Hot Water Manual

OWNER AND INSTALLATION MANUAL

MANUFACTURED BY:
ENERGY KINETICS, INC.
51 Molasses Hill Road
Lebanon, NJ 08833
(908) 735-2066
www.energykinetics.com or www.system2000.com

INSTALLER: PLEASE HANG THIS INSTRUCTION MANUAL AND ACCESSORY INSTRUCTIONS VISIBLY NEXT TO THE HOT WATER SYSTEM USING THE SUPPLIED POUCH.

CONSUMER: PLEASE RETAIN THIS INSTRUCTION MANUAL AND ACCESSORY INSTRUCTIONS FOR FUTURE REFERENCE.

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Please Read This First…

Special Attention Flags

Please pay particular attention to the following flags when you see them throughout this manual.

DANGER: Notifies you of hazards that **WILL** cause severe personal injury, death or substantial property damage.

WARNING: Notifies you of hazards that **CAN** cause severe personal injury, death or substantial property damage.

CAUTION: Notifies you of hazards that **WILL or CAN** cause minor personal injury or property damage.

NOTICE: Notifies you of special instructions on installation, operation, or maintenance that are important, but not normally related to injury or property damage hazards.

INSTALLER NOTE:

ALL INSTALLATIONS MUST BE MADE IN ACCORDANCE WITH ALL NATIONAL, STATE AND LOCAL, PLUMBING, HEATING AND ELECTRICAL CODES THAT MAY DIFFER FROM THIS MANUAL AND IN ACCORDANCE WITH THE FOLLOWING CODES, AS APPLICABLE:

N.F.P.A. No. 70: National Electrical Code
Canadian Electrical Code, Part I

These codes are available from:
National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269-9101.

A hot water storage tank should be installed in such a manner that, if the storage tank or any connection thereto should leak, the resulting flow of water will not cause damage to the area in which it is installed.

A hot water storage tank T&P relief valve and all other devices must be piped to the nearest drain to avoid damage in the event the valve is actuated.

Make sure relief discharge pipes from all reliefs are properly placed to safely contain discharge. Make sure relief discharge pipes, such as from a hot water storage tank, will safely contain hot water and/or boiling water. Reliefs include, but are not limited to, the domestic hot water tank temperature and pressure relief valve. Any other reliefs, such as from the heating system, must also follow these guidelines.

Domestic Hot Water

CONGRATULATIONS ON YOUR PURCHASE OF THE SYSTEM 2000 HOT WATER MAKING kits, parts, and systems. When paired with the System 2000 hot water boiler, with its highly efficient low mass hydronic heat exchanger, you will have a state of the art indirect water heating system. System 2000 is the product of years of engineering and advanced design, which brings together in a single system all elements needed to provide efficient residential and light commercial heat and hot water. This operation and maintenance information has been prepared so that you may better understand and use your **Energy Kinetics Hot Water Heating System**.

Overview

Energy Kinetics offers several ways of making hot water. This manual covers those several ways, one way at a time. You may go directly to the section that applies to your choice of making hot water. We then finish with a plate heat exchanger trouble shooting section.

1. Plate heat exchanger piped into the boiler bypass line.
2. Plate heat exchanger piped as a hot water zone.
3. Indirect tank with internal heat exchange coil, fed by a circulator or zone valve (see underlined below).
4. Hot water making kits, applied to boilers made by other manufacturers.
5. Commercial applications with primary/secondary loop heating.
6. Trouble shooting and diagnostics for plate heat exchangers

Smart Pump Hot Water Making

How it works

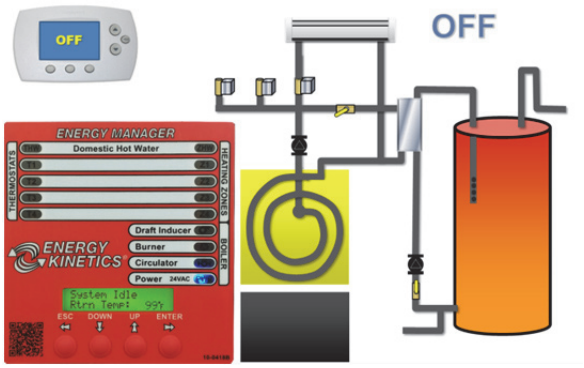
Energy Kinetics uses a Plate Heat Exchanger (PHE) to make domestic hot water, which is then stored in an insulated tank. The PHE separates the boiler water from the domestic water. The boiler circulator pumps hot boiler water through the boiler side of the PHE, while the domestic circulator (the Smart Pump) pumps cold domestic water through the domestic side of the PHE.

The Smart Pump is a low head, low flow circulator that circulates water from the storage tank, through the PHE, and then back into the tank.

Description of Operation

SYSTEM 2000 Stages of Hot Water Making (Similar to a warm air furnace)

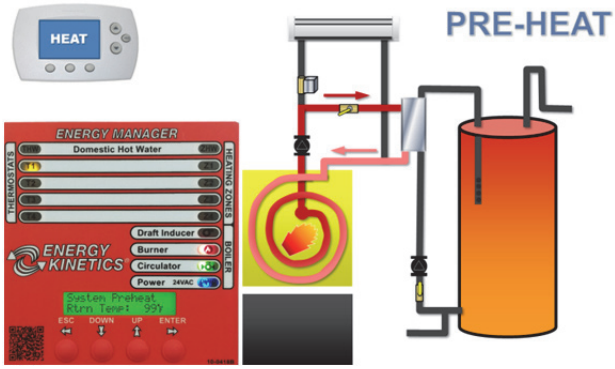
Example shows typical residential application with plate heat exchanger in the bypass



1

OFF

No Tank Thermostat Call



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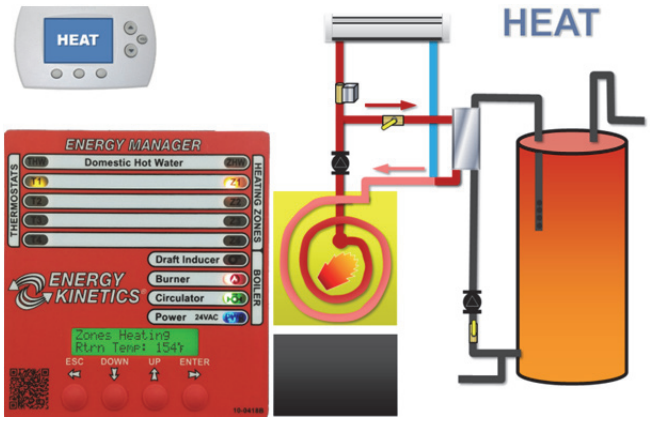
PRE-HEAT

Tank Thermostat Calling

Boiler warming up and circulating water through bypass. This takes about 90 seconds.



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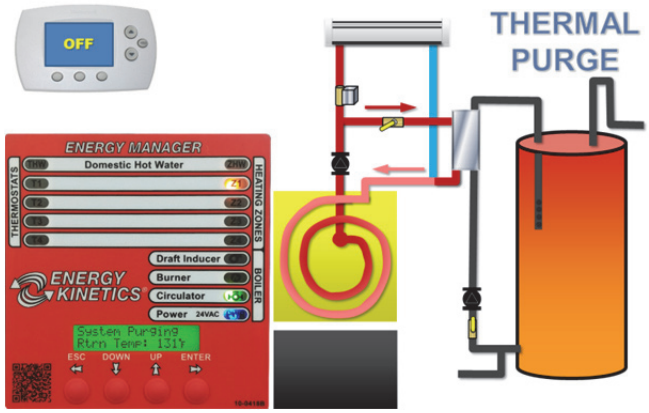
HEAT
Tank Thermostat Calling

Boiler hot. Hot water circulator ON.



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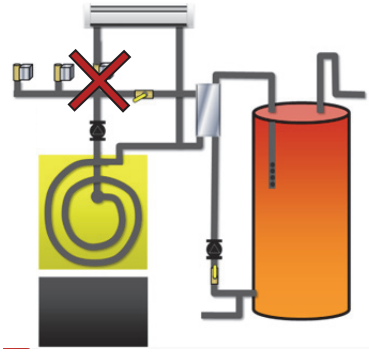
ENERGY RECOVERY
Tank Thermostat Satisfied

Burner was just running so boiler is still hot. Both circulators continue to run, purging heat to the domestic hot water tank.

EXCEPTIONS



For Hot Water Priority

<u>Turn ON Option Switch #10 – Digital Manager</u>
Heating zones will not open until the hot water call is satisfied.

<u>Display Manager:</u> Hot Water Priority is set thru display edit options.

If the hot water call does not satisfy in 25 minutes, the zones will open for any zone that is calling.

Plate Heat Exchanger

The exchange surface is made of 316 stainless steel corrugated plates, sealed by brazing. The corner ports are arranged so that hot water and cold water flow through alternating channels. The brazed plate exchanger can be cleaned by flushing with acid or other chemical cleaning.
Use for domestic hot water, radiant system isolation, heating swimming pools and hot tubs.

Plate Heat Exchangers					
Model	**Rated Hot Water Output BTU/HR[1]**	**Hot Water Output GPM**	**Actual Hot Water Output BTU/HR[2]**	**Boiler Flow GPM**	***Boiler Pressure* Drop PSI**
# 14	**100,000**	**3.6**	**130,000**	**5**	**3.0**
Double Wall *	**100,000**	**3.9**	**150,000**	**5**	**6.7**
# 18	**200,000**	**7.6**	**290,000**	**10**	**3.7**
Double Wall *	**200,000**	**8.9**	**340,000**	**10**	**6.0**
# 23	**300,000**	**10.9**	**410,000**	**12**	**13.0**
# 25	**360,000**	**13.3**	**500,000**	**14**	**11.0**
# 27	**500,000**	**19.9**	**760,000**	**20**	**9.9**

[1] Rated Output based on: 100° F Rise on output temperature
[2] Actual output will be limited by maximum boiler output.
Actual Outputs based on: 180° F Boiler Water Supply Temperature
77° F Rise, Cold Side: 40° F - 117° F
*Double wall plate heat exchangers for use where required by code.

Indirect Water Heater

When water conditions dictate its use, an indirect water heater is used instead of a Plate heat Exchanger to make domestic hot water. An Indirect Water Heater uses an internal coil to heat the domestic water in an insulated stainless steel storage tank. The internal coil separates the boiler water from the domestic water. It is connected to the boiler as a heating zone with a zone valve or zone circulator. The boiler circulator pumps hot boiler water through the internal coil heating the domestic water stored in the tank.

Storage and Production

Storage is better than recovery

- Store 2/3rds of the highest draw
- Stored water available during power outage (city water only)

Fast recovery is better than slow recovery

- EK1: first hour draw, up to 228 gallons* (188 gph production/recovery plus 40 gallon storage tank).
- EK2: first hour draw, up to 395 gallons* (355 gph production/recovery plus 40 gallon storage tank).

*Ratings based on 40 gallon storage tank.

Adequate storage for the single largest draw in the building negates the need to over size the boiler to cover large sporadic loads. A good example is a Jacuzzi type tub where the draw can be as much as 90-120 gallons in a very short time. With at least 80 gallons of storage coupled with the recovery rate of a plate heat exchanger, the tub can be filled without a problem. The tank can recover while the tub is in use. Other smaller demands can also be handled with no problem.

Hot Water Comparison

How much hot water do I really get?

15,000 BTU/Hr is the average recovery rate for an electric hot water heater
35,000 BTU/Hr is the average recovery rate for a gas water heater

4.5kW is about 15,000 BTU

Energy Kinetics rates all equipment with a 77º F rise.

- EK1 is 228 gallons* at 1.00 gph oil firing rate
- EK2 is 395 gallons* at 1.75 gph oil firing rate

*Ratings based on 40 gallon storage tank.

Production Rate / Gallons Per Hour				
Net BTU Output	60º F Rise	77º F Rise	90º F Rise	100º F Rise
15,000	30	23	20	18
20,000	40	31	27	24
30,000	60	46	40	36
40,000	80	62	54	48
50,000	100	78	67	60
80,000	161	125	107	96
100,000	201	156	134	120
200,000	402	312	268	241
250,000	502	390	335	301

Actual hot water production depends on the following:

- Supply water temperature
- Tank thermostat setting
- Boiler output available for hot water production
- Plate heat exchanger cleanliness
- Distance from plate heat exchanger to the tank

Example: The first hour draw for an *electric hot water heater* is only *23 gph* plus 40 gallons in storage for a total of 63 gallons* compared to, *55 gph* plus 40 gallons in storage for a total of 95 gallons* for a *gas water heater* compared to *228 gallons** for an *EK1* with a 1.00 gph oil firing rate.
* Ratings based on 40 gallon storage tank.

Domestic Hot Water Tank Overview

- Geography, what works in your area?
  Before making any decisions on what type of storage tank to use, glass lined or stainless steel, you should be familiar with the water conditions in that area.
- Glass Lined Tanks
  - Suitable for almost any water condition
  - Least expensive tanks available
  - Proper maintenance of the anode greatly extends tank life
  - Energy Kinetics ships 40 gallon glass lined tanks with a 10 year warranty standard with heat & hot water systems, larger sizes available

Typical Residential Hot Water Requirements

Fixture	Flow Rate	Time per Use, Minutes
Shower or Bath	3	5 to 7
Face and Hand Washing	2	2
Kitchen Sink	2	1.5 to 2.5
Clothes Washer	4	5 to 8
Automatic Dishwasher	4	4
Whirlpool, Hot Tub (ask for capacity in gallons)	4	12 to 24+

Vaughn "High Flow" Indirect Tank with Internal Heat Exchanger

- Boiler water circulates thru the internal coil, heating the domestic water in the tank.
- Connect as a heating zone with zone valve or zone circulator
- Wire aquastat to THW zone

Residential Requirements for Hot Water

- When Sizing a Job:
  - Walk around the house to determine what hot water consuming appliances are in use
  - Ask if any additions or alterations are planned that may increase hot water usage
  - Determine peak flow rate (Usually only one large use at a time)
  - Determine the maximum volume draw (Typically clothes washer unless there is a whirlpool)

Add up the expected draw.
Calculate total hot water available.
Total hot water available = Hot water recovery in gallon per hour + Hot water storage in gallons (With an EK System, you can figure 100% of tank capacity as usable water)

Example: **Assume an EK1 with #14 PHE with recovery rate of 188 GPH, 40 gallon storage tank**
Available water to fill a 100 gallon whirlpool with a .42 hr water draw @ 4GPM is: Total, gallons = Storage, 40 gallons (available) + Recovery at 188 GPH X 0.42 hour = 119 gallons. This is marginal. If the draw is more than 4 GPM there will be a shortage.

Example: **Family of four comes home, has dinner, cleans up the mess, showers and does a load of wash.**

Kitchen Sink	2 GPM @ 5 min	10 gal
Dishwasher	4 GPM @ 4 min	16 gal
Showers	4 X 3 GPM @ 10 min	120 gal
Load of clothes	4 GPM @ 8 Min	32 gal
	Total	178 gal

First hour draw on an EK1 with #14 PHE and a 40 gal tank is 228 gallons. This system would handle this load very well.

Commercial Applications

Many commercial applications use multiple boilers and are piped with primary/secondary loop heating systems. With these systems the installer has the option of installing the plate heat exchanger(s) in the boiler bypass (one per boiler), use a Hot Water Zone Kit or as a zone off the primary loop. There are benefits to each and the best location should be determined by the requirements for domestic hot water.

Primary Loop: It allows the use of the larger #23 & #25 Plate Heat Exchangers (PHE) taking advantage of the combined boiler output. Takes advantage of the steady supply of hot water in the loop to generate the domestic hot water (DHW) required when the primary loop is seeing constant activity (cold weather). Allows the use of Indirect Tanks instead of PHE's at locations with very hard water.

Bypass: When Digital Manager controlled boilers are used, the Plate Heat Exchangers can be installed in the boiler bypass (pre-piped from factory) or as a zone right off the boiler using a hot water zone kit. Calls for DHW and DHW Priority (if desired) are handled by the Digital Manager. If the primary loop is subject to warm weather shutdown then installing the PHE(s) in the boiler bypass will allow a very quick recovery of the DHW taking advantage of the boilers low mass design and energy recovery cycle. One PHE can be installed in the bypass piping for each boiler in a multi-boiler installation.

Concept of Operation

Plate heat exchanger installed as a zone *on the primary loop*: (Use a Multi-Boiler Control that has hot water priority)

- The tank thermostat(s) gives a call to the multi boiler control
- The boiler control starts the Smart Pump and the hot water zone circulator.
  (During a call for domestic hot water, the boiler control overrides the outdoor reset during the call and shuts off the loop circulator to provide priority.)

Plate Heat Exchanger(s) installed *in boiler bypass or using a Hot Water Zone Kit*:
(The multi boiler control does not need to have hot water priority)

- Tank thermostat(s) calls System Manager.
- System Manager runs Smart Pump and boiler until hot water call is satisfied.
  Note: Hot water priority can be enabled on the System Manager, which will close zone Z1 (injection loop supply) during the domestic hot water call for up to 25 minutes.
- System Manager initiates the energy recovery cycle and post purges into the storage tank.

Large Volume Storage for Domestic Hot Water

Storage tanks can be piped in series to store large volumes of domestic hot water. Refer to the drawings section of this manual for examples of tanks piped together.

Options for Plate Heat Exchanger Installed in Boiler Bypass
(Example for Two EK2 Boilers)

Domestic Hot Water GPM	Model	QTY	Boiler Output Btu/hr	Boiler Flow GPM	Boiler Pressure Drop PSI
5	#18	1	206,000	10	3.7
10	#18	2	412,000	20	3.7

Options for Plate Heat Exchanger(s) Installed in the Primary Loop
(Example for two EK2 Boilers)

Domestic Hot Water GPM	Model	QTY	Actual Hot Water Output Btu/hr	Boiler Flow GPM	Loop Pressure Drop PSI
7.6	#18	1	290,000	10	3.7
10.6	#23	1	410,000	12	13.0
10.7	#25	1	412,000	14	11.0
10.7	#18	2	412,000	20	3.7

Commercial Requirements for Hot Water

Determine the type of consumption

- Residential – Multiple family
- Commercial – Split out temperature requirements
  - 120º F for fixtures
  - 140º
  - 180º F for dishwashers
    - Additional tank or mixing valve may be required
- Determine attached fixtures
- Type & number
  - Showers
  - Faucets
  - Washing machines
  - Dish washers
  - Hot tubs
  - Spas
  - etc.
- Determine expected usage pattern per ASHRAE recommendations in gallons per hour. Ask questions to make sure there are no surprises.
- Select boiler(s) and heat exchanger(s) based on average water flow.
- Select storage tank size based on peak water flow.
  - Determine peak hot water flow required in gallons per minute
  - Base tank size on usable volume, not capacity volume
- Add capacity as needed to compensate for losses such as circulation and pipe losses.
- Add capacity to building heat load **ONLY IF** the water heating load is more than 25% of the building load.

Sizing Boiler/Storage Tank for Commercial Requirements

To determine the correct size boiler/tank combination for commercial applications:

1. Refer to Tables 1 and 2 for hourly demands of various fixtures found in commercial buildings.
   a) Use a worksheet to determine and record the total number of each type of fixture found in the building. Call this column 1
   b) Use Tables 1 and 2 to find the number of gallons of 140º F water used per hour per fixture. Record this value for each fixture. Call this column 2.
   c) Multiply each line in column (1) by the number in column (2). The result is the total amount of water used for each type of fixture per hour. Record this in column (3).
   d) Total column (3). This is the total amount of water used by all fixtures per hour. This is the POSSIBLE MAXIMUM DEMAND.
   e) The demand factor is shown on Table 1 and is intended to take into consideration the fact that not all fixtures will be in use at the same time. Multiply the total demand calculated in step (d) by this factor. The result is the PROBABLE MAXIMUM DEMAND.
   f) If a commercial dishwasher or laundry is on the job, determine the amount of 140º F water which could be used in an hour. This will depend on the number of machines, the amount of water used per machine, and the way in which the water is to be used. Consult the machine manufacturer and the building owner for this information. Once the maximum hourly usage is known for this equipment, enter it in column (3)
   g) Add the hourly usage for the dishwashers and washing machines to the Probable Maximum Demand. This is the ADJUSTED PROBABLE MAXIMUM DEMAND.

2. Select a storage tank(s) that will meet or exceed the Adjusted Probable Maximum Demand. Calculated in (1g).

* Determine the BTU/hr needed to satisfy the storage tank(s).

* Determine the BTU/hr needed to satisfy the space heating requirement alone.

Size the boiler for the larger of the two. If the requirement to satisfy the hot water load is less than 25% of the total demand, there is no need to increase the boiler size.

Sizing Formula for BTUH Input

Desired temperature	**_____*ºF***
Inlet temperature	**_____ºF**
1. Temperature difference	**_____ºF**
2. Expected flow rate __ GPM x 60 minutes =	**_____ GPH**
3. BTU/gallon ºF (water)	**8.25**
Total expected BTUH output is:	
Temp difference x GPH x 8.25 BTUs =	**_____BTUH**
To find the input required to produce output, divide by the combustion efficiency of the boiler	**_____BTUH**

Table 1

Hot Water Demand per Fixture for Various Types of Buildings
(Gallons of water per hour per fixture, calculated at a final temperature of 140º F)

Fixture	Private Residence	Apartment House	Office Building	Industrial Plant	Hotel	School
Basin, Private Lavatory	2	2	2	2	2	2
Basin, Public Lavatory	-	4	6	12	8	15
Bathtub	20	20	-	-	20	-
Dishwasher	15	15	-	20-100	50-200	20-100
Kitchen Sink	10	10	20	20	30	20
Laundry, Stationary Tub	20	20	-	-	28	-
Shower	30	30	30	225	75	225
Service Sink	15	20	20	20	30	20
Semicircular Wash Sink	-	-	10	15	10	15
Demand Factor	0.30	0.30	0.30	0.40	0.25	0.40

Table 2

General Purpose Hot Water Requirements for Various Kitchen Uses (140º F)

Equipment	GPH
Vegetable Sink	45
Single Pot Sink	30
Double Pot Sink	60
Triple Pot Sink	90
Prescrapper (Open Type)	180
Preflush (Hand Operated)	45
Preflush (Closed Type)	240
Recirculating Preflush	40
Bar Sink	30

Notes:
Assuming 20 psi supply water pressure at equipment
Dishwasher operation at 100% of mechanical capacity

Table 3

Representative Hot Water Temperatures

Use	Temp ºF
Lavatory	
Hand Washing	105
Shaving	115
Showers and Tubs	110
Therapeutic Baths	95
Commercial or Institutional Laundry, Based on Fabric	Up to 180
Residential Dish Washing and Laundry	140
Surgical Scrubbing	110
Commercial Spray Type Dish Washing *	
Single or multiple tank hood or rack type	
Wash	150 min
Final Rinse	180 – 195
Single Tank Conveyor Type	
Wash	160 min
Finial Rinse	180 – 195
Single Tank Rack or Door Type	
Single Temp Wash & Rinse	165 min
Chemical Sanitizing Type **	140
Multiple Tank Conveyor Type	
Wash	150 min
Pumped Rinse	160 min
Finial Rinse	180 – 195
Chemical Sanitizing Glass Washer	
Wash	140
Rinse	75 min

* As Required by NSF
** See manufacturer for actual temp required

Commercial Tank Sizing Worksheet

Description	(1) 140º F Water Gal/hr per fixture		(2) Number of Fixtures		(3) Fixture Total Gal/hr
Basins, Private Lavatory		X		=	
Basins, Public Lavatory		X		=	
Bathtubs		X		=	
Dishwasher		X		=	
Kitchen Sink		X		=	
Laundry, Stationary Tub		X		=	
Pantry Sink		X		=	
Shower		X		=	
Service Sink		X		=	
Semicircular Wash Sink		X		=	
Clothes Washer in Apartment	32	X		=	
Commercial Kitchen Fixtures:					
Vegetable Sink	45	X		=	
Single Pot Sink	30	X		=	
Double Pot Sink	60	X		=	
Triple Pot Sink	90	X		=	
Prescrapper (Open Type)	180	X		=	
Preflush (Hand Operated)	45	X		=	
Preflush (Closed Type)	240	X		=	
Recirculating Preflush	40	X		=	
Bar Sink	30	X		=	

Total Column (3) Possible Maximum Demand	=	
Demand Factor	= X	
Probable Maximum Demand	=	
Hourly Dishwasher Requirement	= +	
Hourly Laundry Requirement	= +	
Adjusted Probable Maximum Demand	=	

Hot Water Requirements for Pools

Temperature Rise* = Boiler BTU Output/Hour X 24 hrs/day = Degrees/Day
Pool Volume (Gallons) X 8.35 (lb/gal)

Temperature rise is assuming that the pool has a cover such as a solar blanket to reduce nighttime losses. All numbers are rounded off.

POOL SIZE (Gallons)	EK1 (BTU/hr)		EK2 (BTU/hr)		EK3 (BTU/hr)	
	104,000	121,000	147,000	206,000	272,000	357,000
10,000	30	35	42	59	66	87
20,000	15	17	21	30	33	44
30,000	10	11	14	20	22	29
35,000	8	9	12	17	19	25
40,000	7	8	11	15	17	22

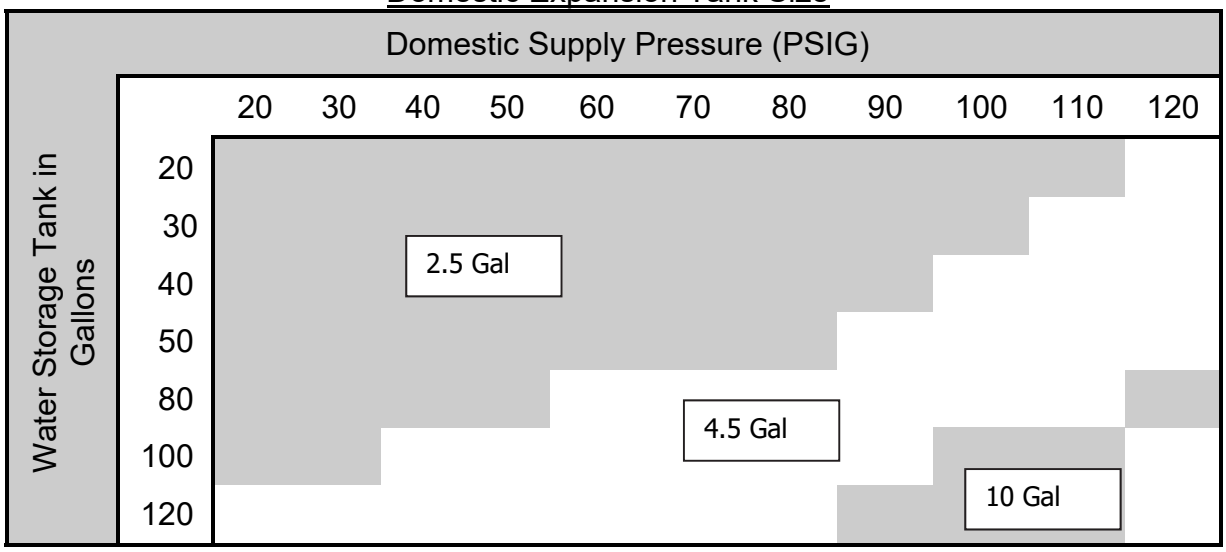
Assumes minimal heat loss

Request a copy of the Pool Heating Procedure from Energy Kinetics' Tech Support Team.

Domestic Expansion Tank Sizing

- Beware of check valves in the cold water supply
- Newer water meters and all flow/pressure regulators have internal check valves
    - Water needs somewhere to expand when heated
- Maximum expansion is 6% increase in volume
- Rule of thumb, size the expansion tank to 10% of storage tank volume.

Domestic Expansion Tank Size



Based On: Heating water from 70º F to 140º F
Factory pre-charge of 40 PSIG – no need to change pressure

As water is heated, it expands. The maximum change is under 6% increase in volume. This increase in volume must be accommodated in any type of closed loop system to prevent the relief valve from discharging.

Domestic water systems may be open or closed. In a typical well system, there is an expansion tank, either open or diaphragm type. This maintains pressure in the house piping without requiring the pump to run every time a faucet is opened. There is very seldom any check or back flow preventer. When hot water is made, the water can expand into this tank.

With town or city water, there is usually a meter and often a pressure reducing valve in the water main entering the house. Newer meters and all pressure reducing valves have an internal check. This turns the house plumbing into a closed system until a faucet is opened. If hot water is produced with no faucets open to accept expansion, the T&P valve may relieve.

Installation of a properly sized expansion tank at the cold water inlet to the storage tank will eliminate this problem.

Hot Water Recirculation

Hot water recirculation can be an energy trade-off. When hot water is needed, it is there immediately so it does save water. However, there is more heat loss from the hot water pipes so more energy is consumed to keep the tank hot.

It often is psychological. The customer wants hot water, the customer gets hot water. This is more evident in large homes, especially if the tap is a long distance from the hot water tank.

The return is teed into the hot water piping from the plate heat exchanger and does not need to be sized more than ½". A small bronze or stainless circulator with check valve is installed on the return near the tank. This may be controlled manually, with a time clock or with a strap-on aquastat set at approximately 110ºF. All loop piping must be insulated.

Refer to drawing SYS-05-001 located in the System Drawings Section of this manual for piping info.

Hot Water Recirculation with a Mixing Valve

With a mixing valve installed, some of the return water is passed through the mixing valve. The remainder goes to the tank. As the return water heats up, the difference in temperature between the cold in and mixed out temperature decreases. This reduces the accuracy of the valve and can allow the supply temperature to rise to that of the temperature at the hot outlet of the tank.

To prevent this from happening and save on the energy consumed due to heat loss, an aquastat should be installed on the return piping of the circulation loop. This way the circulator will only run when the loop temperature falls below the set point of the aquastat, usually 110º F.
Make certain that all piping in the loop is well insulated for minimal heat loss.

Request a copy of drawing SYS-05-009 for piping info.

Receiving and Unpacking

Inspect shipment upon receipt for external damage. When unpacking and uncrating, inspect each item for internal damage. Any damage found should immediately be reported to the freight carrier before installation. The receiver is responsible for following the claims procedure of the freight carrier. The freight carrier is responsible for taking prompt action on all claims. If freight cannot be inspected at the time of delivery, sign the bill of lading "Subject to Inspection" and inspect the shipment as soon as possible after receipt. Replacements for parts damaged in shipment are available upon receipt of a signed copy of a claim report *(concealed damage claims should be filed immediately against the freight carrier by the consignee).*

After unpacking, check each item against the packing list. Inspect it thoroughly for loose parts, instruction sheets and packing lists. Immediately report any missing items. It is wise to complete the installation before discarding packing material. Store all parts where they will not be damaged or lost during installation.

General Assembly

Assembly of various packaged units is illustrated throughout this manual. The use of non-Energy Kinetics supplied pump, controls and accessories should follow good practices. The diagrams and locations presented in this manual are recommended.

Piping

All piping and accessory connections should follow good practice using approved joint sealants.
Call Energy Kinetics to obtain piping and wiring instructions for alternate applications, such as radiant heating, swimming pool heating, multiple boilers, injection loops, etc.

Figures 2B and 2C indicate general system piping arrangement and options. Piping of individual systems may vary from Figures. Figure 2A indicates a typical flow schematic for boiler water and domestic water. Each system will vary according to job location. Supply and return connections are 1"NPT on the EK1 and 1-1/4"NPT on the EK2. The plate heat exchanger may be mounted either vertically or horizontally, depending on the model.

Boiler Mounting

BOILER MOUNTING on TANK STAND, FIG. 2C: Ensure that the boiler is properly mounted to the stand using the 5/16" hardware provided. Bolts should face up so they cannot interfere with removal of the tank at a later time. Holes in boiler legs must line up with holes in the tank stand.

LO-BOY TANK ORIENTATION: The 40 gallon Lo-Boy tank should be positioned with the tank drain pointing towards the front left corner of the drain pan. Push the tank all the way to the back of the stand. Center the tank left to right in the stand.

PIPING SO THE DOOR CAN OPEN: To avoid conflicts with the door opening, piping should be in accordance with **FIG. 2B, 2C** and the section on "Clearance for Cleaning and Service" in the Installation or Tech Manual**.** The door opens and drops into the notches on the boiler legs. The burner and air box also need clearance when the door opens. Do not locate any piping in front of the tank unless clearance from the door is verified. This also applies to the oil line piping and the combustion air piping. **NOTICE:** Air inlet pipe must be disconnected to allow door to swing down.

BOILER MOUNTING on STANDARD BASE, FIG. 2B: The back support bar should be mounted to the holes just in front of the 2" slot. Line up the rear holes in the legs with the holes in the back support bar. Two sets of 5/16" x 1-1/2" bolting hardware are provided and are used to secure the boiler to the back support bar.

Figure 2A

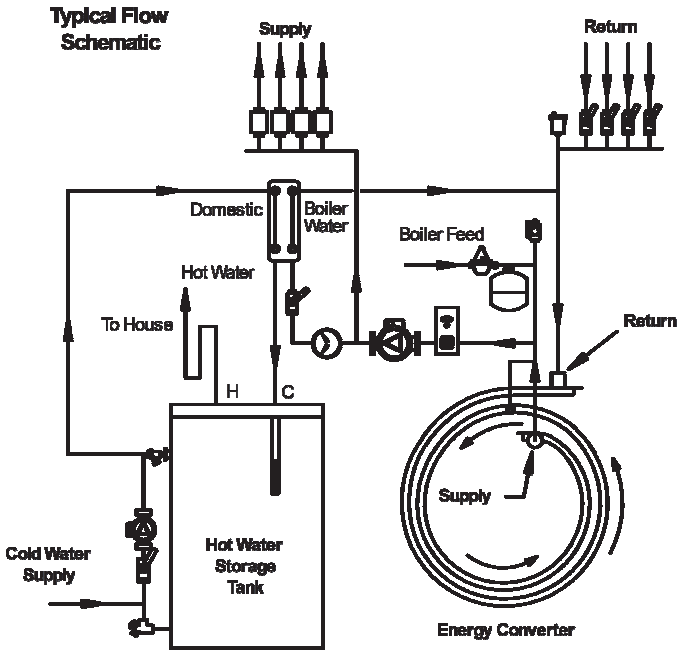


Figure 2B

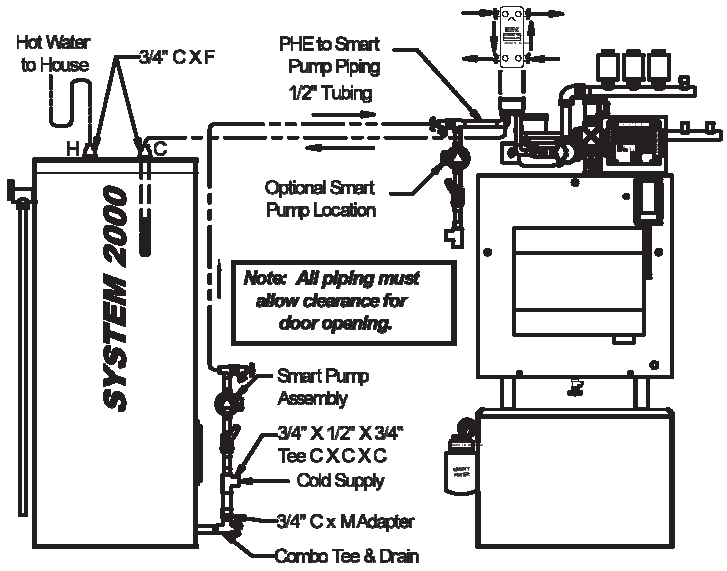


Figure 2C

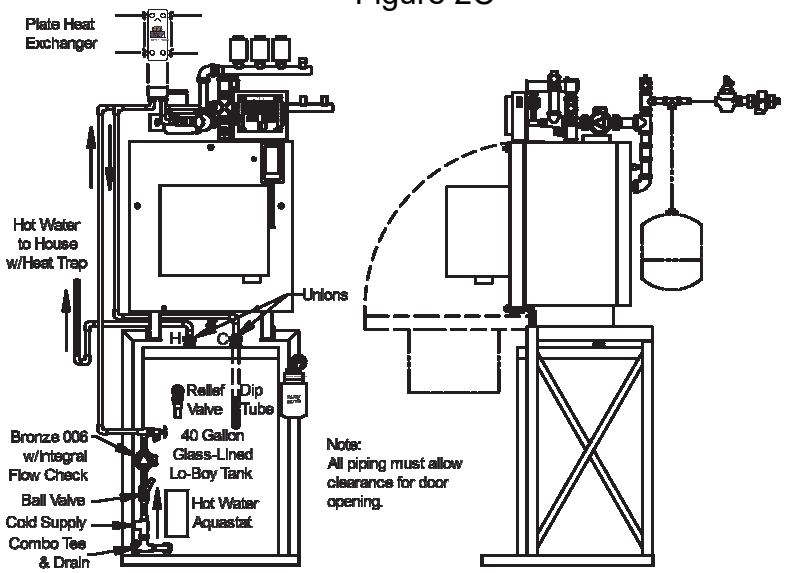
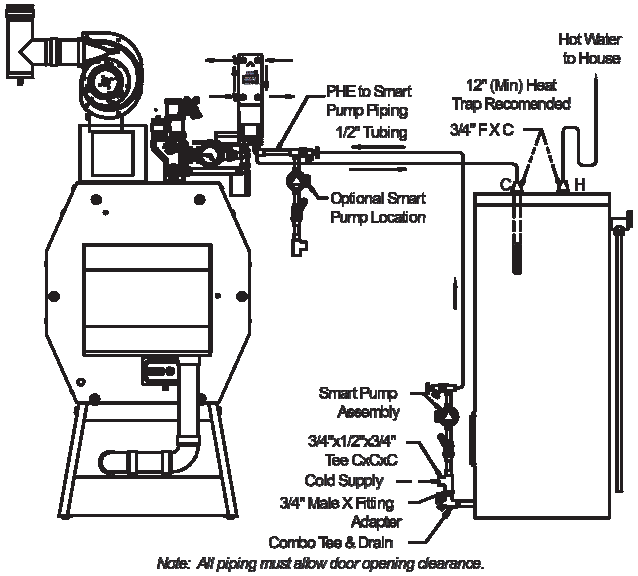


Figure 2D



BOILER PITCH: The Frontier pressure vessel is manufactured with the rear ½ to 1 bubble higher to allow for proper air removal. This pitch is carefully set at the factory when the boiler is built. Be sure to **level the stand** prior to mounting the boiler on the stand. When the stand is level, the pitch is correct and the back of the boiler will be higher than the front. The EK1 Frontier is pitched 1/4" and the EK2 Frontier is pitched 7/16".

Hot Water Storage Tank

FIG. 2C Indicates the arrangement using a 40-gallon Lo-Boy tank and is intended for locations where space is limited.
FIG. 2B Indicates a typical arrangement of the domestic hot water system. The tank may be located adjacent to or in any other convenient location. If greater than 10 feet away, use ¾" lines and an air vent on a high return. Insulation of water lines between the storage tank and Energy Converter and on the hot water supply to the house is recommended for best fuel efficiency. Energy Kinetics supplied storage tanks come complete with high-density foam insulation, a properly located tank thermostat, a temperature/pressure relief valve, and a specially designed dip tube.

Plate Heat Exchanger and Location

NOTICE: The plate heat exchanger is piped at the factory and its location and orientation should not be altered without consulting with Energy Kinetics. The heat exchanger is mounted in the bypass line at the boiler with a ball valve. Systems without a heat exchanger are piped at the factory with the bypass line and ball valve. The bypass valve must be at least partially open for the boiler to operate properly.

Pipe domestic water to the connections as marked on the plate heat exchanger. The Frontier Heat Exchanger is the same heat exchanger as the standard exchanger, but it has been provided with a new "Frontier" label because of the heat exchanger orientation. The heat exchanger should be oriented so that the "Boiler In" symbol is located on the lower right-hand side. When ordering a replacement, order the part number shown in the Assembly Drawing. The heat exchanger will be mounted at the factory either vertically or horizontally, depending on the model.

Depending on water hardness, it can be beneficial to install an Energy Kinetics Scale Stopper to the domestic cold water supply of the hot water storage tank.

The Scale Stopper contains a food grade additive that coats the metal surfaces that it comes in contact with, preventing mineral build up in the plate heat exchanger.

One alternative is to install the plate heat exchanger as a zone using one of Energy Kinetics Hot Water Zone kits. Hot Water Zone kits are designed to reduce the fouling caused by hard water plating out on the domestic side of the plate heat exchanger. Heated water only flows through the boiler side of the heat exchanger during a hot water call, reducing the exposure of the domestic water to a heated surface and reducing the effects of scaling. Adding a Scale Stopper will add even more protection to the system.

Another alternative would be to use one of Energy Kinetics indirect tanks with an internal coil instead of a plate heat exchanger. Again, adding a Scale Stopper for added protection is recommended.

DANGER:

Hot water temperature over 125F can cause severe burns instantly or death by scalding. Children, disabled, and elderly are at the highest risk of being scalded. Test water temperature before bathing or showering. Temperature limiting, anti-scald mixing valves are available and recommended.

Hot water storage tank thermostat does not limit the maximum delivered water temperature. The plate heat exchanger will always provide water that is hotter than 125F into the hot water storage tank where it will mix with the water in the storage tank. The hot water storage tank can deliver water hotter than 125F depending on the degree of tank temperature stratification. If codes place limits on maximum delivered water temperature, an anti-scald mixing valve **MUST** be installed on hot water tank outlet.

WARNING:

The single wall plate heat exchanger complies with 1990 N.S.P.C. provided that both of the following are true:
A) The boiler water (including additives) is practically non-toxic, having a toxicity rating or class of 1 as listed in Clinical Toxicology of Commercial Products, 5th Edition
B) The pressure of the boiler water is limited to a max of 30 psig by an approved safety or relief valve.

Wiring and Controls

The Frontier Heating System is furnished with controls and basic accessories as illustrated and described in this manual. Control, burner and accessory instruction sheets and system wiring diagrams should be attached to this manual for future reference. ***DANGER:*** All wiring must comply with the NEC and any local codes.

Electrical Connection - Line Voltage

POWER SUPPLY: 120 VOLT 60 HZ, 7.5 Amperes

DANGER: **Make All Connections with Power Off at Main Circuit Box**

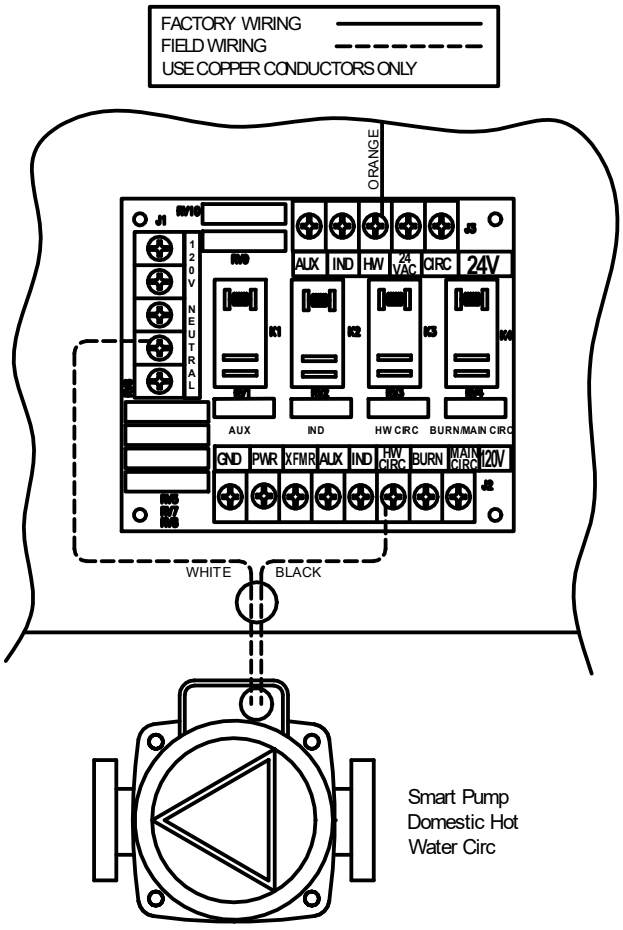
Figures 3A: Connect power to Smart Pump from the relay board located in the system junction box mounted behind the System Manager. Connect the black (hot) lead from the Smart Pump wiring harness to the lug labeled “HW CIRC”. Connect the white (neutral) lead to any open lug on the terminal strip labeled “120V NEUTRAL”. The hot water zone output from the System Manager (orange wire) is factory wired to the “HW” lug on the 24VAC terminal block.

WARNING: The junction box is wired at the factory with the service outlet always powered, even with the System Emergency Switch turned off. To have the service outlet controlled by the System Emergency Switch, move the service outlet black lead to top lug of system switch.

Line Voltage Wiring Diagram

Figure 3A

Relay Board located inside the System Junction Box



Low Voltage Wiring

DIGITAL MANAGER OPERATES ONLY ON 24 VOLTS 60 HZ POWER

WARNING: Make All Connections with Power Off at Main Circuit Box

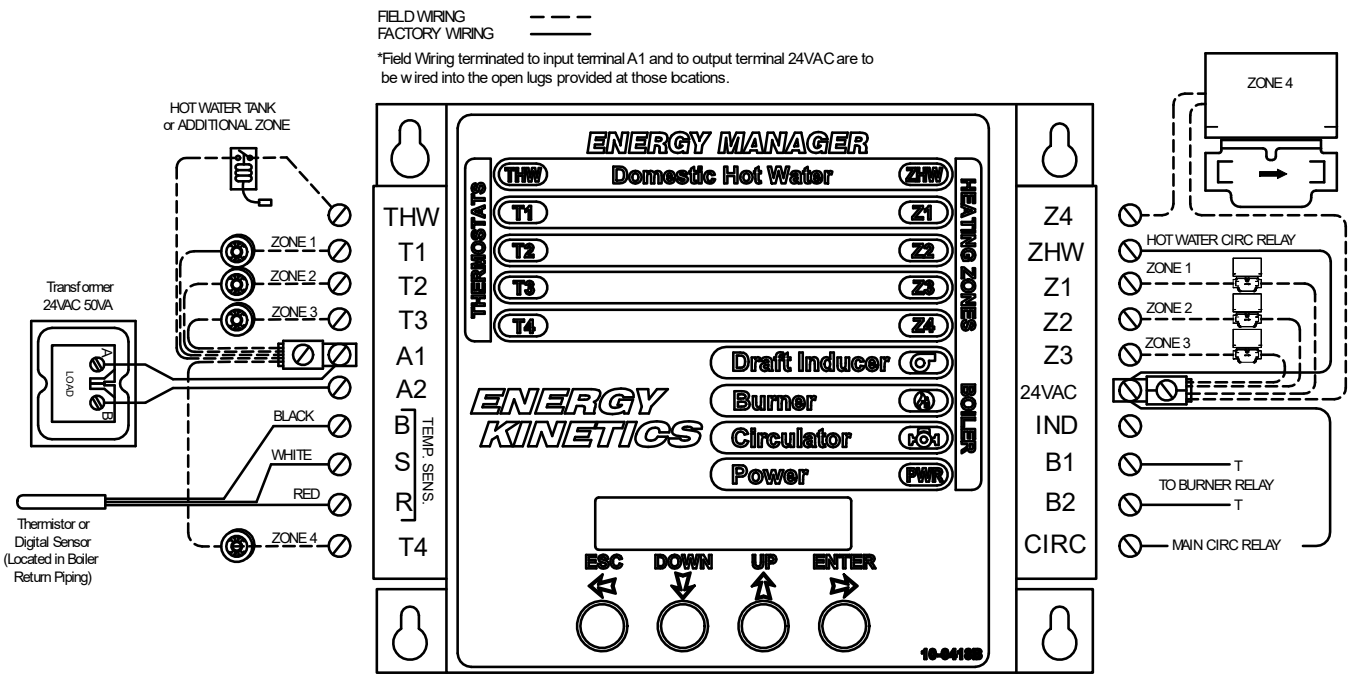
A typical low voltage wiring diagram for the Digital Energy Manager is shown in **Figure 4A**. Thermostats must be located on inside walls away from cold drafts, windows or heat from fireplaces, appliances or sunlight. Set thermostat heat anticipators to 0.1 amps (or "gas" if gas/electric option). Call Energy Kinetics to request alternate low voltage wiring diagrams to handle special situations such as, air handler wiring, heat pump wiring, isolation relays for thermostats, and isolation relays for heat motors or circulators, etc.

The single 24-volt/50VA transformer is suitable for the Digital Manager and five zone outputs (zone valves or relays). **NOTICE:** Additional load such as extra valves may require greater transformer capacity. To add transformers, wire in parallel as follows: wire terminal “A” on one transformer to “A” on the other. Repeat with other low voltage terminal “B”. Be sure to verify 24VAC output from all transformers.

The Digital Energy Manager is designed for hot water and up to four (4) heating zones. Use Energy Kinetics supplied zone valves with two wire connections. For more than four heating zones, use Energy Kinetics expanded 10 or 15 zone Digital Energy Manager, or call Energy Kinetics for alternatives.

System Managers

Figure 4A



Display Manager

How to Use Self-Guided On-Screen Prompts To Edit Options

From the *system status screen*, press the DOWN *key* twice, or until the Option Setup (edit◊) *menu screen* is displayed. Press the ENTER *key* to enter into the *option screens*. From there, use the UP/DOWN *keys* to view each option. Use the ENTER *key* to change the selected option.

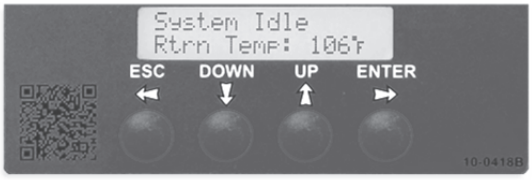
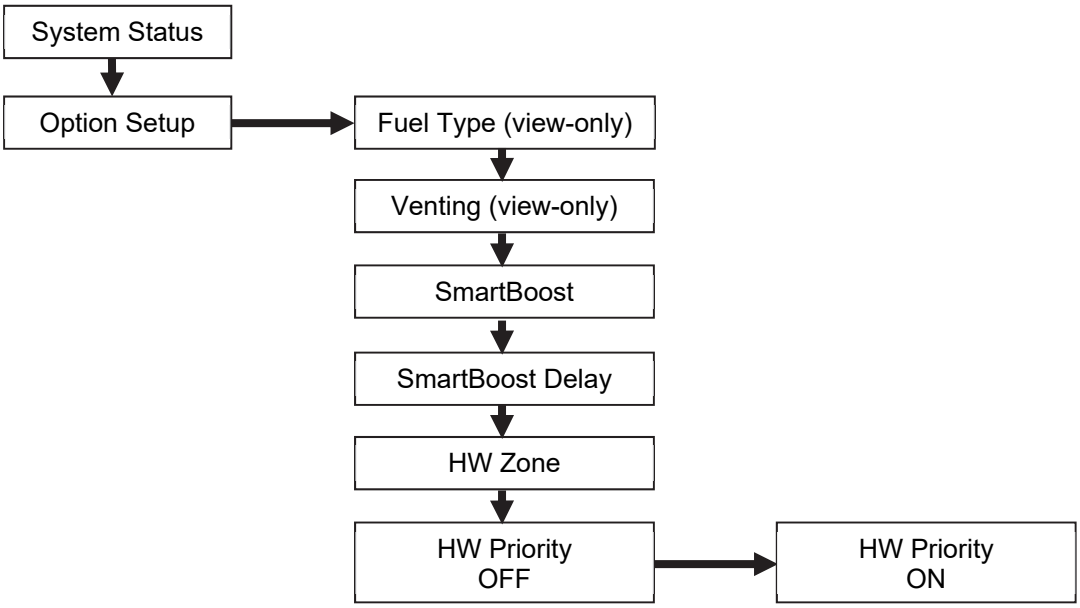


Figure 4B

Display System Status Screen Shown

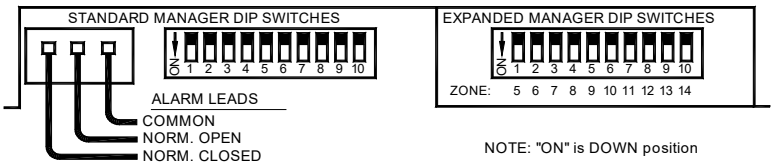
Setting features are self-guided through on-screen prompts



Digital Manager

Digital Energy Manager Option Switch Settings

Switches are located on bottom of Digital Energy Manager



Option Switch	Description	Function	
		ON = DOWN	OFF = UP
10	Hot Water Priority	ON = Priority	OFF = No Priority

For a typical oil fired boiler with a sound chimney, supplying domestic hot water and properly sized heat zones, all option switch settings will be "OFF". Switch 10 is usually off, but when turned on the Manager will close heat zones 1 through 4 during a hot water call for up to 25 minutes.

Hydronic Control Settings

Control	Normal Setting
HOT WATER TANK THERMOSTAT *(Located on domestic storage tank)*	120 ° Normal *(To suit individual installation)*

Prepare for Start Up

DANGER: **MAKE CERTAIN THE FOLLOWING REQUIREMENTS HAVE BEEN SATISFIED BEFORE START UP:**

1. The boiler and piping are completely filled with water.
2. Re-check wiring to ensure that it is correct and in accordance with appropriate wiring diagrams and codes.
3. Adjust bypass valve on boiler side to heat exchanger ½ way open.
4. Adjust valve in domestic hot water circuit under the *Smart Pump* approximately ¾ of the way open.

Start Up Procedure

1. As Unit reaches temperature, Digital Manager “Heating” light will signal heat distribution to zone(s) calling for heat. (On first start up, this will usually be the hot water storage tank zone.)
2. Once boiler water temperature reaches 160° – 180 ° F., adjust hot water temperature flowing to storage tank. With hot water flowing fully from a domestic faucet, adjust valve under domestic circulator pump so water temperature going into tank is approximately 140 ° F. (Hand can be held on pipe just briefly.) Water must be flowing fully from a household hot water tap to accurately adjust flow and temperature entering tank.

Annual Maintenance

1. Back flush plate heat exchanger.
   (See “Hot Water Diagnosis” section for procedure)

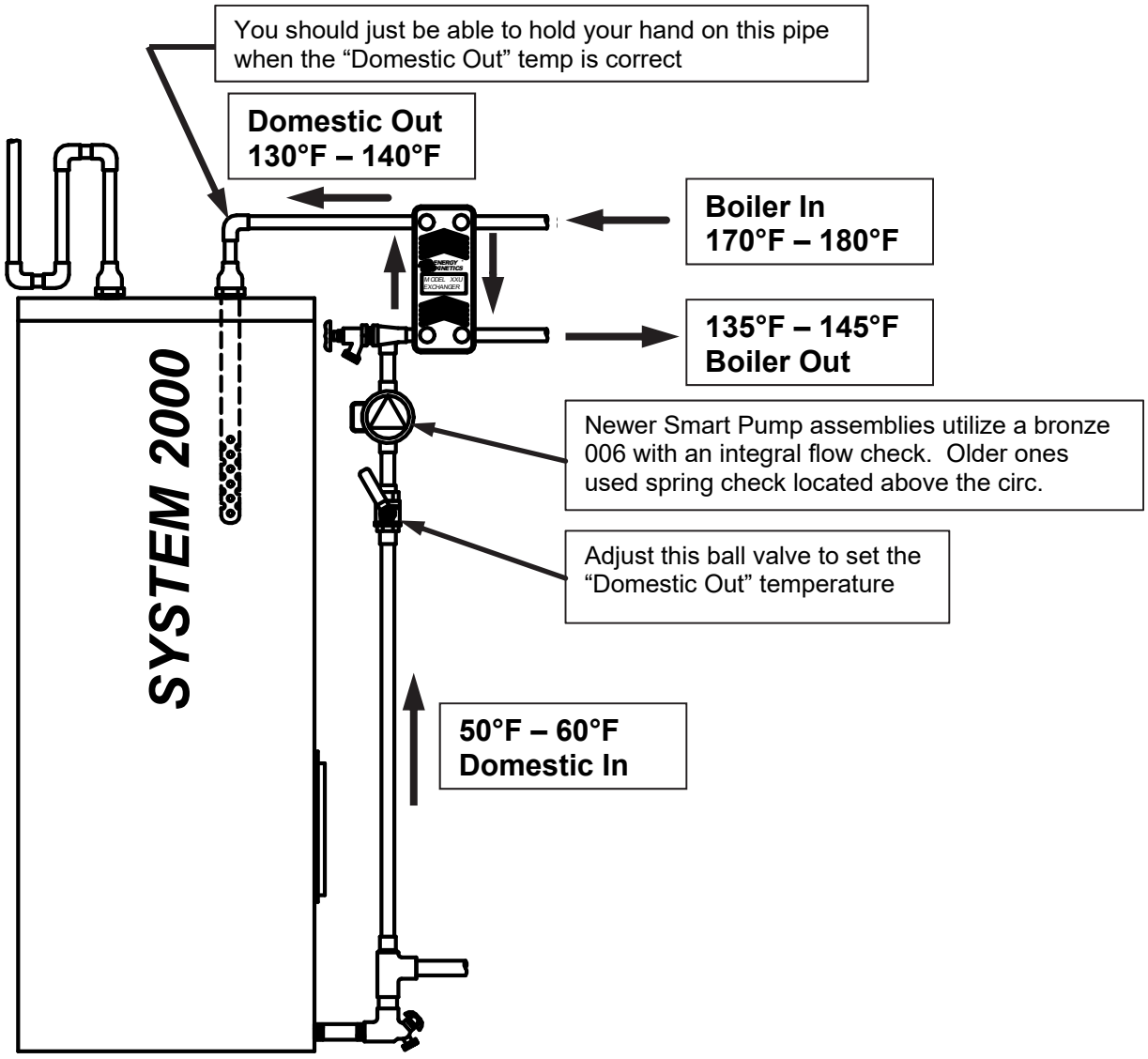
Replacement Parts

PART NO.	DESCRIPTION
10-0416	#14 Plate Heat Exchanger (EK1)
10-0435	#18 Plate Heat Exchanger (EK2)
10-0430C	006 Cartridge for Smart Pump
10-0650	Scale Stopper Kit
10-0650-C	Replacement Cartridge for Scale Stopper
10-0423-10	40 Gal. Standard Glass Lined Tank 10 Yr
10-0425-10	40 Gal Lo-Boy Standard Glass Lined Tank 10 Yr
10-0424-10	80 Gal Standard Glass Lined Tank 10 Yr
10-0426	120 Gal Standard Glass Lined Tank 10 Yr

Hot Water Diagnosis

TEST WITH BOILER MAKING HOT WATER ONLY (Not heating any zones)
Run hot water faucet for entire test

Normal Operation



- A cold 40-gallon tank should turn off the tank thermostat in 18 - 20 minutes on an EK1.
- The tank thermostat closes and lights the HOT WATER input (THW) on the manager. The boiler turns on and goes through the pre-heat cycle (approximately 90 seconds or when return temp reaches 140°F)
- When the boiler returns are up to temperature (90 seconds), the manager energizes the HOT WATER (ZHW) output. This output pulls in the HW CIRC relay and turns on the Domestic Circulator.
  Boiler water circulates through the plate heat exchanger and transfers heat into the domestic water. The domestic water is pulled from the bottom of the tank or the cold water supply. The heated water returns to the top of the tank into the "C" inlet. The System 2000 tank has a dip tube, which disperses the heated water evenly in the top of the tank.

When there is not enough hot water:

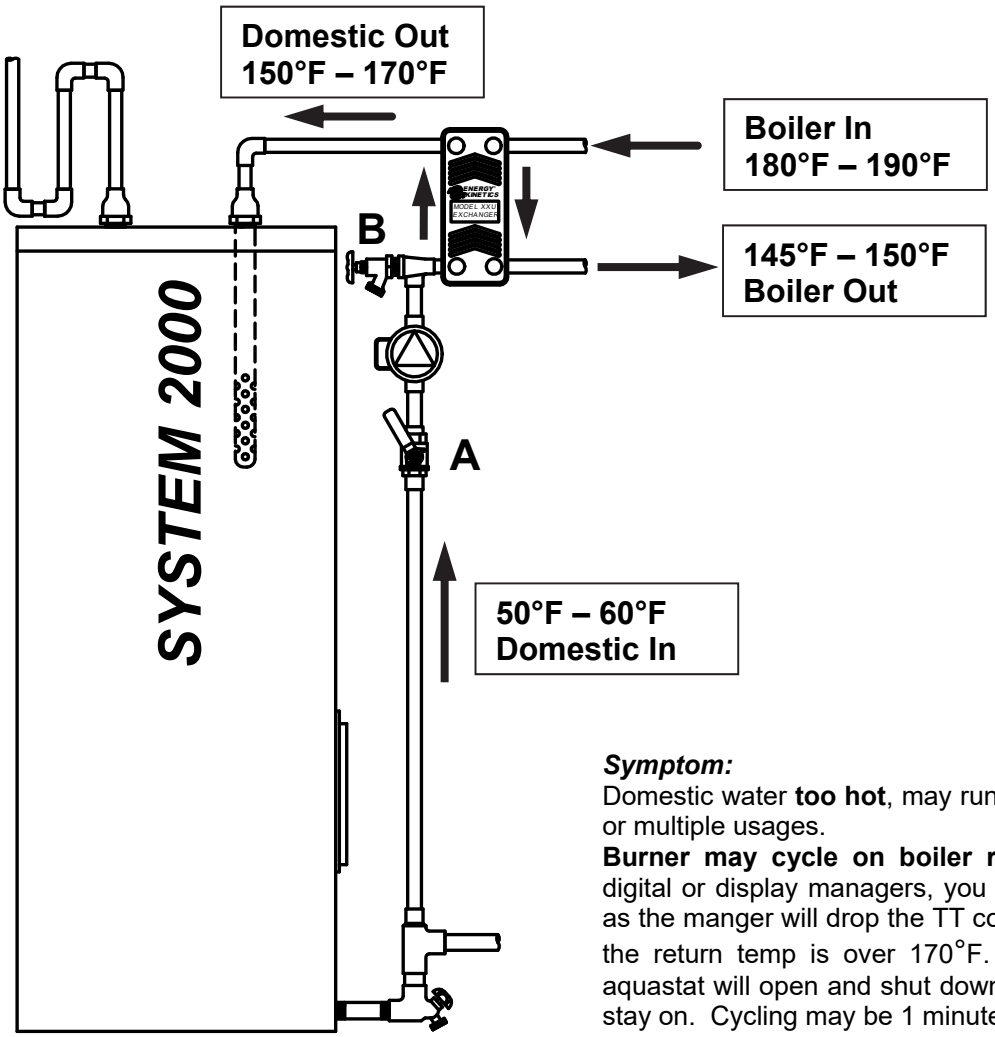
- Is the "HOT WATER" input light on? If not, check wiring from the tank to the manager (THW and A1).
- Check the tank thermostat on the tank, is it working? If not, replace with standard water heater tank thermostat or use bulb type tank thermostat and mount bulb securely to the tank by pushing into the gap between the tank and the tank insulation.

Then, measure all four temperatures into and out of the plate heat exchanger and compare to the next two pages.

Hot Water Diagnosis

TEST BOILER MAKING HOT WATER ONLY (Not heating any zones)
Run hot water faucet for entire test

Domestic Side of Heat Exchanger is Blocked
(Due to lime deposit, silt, etc)



Symptom:
Domestic water **too hot**, may run out of hot water on a long draw or multiple usages.
Burner may cycle on boiler return limit. On systems with digital or display managers, you may see the burner light go out as the manger will drop the TT connection to the burner because the return temp is over 170°F. For older systems the return aquastat will open and shut down the burner, the burner light will stay on. Cycling may be 1 minute on and 1 to 3 minutes off.

Solution:
BACK FLUSH HEAT EXCHANGER- Close ball valve **A** and open back flush valve **B**. Catch water in a clean container. Should get good flow of water with possibly some debris. If flow is slow, replace heat exchanger or acid clean.

DOMESTIC CIRC NOT RUNNING- "Hot Water" output light must be on. Verify power to the circulator. If no power then check wiring to "HW Circ" Relay on the relay board. Otherwise, check circulator.

AIR BLOCKAGE- If the "Domestic Out" piping is overhead at the ceiling level or has a long run, it may be air bound and the domestic circulator is not able to push the air into the tank. This would normally occur only during startup or if a part was replaced and the air was not completely purged. Back flush as above to purge air.

DEFECTIVE CHECK VALVE- Check valve, integral or above circulator may be defective.

ADD SCALE STOPPER- Add an Energy Kinetics Scale Stopper to the cold water supply line feeding the tank.

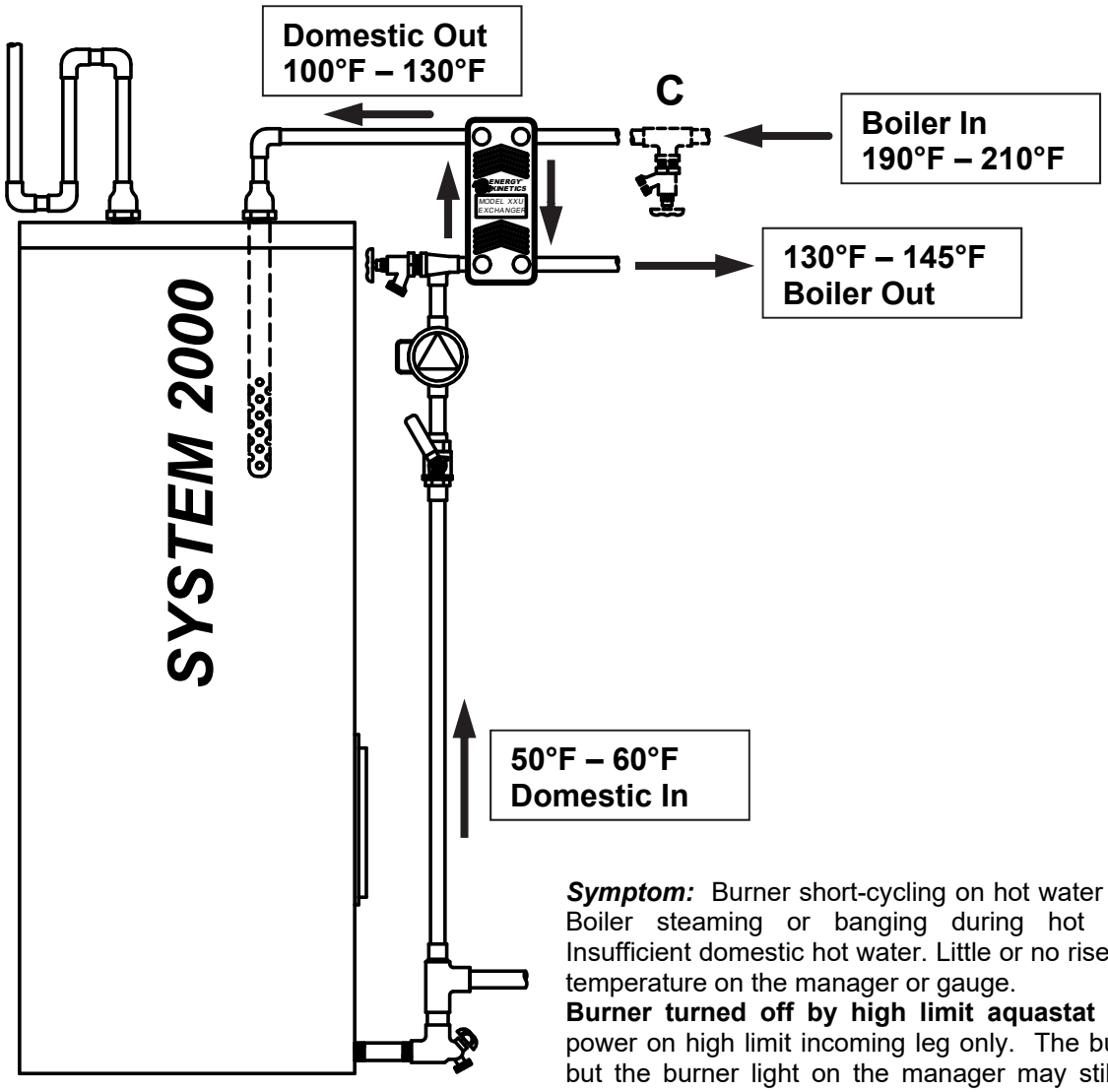
INSTALL A HOT WATER ZONE KIT- Moves the Plate Heat Exchanger from the boiler bypass where hot water is circulated through it whenever boiler is running, to a remote zone where the hot water only flows through the plate heat exchanger when a call for hot water opens the hot water zone valve.

INDIRECT WATER HEATER- Replace the heat exchanger and hot water storage tank with an Indirect Water Heater. Water is heated by a coil inside of the tank

Hot Water Diagnosis

TEST WITH BOILER MAKING HOT WATER ONLY (Not heating any zones)
Run hot water faucet for entire test

Boiler Side of Heat Exchanger is Blocked
(Due to corrosion, system leaks)



Symptom: Burner short-cycling on hot water call or start-up. Boiler steaming or banging during hot water making. Insufficient domestic hot water. Little or no rise of boiler return temperature on the manager or gauge.
Burner turned off by high limit aquastat or DualGard - power on high limit incoming leg only. The burner will be off but the burner light on the manager may still be on. Slow recovery of return temperature.

VERIFY BLOCKAGE- Temporarily install a washing machine hose between a supply side purge valve and return drain valve; or manually open a heating zone valve. If the burner operation returns to normal, this indicates a heat exchanger or bypass blockage.

Solution:
AIR VENT- Check air vent to make sure it is open and all air is out of boiler ***with circulator off.*** Verify that front of boiler is pitched 1/4" above level. For Frontier, boiler is pre-pitched and air is vented from the back of the boiler. Verify that base is level.

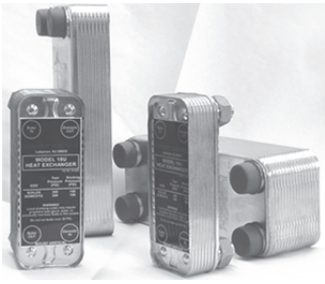
CHECK MAIN CIRCULATOR- Check amperage draw. If not up to speed, amperage draw will be higher than nameplate rating - change cartridge.

PLATE EXCHANGER BLOCKAGE- Remove Heat Exchanger and check the “Boiler In” port. If port has debris, we recommend installation of a tee and drain at location **C** between the bypass valve and the heat exchanger. While piping is open, check bypass line and valve with wire or long screwdriver to be sure it is open and not blocked.
Refill system with bypass closed and back flush heat exchanger through installed drain (use fast feed to get good pressure and flow). If flow is not good, replace heat exchanger.

BOILER PROTECTION KIT- When installed provides Y-strainers for the system return and the boiler bypass ahead of the heat exchanger filtering debris from entering the system

HOT WATER MAKERS

Use for: Domestic Hot Water • Hot Tubs • Radiant System Isolation • Swimming Pool Heating



How Plate Heat Exchangers Work:

The exchange surface is made of corrugated plates sealed by brazing. The corner ports are arranged so that hot water and cold water flow through alternating channels, delivering exceptional heat transfer. These brazed plate heat exchangers can be cleaned by flushing with acid or other chemical processes. For heating swimming pools and hot tubs, contact your field representative or call Energy Kinetics. (Call for pricing)

Now, technology brings an exceptional advancement in the fight against corrosion and mineral deposits. The laws of nature didn't change, but our Sealix® permanent non-stick surfaces help prevent lime and mineral build up for exceptional long term performance in hard water applications.

The Sealix coating is corrosion-resistant stainless steel that's bonded with corrosion proof non-stick Silicon Dioxide. This creates a barrier against fouling, scaling, and corrosion that's durable even under extreme temperatures and pressures. Sealix is ideal for preventing corrosion even in pool heating applications with salt and chlorine. It's so robust it is used in high tech nuclear, medical, and industrial applications dealing with acids and other corrosive chemicals.

Plate Heat Exchanger Part Numbers				
Model	**Connections**			
	With Unions	**With Out Unions**	**Frontier W/O Unions**	**1" NPT**
#14	10-0416	10-0446	10-0446F	N/A
Double Wall Model	N/A	N/A	N/A	10-0446DW
#18	10-0435	10-0447	N/A	N/A
Double Wall Model	N/A	N/A	N/A	10-0447DW
#23	N/A	N/A	N/A	10-0437
#25	N/A	N/A	N/A	10-0540
#27	N/A	N/A	N/A	10-0541

Model	Rated Hot Water Output BTU/HR[1]	Hot Water Output GPM	Actual Hot Water Output BTU/HR[2]	Boiler Flow GPM	*Boiler Pressure* Drop PSI
# 14	100,000	3.6	130,000	5	3.0
Double Wall Model	100,000	3.9	150,000	5	6.7
# 18	200,000	7.6	290,000	10	3.7
Double Wall Model	200,000	8.9	340,000	10	6.0
# 23	300,000	10.9	410,000	12	13.0
# 25	360,000	13.3	500,000	14	11.0
# 27	500,000	19.9	760,000	20	9.9

[1] Rated Output based on: 100º F Rise on output temperature
[2] Actual output will be limited by maximum boiler output.

Actual Outputs based on: 180° F Boiler Water Supply Temperature
77° F Rise, Cold Side: 40° F - 117° F

Union Part Numbers	
Union Set (4) for #14 & #18 PHE	10-0416U

Union (1) 1” NPT, Brass	10-0437-UNION

All Models are Brazed Plate units.
All Plates are 316 Stainless Steel.

Double Wall Plate Heat Exchangers for use where required by code.

Smart Pump for Premier Frontier Systems Piping Installation

The Smart Pump is shipped with all Premier Packages. It greatly simplifies domestic hot water piping of the system.

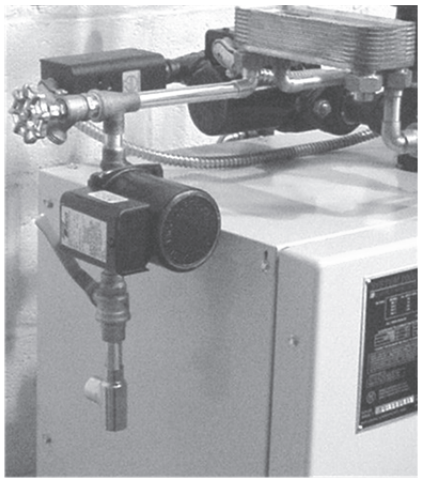
The Smart Pump is a compact assembly and can be located right at the hot water storage tank or right off the Plate Heat Exchanger. This simplifies the domestic water hookup. Piping from the hot water tank is reduced to two connections, one to the Smart Pump and the other to the heat exchanger.

Smart Pump Assembly:
(1) ½" Ball Valve
(1) 006B-IFC* Circ with Harness
(*Integral Flow Check)
(1) ½" Boiler Drain
(1) ½" Tee CxFxC

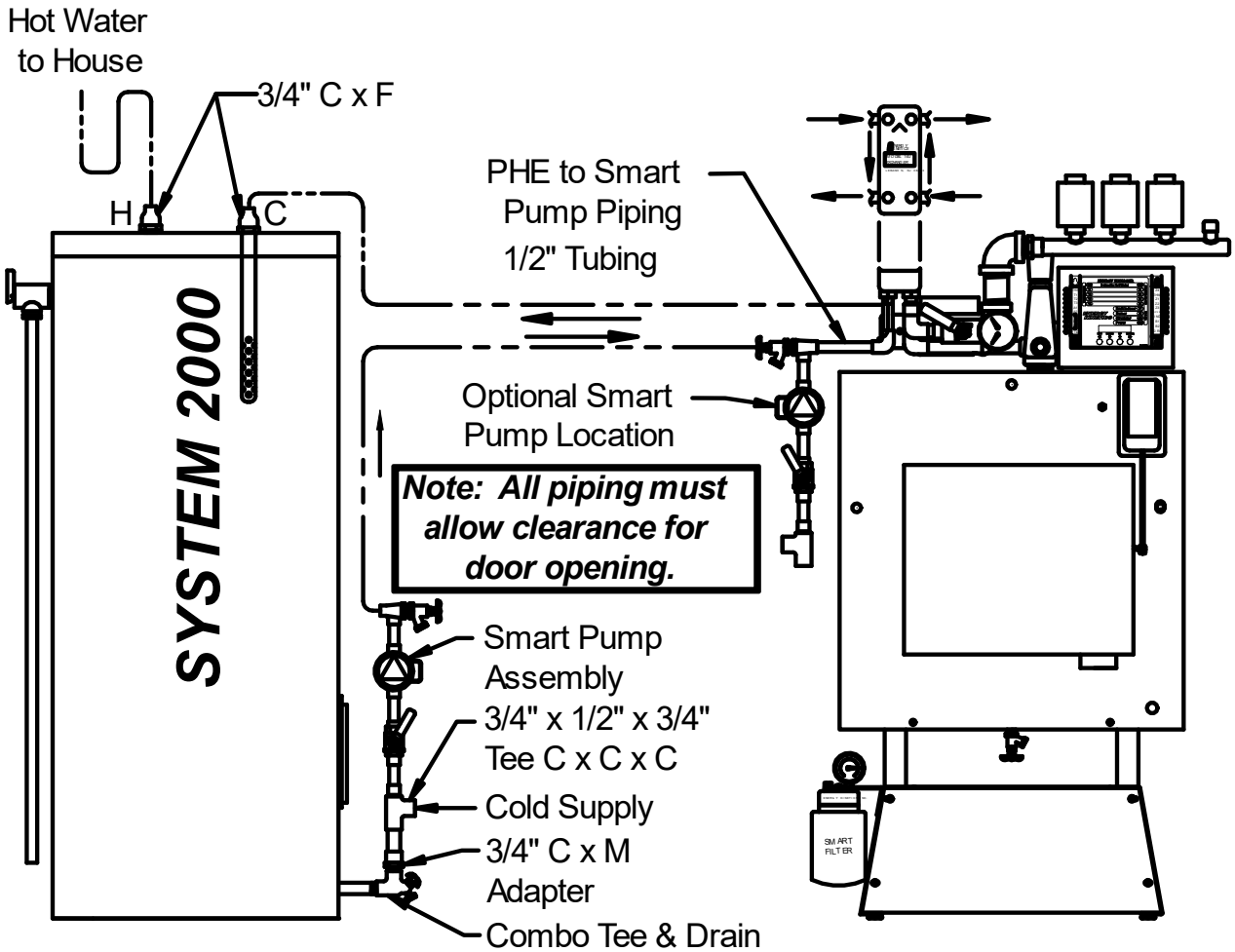
PHE to Smart Pump Piping Assembly:
(1) 6-1/4" long ½" copper
(1) ½" Street Ell
(1) Union w/Nut for PHE

Shipped Loose:
(2) ¾" CxF Adapter
(¾" CxF Unions w/Stackable)
(1) Combo Tee/Drain
(1) Tee ¾"x½"x¾" CxCxC
(2) 4" Cable Ties
(1) ¾" CxM Adapter
(1) Ell ¾" x ½" CxC

Mounted at Boiler



Mounted at Storage Tank



Smart Pump for Standard Boiler Premier Systems Piping Installation

The Smart Pump is shipped on all Premier Packages. It greatly simplifies domestic hot water piping of the system. It pre-pipes and pre-wires the domestic circulator and associated piping.

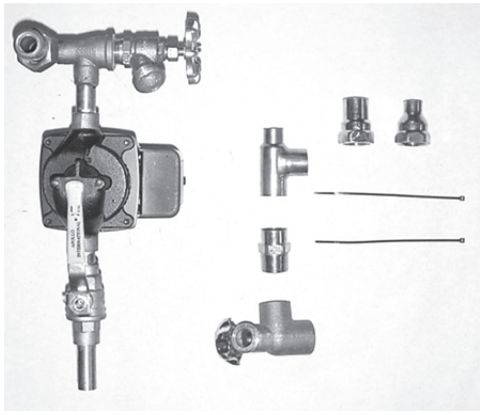
The Smart Pump is a compact assembly and is located right under the plate heat exchanger and close to the boiler. This simplifies the domestic water hookup since both connections are located at the boiler. Piping from the hot water tank is reduced to two connections, one to the ***Smart Pump*** and the other to the heat exchanger.

Smart Pump Assembly:
(1) ½" Ball Valve
(1) 006B-IFC* Circ with Harness
(1) ½" CxFxC Tee
(1) ½" St. Elbow
(1) Heat Exch. Union & Nut
(1) ½" Boiler Drain

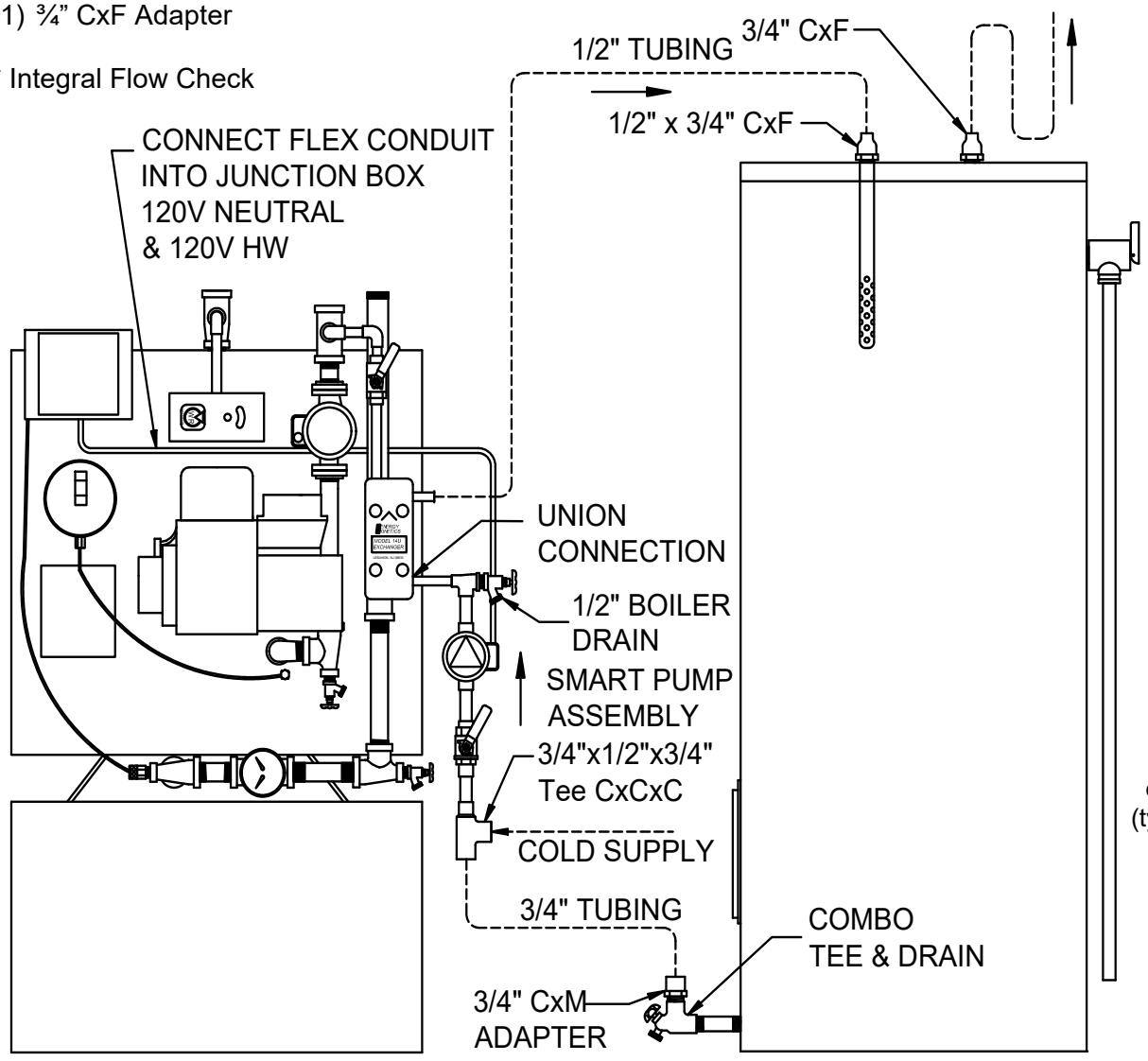
Shipped Loose:
(3) 4" Cable Ties
(1) Combo Tee/Drain
(1) Tee ¾"x½"x¾" CxCxC
(1) ¾" CxM Adapter
(1) ½"x ¾" CxF Adapter
(1) ¾" CxF Adapter

* Integral Flow Check

Smart Pump Assembly



Loose Parts



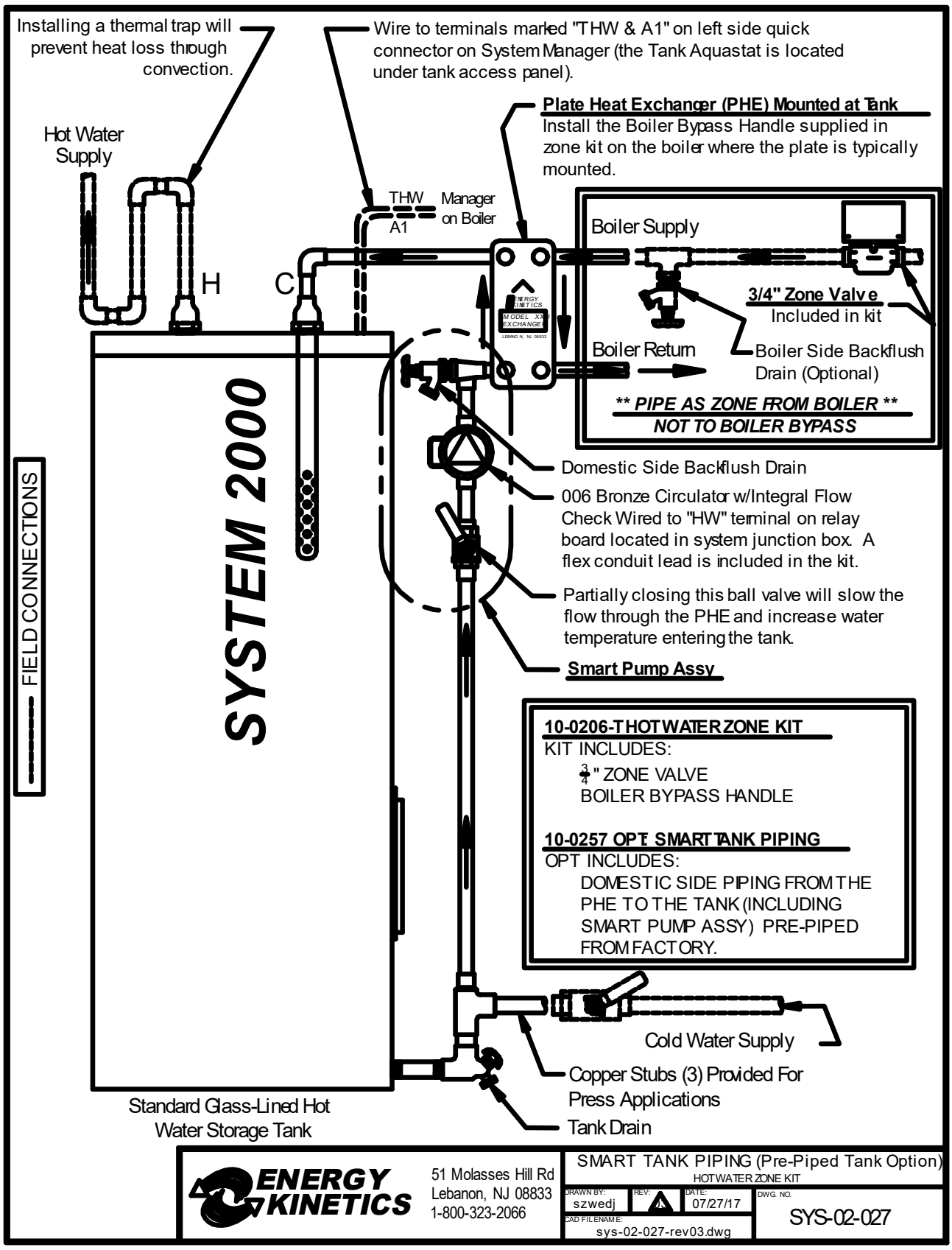
A Scale Stopper installed in the cold water supply is recommended for water with a hardness of up to 20 grains.
Order P/N: 10-0650

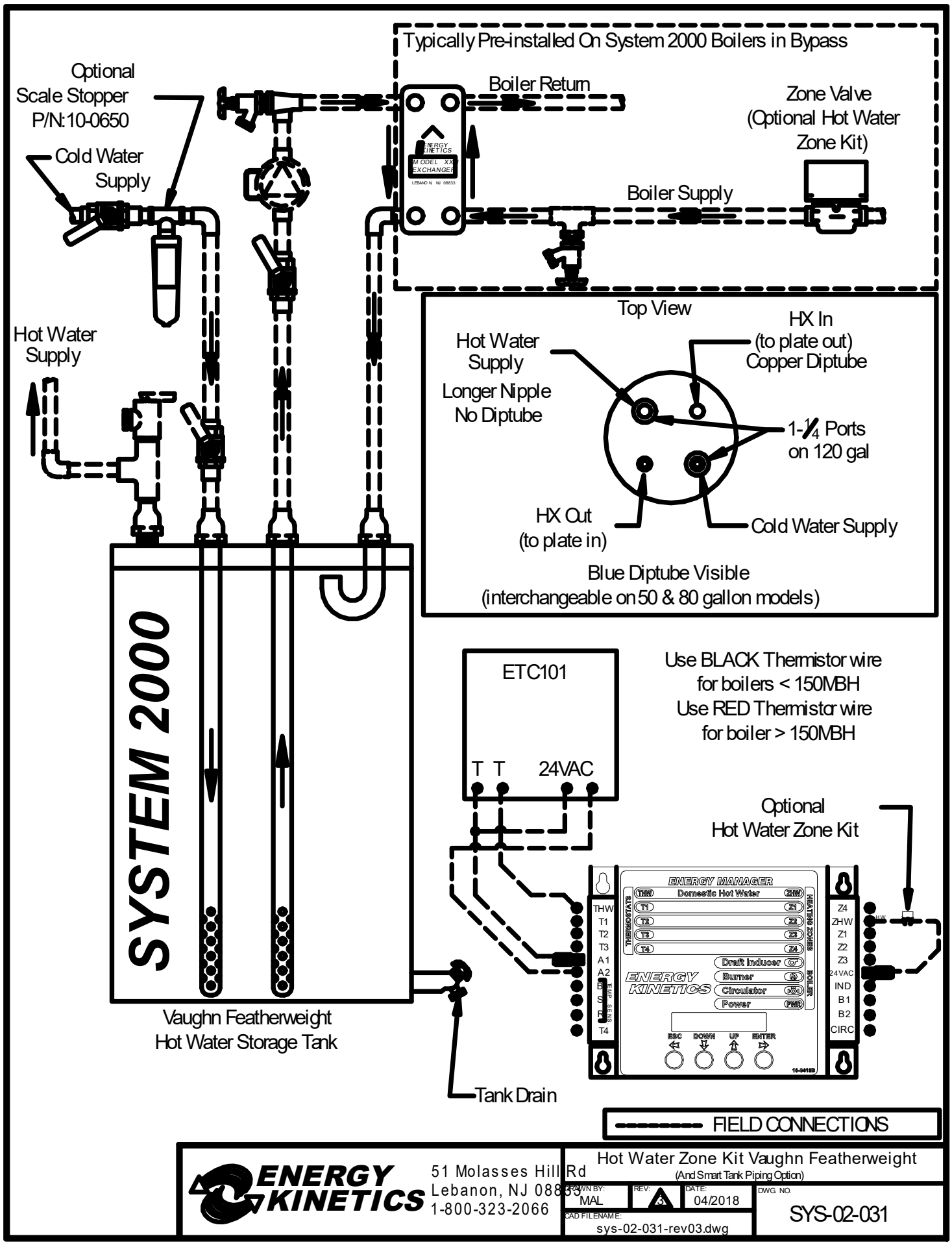
Change the spin-on cartridge as required (typically 7-12 months).

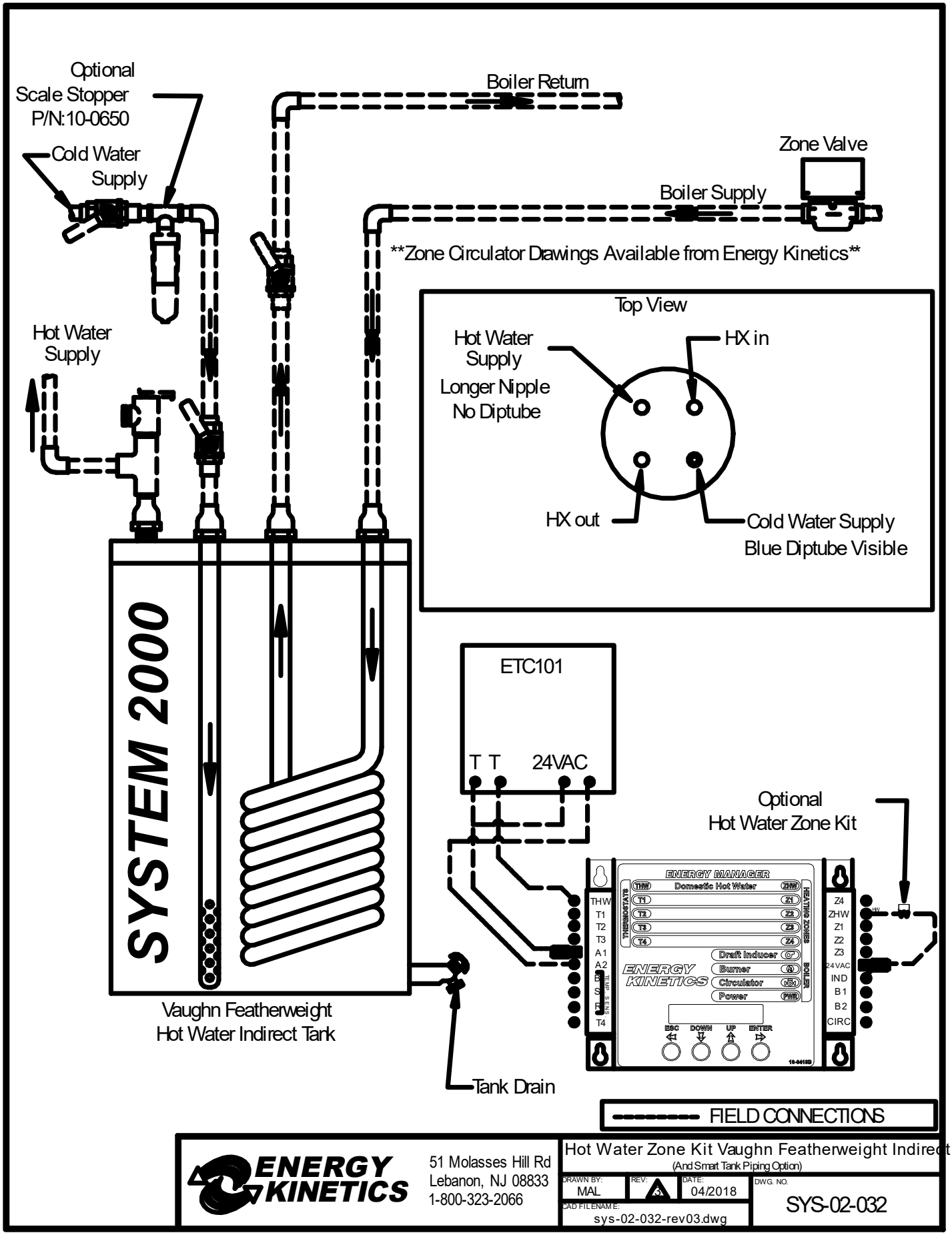
Hot Water Zone Kits

APPLICATION

Energy Kinetics Hot Water Zone Kits are designed to reduce the fouling caused by hard water plating out on the domestic side of the plate heat exchanger. Heated water only flows through the boiler side of the heat exchanger during a call for hot water, reducing the exposure of domestic water to a heated surface and reducing the effects of scaling.




Typically Pre-installed On System 2000 Boilers in Bypass
Optional
Scale Stopper
P/N:10-0650
Cold Water
Supply
Boiler Return
Zone Valve
(Optional Hot Water
Zone Kit)
Boiler Supply
Hot Water
Supply
Top View
HX In
(to plate out)
Copper Diptube
Hot Water
Supply
Longer Nipple
No Diptube
1-1/4 Ports
on 120 gal
HX Out
(to plate in)
Cold Water Supply
Blue Diptube Visible
(interchangeable on 50 & 80 gallon models)
SYSTEM 2000
ETC101
T T 24VAC
Use BLACK Thermistor wire
for boilers < 150MBH
Use RED Thermistor wire
for boiler > 150MBH
Optional
Hot Water Zone Kit
ENERGY MANAGER
Domestic Hot Water
THERMOSTATS
HEATING ZONES
BOILER
Draft Inducer
Burner
Circulator
Power
ESC
DOWN
UP
ENTER
Vaughn Featherweight
Hot Water Storage Tank
Tank Drain
FIELD CONNECTIONS
ENERGY KINETICS
51 Molasses Hill Rd
Lebanon, NJ 08833
1-800-323-2066
Hot Water Zone Kit Vaughn Featherweight
(And Smart Tank Piping Option)
DRAWN BY: MAL
REV: A
DATE: 04/2018
DWG. NO. SYS-02-031
CAD FILENAME: sys-02-031-rev03.dwg


Optional
Scale Stopper
P/N:10-0650
Cold Water
Supply
Boiler Return
Zone Valve
Boiler Supply
Zone Circulator Drawings Available from Energy Kinetics
Hot Water
Supply
Top View
Hot Water
Supply
Longer Nipple
No Diptube
HX in
HX out
Cold Water Supply
Blue Diptube Visible
SYSTEM 2000
ETC101
T T
24VAC
Optional
Hot Water Zone Kit
ENERGY MANAGER
Domestic Hot Water
THW
T1
T2
T3
T4
A1
A2
B
S
R
Z4
ZHW
Z1
Z2
Z3
24 VAC
IND
B1
B2
CIRC
Draft Inducer
Burner
Circulator
Power
ESC
DOWN
UP
ENTER
ENERGY KINETICS
Vaughn Featherweight
Hot Water Indirect Tank
Tank Drain
FIELD CONNECTIONS
ENERGY KINETICS
51 Molasses Hill Rd
Lebanon, NJ 08833
1-800-323-2066
Hot Water Zone Kit Vaughn Featherweight Indirect
(And Smart Tank Piping Option)
DRAWN BY: MAL
REV: 3
DATE: 04/2018
DWG. NO. SYS-02-032
CAD FILENAME: sys-02-032-rev03.dwg

Hot Water Systems A, B, C

SOLVING HOT WATER NEEDS IS AS EASY AS A, B, C

The solution is easy for homeowners who never have enough hot water. High demand, fouled coils, or electric hot water heaters, which do not have adequate recovery, can be easily improved.

Three simple solutions provide gallons of hot water storage capacity to eliminate the problem during peak periods.

Laundry, dishwasher and shower can run at the same time at a steady temperature, and savings can be as much as 60%.

"A" HOT WATER SYSTEM

10-0200 System "A"
10-0201 System "A" w/Energy Saver Relay
10-0202 System "A" Less Tank

PROBLEM: When a hot water coil is installed in the boiler (called a tankless coil), the boiler must run frequently all year, with no usage consideration to maintain water temperature. Even so, high demand or fouled coils result in uneven water temperature that starts off too hot, yet quickly turns too cold before the need for hot water is satisfied.

SOLUTION: For a good boiler with a good coil in good condition, try solution "A". Lower the tank thermostat settings, fire the boiler on demand and reduce the burner firing rate. The coil makes hot water and stores it in the tank to provide plenty of hot water without drastic temperature swings.

INCLUDES:

- 40 gal tank with 2" high density foam insulation.
- Tank thermostat mounted
- Special Dip Tube
- 150# T&P Valve
- Taco Bronze Circulator
- Piping Set; drain, unions, makeup connectors
- Energy Saving Relay

"B" HOT WATER SYSTEM

10-0240 System "B" w/Energy Saver Relay
10-0241 System "B" w/Energy Saver Relay & Zone Valve w/End Switch
10-0242 System "B"

PROBLEM: When hot water is made with old gas or oil fired water heaters, much of the heat escapes up the flue or dissipates through poor insulation. The burner must run frequently all year to replace lost heat, with no consideration for household needs resulting in far more fuel used than needed to provide hot water.

SOLUTION: For a good boiler with a fouled or leaking tankless coil or a boiler without a coil, use Hot Water Maker "B". In contrast to coils, the external Plate Exchanger can be easily serviced because of its accessible location. The storage tank and Plate Exchanger provide plenty of hot water to meet peak demands.

INCLUDES:

- 40 gal tank with 2" high density foam insulation
- 120/gph external Plate Exchanger
- Tank thermostat mounted
- Special Dip Tube
- 150# T&P Valve
- Taco Bronze Circulator
- Piping Set: drain, unions, makeup connectors
- Specify; either CI circulator or Zone Valve with end switch
- Energy Saving Relay

"C" HOT WATER KIT

10-0260 System "C"
10-0261 System "C" w/Energy Saver Relay
10-0262 System "C" w/Energy Saver Relay & Zone Valve w/End Switch

PROBLEM: Depending on the area, electric water heaters cost two to four times more per BTU than direct-fired fuels. Simply stated, the fuel efficiency in electric generation is only 30%, and electricity must be transported through miles of lines. Even with off-peak rates, hot water is frequently needed, made and charged at peak rates in an active household. Direct-fired fuels used in the home provide spectacular savings - 50% to 75%.

SOLUTION: For an existing storage tank, the "C" Kit converts the heat source from expensive electricity or inefficient fuel to an efficient boiler. Any well-insulated tank in good condition may be used; electric, gas or unheated tanks with electric tank thermostat.

INCLUDES:

- 120/gph stainless steel Plate Exchanger
- Taco Bronze Circulator
- Piping Set: drain, unions, makeup connectors
- Specify: either Zone Valve with end switch or Circulator for boiler side
- Energy Saving Relay

NOTE: Modify existing dip tube or order special dip tube separately (Part#10-0500)

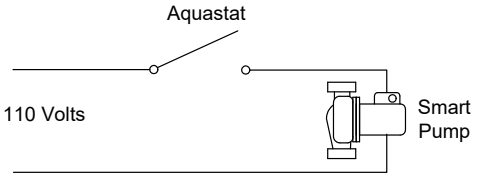
All Tanks are heavily insulated with 2” foam, the equivalent of R-15 for minimal heat loss. Typically, less than eight cents a day is lost, and the water will actually stay hot for several days. Three tank sizes are available: 40 gallon (standard), 80 gallon and 120 gallon.

All tanks have “stratified storage” and come with a special dip tube so the hottest water is always at the top and ready for use. The temperature sensor is located so it permits drawing 10 to 15 gallons of hot water before the boiler is activated. The burner runs infrequently, eliminating the usual short cycles that waste fuel.

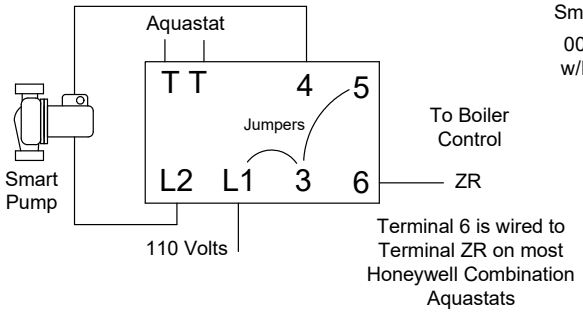
The Plate Exchanger is made of durable stainless steel, recovers at 120 gph with most boilers, and is easily serviced because of its convenient location.

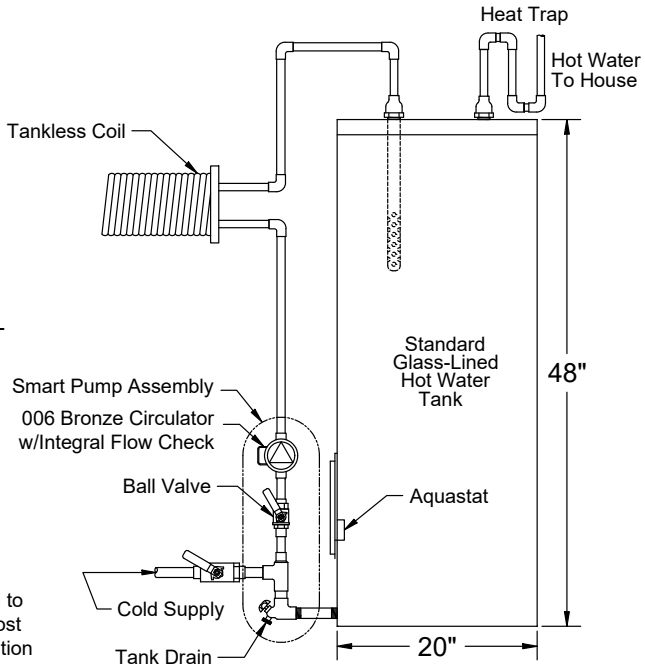
SYSTEM "A" (WITH EXISTING COIL)

1.) LINE VOLTAGE



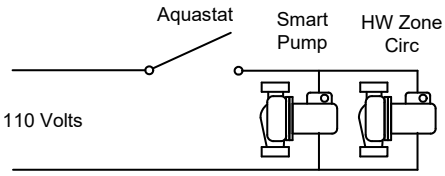
2.) LINE VOLTAGE - ENERGY SAVER CONTROL
(Switching Relay SR100 or Equivalent.)



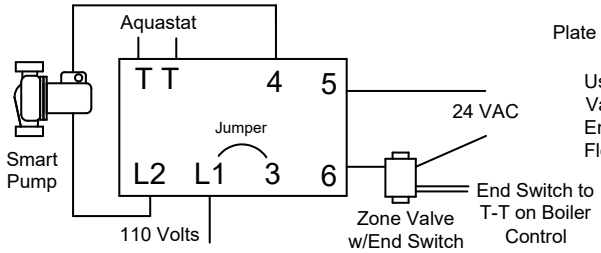


SYSTEM "B" (WITH EXTERNAL PLATE EXCHANGER)

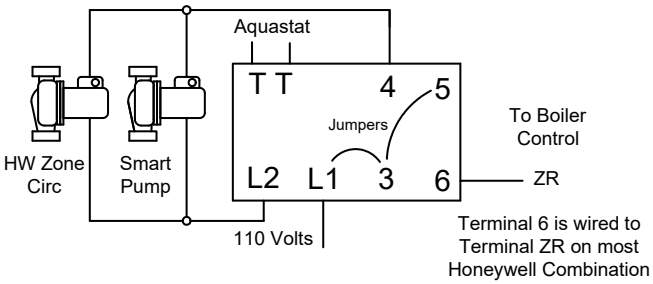
1.) LINE VOLTAGE

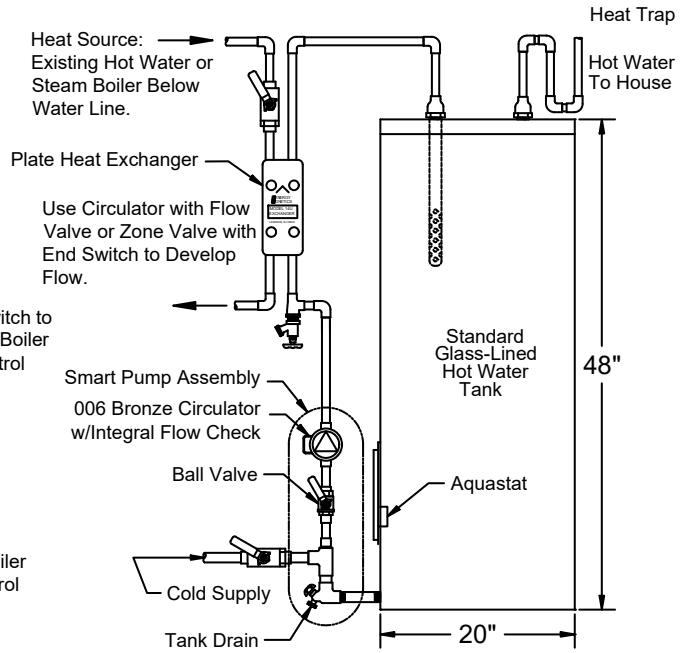


2.) ZONE VALVE - ENERGY SAVER CONTROL
(Switching Relay SR100 or Equivalent.)



3.) LINE VOLTAGE - ENERGY SAVER CONTROL
(Switching Relay SR100 or Equivalent.)



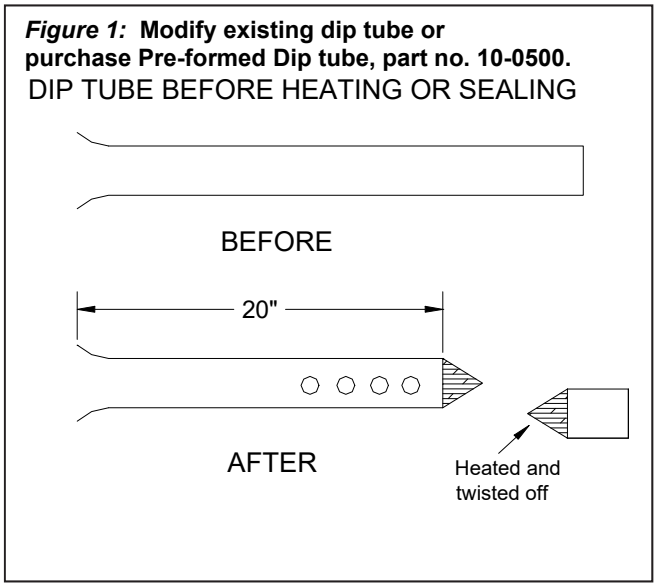


SYSTEM C: (CONVERSION OF ELECTRIC HOT WATER TANK TO INDIRECT HEAT WITH A PLATE HEAT EXCHANGER)

HOT WATER TANK CONVERSION INSTALLATION INSTRUCTIONS

1. Turn off electric supply to hot water tank and disconnect power supply back to circuit breaker.
2. Drain water from tank. Remove drain valve.
3. Disconnect cold supply connection at top of tank. For best results, remove plastic dip tube (1) and do steps (4) and (5).
4. Heat dip tube lightly with torch approx. 20” from top until it melts to permit lower end to be twisted off like an “Ice Cream Cone”, sealing end at same time. Drill eight ¼” diameter holes at bottom end of tube (*See Figure 1)*
5. Reinsert dip tube in top “cold” connection.
6. Insert ¾” brass nipple in tank drain long enough to permit piping and pump to clear tank jacket. *(See Figure 2)*
7. Put the piping assembly together before installing combination tee/drain on tank.
8. Combination tee/drain, ¾” x ½” ¾” tee, ½” ball valve, 006 bronze circulator w/integral flow check , ¾” Ftg x M Adaptor. Install on nipple at bottom of tank and pipe to lower connection on domestic side of plate exchanger.
9. Pipe from top of heat exchanger (Domestic Out) to cold connection at top of tank (where dip tube was inserted).

Figure 1: **Modify existing dip tube or purchase Pre-formed Dip tube, part no. 10-0500.**



10. Bring cold supply (3) to make up connection: ¾” special tee below bronze circulator.
11. Re-pipe hot water supply to house with a heat trap (12” high) optional, but recommended. Heat trap prevents gravity loss of hot water and saves about $20/year.
12. Open lower panel door on hot water tank. Tank thermostat will be used to control hot water temperature through thermostat wire to Manager on input terminals THW & A_1.

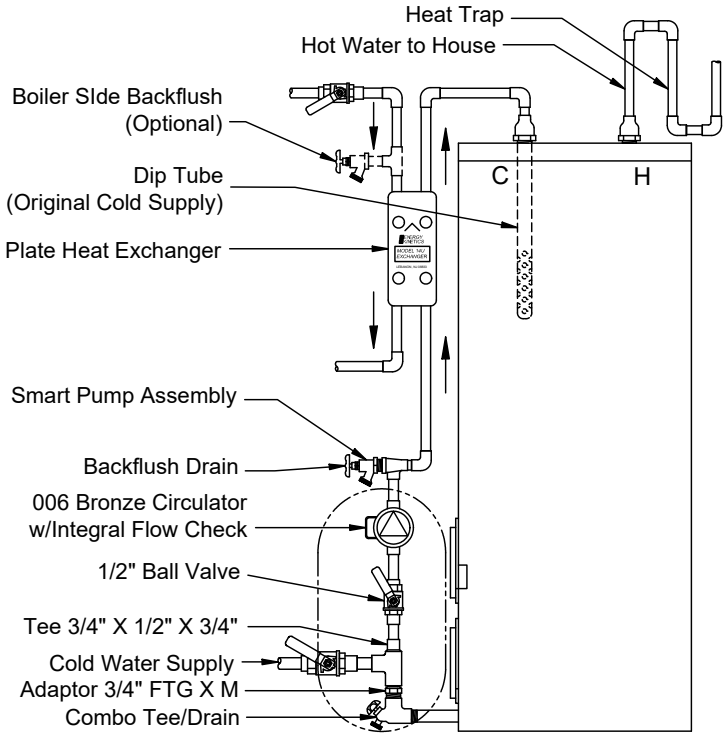
Note:

If tank thermostat is very near bottom of tank, it will cause system to have frequent starts.

If possible, remove tank thermostat and relocate approx. 12” above tank bottom on 40 gallon tank and 8” on the 80 gallon tank.

It may be necessary to wedge tank thermostat against tank at this location by a wooden block or foam insulation between jacket and tank thermostat cover.

Figure 2: **Converting an electric tank**



Typical Indirect Water Heater Installation

Installation Information

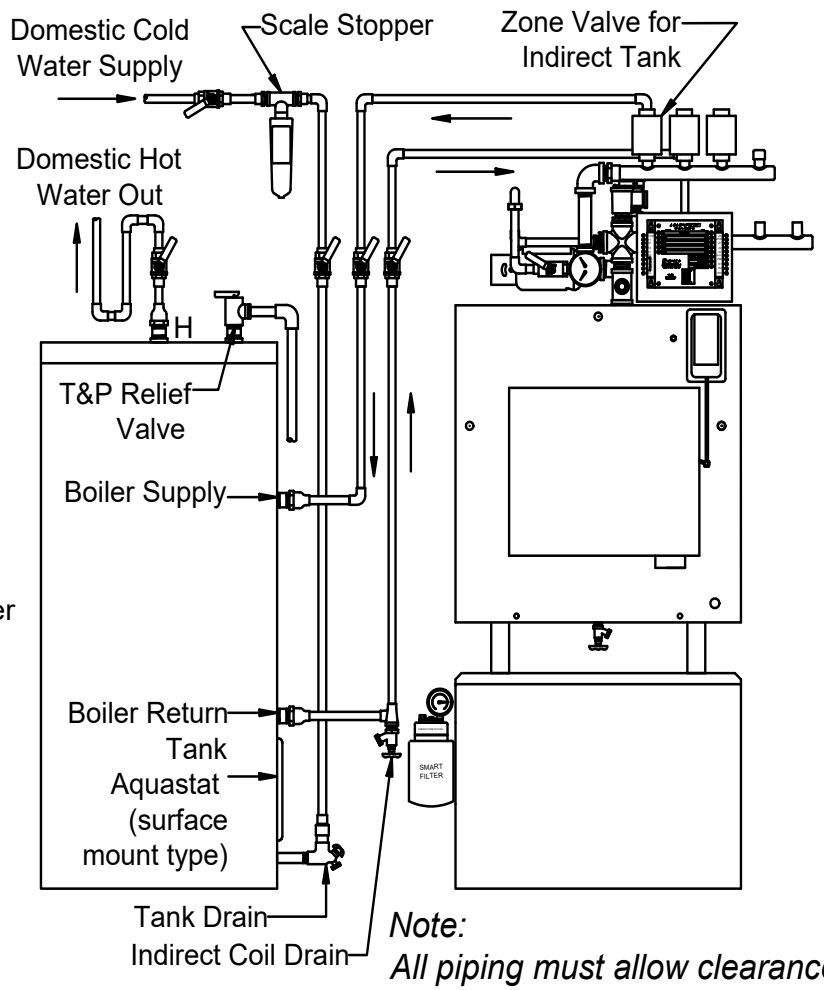
Piping:

Pipe the water heater as shown as a zone separate from any heating zones. Locate it as close to the boiler as practical to reduce piping heat loss and friction loss using ¾" pipe. If long runs between the boiler and the water heater are unavoidable, it is advisable to use 1" pipe and insulate the piping. For fastest delivery of hot water, locate the boiler and water heater as close to the point of use as possible.

If a backflow preventer is installed (required by some codes), a properly sized expansion tank must be used.

A T&P relief valve must be installed.
EK P/N: 10-0422B for EK1 systems
EK P/N: 10-0422D for EK2 systems

Installing a Scale Stopper,
EK P/N: 10-0650 in the domestic cold water supply is recommended.



Note:
All piping must allow clearance for Frontier Boiler door opening.

Wiring: 24VAC

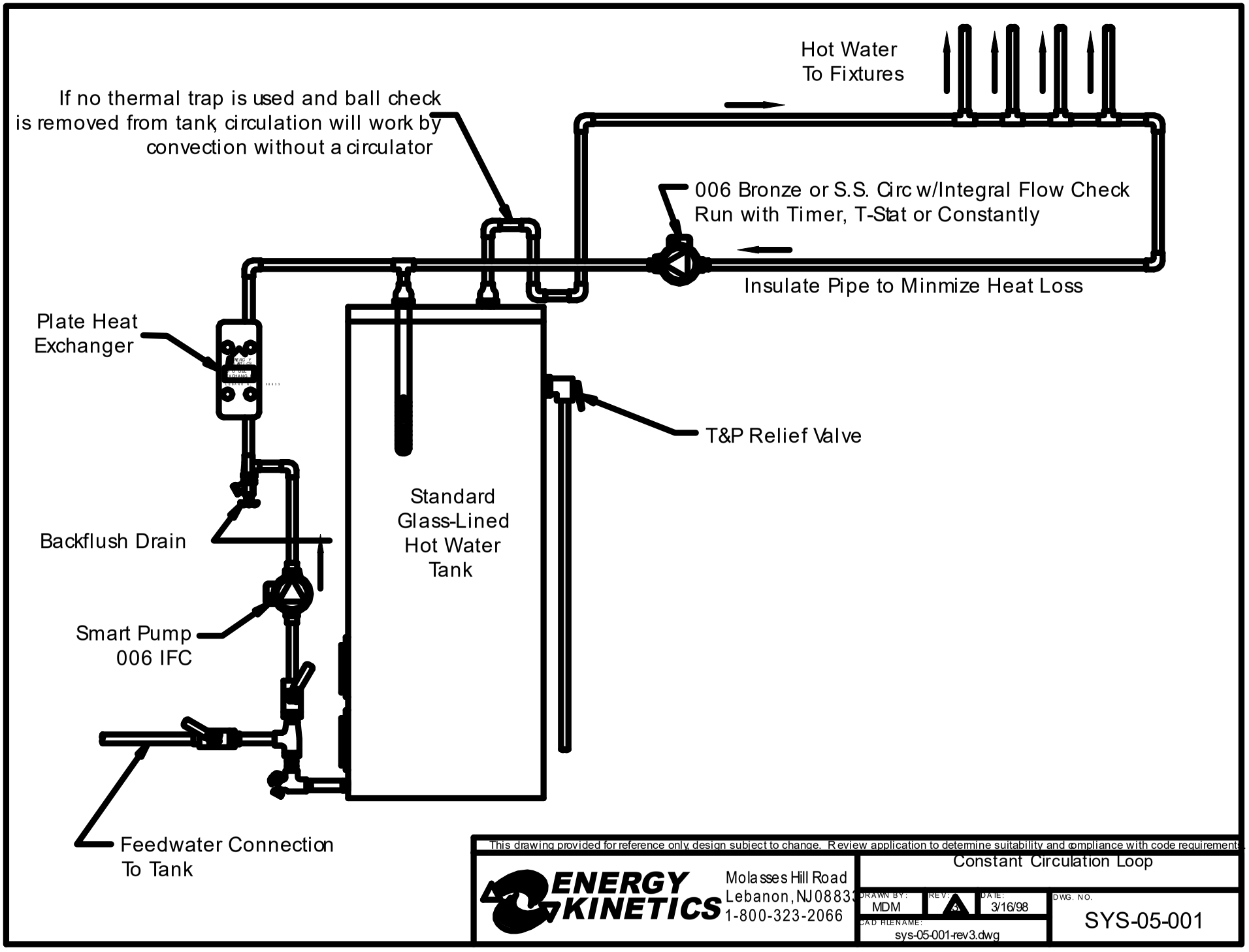
Wire the tank thermostat to THW and A1 on the input (left) side of the System Manager. Wire the zone valve for the hot water tank to 24V and ZHW on the output (right) side.

The System Manager has a hot water priority option, refer to the System 2000 Installation & Service Manual for information.

Initial tank thermostat setting: Hot - 115°F

***EK1 systems require high volume circulator option: 10-0196 (Taco 0010) for 11 gpm boiler flow rate.**

All tank tappings are ¾" NPT Female



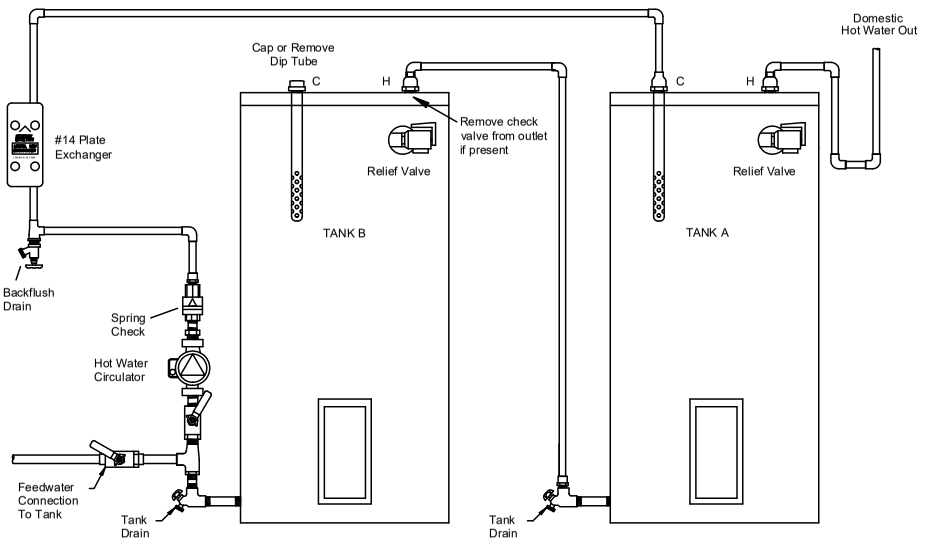
This drawing provided for reference only design subject to change. Review application to determine suitability and compliance with code requirements.

ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 0883
1-800-323-2066

Constant Circulation Loop

DRAWN BY:	REV:	DATE:	DWG. NO.
MDM	A	3/16/98	SYS-05-001

CAD FILENAME: sys-05-001-rev3.dwg



Notes:
1. Assembly may be piped with Plate Exchanger in boiler bypass or near the tanks.
2. If mounting Plate Exchangers remote from boiler use 1" copper pipe with a 1" zone valve to supply water.
3. Use aquastats on both tanks in parallel.
   Set Tank A at 140°F
   Set Tank B at 125°F

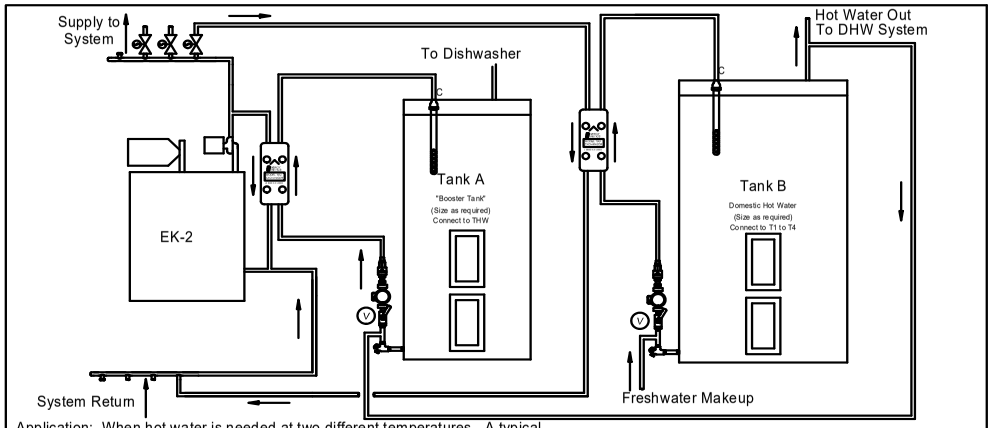
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.

SYSTEM 2000° ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

Dual Hot Water Tank Installation
For Large Storage

DRAWN BY:	REV:	DATE:	DWG. NO.
MDM	1	09/19/2000	SYS-02-015

CAD FILENAME: sys-02-015-rev1.dwg



Application: When hot water is needed at two different temperatures. A typical situation is when domestic hot water (Typically 120F to 140F) and high temperature dishwasher water (Typically 170F to 180F) are both required.

Description of operation:
Tank A has the aquastat set for high temperature (Typically 170F to 180F) and the aquastat is wired into the Digital Manager as a call for hot water (THW). Makeup water for Tank A is preheated by Tank B.
Tank B has the aquastat set for domestic hot water (Typically 120F to 140F) and the aquastat is wired into the Digital Manager as a call for heat to a zone (T1 thru T4). Makeup water for Tank B is cold freshwater makeup.

Note: Turn on Hot Water Priority, switch 10 on the Manager, to prevent space heating until the booster tank has recovered fully.

(V) Tank Temperature is controlled by these valves and the aquastat setting. Closing the valve will slow the flow through the heat exchanger and result in a greater temperature into the tank.

Note: If mounting heat exchangers remote from boiler, but no more than 40 feet, use 1" copper pipe with a 1" Zone Valve to supply boiler water.

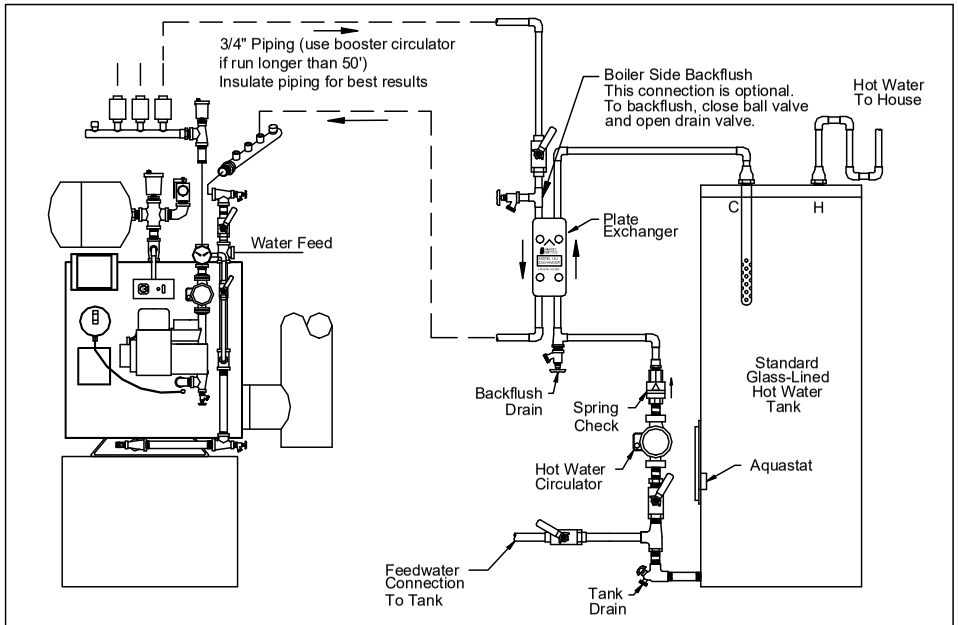
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.

ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

Hot Water Booster Tank
Dual Temperature Hot Water for Dishwasher

DRAWN BY:	REV:	DATE:	DWG. NO.
RB	1	12/15/2005	SYS-02-004

CAD FILENAME: sys-02-004-rev3.dwg



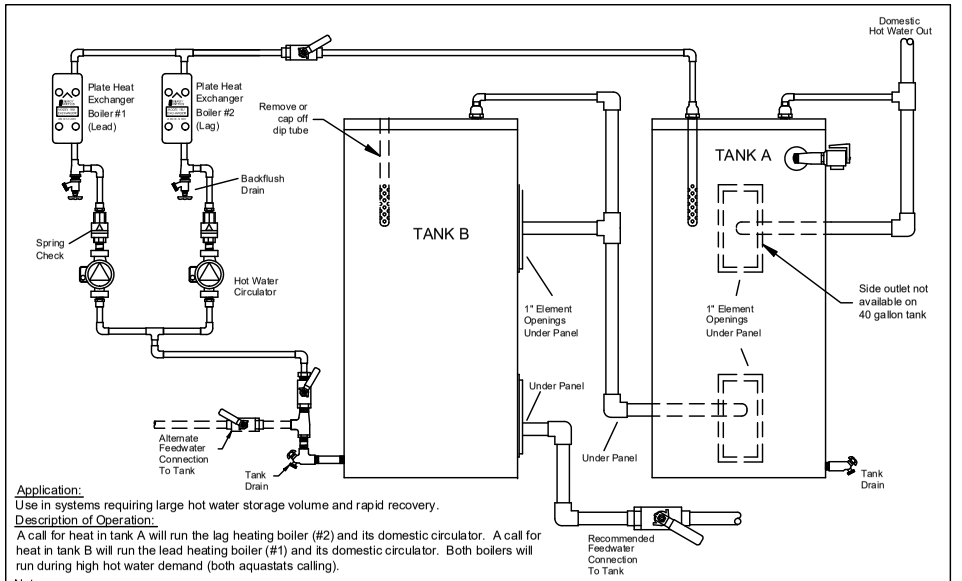
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.

ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

Remote Zone Hot Water Piping

DRAWN BY:	REV:	DATE:	DWG. NO.
RDM	1	11/03/00	SYS-02-017

CAD FILENAME: sys-02-017.dwg



Application:
Use in systems requiring large hot water storage volume and rapid recovery.

Description of Operation:
A call for heat in tank A will run the lag heating boiler (#2) and its domestic circulator. A call for heat in tank B will run the lead heating boiler (#1) and its domestic circulator. Both boilers will run during high hot water demand (both aquastats calling).

Notes:
1. Assembly may be piped with Plate Exchanger in Boiler bypass or near the tanks if using a Heat Only Boiler and 3/4" zone valve.
2. If mounting Plate Exchangers more than 20" from boiler use 3/4" copper pipe with a 3/4" zone valve to supply water.
3. Use aquastats on both tanks in parallel.
   Set Tank A at 140°F
   Set Tank B at 125°F

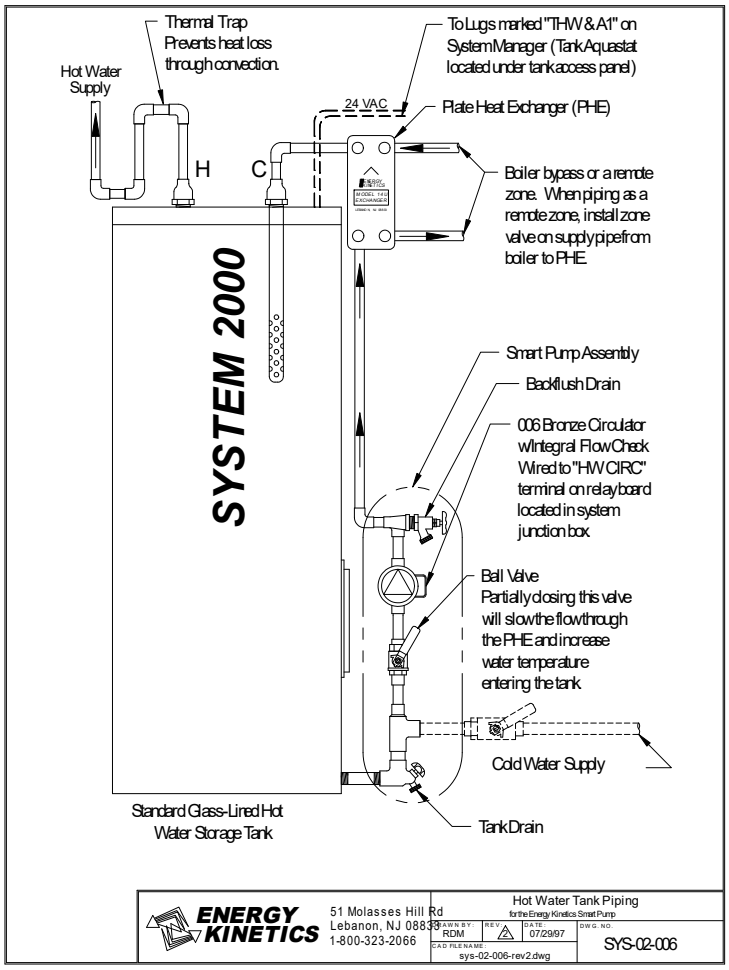
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.

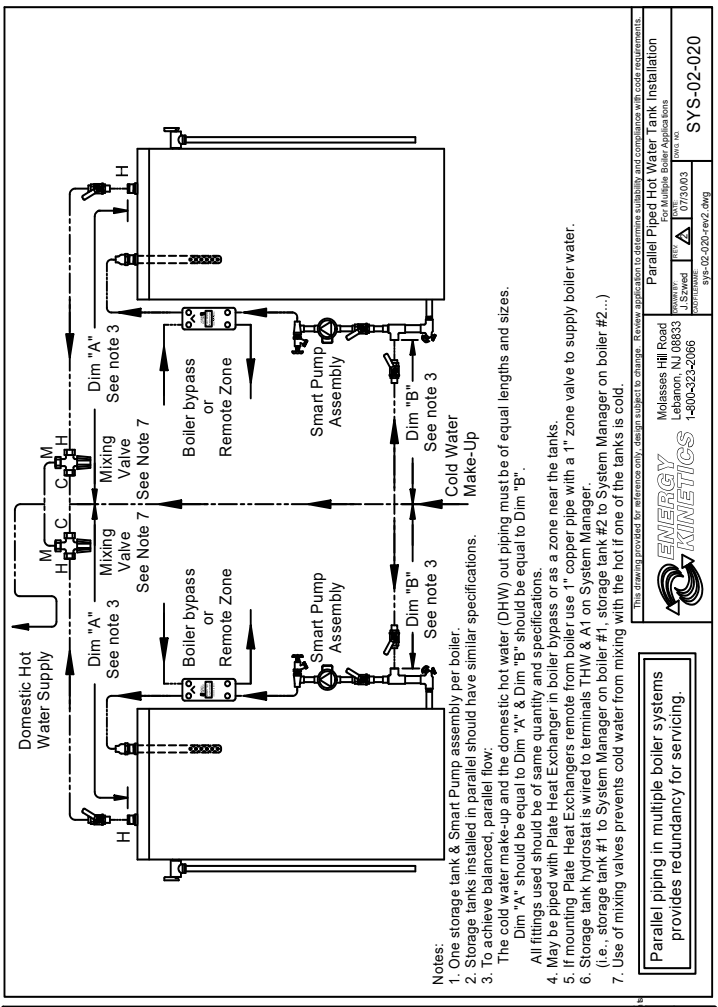
ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

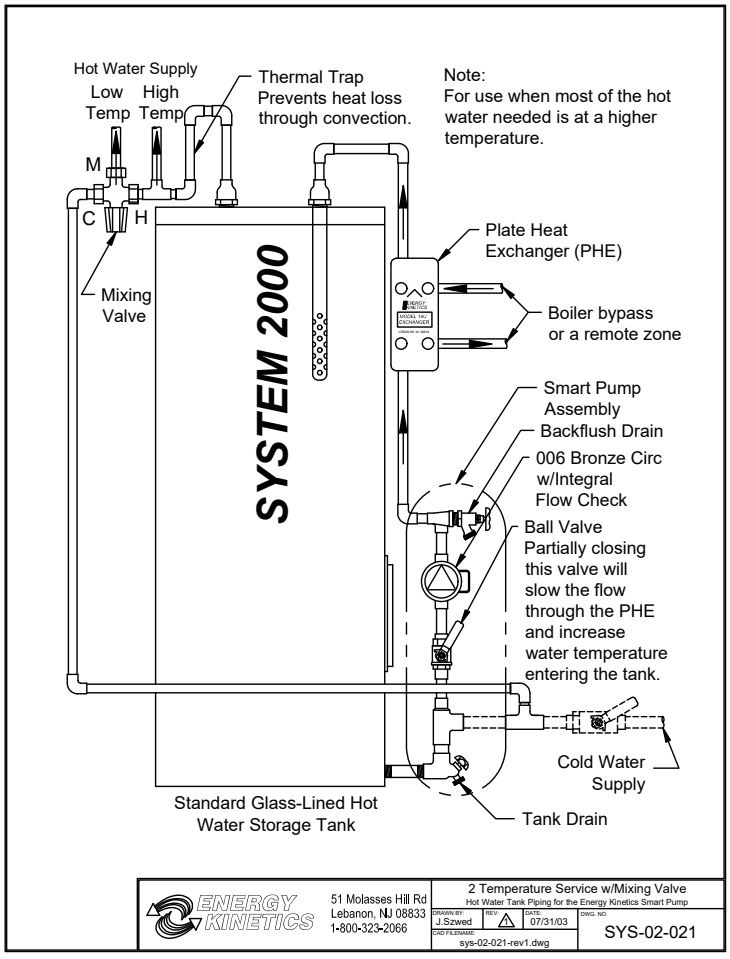
DUAL HOT WATER TANK INSTALLATION
With Two Boiler Feeds

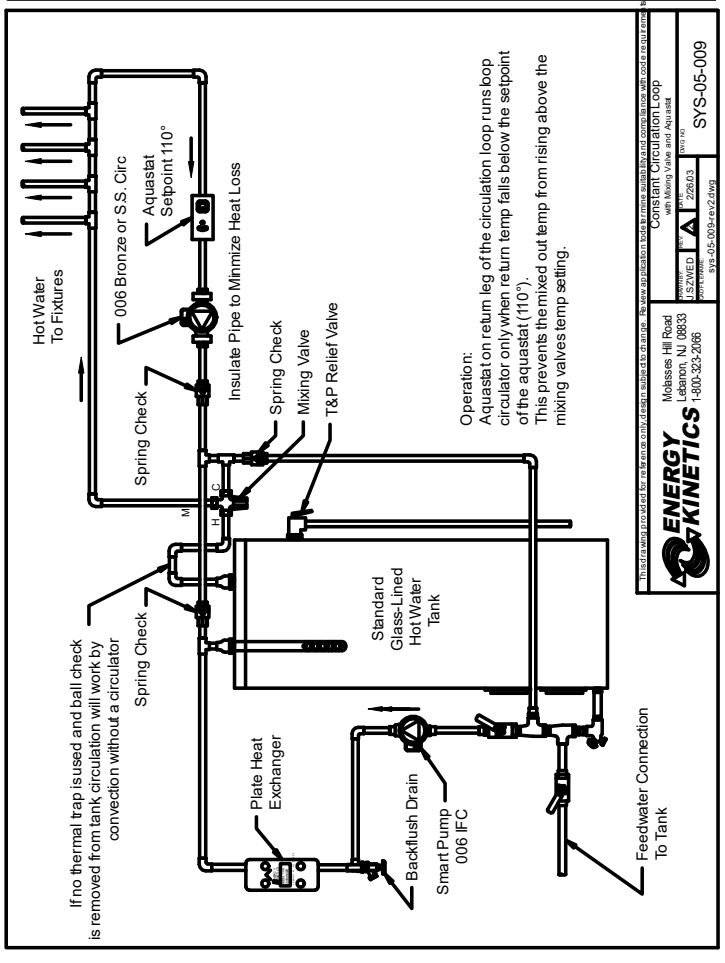
DRAWN BY:	REV:	DATE:	DWG. NO.
RM	1	02/12/98	SYS-02-012

CAD FILENAME: sys-02-012-rev1.dwg


Thermal Trap
Prevents heat loss
through convection.
To Lugs marked "THW & A1" on
System Manager (Tank Aquastat
located under tank access panel)
Hot Water
Supply
24 VAC
Plate Heat Exchanger (PHE)
H
C
Boiler bypass or a remote
zone. When piping as a
remote zone, install zone
valve on supply pipe from
boiler to PHE.
SYSTEM 2000
Smart Pump Assembly
Backflush Drain
006 Bronze Circulator
w/Integral Flow Check
Wired to "HW CIRC"
terminal on relay board
located in system
junction box.
Ball Valve
Partially closing this valve
will slow the flow through
the PHE and increase
water temperature
entering the tank.
Cold Water Supply
Standard Glass-Lined Hot
Water Storage Tank
Tank Drain
ENERGY KINETICS
51 Molasses Hill Rd
Lebanon, NJ 08833
1-800-323-2066
Hot Water Tank Piping
for the Energy Kinetics Smart Pump
DRAWN BY: RDM
REV:
DATE: 07/29/97
DWG. NO.
SYS-02-006
CAD FILENAME: sys-02-006-rev2.dwg


Domestic Hot
Water Supply
Dim "A"
See note 3
Mixing
Valve
See Note 7
Boiler bypass
or
Remote Zone
Smart Pump
Assembly
Dim "B"
See note 3
Cold Water
Make-Up
Notes:
1. One storage tank & Smart Pump assembly per boiler.
2. Storage tanks installed in parallel should have similar specifications.
3. To achieve balanced, parallel flow:
The cold water make-up and the domestic hot water (DHW) out piping must be of equal lengths and sizes.
Dim "A" should be equal to Dim "A" & Dim "B" should be equal to Dim "B".
All fittings used should be of same quantity and specifications.
4. May be piped with Plate Heat Exchanger in boiler bypass or as a zone near the tanks.
5. If mounting Plate Heat Exchangers remote from boiler use 1" copper pipe with a 1" zone valve to supply boiler water.
6. Storage tank hydrostat is wired to terminals THW & A1 on System Manager.
(i.e., storage tank #1 to System Manager on boiler #1, storage tank #2 to System Manager on boiler #2...)
7. Use of mixing valves prevents cold water from mixing with the hot if one of the tanks is cold.
Parallel piping in multiple boiler systems provides redundancy for servicing.
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.
ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066
Parallel Piped Hot Water Tank Installation
For Multiple Boiler Applications
DRAWN BY: J.Szwed
REV:
DATE: 07/30/03
DWG. NO.
SYS-02-020
COMPUTER FILE: sys-02-020-rev2.dwg


Hot Water Supply
Low Temp
High Temp
Thermal Trap
Prevents heat loss
through convection.
Note:
For use when most of the hot
water needed is at a higher
temperature.
M
C
H
Mixing
Valve
SYSTEM 2000
Plate Heat
Exchanger (PHE)
Boiler bypass
or a remote zone
Smart Pump
Assembly
Backflush Drain
006 Bronze Circ
w/Integral
Flow Check
Ball Valve
Partially closing
this valve will
slow the flow
through the PHE
and increase
water temperature
entering the tank.
Cold Water
Supply
Standard Glass-Lined Hot
Water Storage Tank
Tank Drain
ENERGY KINETICS
51 Molasses Hill Rd
Lebanon, NJ 08833
1-800-323-2066
2 Temperature Service w/Mixing Valve
Hot Water Tank Piping for the Energy Kinetics Smart Pump
DRAWN BY: J.Szwed
REV:
DATE: 07/31/03
DWG. NO.
SYS-02-021
CAD FILENAME: sys-02-021-rev1.dwg


Hot Water
To Fixtures
006 Bronze or S.S. Circ
Aquastat
Setpoint 110°
Insulate Pipe to Minimize Heat Loss
Spring Check
Mixing Valve
T&P Relief Valve
Spring Check
Operation:
Aquastat on return leg of the circulation loop runs loop
circulator only when return temp falls below the setpoint
of the aquastat (110°).
This prevents the mixed out temp from rising above the
mixing valves temp setting.
If no thermal trap is used and ball check
is removed from tank circulation will work by
convection without a circulator
Spring Check
Standard
Glass-Lined
Hot Water
Tank
Plate Heat
Exchanger
Backflush Drain
Smart Pump
006 IFC
Feedwater Connection
To Tank
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.
ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066
Constant Circulation Loop
with Mixing Valve and Aquastat
DRAWN BY: J.SZWED
REV:
DATE: 2/26/03
DWG. NO.
SYS-05-009
COMPUTER FILE: sys-05-009-rev2.dwg

Tables:

Plate Heat Exchanger: Boiler Side Temperature vs. Domestic Side Temperature

E ample: #14 PHE with a 007 boiler circulator, maximum domestic flow shown

Load Btu/hr	Side 1 = Boiler Side			Side 2 = Domestic Side			Pressure drop, feet H_2O	
	Temp In	Temp Out	Flow Gpm	Temp In	Temp Out	Flow Gpm	Side 1 Boiler	Side 2 Domestic
114,219	170	123.1	5	50	120	3.28	4.57	1.71
99,093	170	129.4	5	50	130	2.49	4.55	1.00
83,007	170	136.0	5	50	140	1.86	4.55	0.56
65,340	170	143.2	5	50	150	1.32	4.55	0.29
44,545	170	151.8	5	50	160	0.82	4.53	0.11
139,782	180	122.5	5	40	117	3.64	4.53	2.10
133,766	180	125.0	5	50	120	3.84	4.53	2.31
119,012	180	131.1	5	50	130	2.99	4.53	1.43
105,218	180	136.7	5	40	140	2.12	4.53	0.73
103,563	180	137.4	5	50	140	2.32	4.50	0.87
87,133	180	144.2	5	50	150	1.76	4.50	0.50
68,934	180	151.7	5	50	160	1.26	4.50	0.27
153,210	190	126.8	5	50	120	4.40	4.48	3.00
138,763	190	132.8	5	50	130	3.49	4.48	1.91
123,815	190	138.9	5	50	140	2.77	4.48	1.22
108,093	190	145.4	5	50	150	2.18	4.46	0.76
91,234	190	152.4	5	50	160	1.57	4.46	0.46

Plate Heat Exchanger: Boiler Side Temperature vs. Domestic Side Temperature

Example: #14 PHE with a 007 boiler circulator and a 006 domestic circulator

Load Btu/hr	Side 1 = Boiler Side			Side 2 = Domestic Side			Pressure drop, feet H_2O	
	Temp In	Temp Out	Flow Gpm	Temp In	Temp Out	Flow Gpm	Side 1 Boiler	Side 2 Domestic
94,119	170	131.4	5	40	134.2	2	4.55	0.66
87,301	170	134.2	5	50	137.4	2	4.55	0.66
80,386	170	137.0	5	60	140.5	2	4.55	0.66
101,956	180	138.1	5	40	142.0	2	4.50	0.66
95,125	180	140.9	5	50	145.2	2	4.50	0.66
88,228	180	143.8	5	60	148.4	2	4.50	0.66
109,782	190	144.7	5	40	149.9	2	4.46	0.66
102,949	190	147.5	5	50	153.1	2	4.46	0.66
96,034	190	150.4	5	60	156.2	2	4.46	0.65

Tables:

Plate Heat Exchanger: Boiler Side Temperature vs. Domestic Side Temperature

Example: #18 PHE with a 0010 boiler circulator, maximum domestic flow shown

Load Btu/hr	Side 1 = Boiler Side			Side 2 = Domestic Side			Pressure drop, feet H_2O	
	Temp In	Temp Out	Flow Gpm	Temp In	Temp Out	Flow Gpm	Side 1 Boiler	Side 2 Domestic
240,089	170	120.8	10	50	120	6.89	5.73	2.68
209,561	170	127.0	10	50	130	5.27	5.73	1.58
176,799	170	133.8	10	50	140	3.95	5.73	0.90
140,547	170	141.2	10	50	150	2.83	5.71	0.47
97,135	170	150.1	10	50	160	1.78	5.71	0.19
301,989	180	117.9	10	40	117	7.87	5.20	3.19
280,135	180	122.4	10	50	120	8.04	5.68	3.60
250,536	180	128.5	10	50	130	6.30	5.68	2.24
231,215	180	132.5	10	40	140	4.65	5.17	1.14
219,236	180	134.9	10	50	140	4.90	5.68	1.37
185,786	180	141.8	10	50	150	3.74	5.68	0.81
148,304	180	149.5	10	50	160	2.72	5.66	0.43
319,979	190	124.0	10	50	120	9.18	5.64	4.69
291,007	190	130.0	10	50	130	7.31	5.64	3.00
260,900	190	136.2	10	50	140	5.83	5.64	1.92
229,124	190	142.7	10	50	150	4.62	5.64	1.22
194,732	190	149.9	10	50	160	3.57	5.61	0.73

Plate Heat Exchanger: Boiler Side Temperature vs. Domestic Side Temperature

Example: #18 PHE with a 0010 boiler circulator and a 006 domestic circulator

Load Btu/hr	Side 1 = Boiler Side			Side 2 = Domestic Side			Pressure drop, feet H_2O	
	Temp In	Temp Out	Flow Gpm	Temp In	Temp Out	Flow Gpm	Side 1 Boiler	Side 2 Domestic
192,671	170	130.5	10	40	136.4	4	5.73	0.94
178,660	170	133.4	10	50	139.4	4	5.73	0.93
164,552	170	136.3	10	60	142.4	4	5.73	0.93
208,639	180	137.1	10	40	144.4	4	5.68	0.93
194,656	180	140.0	10	50	147.4	4	5.68	0.93
180,442	180	142.9	10	60	150.4	4	5.68	0.93
224,777	190	143.7	10	40	152.4	4	5.64	0.93
210,728	190	146.6	10	50	155.5	4	5.64	0.93
196,512	190	149.5	10	60	158.4	4	5.61	0.93

The chart above shows domestic side values using a 006 domestic circulator, it is the same size circulator used for the Energy Kinetics Smart Pump.

Hot Water Manual

January 2018

Technical Support Hot Line
Customer Service Hot Line
Order Status Hot Line
One Call Does It All!

1-800-323-2066

SYSTEM 2000 ENERGY KINETICS

www.energykinetics.com

51 Molasses Hill Road
Lebanon, NJ 08833-3254
USA