

WATER HEATING PRODUCT GUIDE



Endless Hot Water

*"The Perfect Solution for
Residential and Commercial
Water Heating"*



TANKLESS WATER HEATERS

Welcome to Microtherm's Seisco tankless electric water heating family. I'm David Seitz, the Chief Executive Officer of Microtherm, Inc. The Seisco award winning tankless electric water heating product line incorporates superior technology that has earned five U.S. and many more foreign patents. Microtherm, Inc. introduced 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.

Seisco models are unique and incorporate many features unmatched by the competition. I invite you to investigate 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 and a six-year warranty versus the standard commercial electric water heater warranty of three years.

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 Microtherm, Inc. 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 Microtherm team when I say that "we appreciate your business!"

-David Seitz, CEO



SEISCO



Endless Hot Water

Table of Contents

| | | | |
|--|-------|--|-------|
| Introduction | 4-9 | Sample Calculations | 33 |
| Seisco is Superior | 4 | Calculation Form For Existing Dwelling | 34 |
| PowerShare Technology, Flicker | 5 | NEC-Branch Circuit Protection | 35 |
| Eliminates Flicker | 5 | Capacity of Wire | 36 |
| Ease of Service and Self-Diagnostics | 5 | RA/CA Wire and Breaker Sizing | 37-39 |
| Demand and Energy | 5 | Single and Three-Phase Connections | 40 |
| General Information | 6 | Wiring Connection Diagrams | 41 |
| Construction, Safety, Power Rating, | 6 | Installation Considerations | 42-48 |
| Heat Input, Voltage Rating, Maximum Amperage | 6 | Top/Side/Front Clearance & Mounting Height | 42 |
| Four Chamber Design, Inside View | 7 | HUD Rules For Manufactured Housing | 43 |
| Electrical Capacity, Temp. Rise, Peak Flow Rate | 8 | Where to Install, Prevention of Storage, Temperature | |
| RA Technical Information & Performance | 9 | and Pressure Relief Valve | 43 |
| Residential Model Selection | 10-12 | Plumbing Installation | 44-45 |
| Selecting the Proper Size | 10 | General, Attaching the Water Supply, Temperature and | |
| Electrical Service | 10 | Pressure Relief Valve | 44-45 |
| Home Classification | 10 | Electrical Installation Guide | 45-46 |
| Consumer Preferences | 10 | Connection to Power Supply | 45 |
| Sizing Rules of Thumb | 10 | Supply Side Connection | 45 |
| Low/High Flow Home Sizing Tables | 11 | Pre-Power Check and Power Check | 46 |
| Special Needs Sizing Table | 12 | Operational Checks | 46 |
| Residential Piping Diagrams | 13-15 | Beeps & Flashing Lights, On-Board Self Diagnostic | |
| Hot Water Circulating System Diagram | 15 | Capabilities | 46 |
| Instant Hot Water Diagram | 15 | Water Leak Detection | 46 |
| Residential Application | 16-19 | System Match-Faucets and Heater | 47 |
| Plumbing, Location, | 16 | Solutions for High Flow Applications | 47 |
| Application Diagrams | 17-20 | Temperature Adjustment | 47 |
| Single Story Floor Plan (2 baths) | 17 | Troubleshooting Guide | 48 |
| Two Story Floor Plan (2 /12 baths) | 18 | Appendix | 49-62 |
| Florida Style Home | 19 | 208/380-Volt Model Spec. Recovery Rates | 49 |
| Solar Water Heating Application | 20 | 240-Volt Models Operated At 208 Volts | 50 |
| Multi-Dwelling Sizing | 21-24 | Pressure Drop Curves | 50 |
| Introduction | 21 | Warranty Fact Sheet | 51 |
| Apartments | 22 | Parts Identification | 52-53 |
| Hotel/Motels | 23 | Four Chamber Models | 52 |
| Dormitories | 24 | Two Chamber Models | 53 |
| Commercial Sizing | 25-26 | Cost Comparison | 54-58 |
| kW Input, Amp Draw | 25 | Introduction & Cost Comparisons Methods | 54 |
| 1, 2, and 3 Hour Availability Tables | 26 | Cost Comparison-A Simplified Approach | 55-58 |
| Commercial Piping Diagrams | 27-30 | Introduction/How to Do Cost Comparison | 55 |
| Single or Multiple Units With or Without Booster | 27 | Table 1-Electric Operating Cost | 56 |
| Storage Tank Applications | 28-29 | Table 2-Natural Gas Operating Cost | 57 |
| Manifolding Storage Tanks | 30 | Table 3-Propane Operating Cost | 58 |
| Booster Heaters With Storage Tanks | 30 | Table 4-Break Even Calculation | 58 |
| Electrical Requirements | 31-41 | Competitive Cross Reference Table | 59 |
| General Electrical Information | 31 | Patents & Compliance Listings | 60 |
| Table-240V Model Basic Electrical & Circuit Req | 31 | References and What Others are Saying | 61 |
| NEC-Load Calculations | 32-24 | Calculations and Other Information | 62 |

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 Savings

Natural and propane gas prices are on the rise...doubling in many parts of the United States during the fall and winter of 2005-2006. ***Prices are expected to continue rising...perhaps doubling again! Seisco saves as much as 25% of the cost of hot water when compared to a standard tank type electric water heater.***

Low Installed Cost With Savings

Even though electric rates have risen, the rate of increase is much less than that of natural and propane gas. In many traditionally gas water heating areas, 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.***

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 and commercial sizing guides are provided in this Water Heating Product Guide. Also, Microtherm has technicians standing by to help determine which model best suits your home design and the lifestyle of your home buyers. For immediate help, call 888-296-9293 and ask for sales.
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, homes with only a 200 amp service will easily handle the two largest Seisco models, RA-32 and RA-28, which will provide adequate hot water for most homes. An electrician should check 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 after it is turned on. This guide provides residential and commercial 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.



Endless Hot Water

Introduction

SEISCO IS SUPERIOR

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 owing 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.

Ease of Service and Self-diagnostics: Seisco's micro-processor control is programmed with Seisco's patented control technology to provide 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 worse 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.

GENERAL INFORMATION

Seisco models are manufactured in two basic sizes, a four-chamber unit (15 3/4" x 15 3/4" x 6 1/4") and a two-chamber unit (15 3/4" x 10 1/4" x 6 1/4"). 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 RA/CA-5, 7, 9, 11, & 14 are two-chamber models designed specifically for booster and point-of-use applications. Consult written specification sheets for model specific information.

There are no moving parts or flow restricting devices used in Seisco heaters. Seisco uses electronic temperature sensors, called thermistors, for unique patented flow/no flow activation and detection. In standby, the heater maintains a very subtle temperature gradient. Flow is detected when there is a change 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 light weight 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 1/2 inch, screw-type heating elements are utilized which are interchangeable with heating elements available from virtually any plumbing distributor.

Safety: 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. Dual water level sensors are used to prevent dry firing of the heating elements. 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 14 kilowatts (kW). Refer to Seisco product specification sheets for KW ratings by model.

Heat Input: 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 a 95,564 BTUs of heat input. Refer to Seisco specification sheet for heat input by model.

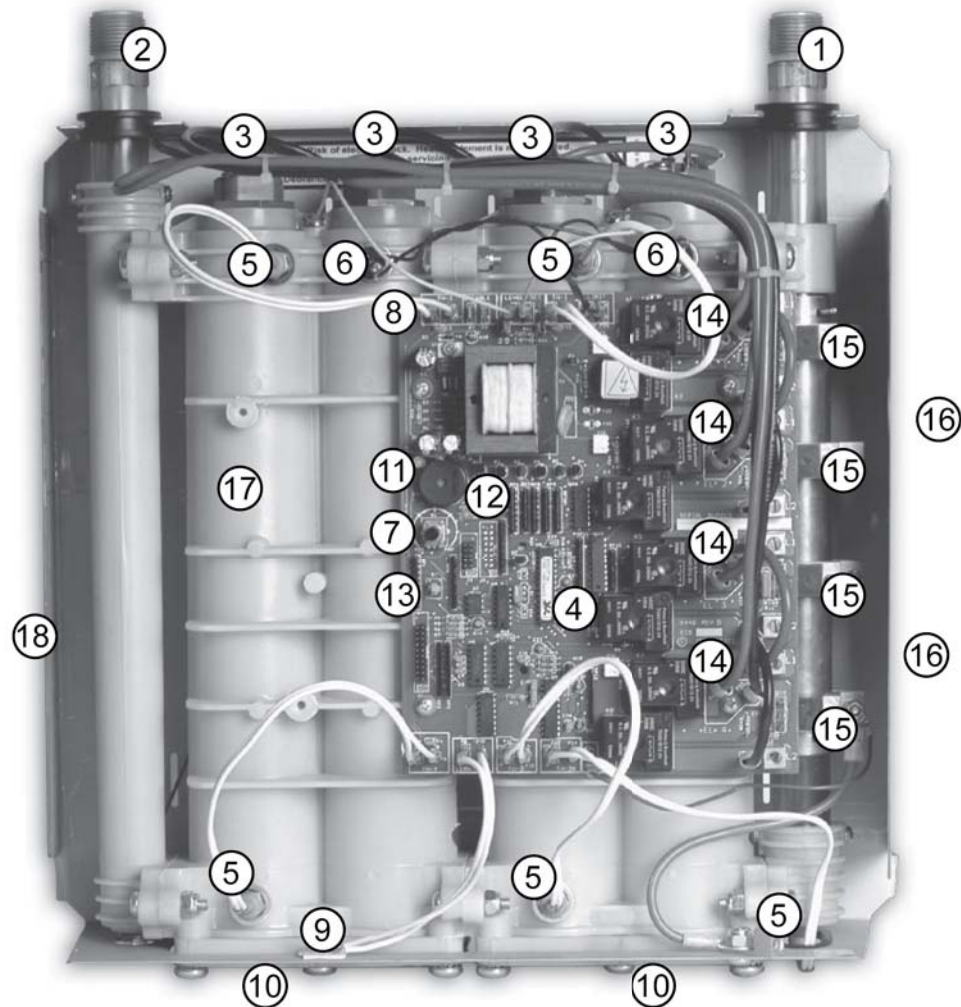
Voltage Ratings: Seisco heaters are manufactured with common 240 volt (AC) heating elements designed for optimum operation on a standard residential 240 volt (AC) electric service, but will operate at 208 volt (AC), a typical commercial voltage, with standard 240 VAC heating elements. However, the power rating and the heat output are reduced by 25%. Models designed for 208 VAC operation, up to 24 kW, at full power and output levels can be special ordered. Refer to the appendix in this publication for performance of 240 volt models operated at 208 volts.

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 can be much less than the maximum rating of the heater. Refer to the maximum amp rating in the electrical requirements section of this publication.



Endless Hot Water

Introduction



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 |

Introduction



Endless Hot Water

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. **Along with the temperature rise, the flow rate must also be determined in order to choose the appropriate Seisco heater. The flow rate is determined by the flow rate of the fixtures using hot water and the user's lifestyle. Due to usage diversity of fixtures, adding the flow rate of all fixtures together to determine demand is overkill.** 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 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.

Designer fixtures and faucets may have unusually high flow rates. For instance, large custom body spa show-

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 |

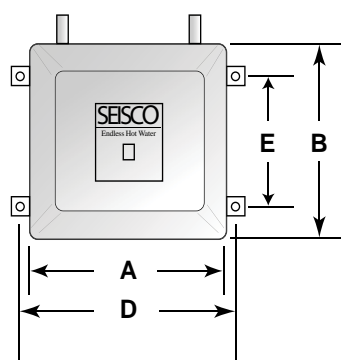


Endless Hot Water

Introduction

ers, whirlpool and Jacuzzi tubs may have faucets with flow rates ranging from 6 gpm to 18 gpm. However, 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).



*Depth: Not Shown On Drawing

**Optional: 1-60 amp. breaker,

***Optional: 2-60 amp. breakers. All

models are 99+% efficient. ****Optional: 2-75-amp. breakers.

| Model | RA-5 | RA-7 | RA-9 | RA-11 | RA-14 | RA-18 | RA-22 | RA-28 | RA-32 |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| KW Input | 5 | 7 | 9 | 11 | 14 | 18 | 22 | 28 | 32 |
| BTU Input | 17,065 | 23,891 | 30,717 | 37,543 | 47,782 | 61,434 | 75,086 | 95,564 | 122,868 |
| A | 10 1/4" | 10 1/4" | 10 1/4" | 10 1/4" | 10 1/4" | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" |
| B | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" | 15 3/4" |
| C* | 6 1/4" | 6 1/4" | 6 1/4" | 6 1/4" | 6 1/4" | 6 1/4" | 6 1/4" | 6 1/4" | 6 1/4" |
| D | 10 7/8" | 10 7/8" | 10 7/8" | 10 7/8" | 10 7/8" | 16 1/8" | 16 1/8" | 16 1/8" | 16 1/8" |
| E | 7" | 7" | 7" | 7" | 7" | 12 1/2" | 12 1/2" | 12 1/2" | 12 1/2" |
| Weight (lbs) | 15 | 15 | 15 | 15 | 15 | 23 | 23 | 23 | 23 |
| 240 V. Amp. | 20.8 | 29.2 | 37.5 | 45.8 | 58.3 | 75.0 | 91.7 | 116.7 | 133.0 |
| # Elements | 2 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 4 |
| Element KW | 2.5 | 3.5 | 4.5 | 5.5 | 7 | 4.5 | 5.5 | 7 | 8 |
| # Breakers (240V) | 1 | 1 | 1 | 1 | 2** | 2 | 2 | 4*** | 4**** |
| Breaker (amps) | 25 | 30 | 40 | 50 | 30 | 40 | 50 | 30 | 40 |

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

| Model | Temp. Rise | 65 | 60 | 55 | 50 | 45 | 40 | 35 | 30 | 25 | 20 | 15 |
|-------|------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| RA-5 | gpm | 0.53 | 0.56 | 0.62 | 0.68 | 0.76 | 0.85 | .98 | 1.1 | 1.4 | 1.7 | 2.3 |
| | 1st Hour | 31.5 | 34.1 | 37.2 | 41.0 | 45.5 | 51.2 | 58.5 | 68.3 | 81.9 | 102.4 | 136.6 |
| RA-7 | gpm | 0.74 | 0.81 | 0.88 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 | 1.9 | 2.4 | 3.2 |
| | 1st Hour | 44.1 | 47.8 | 52.1 | 57.4 | 63.7 | 71.7 | 81.9 | 95.6 | 114.7 | 143.4 | 191.2 |
| RA-9 | gpm | 0.95 | 1.0 | 1.1 | 1.2 | 1.4 | 1.5 | 1.8 | 2.0 | 2.5 | 3.1 | 4.1 |
| | 1st Hour | 56.7 | 61.5 | 67.0 | 73.8 | 81.9 | 92.2 | 105.4 | 122.9 | 147.5 | 184.4 | 245.8 |
| RA-11 | gpm | 1.2 | 1.3 | 1.4 | 1.5 | 1.7 | 1.9 | 2.1 | 2.5 | 3.0 | 3.8 | 5.0 |
| | 1st Hour | 69.3 | 75.1 | 81.9 | 90.1 | 100.2 | 112.7 | 128.8 | 150.2 | 180.3 | 225.3 | 300.5 |
| RA-14 | gpm | 1.5 | 1.6 | 1.7 | 1.9 | 2.1 | 2.4 | 2.7 | 3.2 | 3.8 | 4.8 | 6.4 |
| | 1st Hour | 88.2 | 95.6 | 104.3 | 114.7 | 127.5 | 143.4 | 163.9 | 191.2 | 229.4 | 286.8 | 382.4 |
| RA-18 | gpm | 1.9 | 2.0 | 2.2 | 2.5 | 2.7 | 3.1 | 3.5 | 4.1 | 4.9 | 6.1 | 8.2 |
| | 1st Hour | 113.5 | 122.9 | 134.1 | 147.5 | 163.9 | 184.4 | 210.7 | 245.8 | 295.0 | 368.8 | 491.7 |
| RA-22 | gpm | 2.3 | 2.5 | 2.7 | 3.0 | 3.3 | 3.8 | 4.3 | 5.0 | 6.0 | 7.5 | 10.0 |
| | 1st Hour | 138.7 | 150.2 | 163.9 | 180.3 | 200.3 | 225.3 | 257.5 | 300.5 | 360.6 | 450.7 | 600.9 |
| RA-28 | gpm | 2.9 | 3.2 | 3.5 | 3.8 | 4.2 | 4.8 | 5.5 | 6.4 | 7.6 | 9.6 | 12.7 |
| | 1st Hour | 176.5 | 191.2 | 208.6 | 229.4 | 254.9 | 286.8 | 327.8 | 382.4 | 458.9 | 573.6 | 764.8 |
| RA-32 | gpm | 3.4 | 3.6 | 3.9 | 4.4 | 4.8 | 5.5 | 6.2 | 7.3 | 8.7 | 10.9 | 14.6 |
| | 1st Hour | 204 | 216 | 234 | 264 | 288 | 330 | 372 | 438 | 522 | 654 | 876 |

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. Tubs 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 several hours 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.



Endless Hot Water

Residential Model Selection

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 Bath-rooms | 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 Bath-rooms | 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."

Residential Model Selection



Endless Hot Water

Special Needs Within The Home

Special needs represent non-standard construction characteristics such as shower flow rates greater than 3 gpm, high fill rates for baths or jetted tubs, body showers, multiple washing machines, high flow kitchen and bathroom sink fixtures, or any other special water usage situation.

Two methods may be used to meet the requirements of special needs homes. The desired maximum flow rate can be calculated and multiple Seiscos employed to meet the maximum flow demand, or Seisco can be combined with a storage tank or storage water heater. Table 3 combines high recovery Seisco model(s) with a storage tank or tank water heater to accommodate high flow rates for a short period of time. To determine how long (minutes) a flow rate can be sustained, multiply the storage tank size by .8 and divide the result by the desired flow rate.

Two piping configurations of this system are used, one using the Seisco as an "extender" heater and one using the Seisco as an auxiliary heat source for rapidly recovering the storage tank.

In the first piping arrangement, as a "Extender," Seisco has the ability to provide a limited continuous flow of hot water designed to run one or two showers

indefinitely, or fill a washing machine, etc., after the tank type water heater's storage has been exhausted. The temperature setting of the tank type water heater should be set down to 120°F, reducing standby heat loss. Recovery time of the stored water in the tank type water heater is much longer than the second piping arrangement, up to several hours longer. See the top diagram on page 14.

In the second piping arrangement, Seisco is used as a high input heat source for quickly reheating water in the storage tank. As water in the storage tank is withdrawn, Seisco works to quickly restore used hot water. This is a typical system design used in many large hot water demand commercial applications. The commercial application section of this manual includes various different methods of applying storage tanks with Seisco's high recovery capabilities. This piping arrangement recovers stored hot water very rapidly, usually between 15 and 25 minutes, making the entire capacity of the storage tank available for immediate use. See the bottom diagram on page 14. A common application for this system is to provide water for body showers. Any gallon capacity of storage type water heater or storage tank can be combined with Seisco models. To determine how many minutes a body shower can be used without running out of hot water, use Table 4 below.

Table 3-Residential Sizing - Seisco with A Storage Water Heater or Storage Tank

| Number Bath-rooms | Storage Tank Size | 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 | Maximum Showers in First 10-Minute Period | Maximum Showers in First Hour |
|-------------------|-------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---|-------------------------------|
| 1 | 50 | RA-32 | RA-28 | RA-28 | RA-22 | RA-22 | RA-18 | RA-18 | 1 | 4-6 |
| 2 | 50 | RA-32 | RA-28 | RA-28 | RA-22 | RA-22 | RA-18 | RA-18 | 2 | 6-8 |
| 3 | 65 | RA-32 | RA-28 | RA-28 | RA-22 | RA-22 | RA-18 | RA-18 | 3 | 7-9 |
| 4 | 80 | RA-32 | RA-32 | RA-28 | RA-28 | RA-22 | RA-22 | RA-18 | 4 | 8-10 |
| 5 | 120 | 2 RA-28 | 2 RA-22 | 2 RA-22 | 2 RA-18 | RA-32 | RA-32 | RA-28 | 5 | 10-12 |

Table 4-Minutes of Hot Water Available in Body Shower

| Storage Tank Capacity | Inlet Water Temperature (F) | | | | | | |
|-----------------------|-----------------------------|------|------|------|------|------|------|
| | 40 | 45 | 50 | 55 | 60 | 65 | 70 |
| 50-Gal. | 4.9 | 5.0 | 5.1 | 5.2 | 5.3 | 5.5 | 5.7 |
| 65-Gal. | 6.4 | 6.5 | 6.6 | 6.8 | 6.9 | 7.2 | 7.4 |
| 80-Gal. | 7.9 | 8.0 | 8.1 | 8.3 | 8.5 | 8.8 | 9.1 |
| 120-Gal. | 11.8 | 12.0 | 12.2 | 12.5 | 12.8 | 13.2 | 13.7 |
| 160-Gal. | 15.8 | 16.0 | 16.3 | 16.6 | 17.1 | 17.6 | 18.3 |
| 240-Gal. | 23.6 | 24.0 | 24.4 | 25.0 | 25.6 | 26.4 | 27.4 |

Table 3 Notes: Based on 3 GPM shower heads and all showers running simultaneously for the first shower time. Using piping configuration #1, until the tank has recovered, only one shower is available on a continuous basis. Consider using this table for homes with two or more teenagers. To use this table, do not add 1/2 baths when calculating the number of bathrooms.

Table 4 Notes: Values in the table are based on 120°F stored water, 105°F. body shower, and a total flow rate of 10 GPM. For flow rates other than 10 gpm multiple the values in Table 4 by the conversion factors in the table below.

| GPM | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
|--------|------|------|------|------|------|------|------|------|
| Factor | 1.67 | 1.25 | 1.00 | 0.83 | 0.71 | 0.63 | 0.56 | 0.50 |



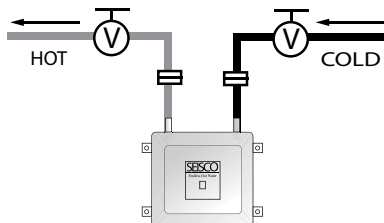
Endless Hot Water

Residential Piping Diagrams

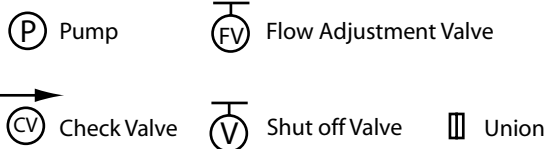
Residential Piping Diagrams

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.

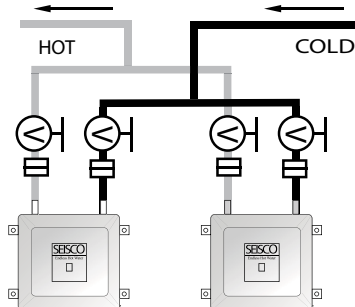


Symbol Legend For All Piping Diagrams



Dual Unit Installation

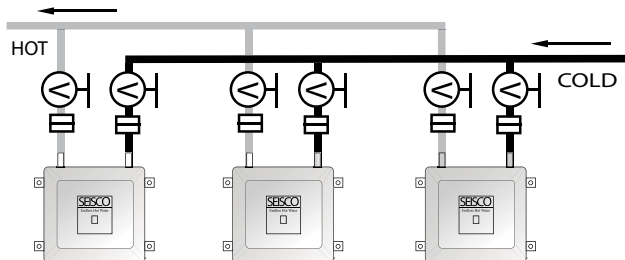
This is the standard piping diagram for two Seisco units plumbed in parallel in a whole house application sized using Table 1 or Table 2. For parallel installations, both Seisco heaters should be the the same model.



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

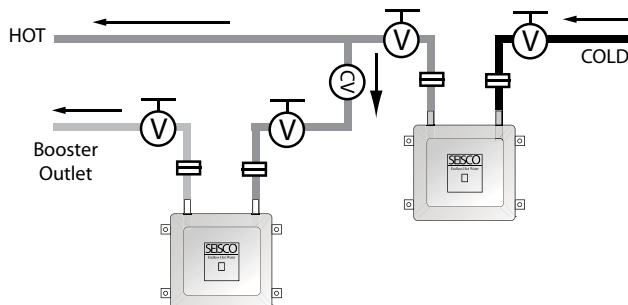
This is the standard piping diagram for three Seisco units plumbed in parallel in a whole house application sized using Table 1 or Table 2. The reverse return piping method is required.



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.

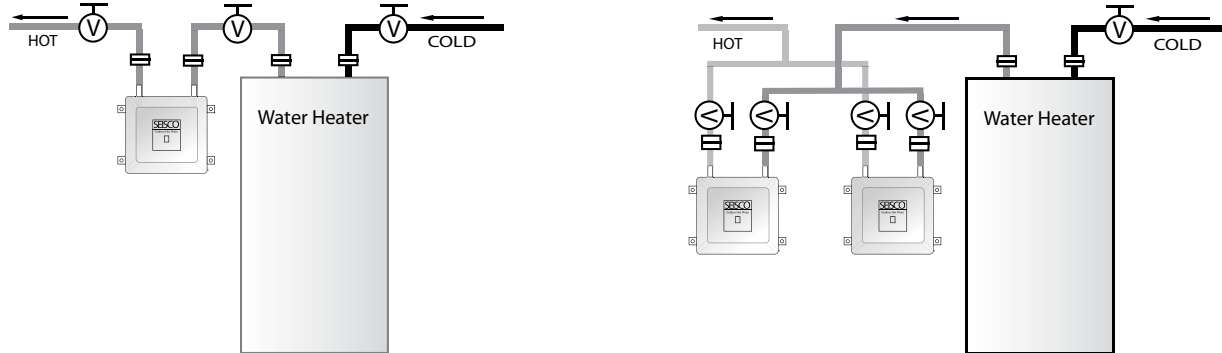


Residential Piping Diagrams



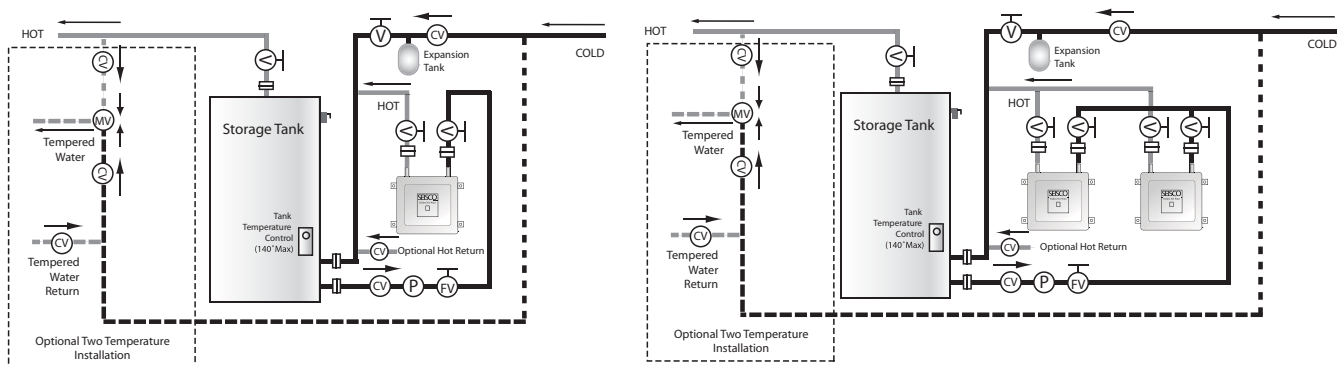
Endless Hot Water

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".

Seisco Model(s) As A High Input Heat Source For A Storage Tank



These are piping diagrams for Seisco units plumbed as a high input heat source for a storage tank for a whole house special needs application sized using Table 3. For parallel installations, all 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.

The storage tank thermostat should be set to 5-10°F. lower than the Seisco(s). Flow through the Seisco heaters should be set to 3-5 gpm per heater using the flow regulating valve. Use only a bronze circulating pump and new components suitable for potable water. Pipe the temperature and pressure relief valve on the storage tank to an open drain in accordance with code. Water lines to the tankless water heaters should be 3/4". The manifold size for multiple Seisco units should be sized by a plumbing engineer.

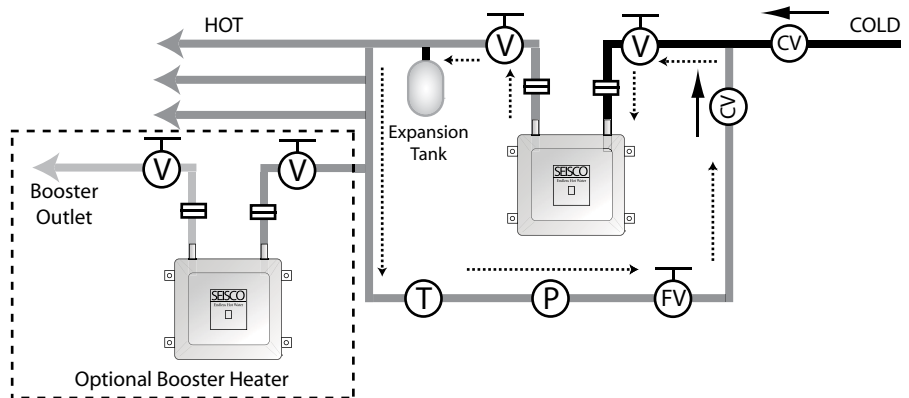
Although not shown, immersion well thermometers are recommended in the outlet piping from each water heater and the outlet of the storage tank. All piping diagrams are shown with an optional mixing valve for two temperature systems. The location of optional return circulation lines are shown for the primary hot water outlet as well as the tempered water outlet. Check valves should be installed as shown. Each water heater and storage tank should have shut off valves for isolation during maintenance, repair, or replacement.

Water expands when heated. Check valves will cause a closed system with no allowance for expansion. Allowance must be made for expanding water or the temperature and pressure relief valve will open to relieve the pressure. Expansion tanks must be installed as indicated on the piping diagram. Consult the expansion tank supplier for the correct expansion tank size and installation procedures.

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 it flows through the water heater.



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 it flows through the water heater.

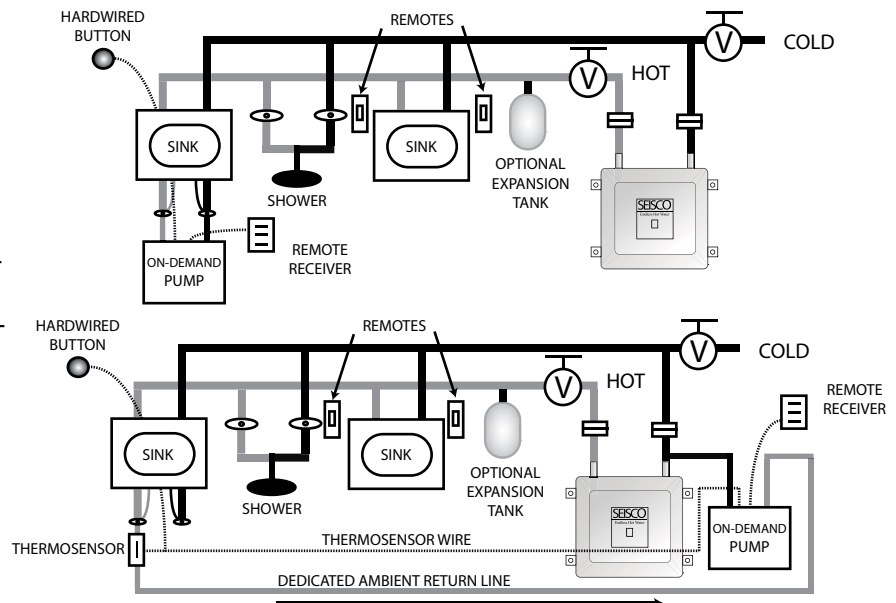
Instant Hot Water On-Demand System

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 on the on-demand system shown above, visit www.gothotwater.com.



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 15° 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 a hot water manifold distribution system. The use of PEX tubing and standard manifolds offer an affordable and unique means for 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. A suitable drain should be installed in such locations. 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.

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 RA-18 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-18 or RA-22, can be located downstream and closer to the master bath. This arrangement helps reduce 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 almost 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.

If it is necessary to install the Seisco heater on the second floor or in the attic, or any other area that is not in the open and cannot be routinely observed, a suitable drain pan should be installed to avoid damaging ceilings, walls and floors in the event of a leak.

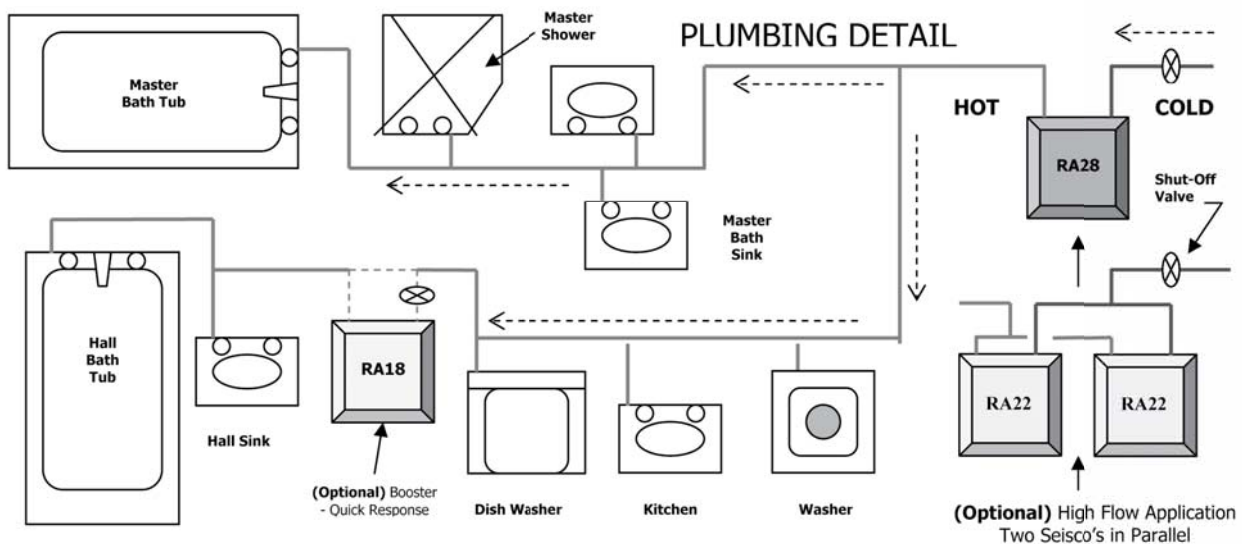
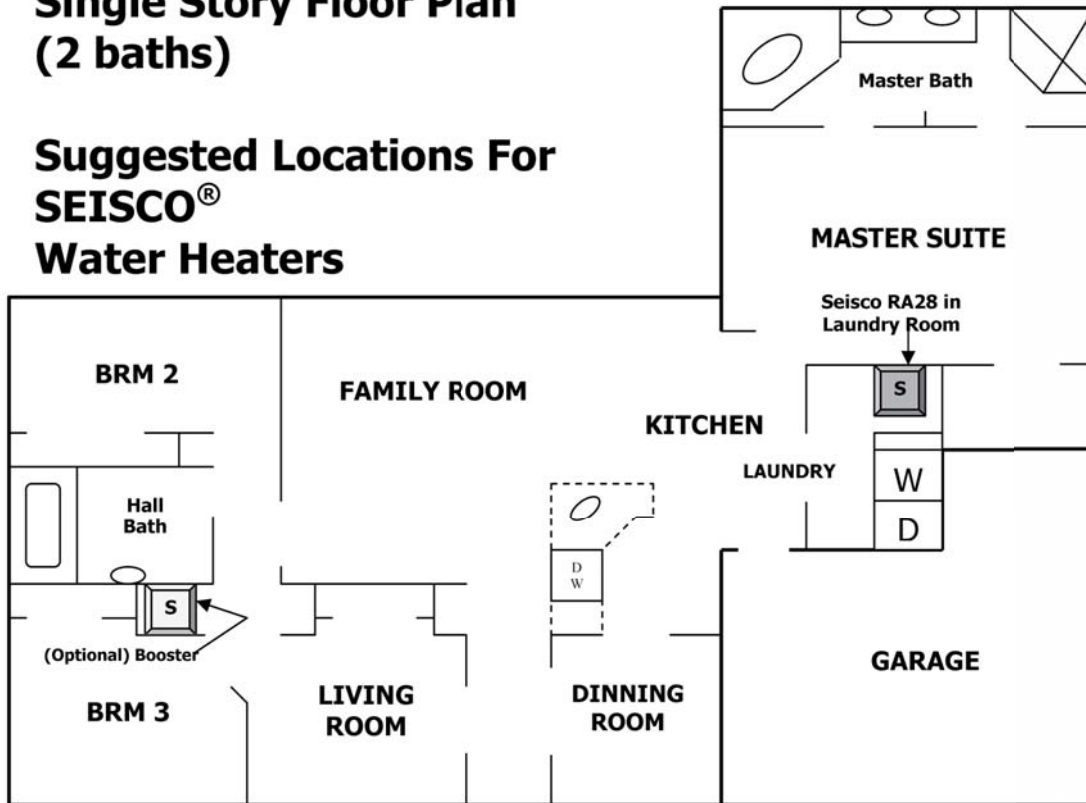


Endless Hot Water

Residential Application

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.

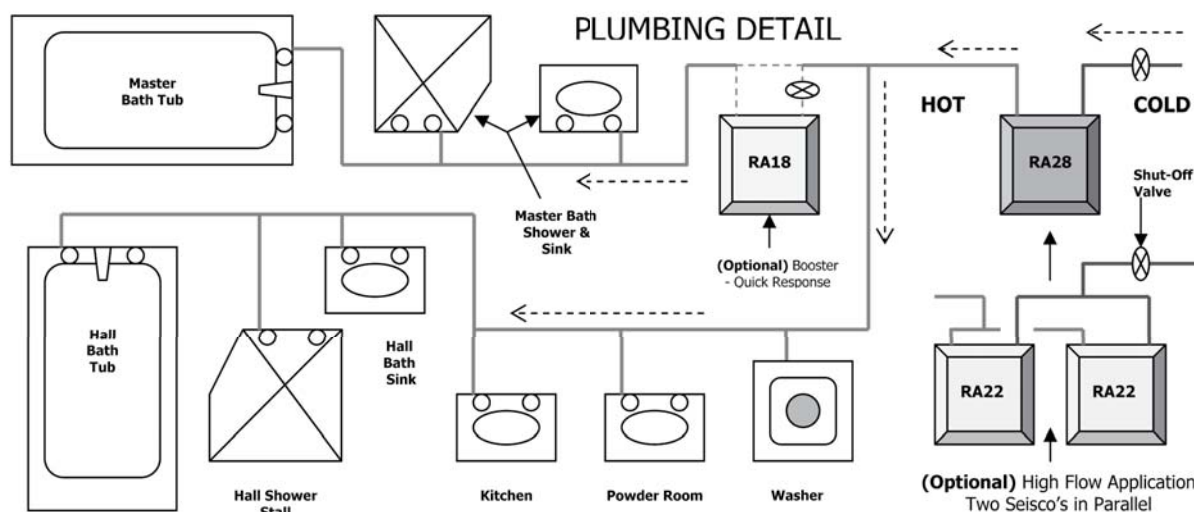
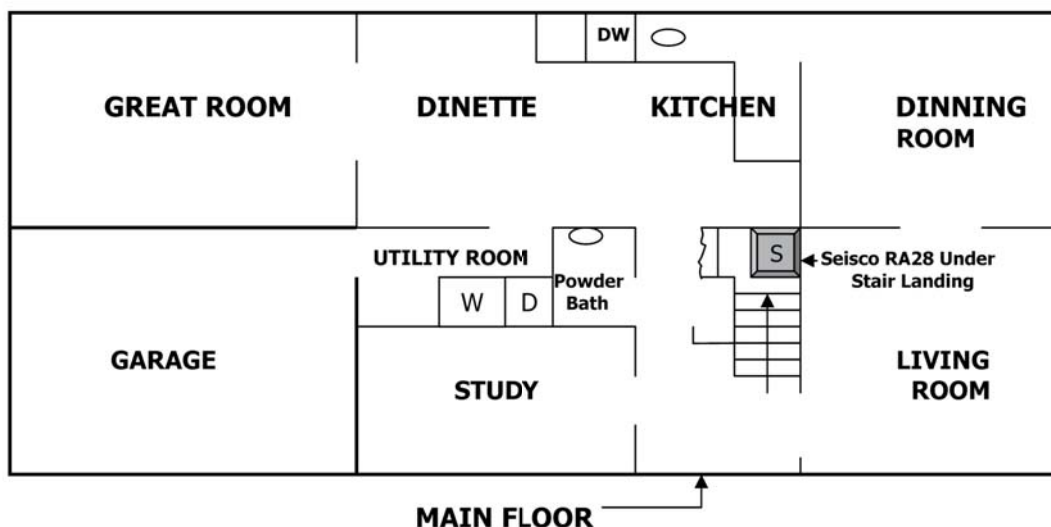
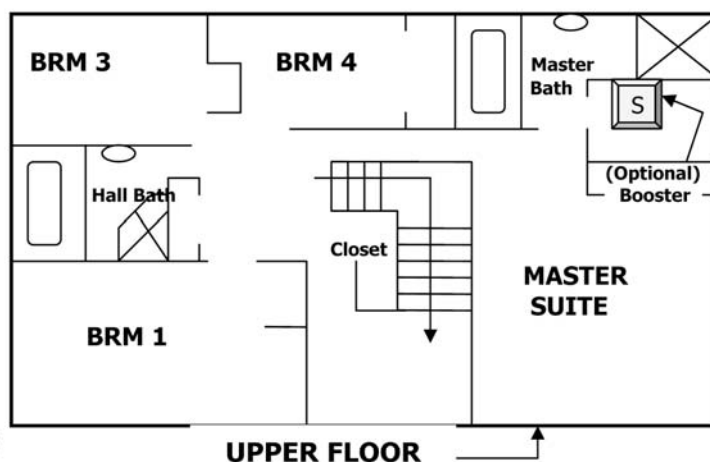
Residential Application



Endless Hot Water

**Two Story
Floor Plan
(2 ½ 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.

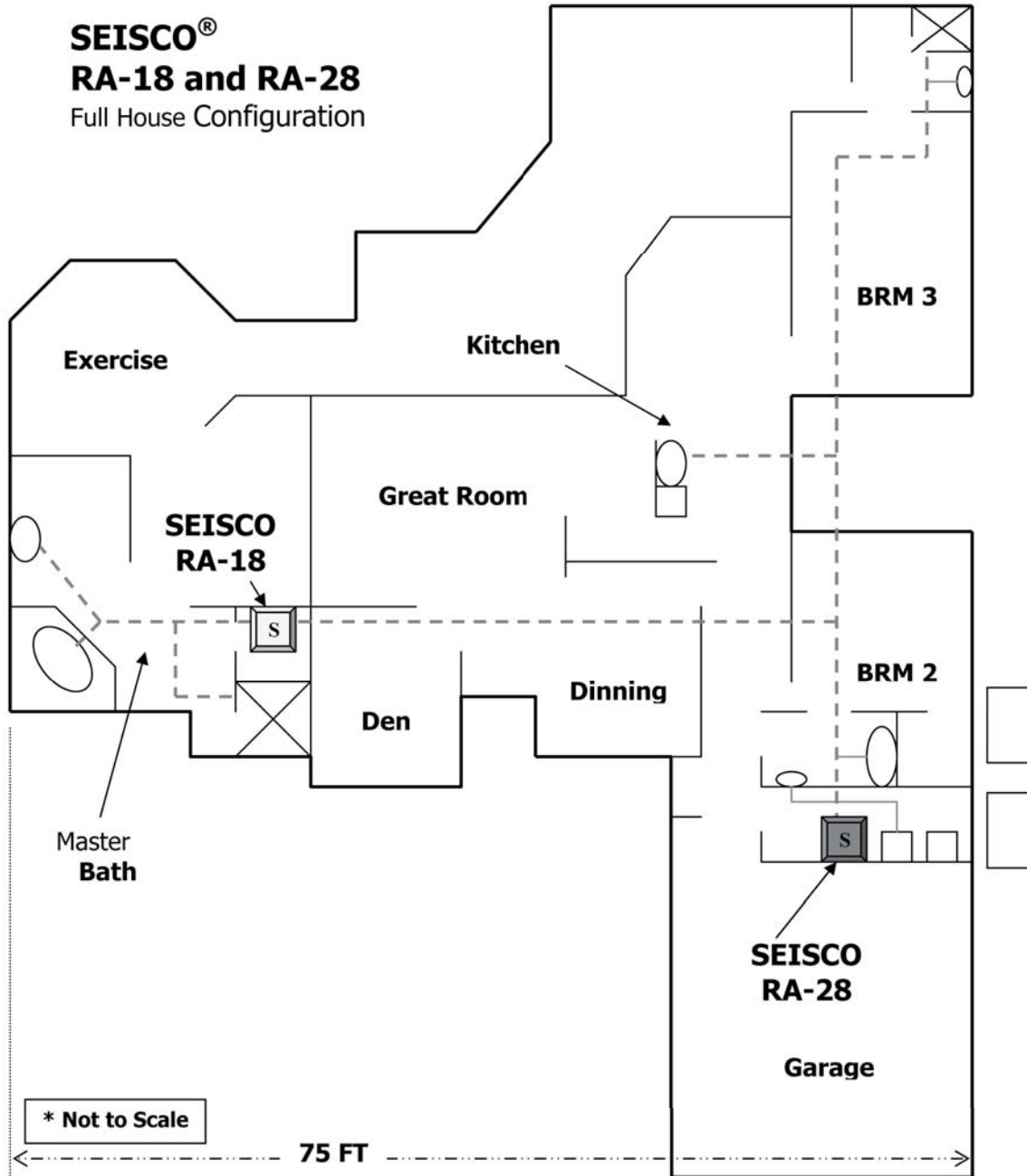


Endless Hot Water

Residential Application

Florida Style Home – Single Story Floor Plan* (SEISCO Full House Model With Booster in the Master Bath for Quicker Response)

SEISCO®
RA-18 and RA-28
Full House Configuration



Note: RA-28 and RA-18 models shown. In homes with high flow showers (above 3 gpm) and/or high flow tubs (8-10.5 gpm), consider model RA-32 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.

Solar Water Heating Application



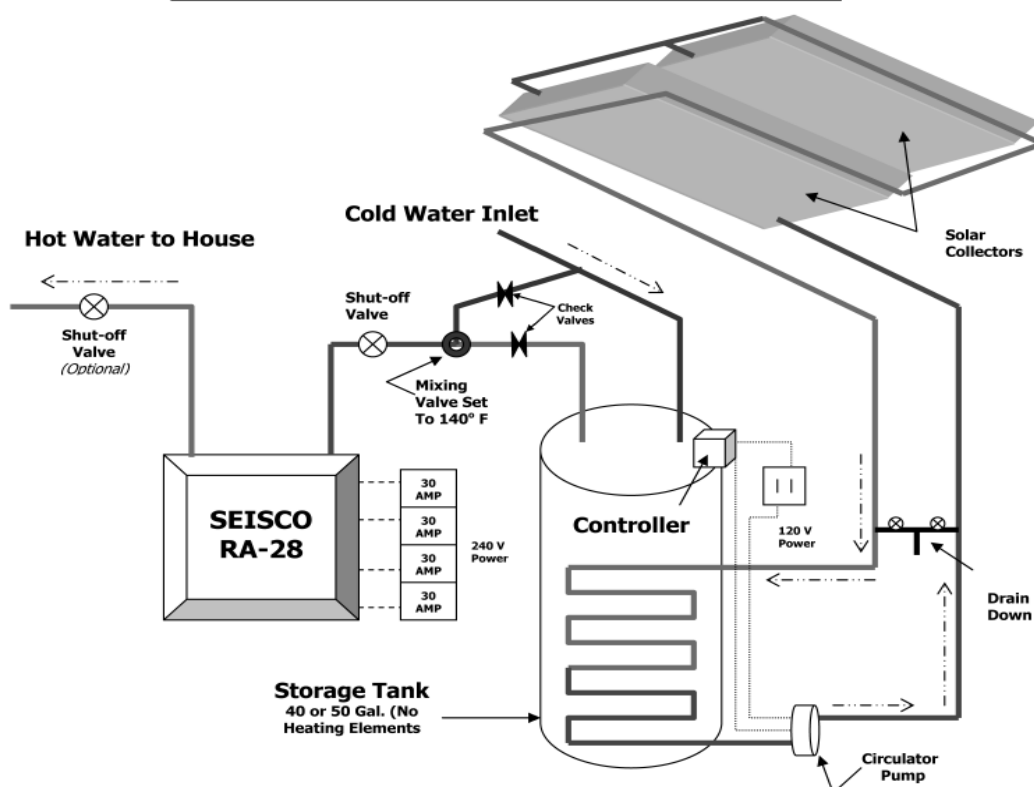
Endless Hot Water

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.

Solar Backup Water Heating Application With Storage Tank and Closed-Loop Heat Exchanger using a SEISCO, Model RA-28



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.

If the Storage Tank contains heating elements, they should be disconnected or the power turned off to enable the Seisco to provide the back-up heating. The Seisco should be set to turn on between 115-120°F.

RA-28 model shown requires FOUR 30 Amp, or TWO 60 Amp, 220/240 VAC circuits from the main electrical panel or from an installed 120 Amp sub-panel or disconnect box. For other models, refer to the Electrical Requirements section of this manual.



Endless Hot Water

Multi-Dwelling Sizing

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 performed 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

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. 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.

| | | 2.5 GPM Shower Heads | | 3 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 | 120 |
| 4 | 10 | CA-18 | CA-18 | CA-18 | CA-18 | 80 | 120 |
| 5-6 | 15 | CA-18 | CA-18 | CA-22 | CA-18 | 120 | 150 |
| 7-8 | 20 | CA-18 | CA-18 | CA-28 | CA-22 | 120 | 150 |
| 9-10 | 25 | CA-22 | CA-22 | 2 CA-18 | CA-28 | 120 | 150 |
| 11-15 | 37 | CA-32 | CA-28 | 2 CA-28 | 2 CA-22 | 120 | 150 |
| 16-20 | 50 | 2 CA-22 | 2 CA-18 | 2 CA-32 | 2 CA-28 | 150 | 200 |
| 21-25 | 62 | 2 CA-28 | 2 CA-22 | 3 CA-28 | 2 CA-32 | 150 | 200 |
| 26-30 | 75 | 2 CA-32 | 2 CA-28 | 3 CA-32 | 3 CA-28 | 160 | 200 |
| 31-35 | 87 | 3 CA-28 | 2 CA-32 | 4 CA-28 | 3 CA-32 | 200 | 250 |
| 36-40 | 100 | 3 CA-28 | 3 CA-28 | 5 CA-28 | 4 CA-28 | 200 | 250 |
| 41-45 | 112 | 3 CA-32 | 3 CA-28 | 5 CA-28 | 4 CA-28 | 200 | 250 |
| 46-50 | 125 | 3 CA-32 | 3 CA-28 | 5 CA-32 | 4 CA-28 | 200 | 250 |
| 51-75 | 187 | 5 CA-28 | 4 CA-28 | 7 CA-32 | 5 CA-32 | 255 | 350 |
| 76-100 | 250 | 6 CA-28 | 5 CA-28 | 8 CA-32 | 7 CA-32 | 300 | 400 |



Endless Hot Water

Multi-Dwelling Sizing

Hotel/Motels-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.

| Number of Units (Rooms) | Number of Occupants | 2.5 GPM Showers | | 3.0 GPM Showers | | Storage Tank Capacity (140°F) | Storage Tank Capacity (120°F) |
|-------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------------------|-------------------------------|
| | | 40°F Incoming Water | 60°F Incoming Water | 40°F Incoming Water | 60°F Incoming Water | | |
| 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-22 | CA-18 | 120 | 150 |
| 11-15 | 22 | CA-28 | CA-22 | CA-28 | CA-28 | 120 | 150 |
| 16-20 | 30 | CA-32 | CA-28 | 2 CA-22 | CA-32 | 150 | 200 |
| 21-25 | 37 | 2 CA-22 | CA-32 | 2 CA-28 | 2 CA-22 | 150 | 200 |
| 26-30 | 45 | 2 CA-28 | 2 CA-18 | 2 CA-28 | 2 CA-28 | 200 | 250 |
| 31-35 | 52 | 2 CA-28 | 2 CA-22 | 2 CA-32 | 2 CA-28 | 200 | 250 |
| 36-40 | 60 | 2 CA-28 | 2 CA-28 | 3 CA-28 | 2 CA-28 | 200 | 250 |
| 41-45 | 67 | 2 CA-32 | 2 CA-28 | 3 CA-28 | 2 CA-32 | 200 | 250 |
| 46-50 | 75 | 2 CA-32 | 2 CA-28 | 3 CA-28 | 2 CA-32 | 200 | 250 |
| 51-75 | 112 | 3 CA-32 | 3 CA-28 | 4 CA-28 | 3 CA-28 | 250 | 350 |
| 76-100 | 150 | 4 CA-32 | 3 CA-32 | 4 CA-32 | 4 CA-28 | 300 | 400 |
| 101-125 | 187 | 4 CA-32 | 4 CA-28 | 5 CA-32 | 4 CA-32 | 350 | 450 |
| 126-150 | 225 | 5 CA-28 | 4 CA-28 | 5 CA-32 | 5 CA-28 | 350 | 450 |
| 151-175 | 262 | 6 CA-28 | 5 CA-28 | 6 CA-32 | 6 CA-28 | 400 | 500 |
| 176-200 | 300 | 6 CA-32 | 6 CA-28 | 8 CA-28 | 6 CA-32 | 400 | 500 |
| 301-250 | 375 | 8 CA-28 | 6 CA-32 | 9 CA-32 | 8 CA-32 | 500 | 600 |
| 251-300 | 450 | 9 CA-32 | 8 CA-32 | 10 CA-32 | 9 CA-32 | 600 | 750 |
| 301-350 | 525 | 10 CA-32 | 9 CA-32 | 12 CA-32 | 10 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

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.

| Number Occupants | 2.5 GPM Shower Heads | | 3 GPM Shower Heads | | Storage Tank Capacity (140°F) | Storage Tank Capacity (120°F) |
|------------------|----------------------|---------------------|---------------------|---------------------|-------------------------------|-------------------------------|
| | 40°F Incoming Water | 60°F Incoming Water | 40°F Incoming Water | 60°F Incoming Water | | |
| 1-10 | CA-28 | CA-22 | CA-32 | CA-28 | 120 | 150 |
| 11-15 | 2 CA-18 | CA-32 | 2 CA-28 | 2 CA-18 | 150 | 200 |
| 16-20 | 2 CA-28 | 2 CA-22 | 2 CA-32 | 2 CA-28 | 200 | 250 |
| 21-25 | 2 CA-28 | 2 CA-22 | 2 CA-32 | 2 CA-28 | 250 | 300 |
| 26-30 | 2 CA-32 | 2 CA-28 | 3 CA-28 | 2 CA-28 | 300 | 400 |
| 31-40 | 2 CA-32 | 2 CA-28 | 3 CA-28 | 2 CA-32 | 300 | 400 |
| 41-50 | 3 CA-28 | 2 CA-28 | 3 CA-28 | 2 CA-32 | 350 | 500 |
| 51-75 | 4 CA-22 | 2 CA-32 | 3 CA-32 | 3 CA-28 | 400 | 500 |
| 76-100 | 4 CA-28 | 3 CA-28 | 4 CA-32 | 3 CA-32 | 500 | 750 |
| 101-125 | 4 CA-32 | 4 CA-32 | 5 CA-32 | 4 CA-32 | 500 | 750 |
| 126-150 | 5 CA-32 | 4 CA-32 | 6 CA-32 | 5 CA-28 | 500 | 750 |
| 151-175 | 6 CA-32 | 5 CA-28 | 7 CA-32 | 6 CA-28 | 500 | 750 |
| 176-200 | 7 CA-32 | 5 CA-32 | 8 CA-32 | 7 CA-28 | 750 | 1000 |
| 201-250 | 8 CA-32 | 6 CA-32 | 10 CA-32 | 8 CA-32 | 750 | 1000 |
| 251-300 | 10 CA-32 | 8 CA-28 | 12 CA-32 | 9 CA-32 | 750 | 1000 |



Endless Hot Water

Commercial Sizing

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)

| Model | kW / Amps | Number of Units | | | | | | | | |
|-------|-----------|-----------------|-----|-----|-----|-----|-----|------|------|------|
| | | 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)

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

Two-Hour Availability (Recovery)

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

Three-Hour Availability (Recovery)

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



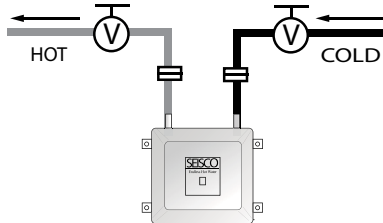
Endless Hot Water

Commercial Piping Diagrams

Single or Multiple Seisco Models with or without a Booster Heater

Single Unit Installation

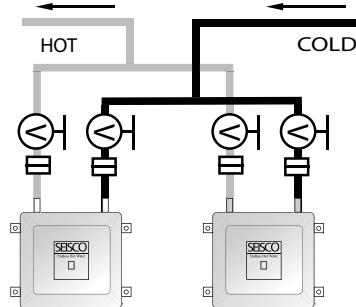
This is the standard piping diagram for a single Seisco in a commercial application.



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.

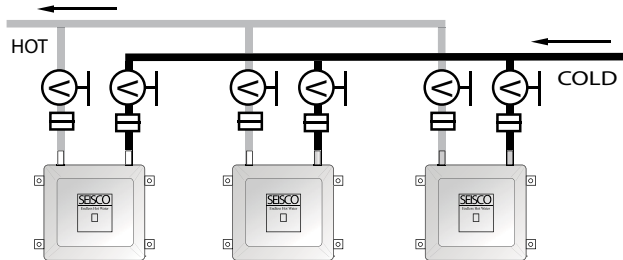
The thermostat setting of both heaters should be in the same position in order to balance the power of both heaters and maximize efficiency. This can be checked by measuring the amp flow through the heating element wires using an amp meter.



More Than Two Units

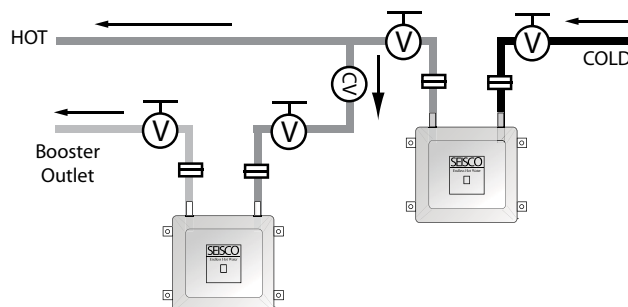
This is the standard piping diagram for three Seisco units plumbed in parallel. The reverse return piping method is required when three or more units are piped in parallel.

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.

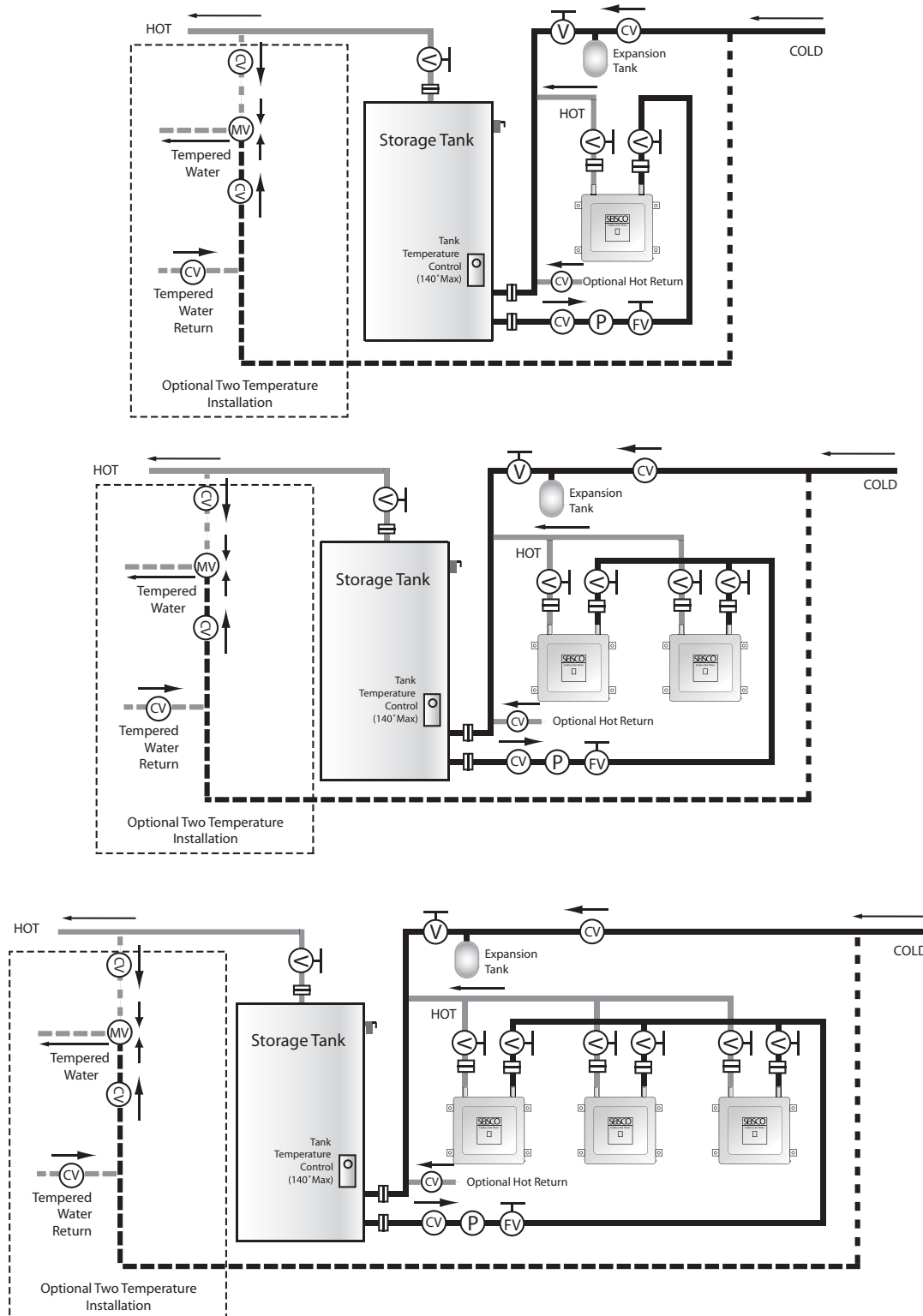


Primary Heater With Booster Heater

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.



Seisco Model(s) As Auxiliary Heat Source





Endless Hot Water

Commercial Piping Diagrams

Piping Diagram Notes For Storage Tank With One or More Seisco Units

Piping diagrams on the preceding page are for Seisco units plumbed as a high input heat source for a storage tank(s). For parallel installations, all Seisco heaters should be the same model. The thermostat setting of heaters plumbed in parallel 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.

The storage tank thermostats should be set to 5-10°F. lower than the Seisco(s). Flow through the Seisco heaters should be set to 3-5 gpm per heater using the flow regulating valve. Use only a bronze circulating pump and new components suitable for potable water. Pipe the temperature and pressure relief valve to an open drain in accordance with code. Water lines to the tankless water heaters should be 3/4". The manifold size for multiple Seisco units should be sized by a plumbing engineer.

Although not shown, immersion well thermometers are recommended in the outlet piping from each water heater and the outlet of the storage tank. All piping diagrams are shown with an optional mixing valve for two temperature systems. The location of optional return circulation lines are shown for the primary hot water outlet as well as the tempered water outlet. Check valves should be installed as shown. A temperature and pressure relief valve must be installed in the storage tank and piped to a drain per code requirements. Each water heater and storage tank should have a shut off valve for isolation during repair or replacement.

Water expands when heated. Check valves will cause a closed system with no allowance for expansion. Allowance must be made for expanding water or the temperature and pressure relief valve will open to relieve the pressure. Expansion tanks must be installed as indicated on the piping diagram. Consult the expansion tank supplier for the correct expansion tank size and installation procedures.

Sequence of Operation

When the system is first energized, the tank temperature control turns on the circulating pump causing cold water to circulate from the bottom of the storage tank through the Seisco(s). The Seisco(s) automatically heat the water as it returns to the storage tank. As warm water enters the storage tank from the Seisco(s), it rises and is displaced by cold water. The pump continues to circulate cold water from the bottom of the storage tank through the Seisco(s) until the thermostat on the storage

tank senses adequate temperature in the tank, shutting down the circulating pump. The Seisco(s) will automatically shut down when flow ceases.

When hot water is drawn from a fixture, it exits the top of the storage tank. When the tank temperature control drops below its set point, the process described above is repeated.

Symbol Legend For Piping Diagrams



Pump



Flow Adjustment Valve



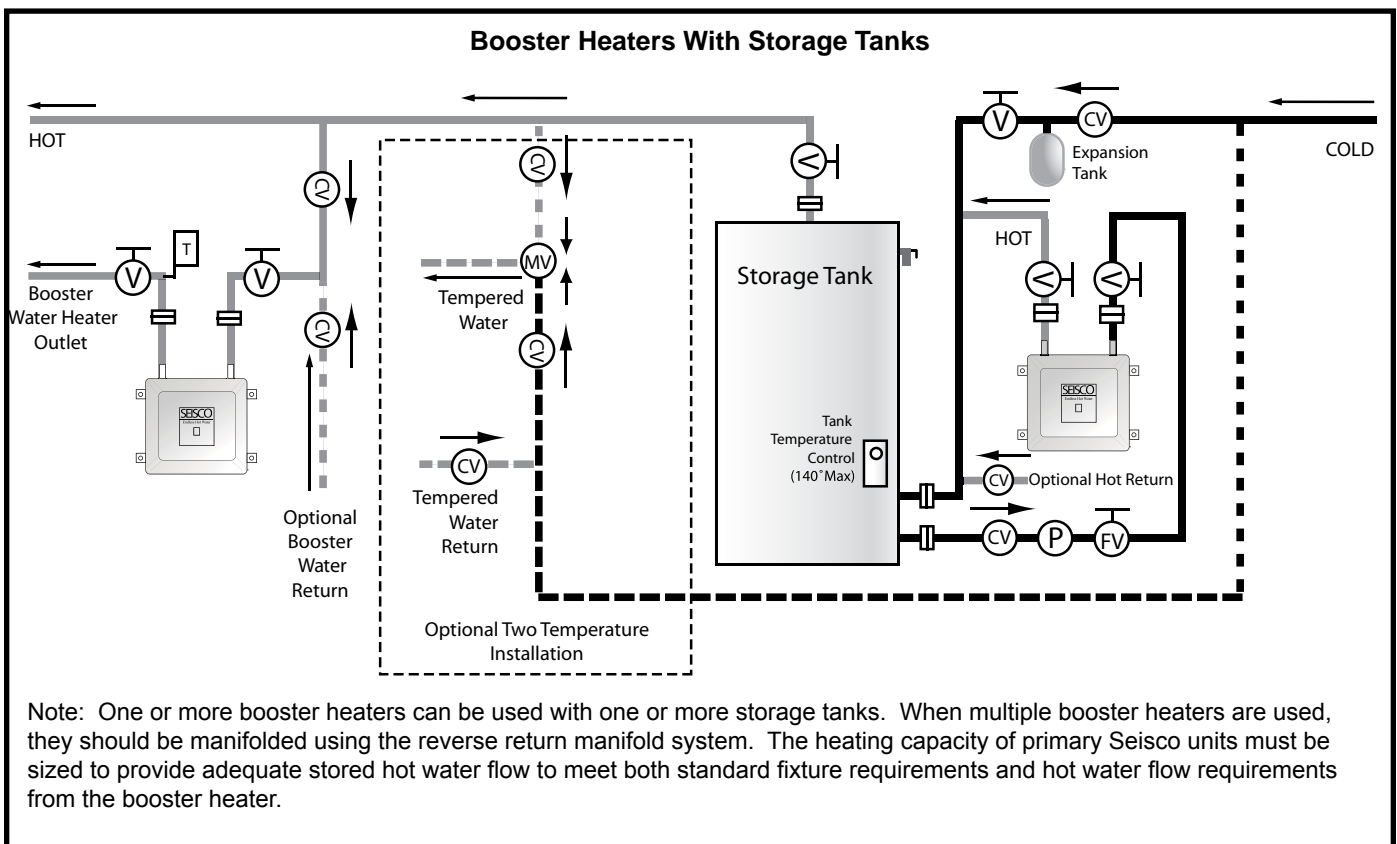
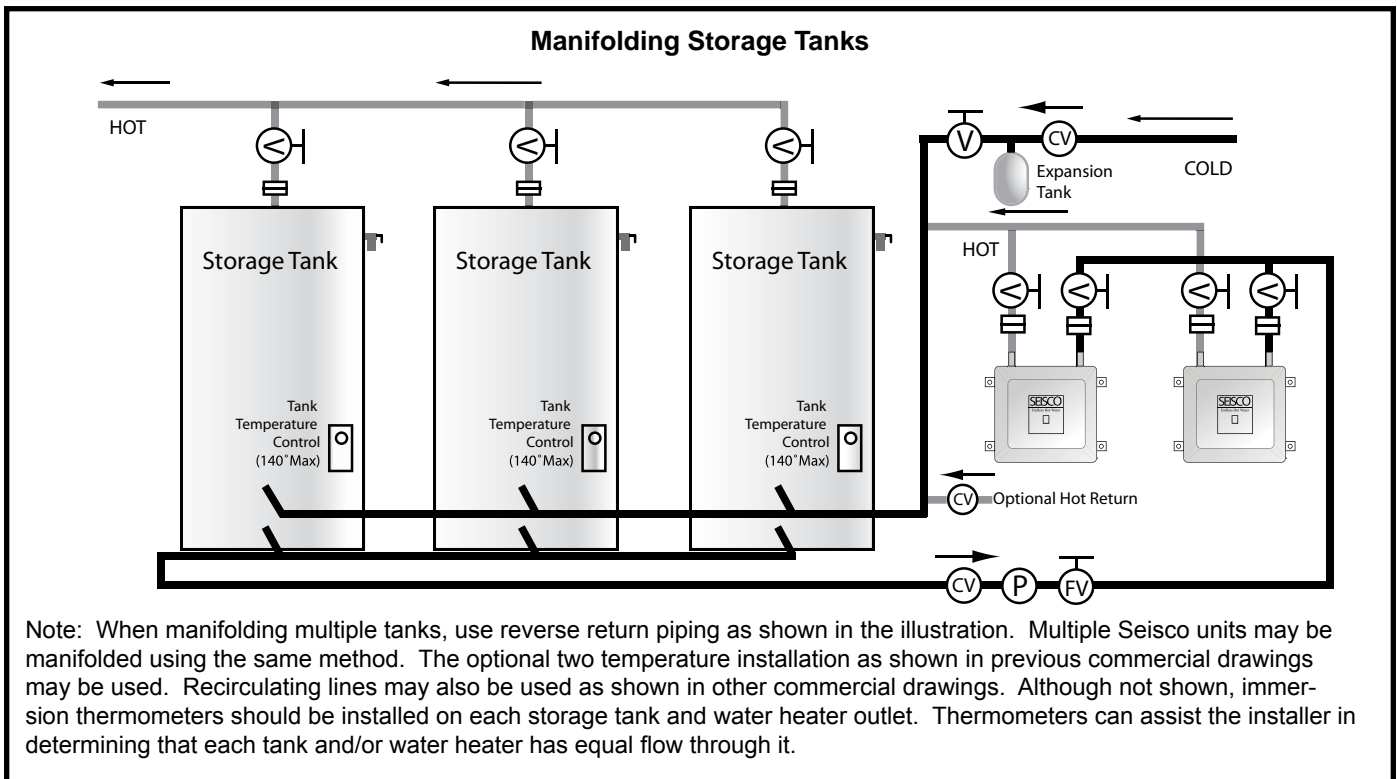
Union



Check Valve



Shut off Valve





Endless Hot Water

Electrical Requirements

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 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.

240 Volt Model Electrical Ratings and Basic Circuit Requirements

| Model | Max. kW | Voltage | Max. Amps. | # OF 2-Wire Circuits | # Double-Pole Circuit Breakers | Circuit Breaker Size (amps) |
|----------|---------|---------|------------|----------------------|--------------------------------|-----------------------------|
| RA/CA-05 | 5 | 240 | 20.8 | 1 | 1 | 25 |
| RA/CA-07 | 7 | 240 | 29.2 | 1 | 1 | 30 |
| RA/CA-09 | 9 | 240 | 37.5 | 1 | 1 | 40 |
| RA/CA-11 | 11 | 240 | 45.8 | 1 | 1 | 50 |
| RA/CA-14 | 14 | 240 | 58.3 | 2* | 2 | 30 |
| RA/CA-18 | 18 | 240 | 75.0 | 2 | 2 | 40 |
| RA/CA-22 | 22 | 240 | 91.7 | 2 | 2 | 50 |
| RA/CA-28 | 28 | 240 | 116.7 | 4 | 4 | 30 |
| RA/CA-32 | 32 | 240 | 133.3 | 4 | 4 | 40 |

Note: For optional breaker sizes, consult the electrical requirements section of this manual.

Electrical Requirements



Endless Hot Water

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/ft² (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/ft² (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



Endless Hot Water

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 |

Electrical Requirements



Endless Hot Water

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.



Endless Hot Water

Electrical Requirements

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 82°C (180°F) 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

Electrical Requirements



Endless Hot Water

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

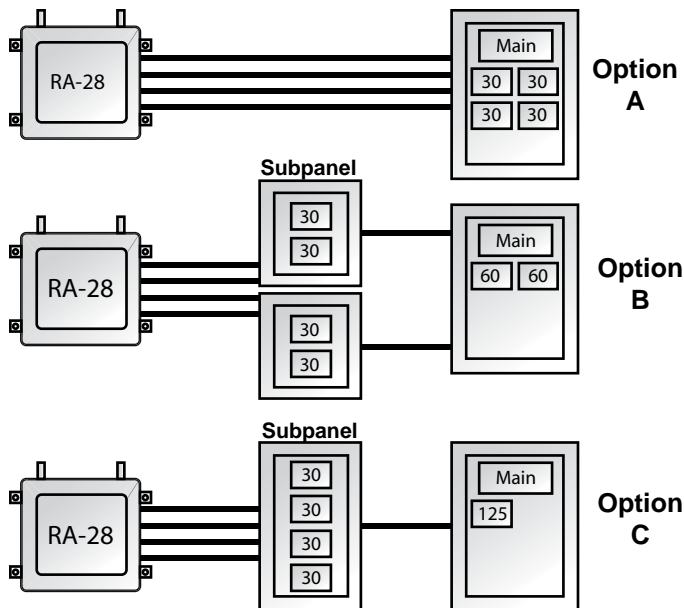
| Size | Temperature Rating of Conductor (See Table 310-13) | | | | | | Size |
|--------------------|--|---|---|---|--|---|--------------------|
| | 60°C (140°F) | 75°C (167°F) | 90°C (194°F) | 60°C (140°F) | 75°C (167°F) | 90°C (194°F) | |
| AWG or kcmil | Types TW, UF | Types FEPW, RH, RHW, THHW, THW, THWN, XHHW, USE, ZW | Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2 | Types TW, UF | Types RH, RHW, THHW, THW, THWN, XHHW, USE | Types TBS, SA, SIS, THHN, THHW, THW- 2, THWN-2, RHH, RHW-2, USE-2, XHH< XHHW, XHHW-2, ZW-2 | AWG or kcmil |
| | COPPER | | | ALUMINUM OR COPPER-CLAD ALUMINUM | | | |
| 18 | — | — | 14 | — | — | — | — |
| 16 | — | — | 18 | — | — | — | — |
| 14* | 20 | 20 | 25 | — | — | — | — |
| 12* | 25 | 25 | 30 | 20 | 20 | 25 | 12* |
| 10* | 30 | 35 | 40 | 25 | 30 | 35 | 10* |
| 8 | 40 | 50 | 55 | 30 | 40 | 45 | 8 |
| 6 | 55 | 65 | 75 | 40 | 50 | 60 | 6 |
| 4 | 70 | 85 | 95 | 55 | 65 | 75 | 4 |
| 3 | 85 | 100 | 110 | 65 | 75 | 85 | 3 |
| 2 | 95 | 115 | 130 | 75 | 90 | 100 | 2 |
| 1 | 110 | 130 | 150 | 85 | 100 | 115 | 1 |
| 1/0 | 125 | 150 | 170 | 100 | 120 | 135 | 1/0 |
| 2/0 | 145 | 175 | 195 | 115 | 135 | 150 | 2/0 |
| 3/0 | 165 | 200 | 225 | 130 | 155 | 175 | 3/0 |
| 4/0 | 195 | 230 | 260 | 150 | 180 | 205 | 4/0 |



Endless Hot Water

Electrical Requirements

RA/CA-WIRE AND BREAKER SIZING



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 RA-28 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 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 RA-28 and subpanel. Two pairs of #6 Cu AWG with ground are required between the subpanels 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 RA-28 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.

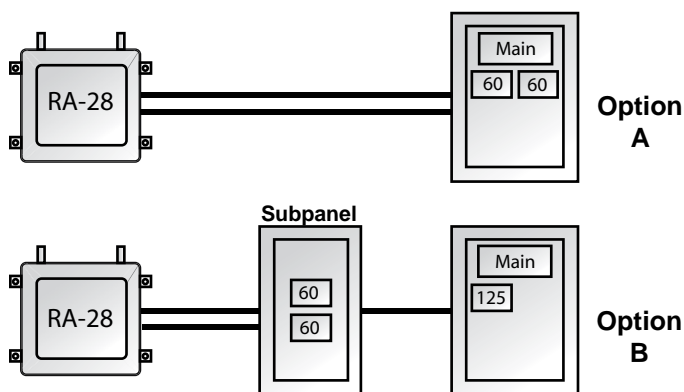
Under the 2005 Edition of the National Electric Code (NEC), article 422.11(f)(3), water heaters and steam boilers employing resistance-type immersion electric heating elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into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

As a result, U.L. has given authorization to Microtherm, Inc., under U.L. Standard 499, to use their U.L. marking on the SEISCO® model RA-28 for connections to two (2) 60 Amp branch circuits instead of the four (4) 30 Amp branch circuits, as was previously required.

The wiring guide below illustrates two new wiring options for the RA-28. In accordance with NEC 422.11(f)(3), two 60 Amp branch circuits are shown connected to the RA-28 directly from the Main Service Panel in the Option A diagram below. In Option B, two 60 Amp branch circuits are shown connected to the RA-28 directly from a sub-panel downstream from the Main Service Panel.

--- CAUTION ---

Before using this two circuit option for the RA-28 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, 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 RA-28 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. Two pairs of #6 Cu AWG with ground are required between the RA-28 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.

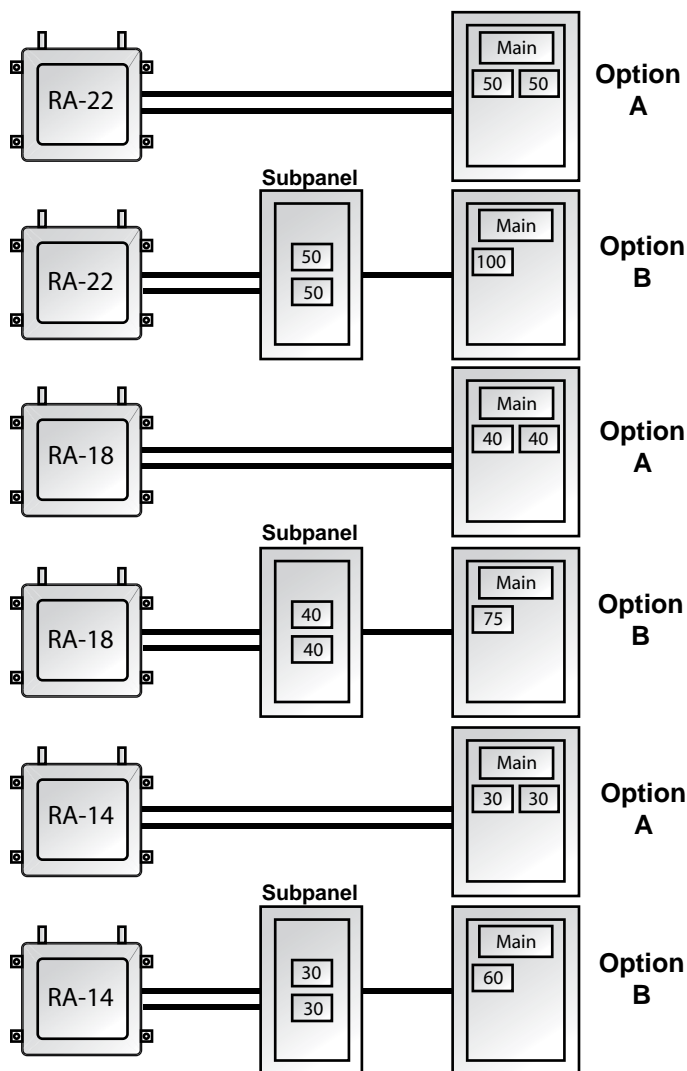
Note: For RA/CA-32 models, use the wiring diagrams on this page and substitute 40 for 30 Amp breakers, 75 for 60 Amp breakers, 150 for 125 Amp breakers, and #4 for #6 AWG. Where shown, #8 and #1 AWG and/or #2/0 AL may be used without replacement.

Electrical Requirements



Endless Hot Water

RA/CA-WIRE AND BREAKER SIZING



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 RA-22 and the main panel.

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 RA-22 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.

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 RA-18 and the main panel.

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 RA-18 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.

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 RA-14 and the main panel.

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 RA-14 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.

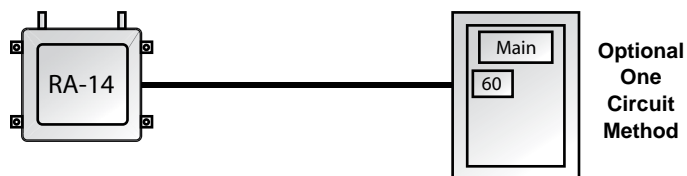
Under the 2005 Edition of the National Electric Code (NEC), article 422.11(f)(3), Water heaters and steam boilers employing resistance-type immersion electric heating elements contained in an ASME-rated and stamped vessel or listed instantaneous water heaters shall be permitted to be subdivided into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

As a result, U.L. has given authorization to Microtherm, Inc., under U.L. Standard 499, to use their U.L. marking on the SEISCO® model RA-14 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 RA-14 directly from the Main Service Panel in the diagram below.

--- CAUTION ---

Before using this one circuit option for the RA-14 Model, 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.



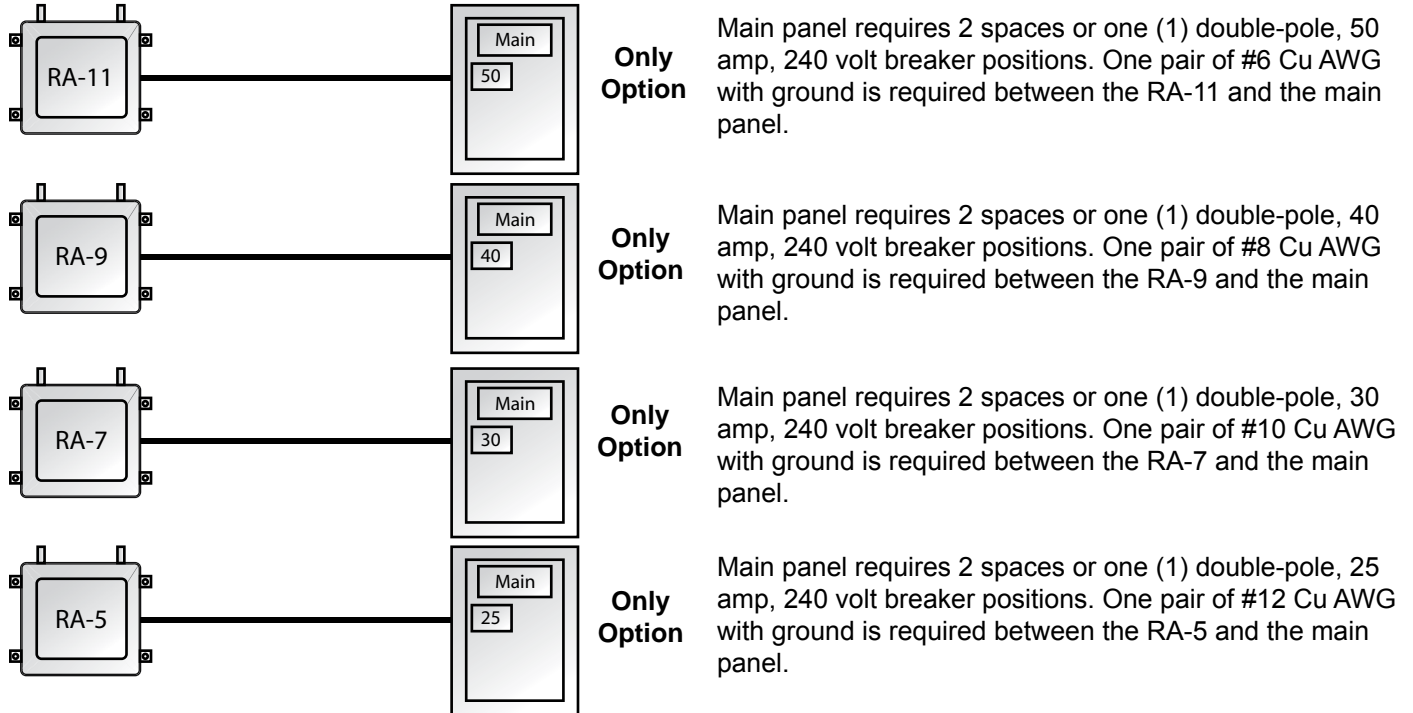
Main panel requires 2 spaces or one (1) double-pole, 60 amp, 240 volt breaker positions. One pair of #6 Cu AWG with ground is required between the RA-14 and the main panel.



Endless Hot Water

Electrical Requirements

RA/CA-WIRE AND BREAKER SIZING



Single and Three -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.

Three-Phase Connections to Single-Phase Heater- Consult the factory for three phases applications.

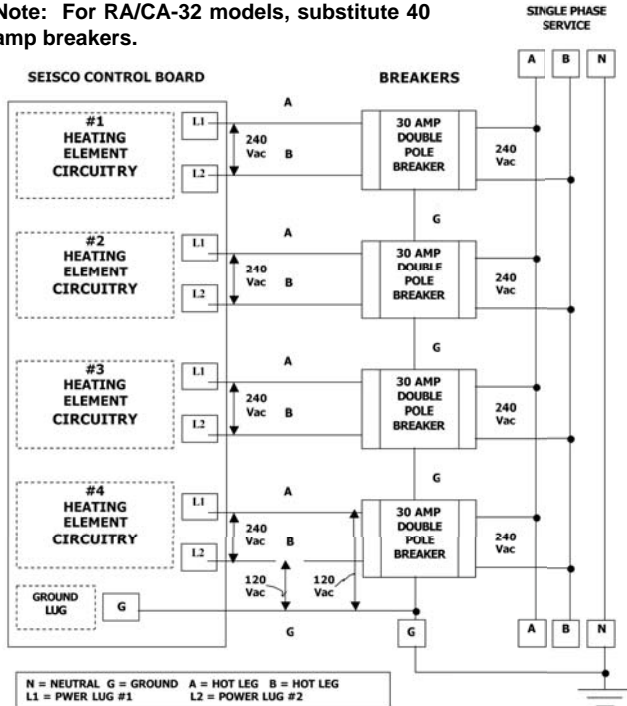


Endless Hot Water

Electrical Requirements

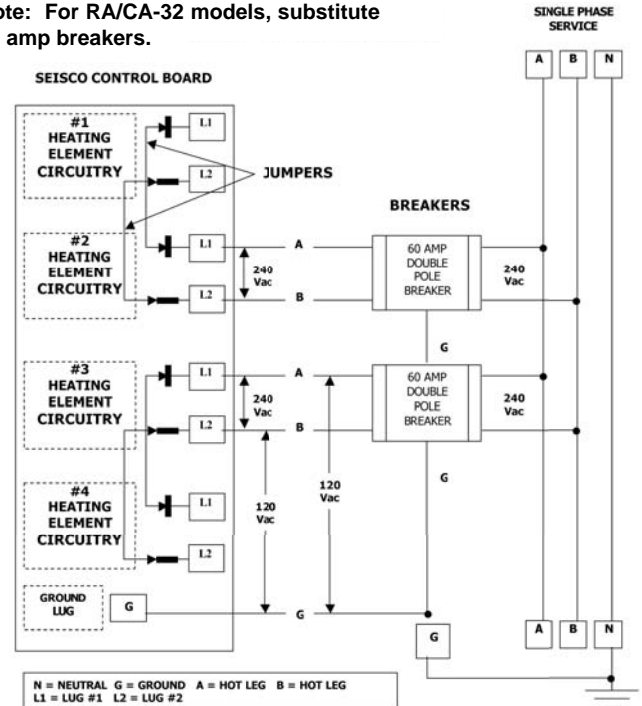
Wiring Connections to Single Phase 240 VAC Supply- RA/CA-28 and RA/CA-32

Note: For RA/CA-32 models, substitute 40 amp breakers.



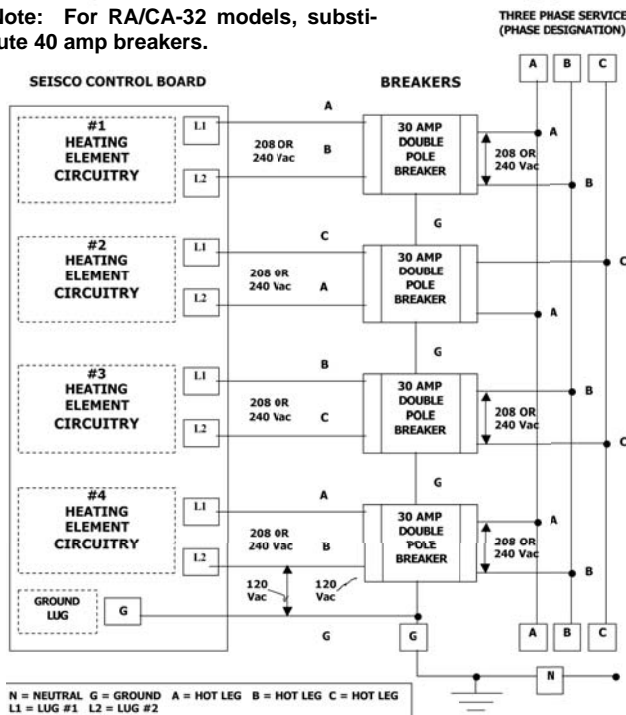
Optional Two Circuit Wiring Connections to Single Phase 240 VAC Supply-RA/CA-28 and RA/CA-32

Note: For RA/CA-32 models, substitute 75 amp breakers.

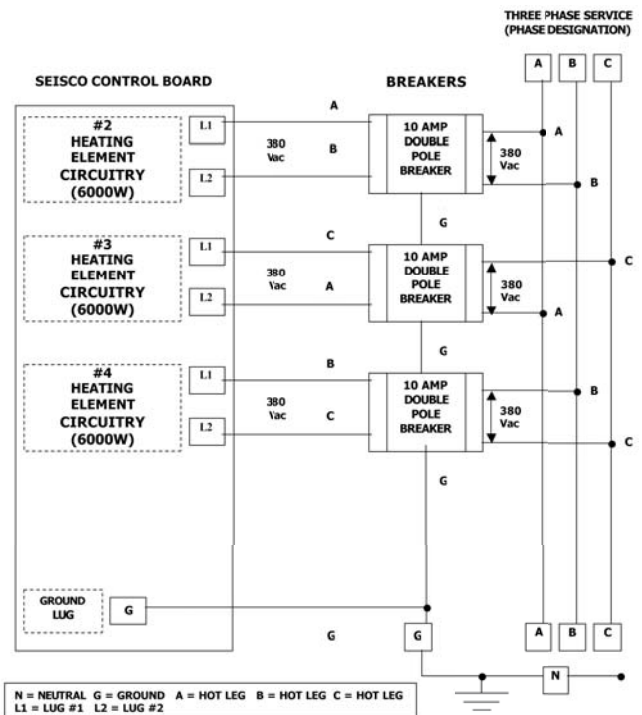


Wiring Connections to 208 or 240 VAC Three-Phase 240 VAC Supply-RA/CA-28 and RA/CA-32

Note: For RA/CA-32 models, substitute 40 amp breakers.



Wiring Connections for Three-Phase Heater with 380 VAC Supply-RA-18-3



Installation Considerations



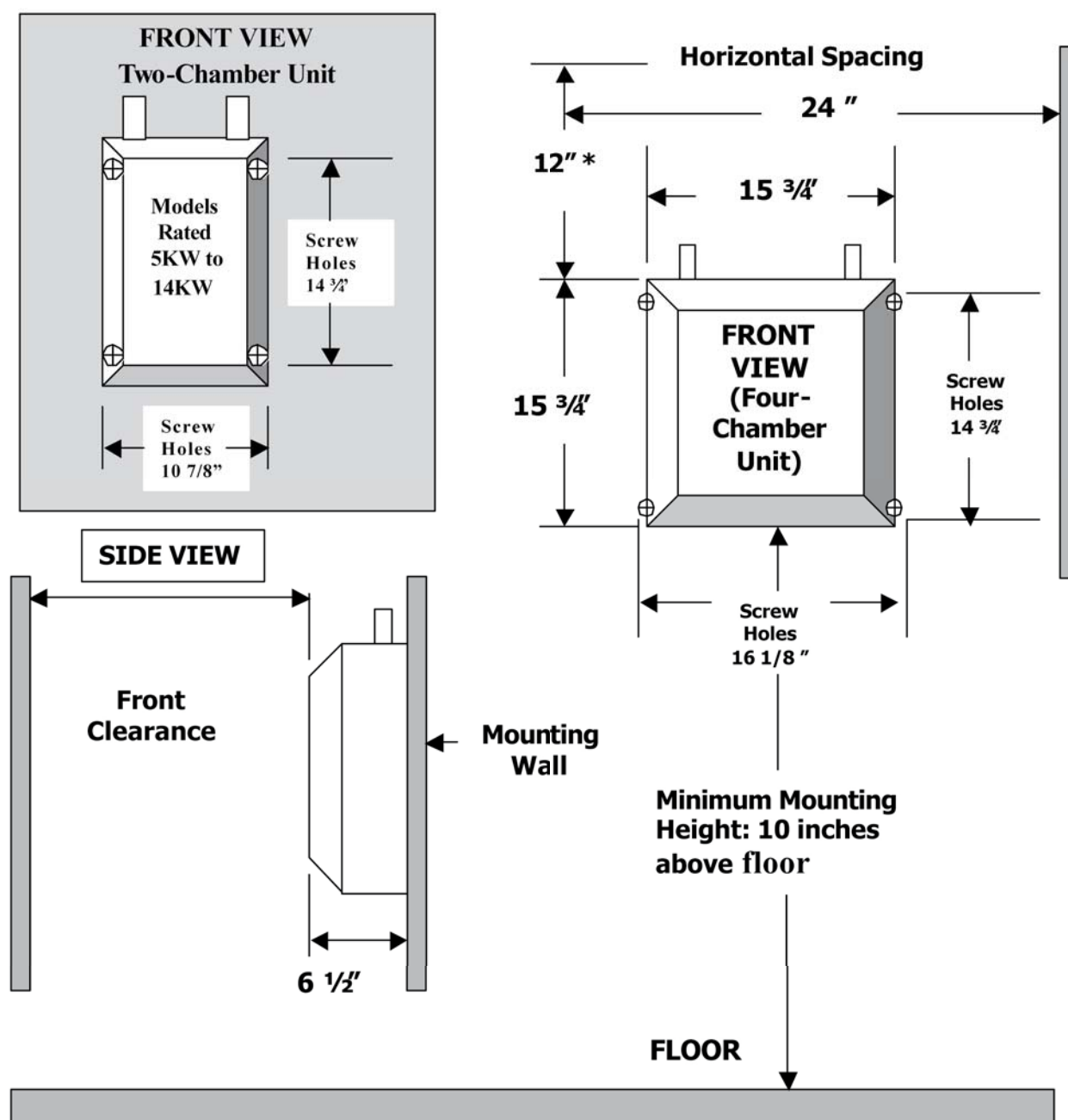
Endless Hot Water

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.





Endless Hot Water

Installation Considerations

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.

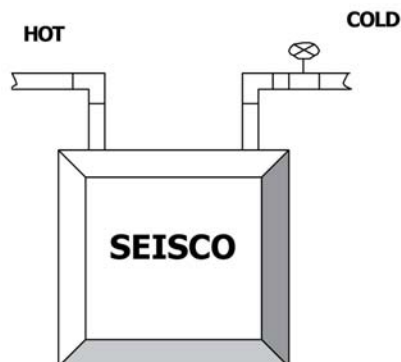
See also-Water Heater Controls, National Electric Code, NEC, 422-47

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 82°C (180°F) 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.



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

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.

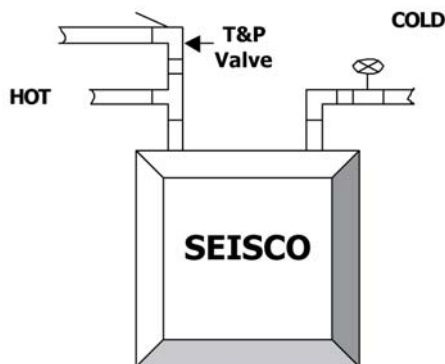
WARNING #2: Never solder water supply lines to the heater's fittings. Heat from the soldering may damage the heat exchanger.

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.



Endless Hot Water

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 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

MODELS RA, CA-14 THROUGH RA, CA-32 REQUIRE MULTIPLE POWER SOURCES. WHEN WIRED DIRECTLY TO THE BREAKER BOX, THEY REQUIRE MORE THAN ONE DOUBLE POLE CIRCUIT BREAKER.

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

FOR MODELS RA, CA-5 THROUGH RA, CA-11, ONE PAIR OF WIRES SHOULD BE ATTACHED WITHIN THE UNIT AT POWER CIRCUIT 1 (CKT 1)-ONE WIRE TO L1 AND ONE WIRE TO L2. FOR MODELS RA, CA, SH-14 THROUGH RA, CA-22, A SECOND PAIR OF WIRES MUST ALSO BE ATTACHED AT POWER CIRCUIT 2 (CKT2)-ONE TO L1 AND ONE TO L2. FOR MODELS RA, CA-28 and 32, A THIRD AND FOURTH PAIR OF WIRES ARE REQUIRED FOR POWER CIRCUITS 3 AND 4 (CKT 3 & CKT 4).

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.

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 RA-5 to RA-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 started. 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



Endless Hot Water

Installation Considerations

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 faucets in the home are a higher flow rate than the design of the Seisco model(s) selected. 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 life-styles, 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.

| 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 |

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 local service contractor** |
| 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** |
| 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 local service contractor** |

* 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 micro-boiler. 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 MICROTHERM, INC. AT 888-296-9293, CENTRAL TIME, DURING REGULAR BUSINESS HOURS FOR AVAILABLE PARTS, DIAGNOSTICS AND REPAIR INFORMATION.**



Endless Hot Water

Appendix

ADDITIONAL TECHNICAL SPECIFICATIONS AND PERFORMANCE TABLES

208 & 380 Volt Model Specifications

| Residential Model | Commer- cial Model | kW Input | Voltage (VAC) | Max Amp Draw | Max BTU/ HR Output | kG-Cal Per Hr. | # Heating Circuits | AMPS Per Circuit |
|-------------------|-----------------------|-------------|------------------|--------------------|-----------------------|----------------------|--------------------------|------------------------|
| RA-24 | CA-24 | 24 | 208 | 115 | 81,910 | 20,652 | 4 | 29 |
| RA-20 | CA-20 | 20 | 208 | 96 | 68,260 | 17,210 | 2 | 48 |
| RA-16 | CA-16 | 16 | 208 | 77 | 54,600 | 13,768 | 2 | 38.5 |
| RA-12 | CA-12 | 12 | 208 | 58 | 40,950 | 10,326 | 2 | 29 |
| RA-10 | CA-10 | 10 | 208 | 48 | 34,130 | 8,605 | 1 | 48 |
| RA-08 | CA-08 | 8 | 208 | 39 | 27,300 | 6,884 | 1 | 39 |
| N/A | CA-18-3 | 18 | 380 | 28 | 61,430 | 15,489 | 3 | 28 |
| N/A | CA-10.5-3 | 10.5 | 380 | 16 | 35,830 | 9,035 | 3 | 16 |

208 & 380 Volt Recovery (gpm & 1st Hour) @ Temperature Rise (F)

| kW Input | Recovery | 65 | 60 | 55 | 50 | 45 | 40 | 35 | 30 | 25 | 20 | 15 |
|-------------|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| RA/CA-24 | gpm | 2.5 | 2.7 | 3.0 | 3.3 | 3.6 | 4.1 | 4.7 | 5.5 | 6.6 | 8.2 | 10.9 |
| | 1st Hour | 151.3 | 163.9 | 178.8 | 196.7 | 218.5 | 245.8 | 281.0 | 327.8 | 393.3 | 491.7 | 655.6 |
| RA/CA-20 | gpm | 2.1 | 2.3 | 2.5 | 2.7 | 3.0 | 3.4 | 3.9 | 4.6 | 5.5 | 6.8 | 9.1 |
| | 1st Hour | 126.1 | 136.6 | 149.0 | 163.9 | 182.1 | 204.9 | 234.1 | 273.1 | 327.8 | 409.7 | 546.3 |
| RA/CA-18 | gpm | 1.9 | 2.0 | 2.2 | 2.5 | 2.7 | 3.1 | 3.5 | 4.1 | 4.9 | 6.1 | 8.2 |
| | 1st Hour | 113.5 | 122.9 | 134.1 | 147.5 | 163.9 | 184.4 | 210.7 | 245.8 | 295.0 | 368.8 | 491.7 |
| RA/CA-16 | gpm | 1.7 | 1.8 | 2.0 | 2.2 | 2.4 | 2.7 | 3.1 | 3.6 | 4.4 | 5.5 | 7.3 |
| | 1st Hour | 100.9 | 109.3 | 119.2 | 131.1 | 145.7 | 163.9 | 187.3 | 218.5 | 262.2 | 327.8 | 437.0 |
| RA/CA-12 | gpm | 1.3 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.3 | 2.7 | 3.3 | 4.1 | 5.5 |
| | 1st Hour | 75.6 | 81.9 | 89.4 | 98.3 | 109.3 | 122.9 | 140.5 | 163.9 | 196.7 | 245.8 | 327.8 |
| RA/CA-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 |
| | 1st Hour | 66.2 | 71.7 | 78.2 | 86.0 | 95.6 | 107.6 | 122.9 | 143.4 | 172.1 | 215.1 | 286.8 |
| RA/CA-10 | gpm | 1.1 | 1.1 | 1.2 | 1.4 | 1.5 | 1.7 | 2.0 | 2.3 | 2.7 | 3.4 | 4.6 |
| | 1st Hour | 63.0 | 68.3 | 74.5 | 81.9 | 91.0 | 102.4 | 117.1 | 136.6 | 163.9 | 204.9 | 273.1 |
| RA/CA-8 | gpm | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.4 | 1.6 | 1.8 | 2.2 | 2.7 | 3.6 |
| | 1st Hour | 50.4 | 54.6 | 59.6 | 65.6 | 72.8 | 81.9 | 93.7 | 109.3 | 131.1 | 163.9 | 218.5 |

Note: This table reflects recovery when 208 or 380-volt elements are installed in the product. For availability of 208- and/or 380-volt model, consult the table above.

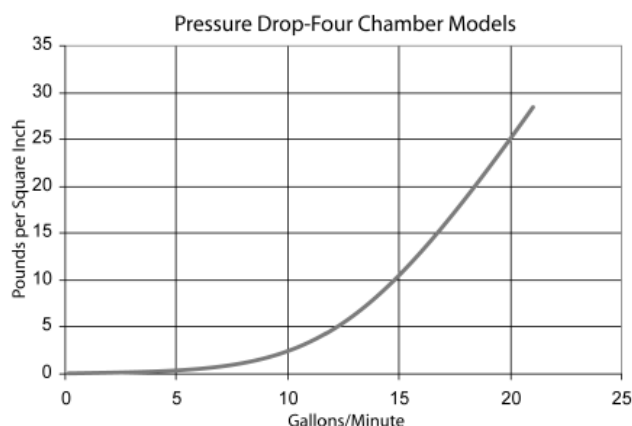
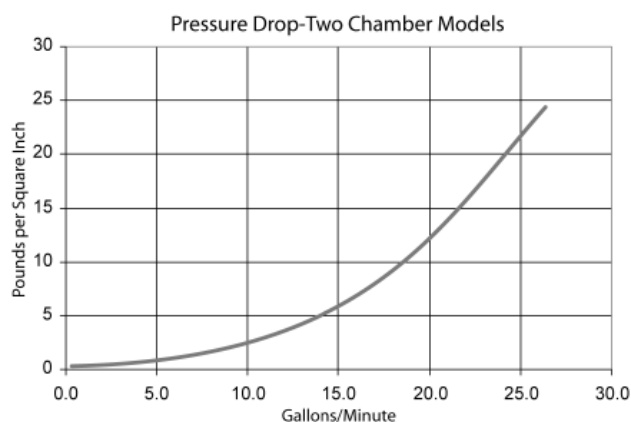
ADDITIONAL TECHNICAL SPECIFICATIONS AND PERFORMANCE TABLES

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

| kW 240V | | Recovery | 90 | 85 | 80 | 75 | 70 | 65 | 60 | 55 | 50 | 45 | 40 | 35 | 30 | 25 | 20 | 15 |
|------------|----------|----------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| kW 208V | | | | | | | | | | | | | | | | | | |
| 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 |
| 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 |

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

PRESSURE DROP CURVES





Endless Hot Water

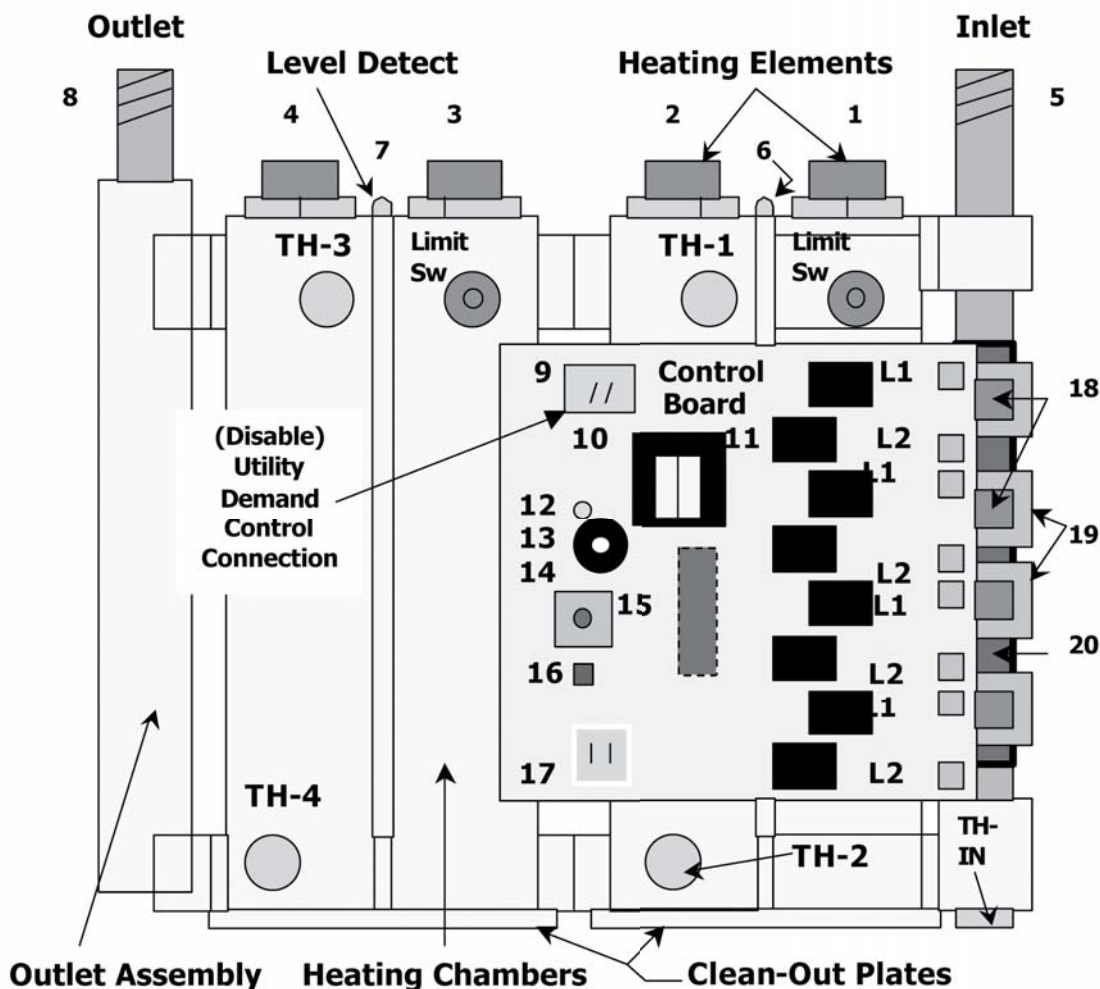
Appendix

WARRANTY FACT SHEET

| | RA Models | SH Models | CA Models |
|--|--|--|---|
| Warranty Term | 10-Year Limited | 10-Year Limited | 5-Year Limited |
| Warranty Activation | Original Purchase Date | Original Purchase Date | Original Purchase Date |
| Warranty Application Coverage | Residential Water Heating Only Including Apartments | Space Heating Applications Only | Commercial/Industrial Water Heating Only |
| Labor reimbursement for part, replacement of repair | Limited Amount Paid During First Year of Warranty Activation | Limited Amount Paid During First Year of Warranty Activation | Limited Amount Paid During First Year of Warranty Activation |
| Parts replacement for defective part or manufacturing workmanship | <p>Year 1: All parts including heating elements, temperature sensors, limit switches, wires, etc.</p> <p>Years 1-3: Circuit Board and Chamber Body</p> <p>Years 4-10: Circuit Board and Chamber Body with up to 15% cost of original retail purchase price of the water heater</p> | <p>Year 1: All parts including heating elements, temperature sensors, limit switches, wires, etc.</p> <p>Years 1-3: Circuit Board and Chamber Body</p> <p>Years 4-10: Circuit Board and Chamber Body with up to 15% cost of original retail purchase price of the water heater</p> | <p>Year 1: All parts including heating elements, temperature sensors, limit switches, wires, etc.</p> <p>Years 1-3: Circuit Board and Chamber Body</p> <p>Years 4-5: Circuit Board and Chamber Body with up to 15% cost of original retail purchase price of the water heater</p> |

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.

PARTS IDENTIFICATION--4-CHAMBER MODELS



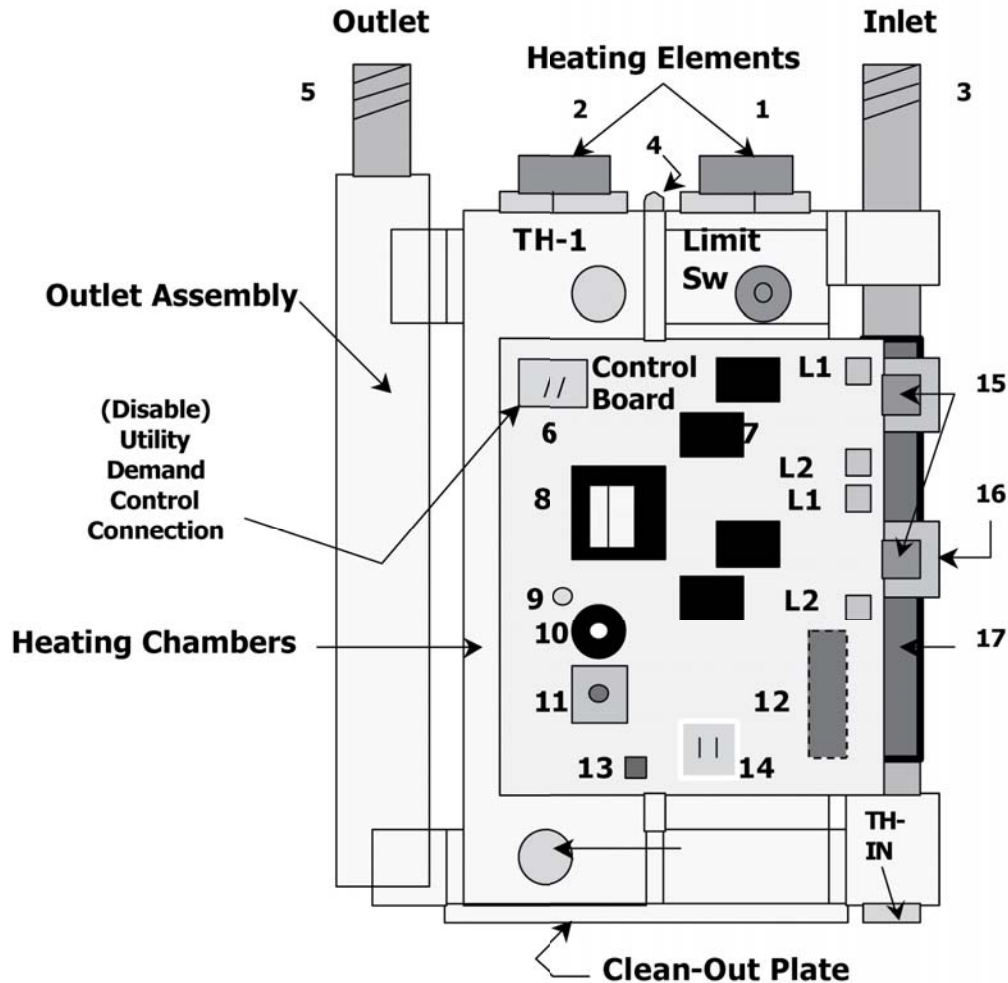
LEGEND

- 1 – Heating Element #1
- 2 – Heating Element #2
- 3 – Heating Element #3
- 4 – Heating Element #4
- 5 – Inlet Water Tube, 3/4"
- 6 – Water-Level Detect Screw
- 7 – Water-Level Detect Screw
- 8 – Outlet Water Tube, 3/4"
- 9 – Disable, Demand Control Switch
- 10 – Transformer
- 11 – Heating Element Relays (8 ea.)
- 12 – LED Light Indicator
- 13 – Audible Speaker
- 14 – Output Temperature Control

LEGEND

- 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 (2)
- 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

PARTS IDENTIFICATION--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

LEGEND

- 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

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 from 20 to 40% 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.



Endless Hot Water

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 $(135-25)+(25/2)=122.5^{\circ}\text{F}$. 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 by 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.

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 |



Endless Hot Water

Appendix

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.

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 |
| \$1.20 | \$232 | \$246 | \$262 | \$281 | \$303 | \$328 | \$358 | \$394 | \$437 | \$492 |
| \$1.25 | \$241 | \$256 | \$273 | \$293 | \$315 | \$342 | \$373 | \$410 | \$456 | \$513 |
| \$1.30 | \$251 | \$267 | \$284 | \$305 | \$328 | \$355 | \$388 | \$426 | \$474 | \$533 |
| \$1.35 | \$261 | \$277 | \$295 | \$316 | \$341 | \$369 | \$403 | \$443 | \$492 | \$554 |
| \$1.40 | \$270 | \$287 | \$306 | \$328 | \$353 | \$383 | \$418 | \$459 | \$510 | \$574 |
| \$1.45 | \$280 | \$297 | \$317 | \$340 | \$366 | \$396 | \$432 | \$476 | \$529 | \$595 |
| \$1.50 | \$289 | \$308 | \$328 | \$351 | \$379 | \$410 | \$447 | \$492 | \$547 | \$615 |
| \$1.55 | \$299 | \$318 | \$339 | \$363 | \$391 | \$424 | \$462 | \$508 | \$565 | \$636 |
| \$1.60 | \$309 | \$328 | \$350 | \$375 | \$404 | \$437 | \$477 | \$525 | \$583 | \$656 |
| \$1.65 | \$318 | \$338 | \$361 | \$387 | \$416 | \$451 | \$492 | \$541 | \$601 | \$677 |
| \$1.70 | \$328 | \$349 | \$372 | \$398 | \$429 | \$465 | \$507 | \$558 | \$620 | \$697 |
| \$1.75 | \$338 | \$359 | \$383 | \$410 | \$442 | \$478 | \$522 | \$574 | \$638 | \$718 |
| \$1.80 | \$347 | \$369 | \$394 | \$422 | \$454 | \$492 | \$537 | \$591 | \$656 | \$738 |
| \$1.85 | \$357 | \$379 | \$405 | \$434 | \$467 | \$506 | \$552 | \$607 | \$674 | \$759 |
| \$1.90 | \$367 | \$390 | \$416 | \$445 | \$479 | \$519 | \$567 | \$623 | \$693 | \$779 |
| \$1.95 | \$376 | \$400 | \$426 | \$457 | \$492 | \$533 | \$582 | \$640 | \$711 | \$800 |
| \$2.00 | \$386 | \$410 | \$437 | \$469 | \$505 | \$547 | \$596 | \$656 | \$729 | \$820 |

(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 | \$695.00 | \$695.00 | \$695.00 | |
| 3 | Subtract line 2 from line 1. | \$805.00 | \$(345.00) | \$(445.00) | |
| 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)* | \$1,405.00 | \$(545.00) | \$(595.00) | |
| 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*** | 42.6 | 3.6 | 6.1**** | |

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.



Endless Hot Water

Appendix

COMPETITIVE CROSS REFERENCES

240 Volt Models

| | | | | | | | | |
|------------------|---------|----------------|----------------------|-------|----------|---------|------------|---------------|
| Leakage Warranty | 10 | 3 | 1 | 10*/5 | Lifetime | 10 | N/A | 10 |
| Parts Warranty | 1 | 3 | 1 | 1 | Lifetime | 1 | N/A | 1 |
| Manufacturer | EEMAX | Stiebel-Eltron | Chronomite | Bosch | SETS | Niagra | Hot Aqua | Seisco |
| kW | Voltage | Model Number | | | | | | |
| 4 | 240 | 35 | DHC3-1, DHC 4-2 | | RP7P | | N42 | 24,30,45 RA-5 |
| 5 | 240 | 55 | DHC 5-2 | 20 | RP1P | | | RA-5 |
| 5.5-7 | 240 | 55, 65 | DHC 6-2 | 60 | | | N-64 | 60,70 RA-7 |
| 7.2-9 | 240 | 75 | DHC 10-2, DHC E-8 | 30 | RP7P | | M075, M-85 | RA-9 |
| 9.5-11 | 240 | 95 | DHC E-10, DHC 10-2 | 40 | RP1P | 110 | N-100 | RA-11 |
| 11.5-14 | 240 | | Tempra 12 | 50 | | 145 | N-120 | RA-14 |
| 15-18 | 240 | 144 | | | RP17PT* | 165,180 | | RA-18 |
| 18.1-22 | 240 | 190 | Tempra 20 | | | 220 | | RA-22 |
| 22.1-28.8 | 240 | 280 | Tempra 24, Tempra 29 | | RP27PT* | 240 | | RA-28 |
| 32-36 | 240 | | Tempra 36 | | | | | RA-32 |

EEMax

Prefixes

- SP=Single point of use with 3/8" compression fittings on top, .5 gpm.
- EX=Flow controlled with 3/8" or 1/2" compression fittings on bottom, .5-2 gpm.

Suffixes

- T=Thermostatic models, .5°F temperature accuracy, 1/2" fittings on bottom, temperature range of 100-145°F.
- P2=Parallel, flow controlled, 1.5-4 gpm
- T2=Parallel with two thermostats, up to 180°F (normal 140°F), 1.5-4gpm
- T=Parallel with single thermostat, .8-4 gpm
- P3=Three-phase, triple module, 1.8-5 gpm
- T3=Three-phase, triple module, up to 180°F, 1.8-5 gpm
- T2T=Three-phase, triple module, thermostatic, .7-4 gpm
- TDR=External thermostatic control, digital readout, .5°F temp. accuracy,
- TDI=De-ionized Water, thermostatic models
- SL=Add for 3/8" compression fitting on inlet/outlet

Stiebel Eltron

- Temperature control from 86-125°F on DHC-E and Tempra models
- DHC and DHC-E=point-of-use models
- Tempra=whole house models
- DHC and DHC-E=1/2" NPT water connections
- DHC=temperature varies with flow
- DHC-E= .45 gpm minimum
- DHC minimum flow rates: 3-1 & 3-2=.32, 4.2 & 4.3 & 5-2=.47, 8.2 & 10-2=.79
- DHC 3-1, 3-2, and 4-2 models shipped with .5 gpm flow restrictors
- Copper heating elements
- Tempra minimum flow rates:12=.29, 20 & 24=.58, 29 & 36=.87
- Bottom inlet/outlet connections on all models

Bosch

- Point-of-use models=10 psi min. pressure requirement, 5-year warranty on chamber and elements, 1-year all other parts, minimum activation flow of .5-.75 gpm, claim 99% efficiency.
- RP17PT and RP27PT=whole house models, all others are point-of-use
- RP2P includes .5 gpm flow restrictor
- Whole house models=dry-fire protected, built-in flow sensors ensures constant output temperature, RP17PT, not recommend where inlet water is below 60°F, claim 90+% efficient with zero standby heat loss, 10-year warranty against leaks, 1-year parts warranty, 3/4" MNPT water connections, electronic flow switch, bottom inlet/outlet connections, and external temperature control knob

Chronomite

- Inlet/outlet connections on the right, compression style.

Prefixes

- E=Instant temp, external temp. control
- M=Microprocessor controlled, factor preset temperature (104°, 110° or 120°F)
- SR=.1 gpm flow rate (no suffix), instant flow, no temperature control

Suffixes

- DI=De-ionized water application
- F=Fixed temperature, factory preset
- L=Low flow,.5 gpm flow rate
- R=Remote accessory
- S=Standard flow, 1 gpm

SETS

- Min. flow rate is .25 gpm
- Lifetime warranty on parts to original owner, \$50 to transfer to next owner.
- Operating range is 5-150 PSI, 40 PSI minimum recommended.
- 3/4" inlet/outlet connections on bottom.
- Proof of installation by licensed plumber or electrician required for warranty.

Niagra

- 5 PSI minimum pressure, 150 PSI max.
- .4 gpm to activate with .3 gpm to turn off
- 10-year warranty on casing, 1-year on parts
- Temperature does not automatically track flow rate.
- 1/2" water connections on opposite sides

Hot Aqua

- Min. flow rate .3-8 gallons, depending on model
- Suffix SI=unknown
- Top inlet/outlet water connections, 1/2" MNPT
- Incoloy heating element
- Includes free installation kit
- Min. pressure is 25 psi

Note: Publication of this cross reference does not constitute an acknowledgement of the validity of competitor's performance or product characteristic claims. It is simply a reference as to which Seisco model can be used in lieu of competitive models. Features and performance of Seisco models may vary from the performance claims for competitive models. When in doubt, consult with your Seisco sales representative.

SEISCO IS A PATH PARTNER

(Partnership For Advancing Technologies in Housing- consisting of 13 agencies including HUD, the DOE, and the EPA, assisted in product evaluation by the Research Department of the National Association of Home Builders.)

January 2000-Seisco was featured as the water heating technology of choice in PATH's National Demonstration Home.

January 2004-Seisco was selected as one of PATH's top 10 technologies.

January 2006-Featured in NextGen Home at the Consumer Electronics Show in Las Vegas, Nevada and at the International Builder's Show in Orlando, Florida (www.nextgenhome.com).

January 2006-Seisco received a Certificate of Commendation for leadership in home building innovation.



EVALUATION PROJECTS

1. Solar Back Up-During the year 2000, the Seisco was selected as the back up for solar water heating in the UNITED STATES DEPARTMENT OF STATE, FORT LAUDERDALE, FLORIDA REGIONAL CENTER BUILDING, which is the STATE DEPARTMENT'S SOLAR SHOWCASE. At the recommendation of PATH and the NAHB Research Department, Seisco is the back up for solar water heating in the prestigious "Armory Park Del. Sol: A Solar Community" at the historic Armory Park in Tucson, Arizona.

2. Government and Other Evaluations-

3.

- **AT&T Sponsored "Home of Tomorrow"** - The Seisco was featured at the State Fair of Texas in October, 2000, in the AT&T sponsored "Home of Tomorrow."
- **Tennessee Valley Authority** - The Tennessee Valley Authority, an agency of the Federal Government, tested the SEISCO and confirmed that its performance met the "manufacturer's claims" and that the SEISCO was 99.3% energy efficient and presented its findings at the ASHRAE Conference in July, 1997.
- **Bonneville Power** - Like the TVA, Bonneville Power Administration (BPA), an agency of the Federal Government, selected the SEISCO for its home of the future, "NeXt" house in July, 1999.
- **American Society of Heating, Refrigeration, and Air-Conditioning Engineers** - DuPont presented SEISCO to the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) in Atlanta, Georgia, in 1996.

PATENTS & COMPLIANCE LISTINGS

U.S. Patents-One or more of the U.S. Patents below covers SEISCO and foreign Patents applications pending.

- #6,246,831 issued June 12, 2001
- #6,080,971 issued June 23, 2000
- #5,866,880 issued February 2, 1999
- #5,325,822 issued July, 1994
- #5,216,743 issued June, 1993

In addition to the U.S. patents, there are many foreign patents issued.

Compliance Listings-Instantaneous Water Heater System Listings with:

- UL/CUL 499/64, File #E118679 / Listed 78P8 (Water Heating Equipment)
- UL 834/165, File #E232824 / Listed 8VA7 (Space Heating Equipment)
- UL/CSA (Canada) - Listed 78P8
- HUD (Housing & Urban Development) - Approved for use in Manufactured Housing, Ref: NFPA 70
- NEC (National Electrical Code)
- NOM (Norma Oficial Mexicana)



Endless Hot Water

Appendix

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."

EEL-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 back-ups 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 Microtherm... 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."

CALCULATIONS AND OTHER INFORMATION

WATER HEATING

Recovery GPH

$$\text{Electric} = (\text{kW} \times 3413) / (8.33 \times \Delta T)$$

$$\text{Gas} = (\text{BTU Input} \times \text{Efficiency}) / (8.33 \times \Delta T)$$

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

Req. Input

$$\text{kW} = (\text{Gals.} \times 8.33 \times \Delta T) / 3413$$

$$\text{BTU} = (\text{Gals} \times 8.33 \times \Delta T) / \% \text{ Efficiency}$$

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

$$\% \text{ Hot} = (M - C) / (H - C)$$

$$\% \text{ Cold} = (H - M) / (H - C)$$

H = Cold Water Temperature

C = Hot Water Temperature

M = Mixed Water Temperature

Miscellaneous

$$\text{gpm} = (\text{kW} \times 6.83) / (\text{temp. rise})$$

$$\text{temp. rise} = (\text{kW} \times 6.83) / \text{gpm}$$

$$\% \text{ Efficiency} = (\text{GHP} \times 8.33 \times \Delta T) / \text{Btu/Hr. Input}$$

$$\text{Btu Output} = \text{GPH} \times 8.33 \times \Delta T$$

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

ELECTRICITY

Singe Phase Power

$$\text{Watts} = \text{Amps} \times \text{Volts}$$

$$\text{Amps} = \text{Watts/Volts}$$

$$\text{Volts} = \text{Watts/Amps}$$

Three Phase Power

$$\text{Amps} = (\text{kW} \times 1000) / (\text{Volts} \times 1.732)$$

$$\text{Volts} = (\text{kW} \times 1000) / (\text{Amps} \times 1.732)$$

$$\text{Watts} = \text{Amps} \times \text{Volts} \times 1.732$$

GAS/OIL

Oil #1 Fuel=136,000 BTU/Gal.

Oil #2 Fuel=138,500 BTU/Gal.

Oil #3 Fuel=141,000 BTU/Gal.

Oil #5 Fuel=148,500 BTU/Gal.

Oil #6 Fuel=152,000 BTU/Gal.

Gas (natural)=1,000 to 1,100 BTU/ft³

Gas (manufactured)=500-550 BTU/ft³

Gas (propane)=2,570 BTU/ft³

Gas (propane)=21,600 BTU/lb

Gas (propane)=91,000 BTU/Gal.

Gas (butane)=3,260 BTU/lb

Gas (butane)=102,600/Gal

TEMPERATURE CONVERSIONS

$$\text{Fahrenheit (F) to Centigrade(C)} = (F - 32) \times .556$$

$$\text{Centigrade (C) to Fahrenheit (F)} = (C \times 1.8) + 32$$

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.

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.

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.

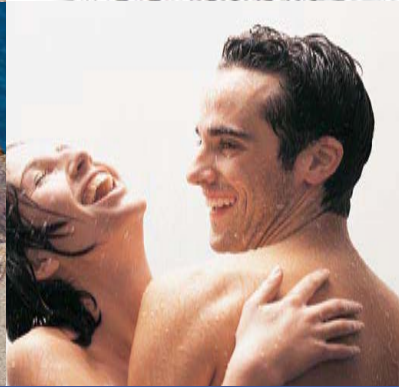
Easy to Service - Although seldom required, cleanout plates on the bottom of the Seisco allow quick easy access for removing sediment or sand. Seisco's self-diagnostic control and an LED light identify service issues through a series of flashes. An audible beep can be used by Microtherm's customer service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



"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



MICROTHERM[®]
INCORPORATED