiency can significantly decrease.
5. Use Table 4 to record the appropriate information for determining the payback or break even point.

Note: Data in the tables may be interpolated between rows and columns. For example, if propane increases in price to $2.40/gallon. The $1.20/gallon row may be used my multiplying the values by 2. If the price went to $2.45/gallon, the $1.20/gallon and $1.25/gallon rows could be added together.

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COST COMPARISON 1-A SIMPLIFIED APPROACH

(Table 1-Electric Water Heater Operating Cost)

	Seisco Operating Cost	Standard Electric Water Heater Operating Cost Based on DOE Test Procedure ($ Dollars) By Energy Factor and Cost per kWh of Electricity								
Cost Per kWh	**.993**	**0.8**	**0.82**	**0.84**	**0.86**	**0.88**	**0.9**	**0.92**	**0.94**	**0.96**
2	74	110	107	105	102	100	98	95	93	91
2.5	93	137	134	131	128	125	122	119	117	114
3	112	165	161	157	153	150	146	143	140	137
3.5	130	192	187	183	179	175	171	167	163	160
4	149	220	214	209	204	200	195	191	187	183
4.5	167	247	241	235	230	225	220	215	210	206
5	186	274	268	261	255	249	244	239	234	229
5.5	205	302	295	288	281	274	268	263	257	252
6	223	329	321	314	306	299	293	286	280	274
6.5	242	357	348	340	332	324	317	310	304	297
7	260	384	375	366	357	349	342	334	327	320
7.5	279	412	402	392	383	374	366	358	350	343
8	298	439	428	418	408	399	390	382	374	366
8.42	313	462	451	440	430	420	411	402	393	385
8.5	316	467	455	444	434	424	415	406	397	389
9	335	494	482	470	460	449	439	430	420	412
9.5	353	521	509	497	485	474	463	453	444	435
10	372	549	535	523	511	499	488	477	467	457
10.5	391	576	562	549	536	524	512	501	490	480
11	409	604	589	575	562	549	537	525	514	503
11.5	428	631	616	601	587	574	561	549	537	526
12	446	659	643	627	613	599	585	573	561	549
12.5	465	686	669	653	638	624	610	597	584	572
13	484	714	696	680	664	649	634	620	607	595
13.5	502	741	723	706	689	674	659	644	631	617
14	521	768	750	732	715	699	683	668	654	640
14.5	539	796	776	758	740	724	707	692	677	663
15	558	823	803	784	766	748	732	716	701	686
15.5	577	851	830	810	791	773	756	740	724	709
16	595	878	857	836	817	798	781	764	747	732
16.5	614	906	884	863	842	823	805	788	771	755
17	633	933	910	889	868	848	829	811	794	778
17.5	651	961	937	915	894	873	854	835	817	800
18	670	988	964	941	919	898	878	859	841	823

COST COMPARISON 1-A SIMPLIFIED APPROACH

(Table 2-Natural Gas Water Heater Operating Cost)

Standard Natural Gas Water Heater Operating Cost Based on DOE Test Procedure ($ Dollars) By Energy Factor and Cost Per Therm of Natural Gas										
Cost/ Therm	**0.85**	**0.80**	**0.75**	**0.70**	**0.65**	**0.60**	**0.55**	**0.50**	**0.45**	**0.40**
$0.9	$159	$169	$180	$193	$207	$225	$245	$270	$300	$337
$1.0	$176	$187	$200	$214	$230	$250	$272	$300	$333	$375
$1.1	$194	$206	$220	$235	$254	$275	$300	$330	$366	$412
$1.2	$212	$225	$240	$257	$277	$300	$327	$360	$400	$449
$1.3	$229	$243	$260	$278	$300	$325	$354	$390	$433	$487
$1.4	$247	$262	$280	$300	$323	$350	$381	$419	$466	$524
$1.5	$264	$281	$300	$321	$346	$375	$409	$449	$499	$562
$1.6	$282	$300	$320	$342	$369	$400	$436	$479	$533	$599
$1.7	$300	$318	$340	$364	$392	$424	$463	$509	$566	$637
$1.8	$317	$337	$360	$385	$415	$449	$490	$539	$599	$674
$1.9	$335	$356	$380	$407	$438	$474	$518	$569	$633	$712
$2.0	$353	$375	$400	$428	$461	$499	$545	$599	$666	$749
$2.1	$370	$393	$419	$449	$484	$524	$572	$629	$699	$787
$2.2	$388	$412	$439	$471	$507	$549	$599	$659	$732	$824
$2.3	$405	$431	$459	$492	$530	$574	$626	$689	$766	$861
$2.4	$423	$449	$479	$514	$553	$599	$654	$719	$799	$899
$2.5	$441	$468	$499	$535	$576	$624	$681	$749	$832	$936
$2.6	$458	$487	$519	$556	$599	$649	$708	$779	$866	$974
$2.7	$476	$506	$539	$578	$622	$674	$735	$809	$899	$1,011
$2.8	$494	$524	$559	$599	$645	$699	$763	$839	$932	$1,049
$2.9	$511	$543	$579	$621	$668	$724	$790	$869	$965	$1,086
$3.0	$529	$562	$599	$642	$691	$749	$817	$899	$999	$1,124

Note: There exists some confusion both inside and outside the water heating industry concerning various definitions of efficiency. For example, recovery efficiency is a term often used by manufacturers is a measure of how much heat produced by the burner of a commercial gas water heater is actually transferred to the water. Most gas water heaters have a recovery efficiency of approximately 80%. Recovery efficiency does not take into account heat lost to the atmosphere while the water heater is standing idle. This is called standby heat loss and is approximately 2 1/2-5% of the energy stored in water per hour. Standby heat loss significantly lowers the overall efficiency of gas water heaters. For example, a standard 50-gallon gas residential water heater will have a recovery efficiency of approximately 75-80%, but the overall efficiency as measured by Department of Energy's (DOE) standardized test method produces an energy factor of approximately 55%. Energy factor as used by the Department of Energy and published by the Gas Appliance Manufacturer's Association (GAMA) is the result of a standardized test measuring the water heater's overall efficiency without taking into account the water heating system. The overall efficiency of producing and delivering hot water to the consumer is not defined, measured, and quantified for official publication by the Department of Energy.

Therefore, when considering which efficiency category to use in the cost calculation, make sure the efficiency is based on the appliance's overall efficiency, not recovery efficiency. To better predict long-term efficiency associated with efficiency degradation due to scale buildup inside a gas water heater, an even lower efficiency number should be considered.

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COST COMPARISON 1-A SIMPLIFIED APPROACH

(Table 3-Propane Gas Water Heater Operating Cost)

Standard Propane Gas Water Heater Operating Cost Based on DOE Test Procedure ($ Dollars) By Energy Factor and Cost per Gallon of Propane										
Cost/Gal	**0.85**	**0.80**	**0.75**	**0.70**	**0.65**	**0.60**	**0.55**	**0.50**	**0.45**	**0.40**
$1.50	$289	$308	$328	$352	$379	$410	$447	$492	$547	$615
$1.75	$338	$359	$383	$410	$442	$478	$522	$574	$638	$718
$2.00	$386	$410	$437	$469	$505	$547	$596	$656	$729	$820
$2.25	$434	$461	$492	$527	$568	$615	$671	$738	$820	$923
$2.50	$482	$513	$547	$586	$631	$683	$746	$820	$911	$1,025
$2.75	$531	$564	$601	$644	$694	$752	$820	$902	$1,002	$1,128
$3.00	$579	$615	$656	$703	$757	$820	$895	$984	$1,094	$1,230
$3.25	$627	$666	$711	$762	$820	$889	$969	$1,066	$1,185	$1,333
$3.50	$675	$718	$765	$820	$883	$957	$1,044	$1,148	$1,276	$1,435
$3.75	$724	$769	$820	$879	$946	$1,025	$1,118	$1,230	$1,367	$1,538
$4.00	$772	$820	$875	$937	$1,009	$1,094	$1,193	$1,312	$1,458	$1,640
$4.50	$868	$923	$984	$1,055	$1,136	$1,230	$1,342	$1,476	$1,640	$1,845
$5.00	$965	$1,025	$1,094	$1,172	$1,262	$1,367	$1,491	$1,640	$1,823	$2,050
$5.50	$1,061	$1,128	$1,203	$1,289	$1,388	$1,504	$1,640	$1,804	$2,005	$2,255
$6.00	$1,158	$1,230	$1,312	$1,406	$1,514	$1,640	$1,789	$1,968	$2,187	$2,461
$6.50	$1,254	$1,333	$1,422	$1,523	$1,640	$1,777	$1,939	$2,132	$2,369	$2,666
$7.00	$1,351	$1,435	$1,531	$1,640	$1,767	$1,914	$2,088	$2,296	$2,552	$2,871

(Table 4-Break Even Calculation)

	Steps	Tankless Gas	50-Gallon Gas	50-Gallon Electric	Your Unit
1	Purchase price of alternative water heater	$1,500.00	$350.00	$250.00	
2	Purchase price of Seisco water heater	$995.00	$995.00	$995.00	
3	Subtract line 2 from line 1.	$505.00	$(645.00)	$(745.00)	
4	Installation cost of alternative water heater	$1,000.00	$200.00	$250.00	
5	Installation cost of Seisco water heater	$400.00	$400.00	$400.00	
6	Subtract line 5 from line 4.	$600.00	$(200.00)	$(150.00)	
7	Total Incremental cost (Add lines 3 and 6)*	$1,105.00	$(845.00)	$(895.00)	
8	Estimated annual operating cost of alternative	$280.00	$466.00	$411.00	
9	Estimated annual operating cost of Seisco	$313.00	$313.00	$313.00	
10	Subtract line 9 from line 8.**	$33.00	$(153.00)	$(98.00)	
11	Break even or payback in years***	33.48	5.52	9.13****	

Note: The tankless gas unit's operating cost is based on overall efficiency of 75%. The tank type gas units is based on an overall efficiency of 45%. *If number is positive, the alternative unit costs more to purchase and install. If negative, the Seisco costs more to purchase and install. **If number is positive, Seisco costs more to operate than the alternative model. If negative, the alternative model costs more to operate than the Seisco. ***If line 10 is positive, this number represents the number of years it will take for the operating cost of the alternative unit to make up for the extra cost of the unit and its installation. If this number is negative, it represents how many years it will take the Seisco to pay for itself based on operating cost savings.

CALCULATIONS AND OTHER INFORMATION

WATER HEATING

Recovery GPH

Electric = (kW X 3413)/(8.33 X ΔT)

Gas = (BTU Input X Efficiency)/(8.33 X ΔT)

To find recovery in gallons/minute, divide by 60.

Req. Input

kW = (Gals. X 8.33 X ΔT)/3413

BTU = (Gals X 8.33 X ΔT)/% Efficiency

kW = kilowatt input
8.33 = weight of one gallon of water
ΔT = temperature rise
BTU = British Thermal Unit-the amount of energy it takes to raise one pound of water one degree F.

% Hot or Cold in A Mixture

% Hot = (M-C)/(H-C)

% Cold = (H-M)/(H-C)

H = Cold Water Temperature
C = Hot Water Temperature
M = Mixed Water Temperature

Miscellaneous

GPM = (kW X 6.83)/(temp. rise)

temp. rise = (kW X 6.83)/gpm

% Efficiency = (GHP X 8.33 X ΔT)/Btu/Hr. Input

Btu Output = GPH X 8.33 X ΔT

Water expands 4.34% when heated from 40°F to 212°F.

ELECTRICITY

Singe Phase Power

Watts = Amps X Volts

Amps = Watts/Volts

Volts = Watts/Amps

TEMPERATURE CONVERSIONS

Fahrenheit (F) to Centigrade(C)=(F-32) X .556

Centigrade (C) to Fahrenheit (F)=(C X 1.8) + 32

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Out With The Old ... In With The New

Patented ***PowerShare*** Technology

SEISCO'S exclusive patented Power Share Technology allows the Seisco whole house heater to be used in virtually any home having a standard 150/200 amp electric service panel. Rarely is an upgrade to the electrical service required.

This technology also eliminates power quality issues such as "light flicker", by modulating power and frequency to the elements and balancing the load. This patented modulation feature allows control of the heaters output between 1-100%. SEISCO uses only the power necessary to heat the amount of water being used. SEISCO provides stable temperature output even as demand varies (no cold water sandwich!)

SEISCO operates well below it's maximum heating capacity in most hot water applications.

SEISCO'S *96+% Thermal Efficiency offers energy savings of 15-50% and more depending on your usage patterns. Only heat water when you need it, virtually eliminating standby heat loss.*

More Usable Space

Reclaim space used for your current water heater or enjoy an extra closet in your new home. 5-14kW models are only 10" W X 16" H X 6" D. 18-32KW models are only 16" W X 16" H X 6" D. Install your SEISCO almost anywhere.

10-Year Limited Warranty* - Due to superior construction, SEISCO's warranty is 67% longer than a standard tank type water heater's 6-year warranty. SEISCO's internal water passages are constructed of a rugged DuPont® nylon and will last more than twice the length of the warranty.

Microprocessor Controlled - With on-board computer logic, SEISCO's microprocessor provides accurate temperature control to avoid uncomfortable temperature variations, self-diagnostics to make servicing easy, a water leak detector to shut down the water heater and sound an alert should a leak occur, and power sharing to the heating elements to prolong heating element life.

Thermistor Temperature Sensing - Five immersion temperature sensors, like those commonly used in expensive commercial water heaters, provide accurate readings to the microprocessor control to facilitate extremely accurate temperature control and to prevent sudden changes in water temperature while you shower.

Lower Electric Bills

SEISCO can save up to 25% on your water heating bill! With an efficiency rating of over 99%, Seisco is the perfect addition to your home. SEISCO eliminates expensive standby energy losses associated with tank type water heaters.

Flow Sensing Without A Switch - Since SEISCO senses water flow by using very accurate electronic sensors, the need for a mechanical flow switch is eliminated. Flow switch failure is a common service issue associated with other tankless water heaters.

Standard Heating Elements - SEISCO uses heating elements like those found in standard tank type electric water heaters making replacement simple, no special parts to purchase and no special skills required.

Easy to Service - Although seldom required, cleanout plates on the bottom of the SEISCO allow quick easy access for removing sediment or sand. SEISCO's self-diagnostic control and an LED light identify service issues through a series of flashes. An audible beep can be used by SEISCO's customer service department to diagnose issues over the phone.

Endless Hot Water

Every member of the family can take a shower one after the other without running out of hot water. Fill the bathtub and have endless hot water to keep it warm. Never run out of hot water again. Switch to SEISCO and end the worry!

PowerShare™ Technology - SEISCO uses only the power necessary to heat the amount of water being used. SEISCO's microprocessor uses electronic triacs to adjust the amount of heat produced by the heating elements from 1-100%. In fact, most of the time, SEISCO is operating well below its maximum heating capacity. This also helps prevent harmful scale buildup and reduces heating element failures.

SEISCO

"The electrical energy savings of the demand (Seisco) water heaters with a parallel piping system over the standard tank with a tree-piping system (tank-tree system) was 34% for the low-use home and 14% for the hi-use home."

–August 2003 report from the National Association of Home Builder's Research Center based on data developed through testing by the National Renewable Energy Laboratories NREL. (***Seisco added***)

Superior Technology and Reliability

SEISCO








Renewable Electric Energy

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