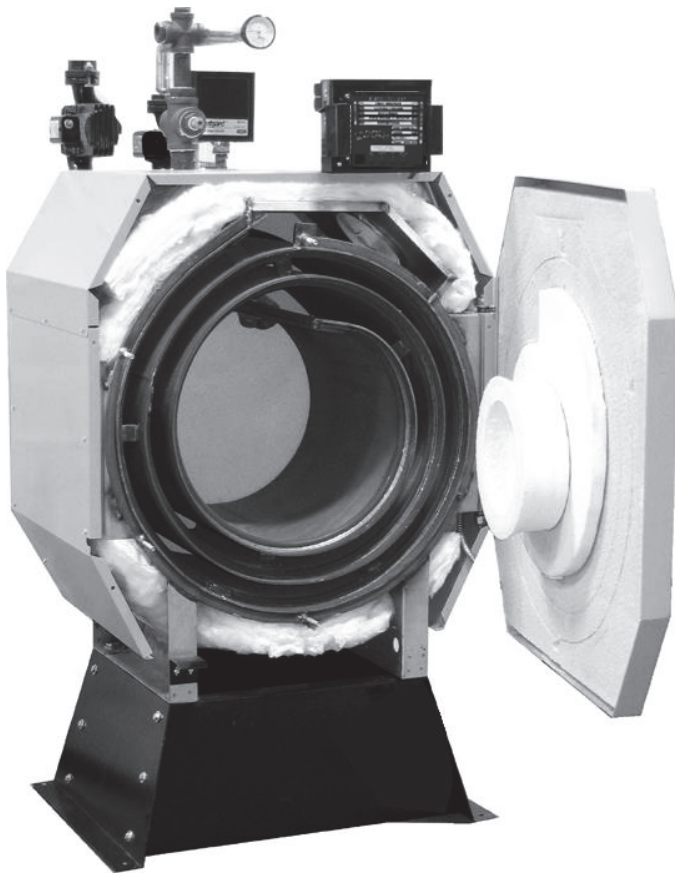




EK3 Frontier **Gas Commercial Boiler**



GAS-FIRED



LISTED

MH27877

ANSI Z21.13-2014

Low-Press Boiler

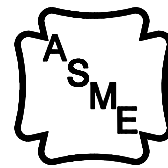
Manufactured By:
Energy Kinetics, Inc.

51 Molasses Hill Road

Lebanon, NJ 08833

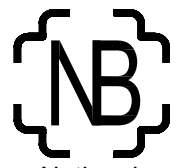
(908) 735-2066

www.energykinetics.com



H

ASME certified by
EKI. Certificate plate
is under the jacket on
the steel vessel.



National
Board Listed

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

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

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.

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result, causing property damage, personal injury or loss of life.

WARNING: Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other gas appliance.

Provide unobstructed combustion air openings sized and located per boiler manual and applicable codes.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from an outside phone.
- Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

WARNING: Installation and service must be performed by a qualified installer, service agency or the gas supplier.

Retain this manual for use by your qualified service technician only.

Should you observe unusual or abnormal operation of the burner or boiler, contact your qualified service technician immediately. Do not attempt to service or repair this product yourself.

WARNING: Have the burner/boiler started up and serviced at least once annually by a qualified service technician. Professional care is necessary to properly service your equipment and verify it is operating reliably. Failure to properly maintain the equipment could result in severe personal injury, death or substantial property damage.

WARNING: You must keep the area around the burner/boiler free from the following. Failure to comply could result in severe personal injury, death or substantial property damage due to potential fire, explosion or equipment damage from corrosive flue products.

- Do not store or use gasoline or other flammable vapors or liquids near or in the same room as the burner.
- Do not use or store laundry products, paint, varnish, thinner or other such chemicals near or in the same room as the burner/boiler. These chemicals cause creation of acids in the burner, heat exchanger and vent system that can cause severe damage.
- Do not store combustible materials near or in the same room as the burner/boiler.

General care and maintenance

- ☐ Please read through the information provided for you in this manual. Ask your qualified service technician to explain normal operation of your equipment.
- ☐ Daily inspect the space around the burner/boiler to verify the area is clean and free of the materials listed above.
- ☐ Periodically watch the operation of your burner/boiler through an operating cycle to verify normal operation. If you notice unusual conditions or equipment behavior, contact your qualified service technician. Follow the instructions on the next page to shut down the burner/boiler while waiting for the technician.

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury (exposure to hazardous materials) or loss of life. Refer to the user's information manual provided with this boiler. Installation and service must be performed by a qualified installer, service agency or the gas supplier (who must read and follow the supplied instructions before installing, servicing, or removing this boiler. This boiler contains materials that have been identified as carcinogenic, or possibly carcinogenic, to humans).

FOR YOUR SAFETY READ BEFORE OPERATING

WARNING:

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

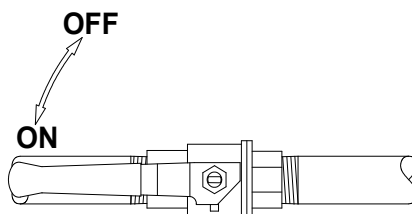
- A. This burner does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. Before OPERATING, smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor. See below.
- C. Use only your hand to turn the gas supply ball valve. Never use tools. If the handle will not move by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control, which has been under water.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above.
2. Set the thermostat(s) to their lowest setting.
3. Turn off all electrical power to the burner/boiler.
4. This burner is equipped with an ignition device which automatically lights the burner.
5. Do not try to light the burner by hand.
6. Turn **Gas Supply Ball Valve** clockwise ↻ to **OFF**.



7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, **STOP!** Follow the safety information above. If you do not smell gas, go to the next step.
8. Turn **Gas Supply Ball Valve** counterclockwise ↻ to **ON**.
9. Set thermostat(s) to desired setting.
10. Turn on all electric power to the burner and boiler.
11. If the burner/boiler will not operate, follow the instructions **“TO TURN OFF GAS TO THE BURNER”** below and call your service technician or gas supplier.

TO TURN OFF GAS TO THE BURNER

1. Set thermostat(s) to their lowest setting.
2. Turn off all electric power to the burner and boiler if service is to be performed.
3. Turn **Gas Supply Ball Valve** clockwise ↻ to **OFF**. Do not force.

EK3 Owner & Installation Manual

RECORD OF INSTALLATION

INSTALLER NAME: _____

INSTALLER ADDRESS: _____

INSTALLER CITY, STATE: _____

DATE INSTALLED: _____

NOTES: _____

This manual covers the Energy Kinetics System 2000 EK3 Frontier Boiler. The boiler is designed and equipped and has been tested to generate hot water in a low pressure closed loop system. The boiler is a major component of a closed loop system that can be used as a heat source for hydronic heating, hydronic air handler, radiant, domestic hot water, spa, and/or pool heating systems. Call Energy Kinetics to obtain piping and wiring instructions for applications, such as hydronic heating, radiant heating, domestic hot water, hydronic air handler, swimming pool heating, multiple boilers, injection loops, etc. The installer of the system is responsible for the final design of the system and for adding the balance of the needed parts to complete the system.

INSTALLER NOTE:

ALL INSTALLATIONS MUST BE MADE IN ACCORDANCE WITH ALL STATE AND LOCAL CODES THAT MAY DIFFER FROM THIS MANUAL.

All installations must be made in accordance with all State and Local Codes, which may differ from this manual and in accordance with the following Codes, as applicable:

National Fuel Gas Code, ANSI Z223.1/NFPA 54:

Installation Codes, CAN/CGA B149

National Electrical Code, ANSI/NFPA 70

Canadian Electrical Code Part I, CSA 22.1, Electrical Code

Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances, ANSI/NFPA 211

Where required by the authority having jurisdiction, the installation must conform to the Standard for: ANSI/ASME CSD-1 Controls and Safety Devices for Automatically Fired Boilers

These codes are available from:

National Fire Protection Association

1 Batterymarch Park

Quincy, MA 02269-9101.

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EK3 FRONTIER GAS HEAT BOILER - COMMERCIAL - RESIDENTIAL

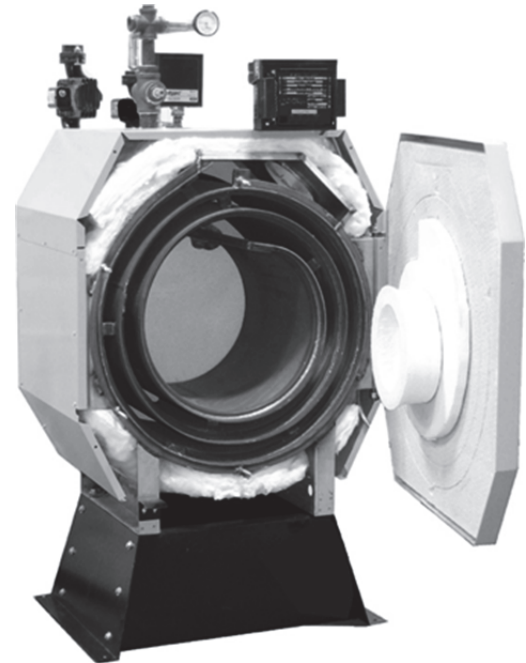
IMPORTANT MESSAGE: These instructions should be carefully read and kept for future reference to gain the best performance from your System 2000 Frontier boiler.

CONGRATULATIONS ON THE PURCHASE OF a SYSTEM 2000 BOILER with its highly efficient low mass hydronic heat exchanger, the Energy Converter. It is the product of years of engineering and advanced design, which brings together in a single system all the elements needed to provide an efficient source for heat and hot water. This operation and maintenance information has been prepared so that you may better understand and use your **Energy Kinetics Frontier Boiler and Heating System**.

The EK3 Frontier is ASME certified and National Board listed, perfect for commercial installations. The required manual reset high temperature limit and the manual reset low water cutoff are both included. The boiler is packaged with circulators, piping, controls, wiring, and burner mounted. The boiler will fit through a 34" doorway.

EK3 Packages Include:

- ◆ Energy Converter (boiler) Flue 7" at 45 degrees,
- ◆ Front Service, thru side swing door, right side hinge.
- ◆ EK3 Firing Rates: 300,000/ 350,000/399,000 Btu/Hour
- ◆ Carlin 201GAS Burner
 - Microprocessor-based interrupted ignition primary control
 - Flame current test jack
 - 9,000 volt solid state electronic igniter
 - 1/6 HP PSC burner motor
 - Removable orifice, increase or decrease burner input
- ◆ Wiring Harness w/ Door Switch and Service Outlet
 - Manual reset high temperature limit
 - Manual reset low water cutoff
- ◆ Complete supply, return, bypass piping
 - Bypass Circulator, Taco 007
 - Injection Circulator, Taco 0012IFC
 - Air Purge with two (2) Air Vents
 - T&P Gauge
 - One (1) 3/4" Drain Valve
 - ASME 30 psi Relief Valve
- ◆ Cold start, cold finish operation with energy recovery
- ◆ Return temperature sensor for condensing protection
- ◆ Relay for control of injection circulator included.

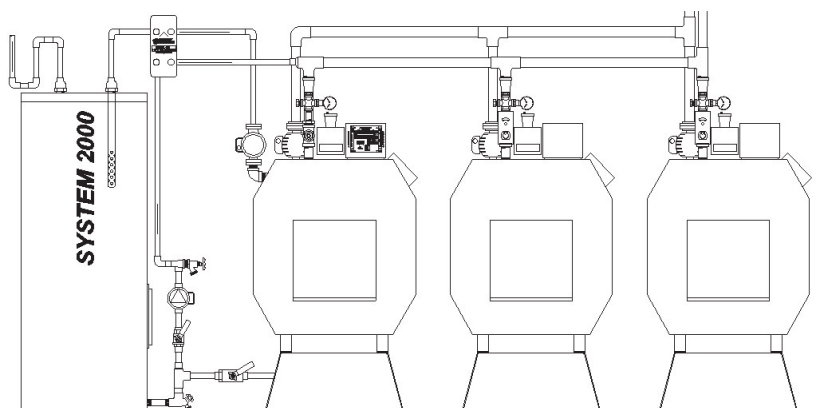


EK3 with Energy manager,
Easy access, front opening door.
Shown with optional base

EK3 Options Include:

- ◆ Air Inlet Box kit for field mounting
- ◆ Fabricated steel base
- ◆ Domestic hot water making is an option, consult the factory for hot water zone kits.

Input (BTU/hr)	Gross Output (BTU/hr) LP	Gross Output (BTU/hr) NG
300,000	260,000	255,000
350,000	299,000	292,000
399,000	335,000	327,000



PRINCIPLE OF OPERATION - SYSTEM 2000 BOILERS

SYSTEM 2000 comprises a heat source, the energy converter, circulating water, and five (or more) zones controlled by an electronic control, the **Energy manager**.

The Boiler sits cold until a thermostat calls for heat. The Energy manager receives the call for heat and turns on the bypass circulator and burner. Water circulates within the boiler as it warms up to operating temperature. When ready, the supply circulator and zone valve(s) open and deliver heat to the zone(s) calling for heat. When the thermostats are satisfied, the Energy manager turns off the burner and enters the energy recovery stage. The circulators and zone valve stay energized to deliver the heat remaining in the boiler to the last zone calling or to the domestic hot water storage tank.

When energy recovery is complete and the Boiler has been cooled off, the Energy manager turns off the system and waits for another thermostat (or tank aquastat) to call for heat. **SYSTEM 2000** runs the burner only when you need heat and delivers that heat only where you need heat.

The System 2000 Energy Converter is the product of advanced thermal engineering. It is designed with two separate passageways, nearly 18 feet long, coiled around each other. Water travels along one passageway from the heat emitters toward the center of the unit. Heated gases travel from the unit center toward the chimney. This is a "forced circulation counter-flow" design and it provides very efficient transfer of heat from the burning fuel to the circulating water. The superior insulation of the boiler minimizes heat losses to the surroundings, resulting in heat directed to the desired zones in an efficient and quiet manner.

SYSTEM 2000 has an extremely high annual efficiency (over 99% of steady state) because it runs only when your heat zones or hot water storage tank needs heat. Energy recovery is completed at the end of each heat call, virtually eliminating off cycle losses.

Your System 2000 holds a minimal quantity of water so it begins to supply heat in about two minutes. This rapid response means that your rooms can be heated quickly to temperature. The System 2000 EK3 Frontier can provide heated water up to 327,000 BTU's per hour on Natural Gas and up to 335,000 BTU's per hour on Propane.

The burner fires into the center of System 2000 where a high temperature, light weight ceramic flame former provides ideal conditions for "near perfect" efficient, pollution-free combustion. Your System 2000 is tightly sealed so all products of combustion pass only to the chimney.

PRINCIPLE OF OPERATION – Energy Manager

The left side of the Manager is the input side, which provides 24-volt power supply and connections for thermostats. The right side is the output side, which starts the burner, circulators, zone valves or zone circulators and the domestic hot water circulator. See photo of the Manager on the cover.

Lights on the Energy manager indicate zone(s) calling for heat (left side) and (right side) lights indicate active zone(s), burner operation and circulator operation. These function lights are an aid in servicing. The following is a typical cycle.

1. **SYSTEM WAITING FOR A CALL:** The boiler is turned off and sits cold, waiting until a call for heat. The red power light on the Manager is glowing.
2. **CALL FOR HEAT:** A room thermostat call starts the cycle. The thermostat light on the left side will turn on for that zone.
3. **PRE-HEAT:** Output lights for the bypass circulator and burner turn on, the bypass circulator starts, and the burner begins firing. Water circulates within the boiler and through the bypass as it warms up to operating temperature.
4. **HEAT:** Once the boiler water has heated up (about two minutes) to 150° F for gas burners (option switch 1 **ON**), the Manager will turn on the zone output light on the right side. The zone valve will open, the main supply (injection) circulator will start and hot water will flow to the zone needing heat. The burner runs as long as there is a thermostat calling and as long as heat is being delivered to the zone. The burner may shut off if the return temperature exceeds 170° F/190° F (RED burner light turns off) or if the high limit temperature is exceeded (RED burner light stays on, but the high limit aquastat shuts the burner off).
5. **ANOTHER CALL FOR HEAT:** If another zone calls for heat while the burner is already running and the return temperature is above 150F, the zone output will turn on, immediately supplying heat to the zone.
6. **MONITOR RETURN TEMPERATURE:** The Manager continually senses the return temperature and will turn off the zone outputs if the return temperature drops below 130° F. With the zone outputs closed, the boiler water will quickly reheat and once the return temperature reaches 150° F, then the Manager will reopen the zone valve and start the supply circulator.
7. **THERMOSTAT SATISFIED:** The thermostat light on the left side will go out. The burner light and the burner will then turn off.
8. **ENERGY RECOVERY:** The bypass circulator, main supply (injection) circulator, and zone valve remain energized. The circulating water will remove the energy from the converter, sending the heat to the last zone that called. The energy recovery stage continues until the return temperature has dropped sufficiently or until maximum timing has been reached. The boiler is now sitting cold, waiting for the next call for heat. Maximum timing for heat recovery

stage is usually set at twenty minutes for space heating zones and is fixed at five minutes for the Hot Water zone. (See Energy manager Option Switch Settings).

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.

MOVING THE BOILER

The boiler is shipped bolted to a pallet. Use a pallet jack or fork lift to move the boiler while mounted on the pallet. The boiler has two features designed to help with moving the boiler. There are four welded in nuts at the top of the front and rear covers that can be used to screw in eyebolts or lifting bolts. Use a chain hoist or cherry picker to lift the boiler. The boiler legs have four holes to accept 3/4" iron pipe. Remove the boiler drain from underneath the front of the boiler and slide (2) 6 foot pieces of 3/4" iron pipe into the holes from side to side of the boiler. Use the two pipes to lift, steer, and stabilize the boiler. Use of a wheeled dolly or cart is recommended once the boiler has been removed from the pallet.

If the front door and burner are removed, then the boiler can be hand trucked from the front and will fit through a 34" door. Use pieces of wood (4x4's) to space the boiler shell from the hand truck uprights, so the mounting studs and the junction box will be protected.

The boiler is 33" wide and will fit through a 34" door when moving from front to back. If the front door and burner are removed and the manual reset aquastat on the rear is removed, the boiler will be 32" front to back and will fit through a 33" door when moving sideways. If the aquastat well on the rear is also removed, then the boiler will be 31" front to back and will fit through a 32" door when moving sideways. When the front door has been removed, the door mounting studs will be exposed and can be easily damaged unless proper care is taken. It is recommended that pieces of wood be attached to help protect the studs from impact.

LOCATION and CLEARANCE

DANGER: Provide clearance to combustible surfaces in accordance with all local and national codes. Follow National Fire Protection Association Bulletin NFPA Installation of Gas Burning Equipment and all applicable codes.

Installation Clearances from Boiler Surfaces, Inches	Clearance to Combustibles	Clearance for Service
Front of boiler	13	36*
Left side of boiler body	0	2
Right side of boiler body	0	16*
Back of boiler body	7	36
Top of boiler body	13	16
Bottom of boiler legs to floor	0	0
B-Vent (Gas Only):from flue pipe	3	3
L-Vent: from flue pipe	3	3
Standard Flue: from flue pipe	9	9

* Minimum recommended clearance to allow door to fully open.

Boiler Weight and Water Content	
Weight	675 lbs
Water Content	7-1/2 gallons
Air Inlet Pipe Size	4"
Boiler Flue Outlet	7"
Supply & Return Piping	1-1/2"

NOTICE: The boiler base or stand must be **level** to allow for proper venting of air from the boiler. The Frontier is manufactured with the BACK of the boiler *higher* than the front to assist in air removal.

COMBUSTION AIR

The System 2000 Boiler must be installed in an area where adequate fresh air is available to support combustion. The EK3 Frontier can be provided with a sealed Air Box that can be piped to air outside the building. Piping of outside air directly to the boiler is highly recommended because it completely isolates the boiler from the interior environment, as well as greatly reducing operating noise from the boiler. In multiple boiler installations, each boiler air intake should be piped separately. The outside air source must be located high enough above grade to be at least 12" above expected snow accumulation. Use 4" PVC to pipe in the fresh air, 20 feet max. and five 90 degree elbows or less. Up to 40 feet max. using 5" PVC and five 90 degree elbows or less.

WARNING: Do not connect any combustion air piping to the burner when input is set for 399,000 Btu/Hr.

Boiler without outside air piping:

WARNING: The confined space shall be provided with two permanent openings, one near the top of the enclosure and one near the bottom. Each opening shall have a free area of not less than one square inch per 1,000 BTU per hour of the total input rating of all appliances in the enclosure, freely communicating with interior areas having adequate infiltration from the outside.

WARNING: Modern buildings of tight construction, as well as the operation of attic and exhaust fans, kitchen ventilation systems, clothes dryers or fireplaces may create conditions of unsatisfactory combustion or venting. Provisions must be made to use combustion air that communicates with a well-ventilated attic or with the outdoors (such as using a louver or grate). The opening should have a free area of not less than one (1) square inch per 4,000 BTU per hour of the total input rating.

CHIMNEY VENTING

WARNING: Masonry chimneys must have a tile or metal liner. The liner must:

- 1) Extend above the masonry.
- 2) Have an insulating air gap, isolating the liner from the chimney, allowing for rapid heat-up and draft establishment.
- 3) Be sealed at each joint to prevent air infiltration and damage from condensation.
- 4) Corrugated metal liners should be at least 8" diameter.

NOTICE: Inspect Chimney and Chimney base after initial three months of operation.

The installation of a chimney cap is recommended. The base of the chimney must always have a drop leg below the flue connector to allow scale and condensation to accumulate without blocking the flue pipe.

CAUTION: If drop leg is in excess of 12 inches deep, backfill with loose gravel or sand to obtain a maximum of 12-inches depth. All clean out doors must be sealed to prevent cold air entry into chimney.

In retrofit installations, have chimney thoroughly cleaned. Carefully inspect chimney, base of chimney, and liner prior to installation of System 2000 Boiler.

CAUTION: If liner is not sound or if existing tile liner fails to contain intermittent condensation, or if excessive debris is found at the base of the chimney, then it is recommended to install a properly sized metal liner approved for use with gas heat appliances.

The metal liner diameter and length should be as recommended by the metal liner manufacturer. Corrugated metal liners should be at least 8" diameter. Connection of a flexible metal liner directly to the flue collar of the boiler is an acceptable connection method and is recommended. Alternatively, a flexible metal vent connector may be used between the flue collar of the boiler and a flexible metal liner. Call Energy Kinetics for details on metal liners.

Chimney connectors should be positioned to create the shortest possible run of flue pipe to the chimney. The overall horizontal length of flue piping should not exceed 15 feet. Long runs or low firing rates may require insulated flue pipe such as L-Vent or All-Fuels to keep the temperature at base of chimney adequate for draft and to prevent corrosion of piping and connectors.

Because the System 2000 boiler uses a power burner, the flue pipe may experience some positive pressure on start up. Energy Kinetics recommends that all pipe joints be sealed with high temperature silicone sealant to ensure passage of all combustion products to the chimney.

Normally, pitch horizontal flue pipe up toward chimney approximately ¼" per foot. For existing installations, it is permissible for the flue connection of the boiler to be higher than the chimney thimble, provided adequate draft is established.

If a minimum of +0.08" w.c. draft overfire is not present after sufficient burner run time to heat up the chimney, there is a problem that will need to be corrected. Call Energy Kinetics for help resolving draft problems. Under normal circumstances, there is NO need for a DRAFT REGULATOR and one should not be installed. Call Energy Kinetics with questions about flue pipe sizing.

WARNING: No solid fuel appliance or fireplace should be installed in a flue common with this heating appliance. The flue gas exit of the venting system must be at least three (3) feet above the point at which it passes through the roof and at least two (2) feet higher than any portion of a building within 10 feet horizontally of its location.

L-VENT CHIMNEY

SYSTEM 2000 Boilers typically have flue gas temperatures between 350° F and 450° F during normal operation. Due to the low flue gas temperatures, L-Vent chimney pipe is suitable for use with SYSTEM 2000 Boilers. L-Vent chimney pipe may require smaller chase dimensions than other chimney pipe materials and should be considered for new installations with SYSTEM 2000 Boilers. Call Energy Kinetics for help locating sources of L-Vent.

1. L-Vent must be U.L. Listed to U.L. 641.
2. L-Vent to be installed in accordance with the vent manufacturer's instructions.

System 2000 and L-Vent must be installed in strict compliance with all State and Local Codes and with the regulations of the authorities having jurisdiction, which may differ from and which take precedence over these instructions or the vent manufacturer's instructions.

B-VENT CHIMNEY

Gas Heat SYSTEM 2000 Boilers at factory default firing rates have flue gas temperatures between 350° F and 450° F during normal operation. Refer to the burner settings table for the default firing rates. Due to the low flue gas temperatures, Type B gas vent chimney pipe is suitable for use with Gas Heat SYSTEM 2000 Boilers. Type B gas vent chimney pipe is double walled and may require smaller chase dimensions than other chimney pipe materials and should be considered for new installations with Gas Heat SYSTEM 2000 Boilers.

A Type B gas vent system shall extend at least five (5) feet of height above the breech of the boiler.

Refer to the section on Gas Vent Termination in the National Fuel Gas Code to determine Minimum Height from Roof to Lowest Discharge Opening required.

Type B gas vent must be U.L. Listed to U.L. 441. Type B gas vent to be installed and supported in accordance with the vent manufacturer's instructions.

Gas Heat System 2000 boilers and Type B gas vent must be installed in strict compliance with all State and Local Codes and with the regulations of the authorities having jurisdiction, which may differ from and which take precedence over these instructions or the vent manufacturer's instructions.

REMOVAL FROM COMMON VENT SYSTEM

When any existing appliance, such as a boiler, is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it. Testing of the remaining venting system must be performed according to the following procedure.

At the time of removal of the existing appliance, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies, which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage after five minutes of main burner operation. Use a draft gauge or pressure gauge to verify that the vent pipe at the breech of the appliance is under draft (negative pressure) relative to the room.
6. Repeat 4) and 5) for each appliance connected to the common venting system, one appliance at a time.
7. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
8. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CGA B149, Installation Codes. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or CAN/CGA B149, Installation Codes.

GAS BURNER MOUNTING

EK3 Frontier Gas Heat Boilers are shipped from the factory with the burner mounted. If the burner ever needs to be remounted, follow these directions. The burner flanges are designed to insert the burner head 2-3/8" into the boiler. Energy Kinetics supplies a ceramic sleeve (the amulet), to protect the burner head from the heat of combustion, and then seals the air tube flange joint with a high-grade retort cement. The ceramic sleeve must be installed or burner damage will occur.

NOTICE: Gas burners should be installed according to burner manufacturer instructions, according to installation instructions below, and with consultation from Energy Kinetics for any special considerations or adjustments.

To install burner, start by checking electrode and flame sense rod position per manufacturer's specifications prior to assembly to unit. Test fit the amulet by inserting the amulet into the boiler opening. If the amulet doesn't easily slide into the boiler, then gently sand the outside diameter of the amulet until it will fit into the boiler opening. Test fit the amulet onto the burner head. The amulet for the Carlin burners has a smooth interior. If the amulet is a tight fit on the burner head, then slightly moisten inside the amulet with water.

Place a 3/8" bead of retort cement onto the burner head at the flange to air tube joint, and slide the (moistened) amulet over the burner head and against the flange. Ensure proper seating of the amulet by pressing the amulet onto the burner with a flat object. Leave the excess retort cement at the amulet to flange joint and the cement will provide an airtight seal of the air tube flange to the boiler face.

The Carlin amulet does not have an edge and when fully seated the amulet will be flush with the front of the Carlin burner head. If needed, trim the front edge of the amulet to be flush with the front of the burner head.

Once the amulet has been seated and trimmed, then install the burner into the boiler by carefully inserting the air tube with amulet into the boiler opening while aligning the burner flange holes with the boiler studs. Install flat washers and nuts onto the boiler studs and tighten all nuts evenly.

GAS BURNER SETTINGS

201GAS Burners are shipped from the factory standard with the 350,000 BTU/hr firing rate orifice. The SYSTEM 2000 Boiler can be fired over a range of firing rates to suit the needs of the application. The following table lists approximate settings for Carlin 201GAS burners based on extensive testing.

CAUTION: Final settings for each burner and firing rate for a particular installation **must** be determined by using combustion test equipment and following the instructions given under "Start Up Procedure".

EK3 with 201Gas Burner	Input BTU/hr	Opening Behind Pressure Switch Plug Installed	Orifice Size Installed In 1" X 2" Nipple	Approximate Air Band Setting	Air Tube Insertion Length	Diffuser Style
Natural Gas	300,000	YES	27/64" (0.422)	10	2-3/8"	A
	350,000*	YES	1/2" (0.500)	35	2-3/8"	A
	399,000	NO**	23/32" (0.719)	65	2-3/8"	A
Propane	300,000	YES	23/64" (0.359)	16	2-3/8"	A
	350,000*	YES	13/32" (0.406)	50	2-3/8"	A
	399,000	NO**	29/64" (0.453)	85	2-3/8"	A

* Default Factory Setting

** Remove plug from opening behind pressure switch for 399,000 BTU/hr firing rate to allow adequate air combustion air flow. Do not connect any air intake piping when upfiring burner to the 399,000 Btu/hr rate, or upsize intake to 5" PVC.

GAS PIPING SYSTEMS

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of the gas supply piping system at test pressures in excess of 1/2 psi (3.5 kPa, 14 in wc).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas piping system at test pressures equal to or less than 1/2 psi (3.5 kPa, 14 in wc).

A manual shut off valve and a sediment trap must be provided in the gas piping upstream of the regulator and electric gas valve at the boiler. The boiler and its gas connection must be tested for gas leakage before placing the boiler in operation.

Gas piping must be properly sized in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or according to state and local codes as applicable. Gas piping must be sized to provide the maximum firing rate gas flow for all appliances in the building. For Natural Gas installations, be sure to verify that the gas meter is properly sized for all appliances. Do not use any service 90° elbows. Use only full port shutoff valves. If in doubt, oversize the piping.

The following table provides suggested sizing for Black Iron Pipe. Be sure to add the appropriate equivalent length for every fitting and elbow used. For other types of pipe or tubing, consult NFPA 54 or the manufacturer of the pipe or tubing or your gas supplier for pipe sizing information.

For Natural Gas, drawing up to 399,000 Btu/Hr (399 Cubic Feet per Hour).

Capacities in Cubic Feet per Hour for Black Iron Pipe Carrying Natural Gas or Propane											
NATURAL GAS						PROPANE					
Pipe Size (inches)	Total Length of Gas Piping from Meter to Burner Connection (Feet)					Pipe Size (inches)	Total Length of Gas Piping from Meter to Burner Connection (Feet)				
	20	40	60	80	100		20	40	60	80	100
	Natural Gas @ .60 Specific Gravity, Pressure Drop 0.3 in. w.c. *						Propane Gas @ 1.55 Specific Gravity, Pressure Drop 0.3 in. w.c.				
1	350	245	195	170	150	3/4	118	81	65	56	49
1-1/4	730	500	400	350	305	1	217	152	121	105	93
1-1/2	1100	760	610	530	460	1-1/4	453	310	248	217	189
Pipe Size (inches)	Natural Gas @ .60 Specific Gravity, Pressure Drop 0.5 in. w.c. *					Pipe Size (inches)	Propane Gas @ 1.55 Specific Gravity, Pressure Drop 0.5 in. w.c.				
1	465	320	260	220	195	1	288	198	161	136	121
1-1/4	950	660	530	460	400	1-1/4	589	409	329	285	248
* For Natural Gas with a Specific Gravity other than 0.60, Consult National Fuel Gas Code for Correction Factor											

* For Natural Gas with a Specific Gravity other than 0.60, Consult National Fuel Gas Code for Correction Factor

Draft Loss Definition: The draft loss through boiler is found by subtracting the overfire draft reading from the breech draft reading. For example, if the breech draft is -0.04" w.c., and overfire draft is +0.02" w.c., then subtracting the two readings gives a draft loss of 0.06" w.c., which is acceptable. If the draft loss exceeds 0.10" w.c., then the boiler may need to be cleaned or there may be some other blockage that will need to be addressed.

1. **DANGER:** Verify proper operation of high limit aquastat:

Auto Reset High Limit

- i. Remove all heat and hot water calls (No input lights on left side of manager).
- ii. Turn System switch off, then remove red sensor lead from the left side quick connect.
- iii. Verify the auto reset high limit aquastat is set at 215° F.
- iv. Restore power. "E100 Sensor Err" will display on the Energy Manager, and the burner should start momentarily.
- v. At approximately 205° F to 215° F, the high limit aquastat should shut off burner.
- vi. Turn off power and reconnect the red sensor lead.

Manual Reset High Limit

- i. Remove all heat and hot water calls (No input lights on left side of manager).
- ii. Turn System switch off, then remove red sensor lead from the left side quick connect.
- iii. Change the manual reset high limit aquastat from 220° F down to 190° F
- iv. Restore power. "E100 Sensor Err" will display on the Energy Manager, and the burner should start momentarily.
- v. At approximately 180° F to 190° F, the manual reset high limit aquastat should shut off burner.
- vi. Turn off power, reset the aquastat to 220° F and reconnect the red sensor lead.

2. **DANGER:** Verify proper operation of Low Water Cut-Off: Press and hold the Test/Reset button for 5 seconds (30 seconds for manual reset). The display will read LCO. The red Low Water light should illuminate and the LWC circuit will de-energize.
3. **DANGER:** Verify proper operation of boiler pressure relief valve by following instructions on pressure relief valve, which calls for a 'try lever test'. Make sure discharge pipe is properly placed to safely contain discharge and open relief valve using the try lever.

AQUASTAT SETTINGS

With Energy manager:

- 11D18 automatic reset high limit, set at 215° F, 10F Differential (205° F/215° F)
- L4006E manual reset high limit, set at 220° F
- Or, Carlin EZ-Temp manual reset high limit, set at 220° F
- Or DualGard 2450-3 automatically configured to 200°F automatic and 205°F manual reset
- L4006B reverse control on return, set at 150° F, 20° F Differential (130° F/150° F)
-

DANGER: Double check that the manual reset high limit aquastat is set to 220° F. Do not exceed a setting of 220° F.

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 the manual are recommended.

BOILER MOUNTING

PIPING SO THE DOOR CAN OPEN: To avoid conflicts with the door opening, piping should be in accordance with the boiler specifications drawing and the piping schematics in this manual. The door opens to the right hand side of the boiler. The burner and air box also need clearance when the door opens. Do not locate any piping in front of the boiler unless clearance from the door is verified. This also applies to the gas line piping and the combustion air piping. **NOTICE:** Air inlet pipe must be disconnected to allow door to swing open.

BOILER PITCH: The Frontier pressure vessel is manufactured with the rear 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 a stand. When the stand is level, the pitch is correct and the back of the boiler will be higher than the front.

ZONE CONTROL

ZONE CONTROL BY VALVE: The SYSTEM 2000 Boiler is designed to provide multi-zone control of the heating system and optionally can supply domestic hot water. Energy Kinetics recommends full port, 24-volt zone valves for control of each heating zone. **Note:** A system using single zone injection, (injecting into a primary loop) *does not* require the use of a zone valve to provide control for preheat or to maintain temperature during operation. The Taco 0012 system injection circulator is all that is needed.

ZONE CONTROL BY CIRCULATOR: Zone control by circulators requires a flow valve, circulator and 24-volt relay (fan type such as Honeywell R8225B) for each zone. The boiler bypass circulator is still used in these cases. The Taco 0012 system injection circulator may be used as one of the zone circulators if it meets the requirements for one of the zones.

NOTICE: Refer to piping schematic for location of zone circulators.

ZONE PURGING: Valves to isolate and purge individual zones should be installed according to good piping practices.

EXPANSION TANK SIZING: The type and size of expansion tank depends on the total system water volume. The EK3 Frontier contains 7-1/2 gallons of water.

NOTICE: Sizing must consider **cold start** and **hot operation** due to system concepts of energy recovery and rapid heat up.

BOILER BYPASS CIRCULATOR

NOTICE: Systems are piped at the factory with the boiler bypass circulator. The bypass circulator piping and wiring must not be changed from the factory configuration. The bypass circulator runs whenever the burner is powered for heat and ensures the proper flow rate through the boiler.

FILLING WITH WATER VENTING, and PURGING

When piping is completed and all accessories installed, the Converter and piping should be filled with water. The Converter purges itself of air when properly installed. Each zone should be purged until a steady stream of water without air passes out of purge hose. Vent all radiation.

NOTICE: DO NOT START BURNER UNTIL CONVERTER AND SYSTEM ARE FULL OF WATER. Fill to normal cold system pressure, 10 to 12 psi on pressure gauge. Before placing system in operation, carefully check for leaks throughout system. Tighten pipe joints, circulator flanges; check gaskets, etc., as needed.

BOILER WATER TREATMENT

Addition of boiler water treatment is recommended to reduce lime buildup inside the boiler. Energy Kinetics recommends addition of one quart of 8-Way Boiler Treatment per 30 gallons system water. 8-Way Boiler Treatment is recommended to treat water up to medium hardness. Call Energy Kinetics for more details about boiler water treatment and about hard water conditions.

ANTI-FREEZE

Only non-toxic antifreeze (such as Propylene Glycol) should be used if adding anti-freeze to a system that produces domestic hot water. Hard water should not be used in combination with generic antifreeze. Energy Kinetics supplies a quality inhibited Propylene Glycol anti-freeze with orange dye and an antifoam agent. 8-Way Boiler Treatment can be added to Energy Kinetics anti-freeze and is recommended in areas of medium water hardness. **NOTICE: Thoroughly clean system prior to adding antifreeze.** TSP is recommended for removing flux and other oil based compounds. Once system has been cleaned and flushed, then add antifreeze to obtain approximately a 30% by volume mixture of antifreeze in water. Call Energy Kinetics for assistance in calculating how much anti-freeze to add to system.

WINTERIZING

NOTICE: If the SYSTEM 2000 Boiler may be exposed to freezing temperatures, then anti-freeze should be added. When a property is winterized by draining all domestic water piping, then the SYSTEM 2000 Boiler must be protected. It is not recommended to drain the SYSTEM 2000 Boiler, because introducing air into the boiler can cause rusting inside the boiler shell and also because the Energy Converter has a spiral water passage that cannot be completely drained of water. When draining the domestic water piping system, be sure to drain the domestic side of the plate heat exchanger. If the hydronic system will not be drained, then add enough anti-freeze to protect the entire hydronic system including the boiler, piping, radiation, circulators, etc. If the hydronic system will be drained, then add shut off valves to isolate the boiler and add anti-freeze to the boiler only, as follows. Drain water from the boiler and then add anti-freeze to the boiler. Refill boiler with water and run boiler circulator through the bypass to distribute antifreeze within boiler. Propylene Glycol in water will provide the following freeze protection: 30% down to

+8F, 40% to -8F, and 50% to -27F. Energy Kinetics recommends using 30% anti-freeze to obtain the best boiler performance. Use over 30% anti-freeze only if lower temperature freeze protection is mandatory.

Caution: Always keep the fuel supply valve shut off if the burner is shut down for an extended period of time.

PIPING and WIRING DIAGRAMS

All piping and threaded accessory connections should follow good practice using approved joint sealants.

Use Energy Kinetics Smart Thread Sealant P/N 10-0620

Energy manager

The Energy manager controls one or more zones directly off the boiler and benefit from the Energy manager's energy recovery cycle, such as for large load with multiple zones (5 & 15 zone versions of the Energy manager are available), primary/secondary injection with multiple boilers, or as a dedicated hot water maker. The Energy manager has built in condensing protection. Tekmar multiple boiler controls are recommended, for 2, 4, 9, or more boilers.

For piping and wiring boilers with a **Energy manager and single zone injection**, refer to drawing SYS-08-019. This drawing shows the factory wiring of the Energy manager boiler.

For piping and wiring boilers with an **Energy manager with heat, domestic hot water and injection**, refer to drawing SYS-08-020. The factory wiring must be field modified per this drawing. The blue leads from the 24V relay mounted to the system junction box must be moved. One from Z1 lug to the Circ lug and the other one wired in parallel with the zone valve end switches which are fed from the 24VAC lug.

For piping and wiring boilers with an **Energy manager with heat and domestic hot water**, refer to drawing SYS-08-021. The factory wiring must be field modified per this drawing. The blue leads from the 24V relay mounted to the system junction box must be moved. One from Z1 lug to the Circ lug and the other one wired in parallel with the zone valve end switches which are fed from the 24VAC lug.

For piping and pipe sizing of Primary/Secondary Loops, refer to drawing SYS-04-019.

NOTE: When zoning with zone valves, make sure the piping/wiring configuration prevents "dead-heading" of the 0012 system circulator. Four wire zone valves as shown in drawings SYS-08-020 and 08-021 use end switches to pull in a relay that starts the system circulator after the zone valve has opened. A bypass installed on the end of the supply and return headers that is adjusted by a ball valve allows 2 wire zone valves to be used as shown in drawing SYS-08-023.

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, 15 Amperes

System 2000 requires 120 VAC. The supply voltage must be within 108 VAC min / 132 VAC max for reliable operation of the boiler and the Manager. An easy way to check the supply voltage is to plug a voltmeter in at the service outlet located on the side of the system junction box.

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

Connect power from a separate 15 AMP fused circuit. Install 3rd wire grounding for proper bond between all electrical accessories. The system switch is included so power can be shut off at the unit for servicing.

Pigtails are provided for the line voltage power connection. Connect black pigtail to hot, white pigtail to neutral, and the green pigtail to ground.

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. A manual reset low water cut-off is factory installed by Energy Kinetics, either as a standalone control, or integrated in the DualGard 2450-3

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. Verify that proper gas orifice size is used.
4. Verify electrode and flame sense rod settings.
5. Verify the burner settings for air band position. (see "Gas Burner Settings" Table).
6. Gas supply is connected to burner. Gas supply lines and shut-off valves are open.
7. Gas lines are purged.
8. Verify operating gas pressure at inlet of gas valve.
9. Flue pipe properly connected from unit to chimney. All joints are secured and sealed.
10. Combustion air supply is available and sufficient. (See "Combustion Air")
11. Punch a 1/4" sampling hole in flue pipe as near to unit as possible in flue outlet and loosen 1/8" plug in front jacket (to right of burner) for use as the overfire sampling location.

START UP PROCEDURE

Turn on system supply switch and burner supply switch. The Energy manager lights should come on briefly, the circulator relay should close briefly, and then the Energy manager should only show one red light next to 'power'.

1. Adjust a thermostat to call for heat. Burner and main circulator should come on at the same time. If not, check primary control and reset it if necessary.
2. Check for burner light off. If gas piping is not well purged, then several starts may be required to clear air from gas piping.
3. On light off, water temperature and chimney temperature will start to rise. A slight odor is common on initial light off as combustion chamber and converter surfaces warm for the first time.
4. **NOTICE:** Perform carbon monoxide test immediately after light off. If the carbon monoxide exceeds 400 ppm *air-free* after one minute of operation, shut off boiler immediately and repeat "Prepare for Start Up" checklist. (See "Air-free method of measuring CO")
5. Once the boiler heats up and reaches temperature, Energy manager "Heating" light will signal heat distribution to zone(s) calling for heat.
6. Allow system to run about 15 minutes before testing and recording burner operation. (See "Gas Burner Operation")

The AIR-FREE METHOD OF MEASURING CO

Air-free measurement of CO takes account of the amount of excess air by incorporating an adjustment to the as-measured ppm value, thus simulating air-free (oxygen-free) conditions in the combustion gases. To do this, a reading of oxygen (O₂) or carbon dioxide (CO₂) percentage is taken from the combustion gases along with the as-measured CO reading. This can be done with a meter having the capability of measuring CO *and* O₂ or CO₂ percentage, or it can be done with two different meters, one measuring CO ppm and one measuring O₂ or CO₂ percentage.

If air-free CO is determined with a single meter, an integral electronic chip calculates the air-free level from as-measured CO ppm and O₂ percentage.

If two meters are used, the equations below can be used to determine the air-free level of CO in a combustion gas sample. For natural gas or propane, using as-measured CO ppm and O₂ percentage:

$$CO_{AFppm} = \left(\frac{20.9}{20.9 - O_2} \right) \times CO_{ppm}$$

For propane, using measured CO ppm and CO₂ percentage:

$$CO_{AFppm} = \left(\frac{14}{CO_2} \right) \times CO_{ppm}$$

For natural gas, using measured CO ppm and CO₂ percentage:

$$CO_{AFppm} = \left(\frac{12.2}{CO_2} \right) \times CO_{ppm}$$

Where:

CO_{AFppm} = Carbon monoxide, air-free ppm

CO_{ppm} = As-measured combustion gas carbon monoxide ppm

O₂ = Percentage of oxygen in combustion gas, as a percentage

CO₂ = Percentage of carbon dioxide in combustion gas, as a percentage.

GAS BURNER OPERATION

NOTICE: For reliable operation, set Air-Fuel mixture conservatively based on installation conditions. Carbon dioxide, Oxygen, and Carbon Monoxide readings should be taken through 1/4" test port in front jacket opening just to right of burner (see FIG. 5A). Sample tube must extend at least six (6) inches into front cover to obtain accurate readings. A test port is provided for the flue box (see FIG. 5A) to measure draft loss.

NOTICE: For accurate efficiency calculations, measure flue gas temperature in flue pipe at flue outlet. Flue box and over fire temperatures may be higher than flue gas temperature measured in the flue pipe.

Note: When Air Box is used, CO₂/O₂ must be checked with air box cover in place.

AFTER 15 MINUTES RUNNING, CHECK AND RECORD:

- | | | |
|-------------------------------------|---|---|
| 1. DRAFT AT OVER FIRE/CHIMNEY | -0.02" w.c minimum | 2 |
| 2. O ₂ | | |
| LP Gas..... | 3.0% to 4.5% | |
| Natural Gas..... | 3.0% to 4.5% | |
| 3. STACK TEMPERATURE | 350° to 450° F | |
| 4. CO TEST..... | Must be less than 400 ppm <i>air-free</i> | |

Draft over fire with a chimney should be -0.02" to -0.12" w.c.

If not, recheck chimney, chimney base and flue pipe for blockage or clean out door openings.

1. **DANGER:** Verify proper operation of the automatic reset high limit aquastat:
 - a. Remove all heat and hot water calls (No input lights on left side of manager).
 - b. Turn System switch off, then remove red sensor lead from the left side quick connect.
 - c. Restore power. "E100 Sensor Err" will display on the Energy Manager, and the burner should start momentarily.
 - d. At approximately 205° F to 215° F, the high limit aquastat should shut off burner.
2. **DANGER:** Verify proper operation of the manual reset high limit aquastat:
 - a. Remove all heat and hot water calls (No input lights on left side of manager).
 - b. Turn System switch off, then remove red sensor lead from the left side quick connect.
 - c. Change the manual reset high limit aquastat from 220° F down to 200° F
 - c. Restore power. "E100 Sensor Err" will display on the Energy Manager, and the burner should start momentarily.
 - d. At approximately 190° F to 200° F, the manual reset high limit aquastat should shut off burner.
 - e. Turn off power, reset the aquastat to 220° F and reconnect the red sensor lead.
3. **DANGER:** Verify proper operation of Low Water Cut-Off: Press and hold the Test/Reset button for 5 seconds (30 seconds for manual reset). The display will read LCO. The red Low Water light should illuminate and the LWC circuit will de-energize.
4. **DANGER:** Verify proper operation of boiler pressure relief valve by following instructions on pressure relief valve, which calls for a 'try lever test'. Make sure discharge pipe is properly placed to safely contain discharge and open relief valve using the try lever.
5. **NOTICE:** Check that each thermostat operates proper zone.
6. Verify flame failure lockout of Carlin 60200FR burner control
 - a. Install a hose barb fitting in the gas train manifold pressure tap and connect with a hose to a U-tube manometer.
 - b. Close the main manual gas valve and turn the combination gas valve knob to ON.
 - c. Turn on power to System 2000 boiler and adjust a thermostat to call for heat.
 - d. Burner motor will start. The burner control will run the burner motor for 30 seconds (pre-purge), and then start the ignitor. Approximately one second later, the gas valve will open. (The manometer should show low (about 1" w.c.) pressure, because the main manual gas valve is closed.)
 - e. After the end of the Trial For Ignition period, the burner control will lockout and turn on the red LED. The ignitor will shut off and the gas valve will close. Turn off power and adjust the thermostat to stop the call for heat.
 - f. If lockout does not occur, replace the burner control.

Energy Manager Use the Energy Manager control with one or more zones directly off the boiler is needed and benefit from the Energy Manager energy recovery cycle, such as for large load with multiple zones (5 10 & 15 zone versions of the Energy Manager are available), primary/secondary injection (5 10 & 15 zone ERC Controls are available) with multiple boilers, or as a dedicated hot water maker. The Energy Manager has built in condensing protection. Tekmar multiple boiler controls are recommended, for 2 or more boilers.

For piping and wiring boilers with a **Energy Manager and single zone injection**, refer to drawing SYS-08-019. This drawing shows the factory wiring of the Energy Manager boiler.

For piping and wiring boilers with a **Energy Manager with heat, domestic hot water and injection**, refer to drawing SYS-08-020. The factory wiring must be field modified per this drawing. The blue leads from the 24V relay mounted to the system junction box must be moved. One from Z1 lug to the Circ lug and the other one wired in parallel with the zone valve end switches which are fed from the 24VAC lug.

For piping and wiring boilers with a **Energy Manager with heat and domestic hot water**, refer to drawing SYS-08-021. The factory wiring must be field modified per this drawing. The blue leads from the 24V relay mounted to the system junction box must be moved. One from Z1 lug to the Circ lug and the other one wired in parallel with the zone valve end switches which are fed from the 24VAC lug.

For piping and pipe sizing of Primary/Secondary Loops, refer to drawing SYS-04-019.

NOTE: When zoning with zone valves, make sure the piping/wiring configuration prevents “dead-heading” of the 0012 system circulator. Four wire zone valves as shown in drawings SYS-08-020 and 08-021 use end switches to pull in a relay that starts the system circulator after the valve has opened. A bypass installed on the end of the supply and return headers that is adjusted by a ball valve allows 2 wire zone valves to be used as shown in drawing SYS-08-023.

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. All wiring for installations in Canada must be done in accordance with the Canadian Electrical Code, Part I.

ELECTRICAL CONNECTION - LINE VOLTAGE

POWER SUPPLY: 120 VOLT 60 HZ, 15 Amperes

System 2000 requires 120 VAC. The supply voltage must be within 108 VAC min / 132 VAC max for reliable operation of the boiler and the Manager. An easy way to check the supply voltage is to plug a voltmeter in at the service outlet located on the side of the system junction box.

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

Connect power from a separate 15 AMP fused circuit. Install 3rd wire grounding for proper bond between all electrical accessories. The system switch is included so power can be shut off at the unit for servicing.

Pigtails are provided for the line voltage power connection. Connect black pigtail to hot, white pigtail to neutral, and the green pigtail to ground.

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. A manual reset low water cut-off is factory installed by Energy Kinetics, either as a standalone control, or integrated in the DualGard 2450-3.

PREPARE FOR START UP

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

12. The boiler and piping are completely filled with water.
13. Re-check wiring to ensure that it is correct and in accordance with appropriate wiring diagrams and codes.
14. Verify that proper orifice is used and installed correctly.
15. Verify electrode settings.
16. Verify the burner settings for air band position and head position (*see "Gas Burner Settings" Table*).
17. Gas supply is connected to burner. Gas supply lines and shut-off valves are open.
18. Fuel pump and fuel lines are purged.
19. Verify operating oil pressure at gauge port.
20. Flue pipe properly connected from unit to chimney. All joints are secured and sealed.
21. Combustion air supply is available and sufficient. (*See "Combustion Air"*)
22. Adjust valve in domestic hot water circuit under circulator approximately $\frac{3}{4}$ of the way open.
23. Punch a $\frac{1}{4}$ " sampling hole in flue pipe as near to unit as possible in flue outlet for flue gas temperature and loosen 1/8" NPT hex plug in front jacket (to right of burner) for the over fire sampling location.
24. **CAUTION:** All covers, enclosures, and guards must be maintained in place at all times, except during maintenance and servicing.
25. **CAUTION:** Do not start burner unless the front door is closed and the nuts have been properly tightened.

ENERGY MANAGER

Install Energy Manager

The Energy Manager is shipped in its own protective shipping box. **NOTICE:** The option switches can be set very easily before the Manager is installed. Locate the prewired quick connectors fastened to the front of the junction box by two cable ties. Cut the two cable ties and discard. Fasten the Energy Manager to the junction box with the four corner screws. Slide the two quick connectors onto the Energy Manager. Label each zone on the manager, using the adhesive labels supplied.

Low Voltage Wiring

Energy Manager Operates Only On 24 Volts 60 HZ Power

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

Typical low voltage wiring diagrams for the Energy Manager are shown along with piping schematics near the back of this manual (refer to table of contents). 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 "hot water"). 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 Energy 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 Energy Manager is designed to heat domestic water and up to four (4) heating zones. Use Energy Kinetics supplied zone valves with four wire connections. For more than four heating zones, use Energy Kinetics expanded 10 or 15 zone Energy Manager, or call Energy Kinetics for alternatives.

START UP PROCEDURE

7. Turn on system supply switch and burner supply switch. The Energy Manager lights should come on briefly, the circulator relay should close briefly, and then the Energy Manager should only show one red light next to 'power'.
8. The hot water tank aquastat should call for heat, if not, adjust a thermostat to call for heat. Burner and bypass circulator should come on at the same time. If not, check primary control and reset it if necessary.
9. Check for burner light off. Purge gas line and bleed out air using safe industry practice.
10. On light off, water temperature and chimney temperature will start to rise. A slight odor is common on initial light off as combustion flame former and converter surfaces warm for the first time.
11. **NOTICE:** Perform smoke test immediately after light off. Smoke test should show yellow after initial one minute of operation due to the combustion flame former sizing heating up. If the smoke test shows dark grey or black after one minute of operation, shut off boiler immediately and repeat "Prepare for Start Up" checklist.
12. As Unit reaches temperature, Energy 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.) 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.
13. Allow system to run about 15 minutes before testing and recording burner operation. (*See "Oil Burner Operation"*)
14. **CAUTION:** Do not attempt to start the burner when excess oil has accumulated, when the unit is full of vapor, or when the combustion flame former is very hot.
15. **CAUTION:** NEVER BURN GARBAGE OR PAPER IN THE UNIT, AND NEVER LEAVE COMBUSTIBLE MATERIAL AROUND IT.

INSTALL ENERGY MANAGER

The Energy Manager is shipped in its own protective shipping box. **NOTICE:** The option switches can be set very easily before the Manager is installed. Locate the pre-wired quick connectors fastened to the front of the junction box by two cable ties. Cut the two cable ties and discard. Fasten the Energy Manager to the junction box with the four corner screws. Slide the two quick connectors onto the Energy Manager. Label each zone on the manager, using the adhesive labels supplied.

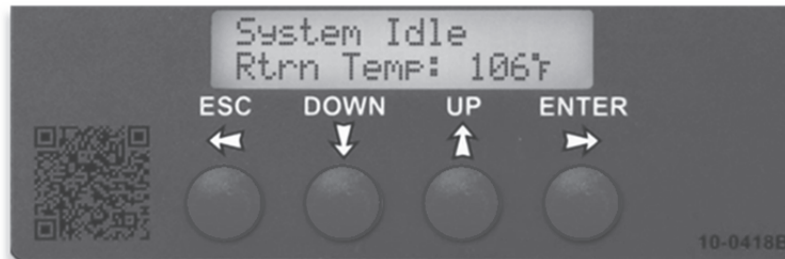
Five Zone Display Manager

The **Display Manager** is an **Energy Manager** that is equipped with an *LCD display*, and four *pushbutton keys*. With the exception of the Fuel Type (oil/gas) and Venting (chimney/inducer) options, all setup options are selected through *option screens* via the *display* and *keys*. The Fuel Type and Venting options can be viewed, but not set, in the *option screens*. These two options can only be set using the physical dip switches on the bottom of the Manager board.

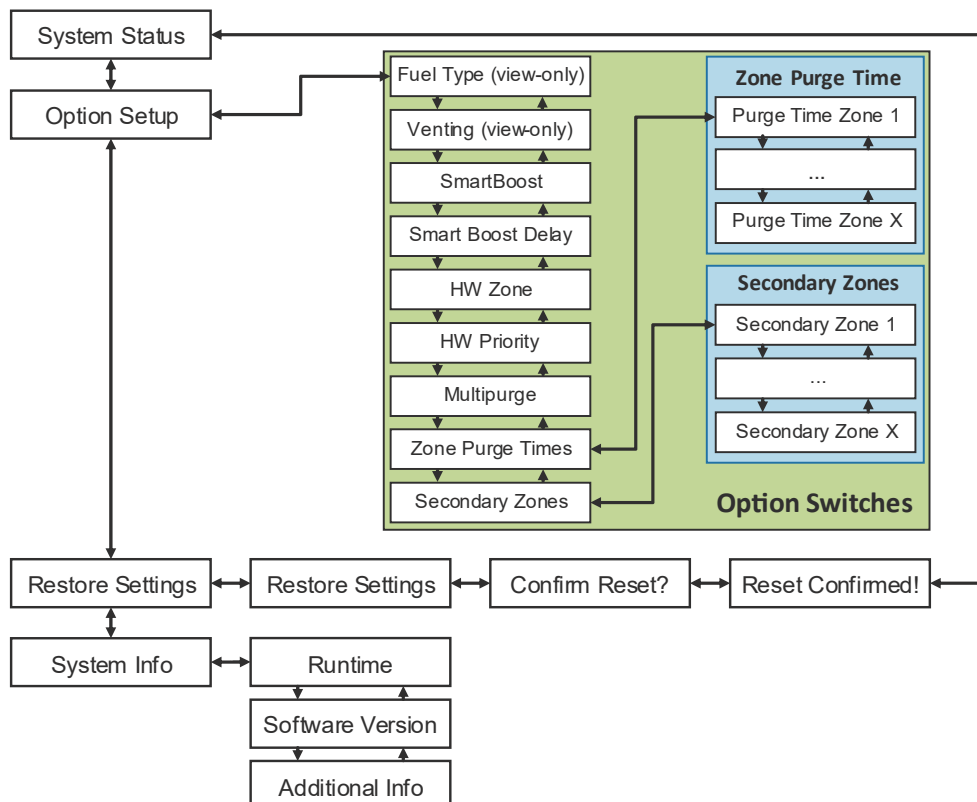
- To access the *option screens*, you must first ensure the manager is powered; if the manager is powered, the blue “PWR” LED will be on. If the blue LED is on, but the screen is not illuminated, press any *key* to wake the *display*.
- Use the UP/DOWN *keys* to view additional *menu screens*. Use the ENTER/ESC *keys* to enter/exit *submenus*. The ENTER *key* is also used to change *options* from the *option screens*.

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.



Setting features are self-guided through on-screen prompts



Dip Switch Settings

Set dip switches for Fuel type: Oil or Gas and Vent type: Chimney or Inducer

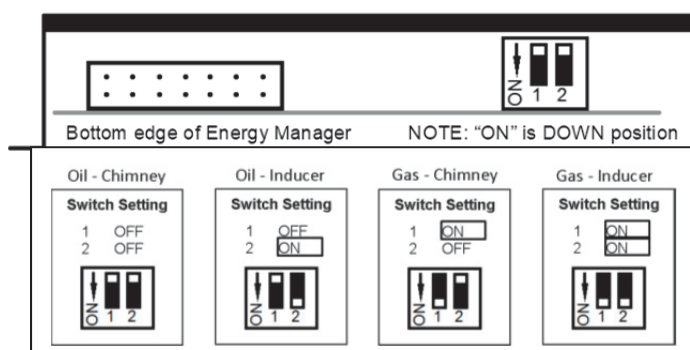


Figure 4B

Display Manager Option Menu Descriptions

Fuel Type - VIEW-ONLY. Must be set using physical dip switch on bottom of Manager Board

This menu can be used to **view** the setting of physical dip switch one, which determines the Fuel Type setting.

Venting - VIEW-ONLY. Must be set using physical dip switch on bottom of Manager Board

This menu can be used to **view** the setting of physical dip switch two, which determines the Venting setting.

SmartBoost™ - Default setting is OFF

This option turns the SmartBoost function ON or OFF. While ON, if a zone has been calling for heat for 25 minutes (optionally 45 minutes), then SmartBoost kicks in to help satisfy that zone sooner by boosting the maximum return temperature to be 190°F/175°F from the standard 170°F/155°F. The boosted zone will stay at the 190°F/175°F setting for up to 25 minutes after the call is satisfied.

SmartBoost™ Delay - Default setting is 25 Minutes

This option sets the delay to either 25 minute or 45 minutes before SmartBoost raises the maximum return temperature to be 190°F/175°F. This option only impacts boiler operation if SmartBoost is ON.

HW Zone - Default setting is Hot Water

This option will allow the hot water zone to be turned into a heating zone. While this option is set to Heating, the "Hot Water Zone" will act as a heating zone with 20 minutes of thermal purge. This change will allow the hot water zone to become a fifth heating zone, for those cases where domestic hot water isn't required.

HW Priority - Default setting is NO

This option allows the Hot Water Zone to have priority over heating calls for 20 minutes. While this option is set to YES, the Energy Manager will ignore heating calls to the system for the first 20 minutes of a hot water call. After 20 minutes, or when the hot water call is satisfied, the system will resume providing heat to the rest of the zones.

MultiPurge™ - Default setting is OFF

This option turns the Multipurge function ON or OFF. While ON, any zones finishing in the prior 20 minute period will purge with the last zone satisfied. Setting the Purge Time for a given zone to 5 minutes prevents that zone from multi-purging.

Zone Purge Times - Default setting for each zone is 20 Minutes

This option sets either a 20 minute or 5 minute purge time for heating zones. After all zone calls have been satisfied, there may still be heat remaining in the boiler. Instead of wasting that remaining heat, the Energy Manager will keep the last calling zone (or zones, if Multipurge is ON) open to allow the heat to be purged out of the boiler and into the system. The user is able to choose to let the boiler purge for either 5 minutes or 20 minutes before closing the zone. Any zone set to 5 minutes will also have Multipurge disabled for that zone. Regardless of the selected option, the Energy Manager will always end purging and close the zone when the return temperature has dropped sufficiently.

The following types of zones are recommended to have a 5 minute purge time.

- AIR HANDLER / FAN COIL
- VERY SMALL ZONE (like an individual bathroom)
- RADIANT ZONE with STORAGE TANK

Secondary Zones - Default setting for each zone is OFF

This option allows for primary/secondary operation. If any secondary zone is enabled, the manager will assume that zone 3 controls the injection zone (IZ) and zone 4 controls the loop circulator (LC). Any zone that gets a call while set as a secondary zone will also activate the IZ and LC, when needed. Thermostats connect to zone 1 (T1) and zone 2 (T2). If the hot water zone is set as a heating zone, the HWZ will also be displayed under the Secondary Zones options.

INSTALLATION TIPS

• Dip Switches "OFF"

Display Managers are shipped with both *dip switches* "OFF" (set for an oil system with a chimney).

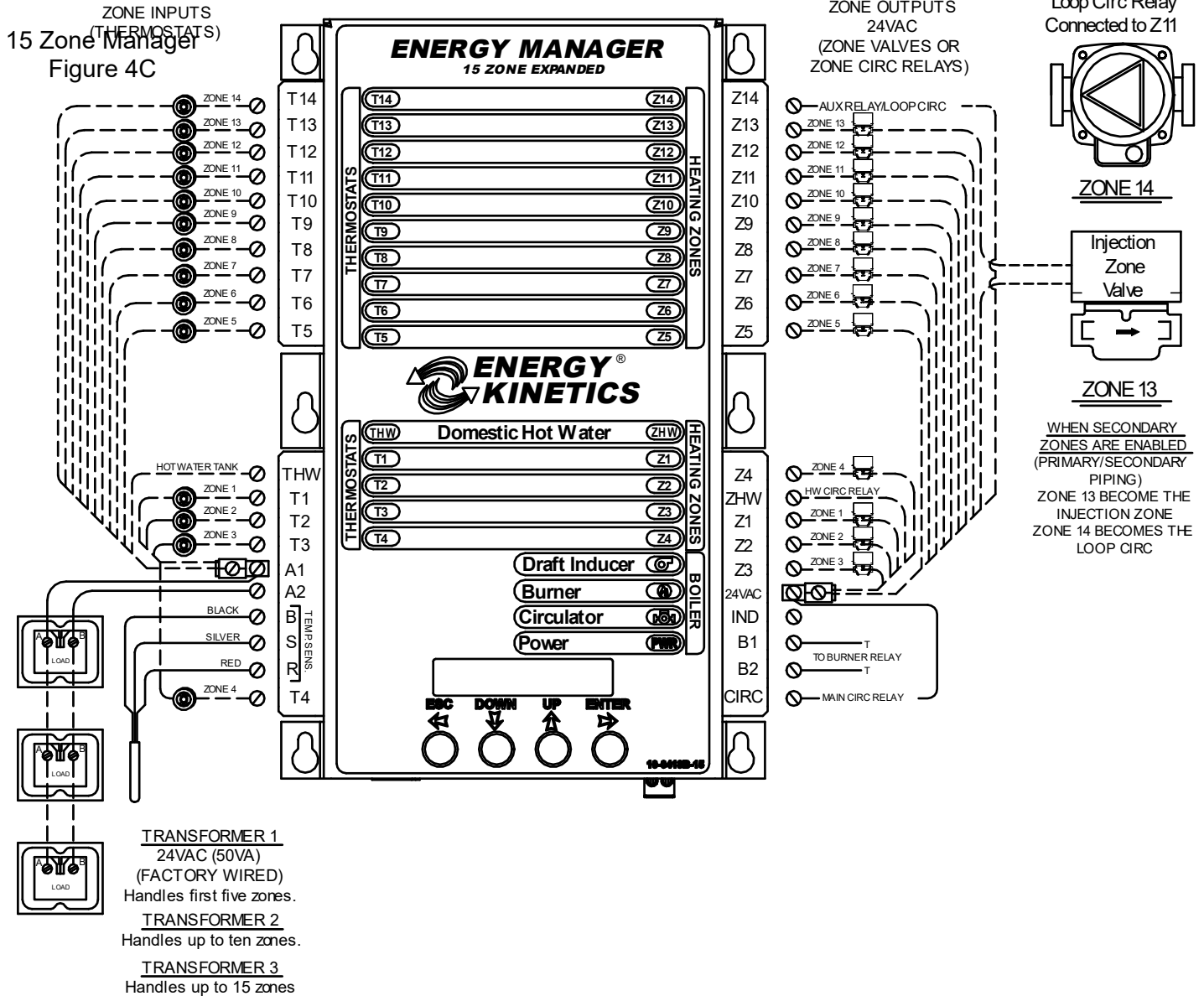
• Burner Restart

Thermostat short cycle protection is 25 seconds

• Manager Reset

Shutting the power off momentarily and then back on again resets the manager from the short-cycle delay or an error condition.

EXPANDED ENERGY MANAGER

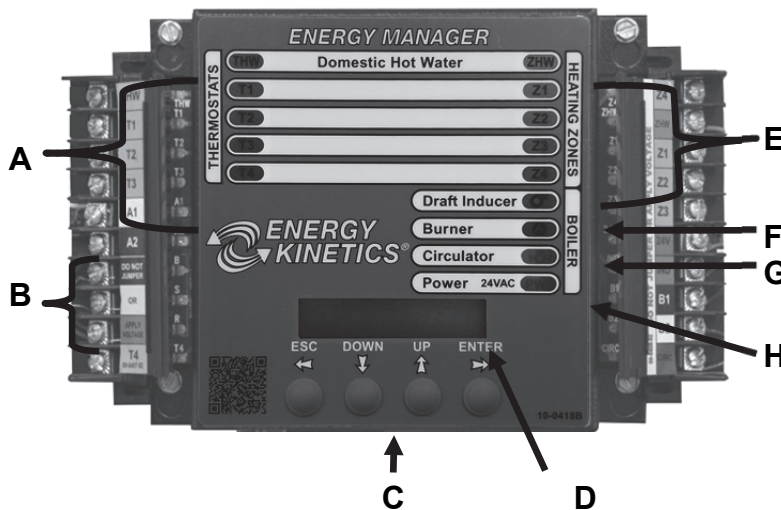


15 ZONE MANAGER INSTALLATION INSTRUCTIONS

- Remove cover from junction box.
Use a free knockout on the top of the junction box to mount a second or third transformer, wire black lead to "XFMR" and white lead to "NEUTRAL" on relay board in box. (Use sections marked "120 VOLTS" only.) A second junction box is not needed for the expanded Energy Manager. Wire additional transformer(s) in parallel with first transformer. To wire in parallel, wire terminal "A" on one transformer to "A" on the other. Repeat with other low voltage terminal "B". Verify 24VAC output from all transformers BEFORE reconnecting the Manager.
- Mount long panel on top of box cover with long screws provided in lower 4 holes with spacers down.
- Mount expanded Energy Manager to cover plate over 4 long screws and 2 wide bolts (top 2 holes).
- Wire the bottom half of expanded manager as 5 zones Energy Manager. For top half, attach one thermostat lead to a zone and the other to A1 on lower half of manager. Attach one lead from zone valve or relay to corresponding zone output and the other lead to 24VAC on lower half.
- Option switches set fuel type (oil or gas) and venting (chimney or power vented).
See Location of Switches: **Figure 4B**.
- NOTE:** When using secondary zones with 15-zone manager, zone 13 controls injection zone, and zone 14 controls loop circulator.

NOTICE: When operating without an expanded manager, use a 5 zone service board for the lower half. If you do not have a service board, refer to "Operation of Boilers without Energy Manager" in the Tech Manual.

Energy Manager Operation



WARNING: Do Not Jump!

If you apply 24VAC to any Energy sensor lead with the sensor connected to the Manager, you will burn out both the sensor and the Manager in less than a second.

NOTE: The Manager cannot lockout the primary control on the burner. The E140 error code will usually indicate that a burner lockout has occurred.

Testing Manager Lights: To confirm operation of the Manager lights, turn power off briefly and power up the Manager. On startup, all output lights will turn on for a brief moment and LCD back light is turned on.

A) Thermostat Lights:

Indicate a thermostat calling for heat. If all lights are OFF, the burner will not run because there is no call for heat. T₄ is located on the bottom. SET HEAT ANTICIPATORS FOR 0.1 AMPS. There is a 25 second delay to prevent thermostat short cycling.

B) Return Temperature Thermistor:

Senses return temperature and is required for manager to work properly. If the thermistor has failed, the E100 error code is displayed for the first ten minutes. After ten minutes, the manager switches to and displays E190 error code (Classic Mode). Disconnecting the RED lead will cause the manager to run in these modes also.

C) Option Switches:

Set option switch 1 to **ON** for systems with a gas burner. Set option switch 2 to **ON** for sidewall vent systems.

D) LCD Display:

Displays boiler RETURN temperature, not supply temperature.

- The Manager is the **operating aquastat** and will turn off the burner if **return** temperature reaches 170°F (operating limit).
- The zone outputs will open when the return temperature is above 140°F and close zone outputs when the return temperature drops below 120°F. If a new zone calls when the returns are below 140°F the new zone will not open until the temperature exceeds 140°F (even if other zones are open).
- The boiler will typically take about 2 minutes to reach 140°F from a cold start.

When the Manager is working properly and has found a condition that needs service, the E100, E130, E140, E150 or E190 error codes will be displayed along with a description of what the error code means. See page 27.

E) Heating or Zone Lights:

Indicate 24-volt power from 24VAC to Z_X (Z_{HW}, Z₁, Z₂, Z₃, and Z₄). This provides power to 24-volt zone valves or zone circulator relays. **NEVER JUMPER THIS CONNECTION!**

F) Inducer Light On:

Indicates 24 volts from IND to 24VAC. This pulls in the 24-volt coil on the inducer relay, providing 120-volts to the power vent. *This will only operate with option switch 2 ON.*

G) Burner Light On:

Indicates a closed contact between B₁ to B₂. This is wired to T-T on the burner primary control.

H) Circulator Light:

On indicates 24 volts from manager CIRC to manager 24VAC. This pulls in the 24-volt coil on the Burner/Main circulator relay, providing 120-volt power to both the main circulator and the burner.

Energy Manager Check

Troubleshooting

The burner will not run unless there is a call for heat (thermostat call) or a call for domestic hot water (tank aquastat).

Note: Do NOT Jumper Connections or Apply Voltage to Test the Manager.

Follow these simple steps:

1. Look at the Manager
2. See what it is telling you is supposed to be happening.
3. See if it is happening, and if it is not, find out why (see below).
4. If you do not find the problem, perform the 2 Minute Energy Manager Diagnostic to check all Manager functions.

These are the thermostat input lights. These lights indicate when a thermostat is calling and only come on when there is an external connection.

- If the light is not ON, check the thermostat and thermostat wiring.
- If the light is ON, the thermostat is calling.

These are zone output lights.

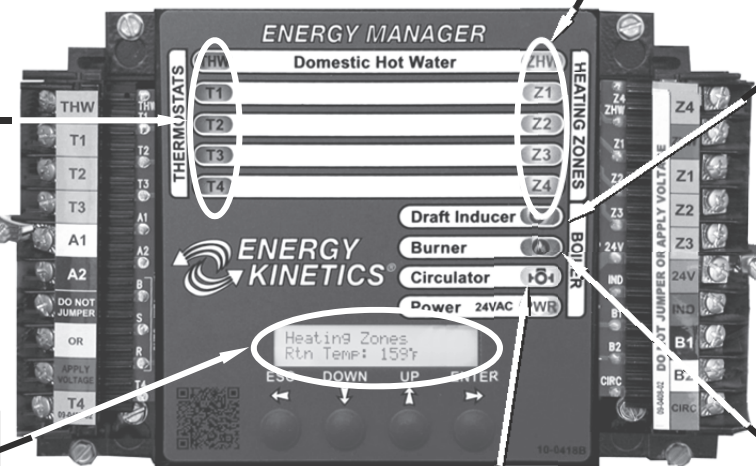
- If the light is ON, the zone valve should be open. For hot water, the bronze circulator should be running.
- If zone valve is not open with the light on, check the zone valve and zone valve wiring. For hot water, check the hot water relay, wiring, and the bronze circulator.

This is the power vent inducer output. This light should only operate if dip switch 2 is on.

- If the light is ON, the inducer should be running.
- If the light is on and the inducer is not running, check the inducer, wiring, and inducer relay and wiring.

This is the LCD display.

- If no alerts are present, the display will show the *operation mode* and the *return temperature*.
- If an alert is detected, it will be displayed here, along with brief diagnostic or informational details.



**INPUT SIDE
(Thermostats)**

**OUTPUT SIDE
(Heating Zones)**

This is the burner/main circulator output. This light indicates 24 volts is applied to the burner/main circulator relay coil.

- If the light is ON, the main circulator will be running, and the burner primary control should have line voltage.
- If the light is on and the circulator is not running, check the burner/main circulator relay, the circulator, and associated wiring.

This is the burner output. This light indicates T-T is made on the burner.

- If the light is ON, the burner should be running.
- If the light is on and the burner is not running, check the burner, limit aquastat, wiring, burner/main circulator relay, and burner service switch.

Remember:

- 1) Most 'no heat' problems are not caused by the Manager.
- 2) The Manager cannot cause a burner lockout.

2-Minute Energy Manager Diagnostic

Most no-heat problems are not caused by the manager. Perform this test to prove proper manager function. Do NOT replace the manager if it functions properly in these tests.

The manager cannot cause a burner lockout.

Step 1:

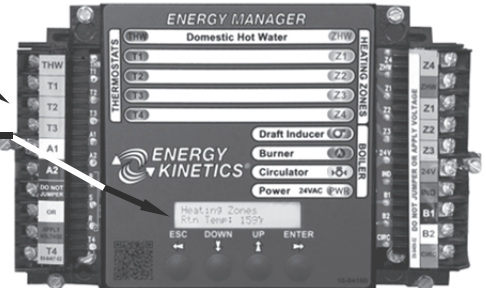
Make sure you have no thermostat calls (turn thermostats down or disconnect after labeling zones).

Step 2:

Turn Service Switch OFF for 5 seconds.
Turn Service Switch ON while carefully observing the display.
The display should briefly show "Startup Selftest", before changing to show the manager mode and return temperature.
The BLUE power light will remain ON whenever the board is powered.*

This proves the following:

- The display works
- The board is able to detect the board type and mode
- The processor is functioning properly

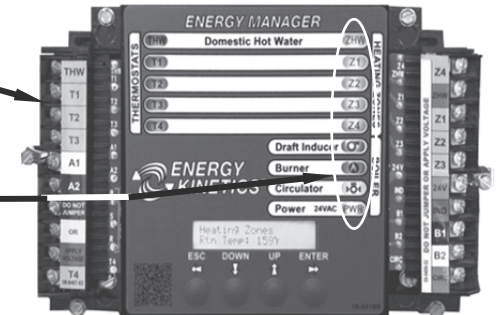


Step 3:

Turn Service Switch OFF for 5 seconds.
Turn Service Switch ON while carefully observing the output lights. The output lights should all turn on for about a second, and then turn OFF.
The BLUE power light will remain ON whenever the board is powered.*

This proves the following:

- All the output lights work
- 24 VAC should be present
- The processor is functioning properly (second verification)



*If you observe problems in step 2 or step 3, turn Burner Service Switch OFF, disconnect the right hand (output) quick-connector and repeat steps 1, 2, and 3. If problem persists, call technical support or replace manager. Note malfunction on warranty tag and return manager to Energy Kinetics. If problem goes away, there is a problem with the output wiring – check all wiring, re-connect quick-connector and repeat steps 1, 2 and 3 until problem is resolved.

You're done. The manager is functioning properly. Remember to reset thermostats to original set point, to re-connect wiring connections, connect the quick-connector and to turn the Service Switch ON

Additional Manager Tests

*Perform the following tests **ONLY** if you have any of the following:*

Case 1) Zones heating intermittently

*Case 2) E140 or E150 displayed **WITHOUT** a burner lockout*

Case 3) E100 or E190 displayed

If you have a burner lockout, troubleshoot as any conventional burner lockout.

Case 1: Zones heating intermittently

Step 1: Have all connected thermostats including hot water aquastat call continuously for at least 10 minutes. Service Switch must be ON. Turn burner switch off to prevent zone overheating and to maintain thermostat calls continuously.

Step 2: Observe thermostat Lights.

- If any thermostat input lights (left side) are not ON, check wiring and thermostats.
- If thermostat input light (left side) is OFF within 10 minutes, and with thermostat call present, thermostat input LED is bad. **Solution:** Move thermostat wire lead and zone valve wire lead to a different zone or replace manager.

Case 2: E140 or E150 alert without burner lockout

Step 1: Turn service switch OFF and disconnect right hand (output) quick-connector.

Step 2: Using a multi-meter, check the resistance from B1 to B2 on the manager solder strips. This will be an open circuit (infinite resistance).

Step 3: Turn service switch ON and start a thermostat call while observing the resistance from B1 to B2. Burner light should come on.

- If resistance is less than 3 ohms, manager is functioning properly. Look elsewhere for a problem.
- If resistance is greater than 3 ohms after 3 seconds of operation, B1-B2 contact is bad. **Solution:** Replace manager.

Case 3: E100 or E190 alert without burner lockout

Step 1: Check the sensor wiring and quick-connectors to ensure proper contact. To improve contact, remove and squeeze the plastic quick connect at all terminals with flat pliers so the gap just closes.

Step 2: Replace sensor if no wiring or quick-connector issues are identified.

Display Manager Return Sensor (Thermistor) Testing

The temperature sensor in the return line allows better boiler control, and virtually eliminates condensation caused by cold returns.

The temperature sensor is a thermistor sealed with epoxy inside a stainless steel well. The thermistor communicates continuously with the Manager thousands of times a minute.

The Display Manager is the tester of the display manager thermistor. It verifies that it is connected and working properly, if not, will either say "Sensor Fault, Replace Soon", indicating that one pair is bad or display the E100 or E190 error code.

- *The thermistor can be tested with an ohm meter, at room temp (approx. 77F) it should read ~10K Ohms between the black and red wires and between the white and red wires. As long as one pair is good, the manager will read the correct return temperature but display the "Sensor Fault, Replace Soon" message.*
- *Never connect 24 volts to the black, white or red sensor terminals (labeled B, S, or R.)*
- *A caution: T4 thermostat input is adjacent to R, the red sensor terminal. When making thermostat connections, never do so with power on.*
- *Once firm proper connections have been made, power up.*

WARNING: Do Not Jump!

To test the functioning of each output zone, never apply a jumper to the Energy Manager output terminals. The easiest way to test each zone output is to remove the red sensor lead. The Manager should go into Service Board Mode (E100) for 10 minutes, followed by Classic Manager Mode (E190). Adjust each thermostat to call for heat and the corresponding zone should come on if working properly.

Rule #1: Never use a jumper to test the function of the Energy Manager.

Rule #2: Never use a jumper to test the function of the Return Sensor.

Rule #3: Never use a jumper to test the zones outputs.

Rule #4: Only use a jumper from A1 to the thermostat inputs, if you can't reach the thermostats.

Rule #5: Always carry a Service Board with you.

LINE VOLTAGE RELAYS

Remember that behind the Manager is the junction box with the line voltage relays. The line voltage relays are controlled by the Manager.

The burner and bypass circulator power is controlled by one line voltage relay. If both burner and bypass circulator are without power, check the relay. The main supply (injection) circulator on a boiler with a Energy Manager is powered by a fan relay mounted on the junction box. If the main supply circulator is without power, check the fan relay.

If the domestic hot water circulator does not have power, check the hot water relay.

LINE VOLTAGE

System 2000 requires 120 VAC. The supply voltage must be within 108 VAC min / 132 VAC max for reliable operation of the boiler and the Manager. An easy way to check the supply voltage is to plug a voltmeter in at the service outlet located on the system junction box.

SURGE SUPPRESSION

The Relay Board located in the system junction box is equipped with built-in surge suppression on the 120VAC circuit.

TROUBLESHOOTING with the ENERGY MANAGER

Display Manager Error Codes and Faults

An error code on the display indicates that Display Manager has detected a problem.

- E100:** Temperature sensor is not working properly. This indicates that the Manager is in service board mode. **Circulator and inducer run constantly**, burner runs off the high limit aquastat. All inputs turn on respective outputs. If the sensor is not detected within ten minutes, the Manager will change to E190 mode.
- E190:** After ten minutes in E100 mode the Display Manager switches to E190 mode. This indicates that the Manager is operating in Classic Manager Mode. The boiler will operate as **cold start** instead of maintaining temperature as when in service board mode. When a thermostat calls, the system will **pre-heat** for two minutes before opening the zone output and will **post purge** for whatever the zones max purge time is set.
- Check Sensor wiring. *Check sensor leads for loose connections or damage. If connections and wiring look good, **replace the sensor**.*
- If Manager is left in this mode, set Dual Guard high limit to "Service Mode".
- E130:** Excessive temperature condition. Zones could not extract heat from boiler. *Check zone valves, heat exchanger and boiler circulation. High limit aquastat may not be functioning.*
- E140:** Boiler is in Freeze Protection Mode, Burner light off, Circulator light on, Heating zone outputs on. This means that the boiler return temperature did not increase enough to open zones within 27 minutes.

Does Primary Control need to be reset?

- YES:** Troubleshoot as standard burner lockout.
- NO:** Did homeowner reset control?
- YES:** Troubleshoot as standard burner lockout.
- NO:** Reset Manager. Run through standard heat cycle.

Does boiler return heat up properly?

- NO:** Check circulator. Possible closed or blocked bypass. Look for a zone valve not holding.
- YES:** Intermittent problem. Check low voltage wiring for tightness from Manager through relay board and cad cell relay to TT. Check line voltage at burner, in and out of cad cell relay. Check LWCO, Check limit aquastat for proper operation. See if burner/main circulator relay is properly plugged in and working properly.

- E150:** The return temperature did not reach 100°F after seven minutes. The manager will pulse the output of the calling zone for one minute on and one minute off. If the return increases within 20 minutes, the system will continue to run and supply heat while displaying the E150 code, indicating a boiler side blockage and that the manager is operating in Classic Manager Mode. When a thermostat calls, the system will pre-heat for two minutes before opening the zone output and will post purge for whatever the zone max purge time is set. If after 20 minutes the return does not heat up, the Manager will change to E140 mode.

- Sensor Fault:** On power-up, or display wake-up, the display will briefly show the message: "**Sensor Fault; Replace Soon**". This indicates that one of the two dual thermistors is giving an invalid reading. Check to ensure that all thermistor leads are securely connected and tightened on the left-hand side quick-connect. If the connections are secure, and the message is still displayed on power-up or display wake-up, the thermistor should be replaced.

TO RESET MANAGER

The Manager can be reset to normal operation by turning the system switch off and back on.

- WARNING:** **Do Not Jump!** If you apply 24VAC to any temperature sensor lead with the sensor connected to the Manager, you may instantly burn out both the sensor and the Manager circuit.

OPERATION WITHOUT the ENERGY MANAGER

SERVICE BOARD MODE:

The Display Manager can be placed into “E100 (SERVICE BOARD)/E190 (CLASSIC MANAGER MODE)” by turning off the system switch and removing the RED temperature sensor lead from the left side input connector, and turning power back on. Removing the RED lead is similar to inserting the traditional green “Service Board”. The traditional service board may still be used if desired. E100 (SERVICE BOARD) allows the boiler to run like a conventional boiler for the first ten minutes. After which, it will switch to the E190 (CLASSIC MANAGER MODE). In CLASSIC MANAGER MODE, instead of maintaining temperature, the system will operate as the original “Classic” manager did. The burner will only run during a call for heat and will post purge to the last zone(s) calling based on time instead of temperature and time.

TEMPORARY OPERATION WITH JUMPERS

(With partially functional Manager still in place and without service board)

If a particular function of the Manager fails, use appropriate jumper action below with Manager in place.

BURNER: Jumper BB or TT on burner control. Burner will run on limit whenever Manager calls circulator. The boiler may overheat slightly during energy recovery. Temporarily reset limit aquastat to 165°/180° F.

MAIN CIRCULATOR: Remove blue CIRC lead from right side and connect to A2 on the left side, using an extension lead. The circulator will run constantly and the burner runs on Manager call.

ZONE/HOT WATER CONTROL: Remove zone valve and thermostat leads for zone. Connect a thermostat lead to A1. Connect a zone valve lead to A2. Wire the remaining thermostat and zone valve leads together. Zone valves will open whenever the Thermostat calls but it will not activate manager. If system is active, zone will receive heat when another calls or run system with high limit aquastat set to 165°/180° F and zone will get heat on call.

IF A PLUG-IN RELAY FAILS: Replace with spare relay. If spare is not available, temporarily install a relay with 24VAC coil and 120VAC contacts. Contact Energy Kinetics for connection details.

EMERGENCY HEAT WITHOUT ENERGY MANAGER or RELAY BOARD

(Temporary Operation Only – 5 minute wiring change)

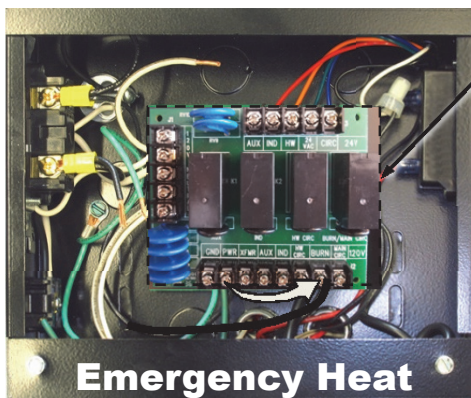
Method A (Heat and Hot Water):

If the relay board is functioning properly, install a service board or follow the wiring instructions in the Owner and Installation Manual to run without a manager.

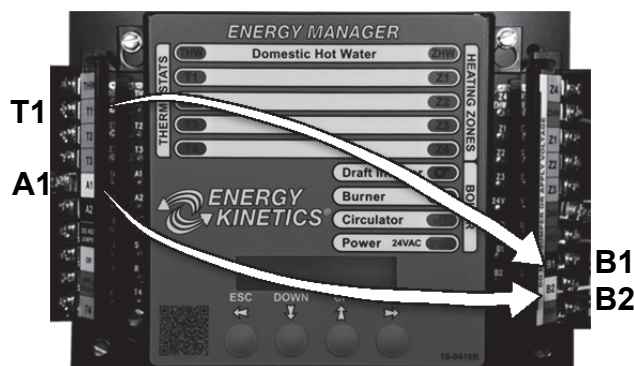
Method B (Heat Only) – Temporarily relocate (3) wires shown by arrows:

- 1) Move the black 120VAC wire from PWR to BURN (shown below).

This will apply power continuously to the main circulator which will circulate water throughout all of the open heating zone valves. The stairway switch may be used to stop the circulator (and inducer if sidewall vented) if desired.



Relay Board



- 2) Select **one** thermostat that will control when the boiler runs to add heat to the house. Move that representative thermostat (T1, T2, T3, or T4) from the left side of the manager to B1. Move the other wire from that thermostat from A1 to B2. *B1 and B2 connect internally to TT on the burner.*
- 3) Turn down the high limit aquastat to 165°F/180°F and test and confirm proper and safe function. *When returning to service, reset high limit to 205°F/215°F.
- 4) Manually open all desired zone valves and close return valve a bit.
There will not be any condensing protection without the manager; closing the return a bit will help limit condensing of flue gases.

NOTE for sidewall vent systems: Add a 120VAC jumper from BURN to IND. This will run the inducer continuously, so caution should be used in systems without antifreeze.

ANNUAL MAINTENANCE

Summary: Each year an efficiency check is recommended as part of basic maintenance. It is recommended that CO, CO₂/O₂, stack temperature, draft at the breech and draft over fire be checked. A draft loss through boiler of .06" to .10" w.c. is normal. If greater, inspect and clean as below. If readings compare favorably with those of the original installation combustion tests, no further cleaning may be required.

Draft Loss Definition: The draft loss through boiler is found by subtracting the overfire draft reading from the breech draft reading. For example, if the breech draft is -0.04" w.c., and overfire draft is +0.02" w.c., then subtracting the two readings gives a draft loss of 0.06" w.c., which is acceptable. If the draft loss exceeds 0.10" w.c., then the boiler may need to be cleaned or there may be some other blockage that will need to be addressed.

1. Check system efficiency and draft loss when you arrive. If it is about the same as the prior year, it is quite certain that not much has changed.
2. Loss in efficiency or excessive draft loss indicates a build up within boiler and the boiler should be cleaned. Also check covers for air leaks if draft loss is high and tighten as needed.
3. **CAUTION: A DUST MASK MUST ALWAYS BE WORN AS A PRECAUTIONARY MEASURE PRIOR TO ACCESSING ANY INTERNAL BOILER SURFACES.**
4. Prior to opening the front door, ensure that power to the boiler is shut off and that all objects that may interfere with the opening door are removed. Shut off the gas supply and disconnect the gas piping. Combustion air piping to the burner must be removed.
5. **OPENING THE BOILER:** To open the boiler, loosen, but do not remove, the two right side nuts. Remove the four 3/8" nuts located at top center, bottom center and middle left.
6. Inspect the front insulation components for any signs of damage. Replace if necessary.
7. Inspect the flue passages and the flue box for accumulations of soot or scale.
8. If passages are clean and there is no sign of scale in the last passage, close door, clean stud threads, and secure tightly.
9. Clean passages only if dirty. Follow the procedure below, otherwise skip to #11.

CLEANING PROCEDURE

- a. **CAUTION: DO NOT TOUCH, SCRAPE, VACUUM, OR MUTILATE THE CERAMIC FLAME FORMER CEMENTED TO THE FRONT LINER BOARD.** The first inner pass should not require any cleaning. Insert vacuum tube into back of bottom passage and then brush outer passages from top of unit to bottom on left and right in each circuit. Vacuum loose scale and soot at the bottom of the outer pass and in the flue box.
- b. If there is a large accumulation of scale, then the boiler is probably operating with cold return temperatures. Set the Energy manager Option Switch 1 to "ON" to maintain a higher return temperature during operation. If scaling persists, increase firing rate (see "Burner Operation" section and "Burner Settings" Table).
- c. Check flue pipe and base of chimney to be certain there is no blockage of flue passage.
10. Inspect and check the following. Adjust/replace parts as necessary.
 - Igniter
 - Porcelain Condition (remove drawer assembly)
 - Check and clean flame sense rod
 - Electrode Setting
 - Fan/Air Inlet for dirt and lint
 - Check diffuser plate
11. Inspect the amulet for cracking or other physical damage. Replace the amulet if necessary.
12. Verify that the burner is centered with the flame former. Secure and tighten the four nuts. In addition, check the two 3/8" nuts on the hinge bolts and ensure that they are tight. Do not over tighten; tighten snugly enough to compress the door insulation.
13. **Caution:** Do not start the burner unless the front door is closed and the nuts have been properly tightened.
14. Lubricate motors. Open/close zone valves several times to check that they move freely.
15. Back flush plate heat exchanger.
16. Start burner. Check safety functions as described under "Burner Operation", including high limit aquastat, pressure relief valve and primary control.
17. Measure and reset air for CO₂/O₂. Take overfire flue gas sample through the over fire test port next to the burner. Use 1/4" copper or steel tube inserted at least eight (8) inches.
18. Check and record:
 - a. **DRAFT AT OVER FIRE/CHIMNEY:** * -0.02" w.c minimum.
*If not, re-check chimney, chimney base and flue pipe for blockage or clean out door openings.
 - a. **CO₂/O₂** (test over fire, through test port next to the burner)
 - b. **STACK TEMPERATURE:** 350° to 450° F
19. All cover plates, enclosures, and guards must be maintained in place at all times, except during maintenance and servicing.
20. **Caution:** do not attempt to start the burner when excess gas has accumulated.
21. **Caution:** Always keep the gas supply valve shut off if the burner is shut down for an extended period of time.

AMULET REPLACEMENT

It is recommended that a new ceramic sleeve “amulet” be installed each time the air tube is removed from unit. See instructions that come with each amulet. The Frontier amulet is larger than the standard amulet, so be sure to order the proper part number shown in the Assembly Drawing. Using a standard amulet will allow excessive heat back to the front jacket and may damage burner tube.

FLAME FORMER REPLACEMENT

The flame former is of high quality refractory ceramic fiber material and will normally not need to be replaced. A replacement, if required, is available from Energy Kinetics. Ensure that the burner head is protected by the amulet, wet pack or a similar material.

CAUTION: A dust mask must be worn during replacement:

WARNING: Ceramic fiber or fiberglass materials, may contain carcinogenic particles (cristobalite) after exposure to heat. Airborne particles from fiberglass or ceramic fiber components have been listed as having potential health effects. Take the following precautions when removing, replacing and handling these items.

Precautionary procedures:

Avoid breathing dust and avoid contact with skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves and eye protection. Use a properly fitted NIOSH certified respirator for dusty activities and where exposure levels are unknown.

Use hand tools whenever possible if cutting or trimming is required. Power tools generate significantly more airborne dust.

Use vacuums with HEPA-filters for clean up. If HEPA-filter vacuum are not feasible, lightly spray fiber materials and work area with a water mist before sweeping or bagging of debris.

Wash exposed skin with soap and water after handling.

Do not use compressed air to clean work clothes or work area.

Wash work clothes separately from other clothing. Rinse washer thoroughly afterwards.

Avoid smoking, eating or drinking while dust is present in the work area.

REPLACEMENT PARTS

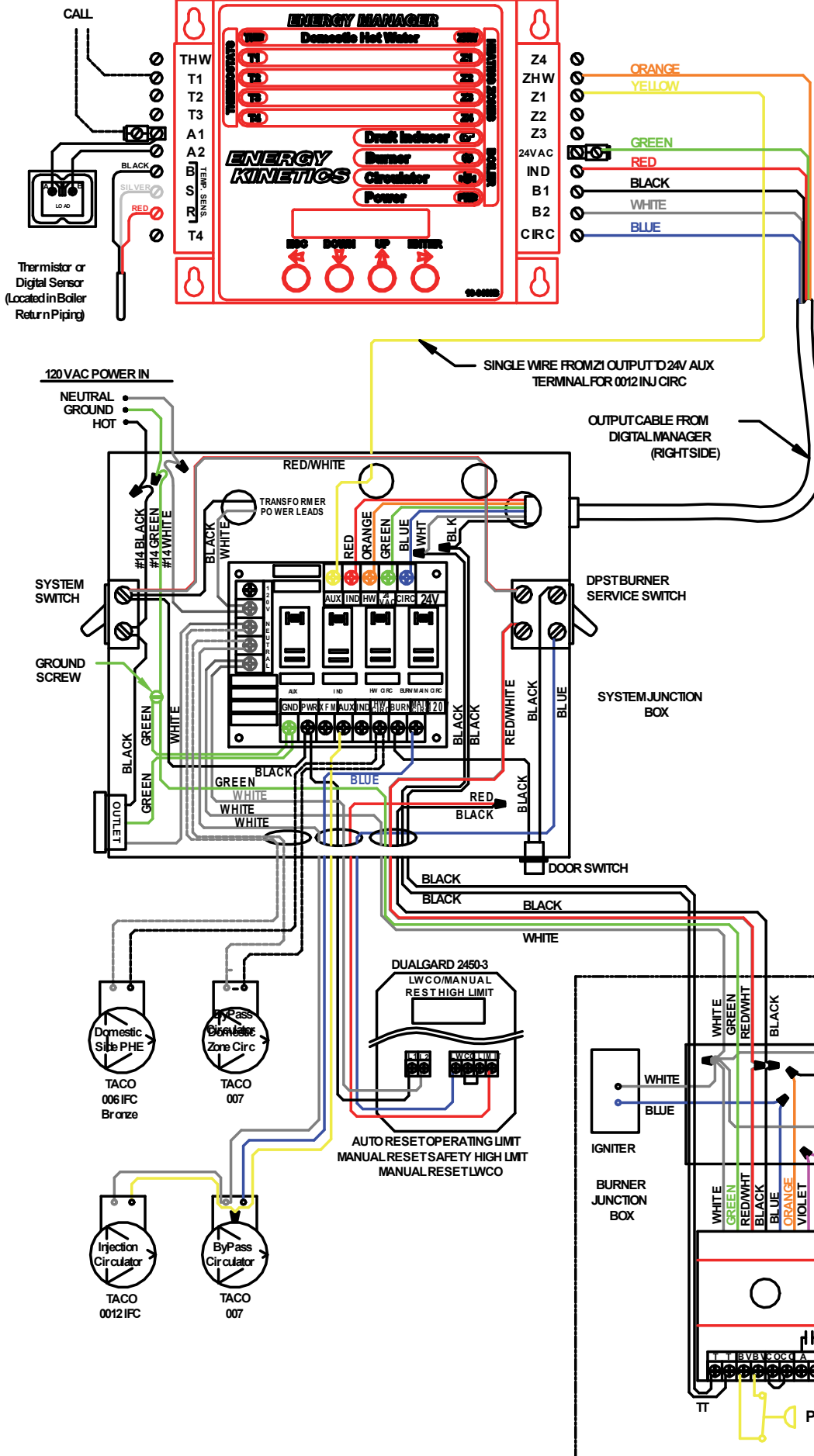
Obtain replacement parts from your local Energy Kinetics dealer.

Contact Energy Kinetics at 800-323-2066 Or www.energykinetics.com for help locating your nearest authorized dealer.

Part Number	Description
10-0494-3	AIRBOX KIT FOR EK3 FRONTIER, NO INLET SCREEN
10-0494-G	AIRBOX KIT, EK3 GAS, FLANGE MOUNT, NO INLET SCREEN
10-0536	EK3 BOILER STAND
10-0760	EK3 HALF CHAMBER FLAME FORMER
10-0761	EK3 FRONTIER FRONT DOOR
10-0762	EK3 FRONT PACMAN
10-0763	EK3 REAR PACMAN
10-0764	EK3 LEFT SIDE COVER
10-0765	EK3 FRONT INSULATION BD
10-0766	EK3 REAR INSULATION BOARD
10-0767	EK3 RIGHT SIDE COVER
10-0768	EK3 TOP COVER
10-0769	EK3 REAR COVER
10-0770	EK3 PUFF SWITCH KIT

ENERGY MANAGER

SYS-08-024 EK3 Gas with Digital Manager



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

EK3 Gas Fired with Digital Manager

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



DWG. NO.

DATE: 08/02/06

REV: JS

DRAWN BY: JS

CAD FILE NAME:

sys-08-024-rev08.dwg

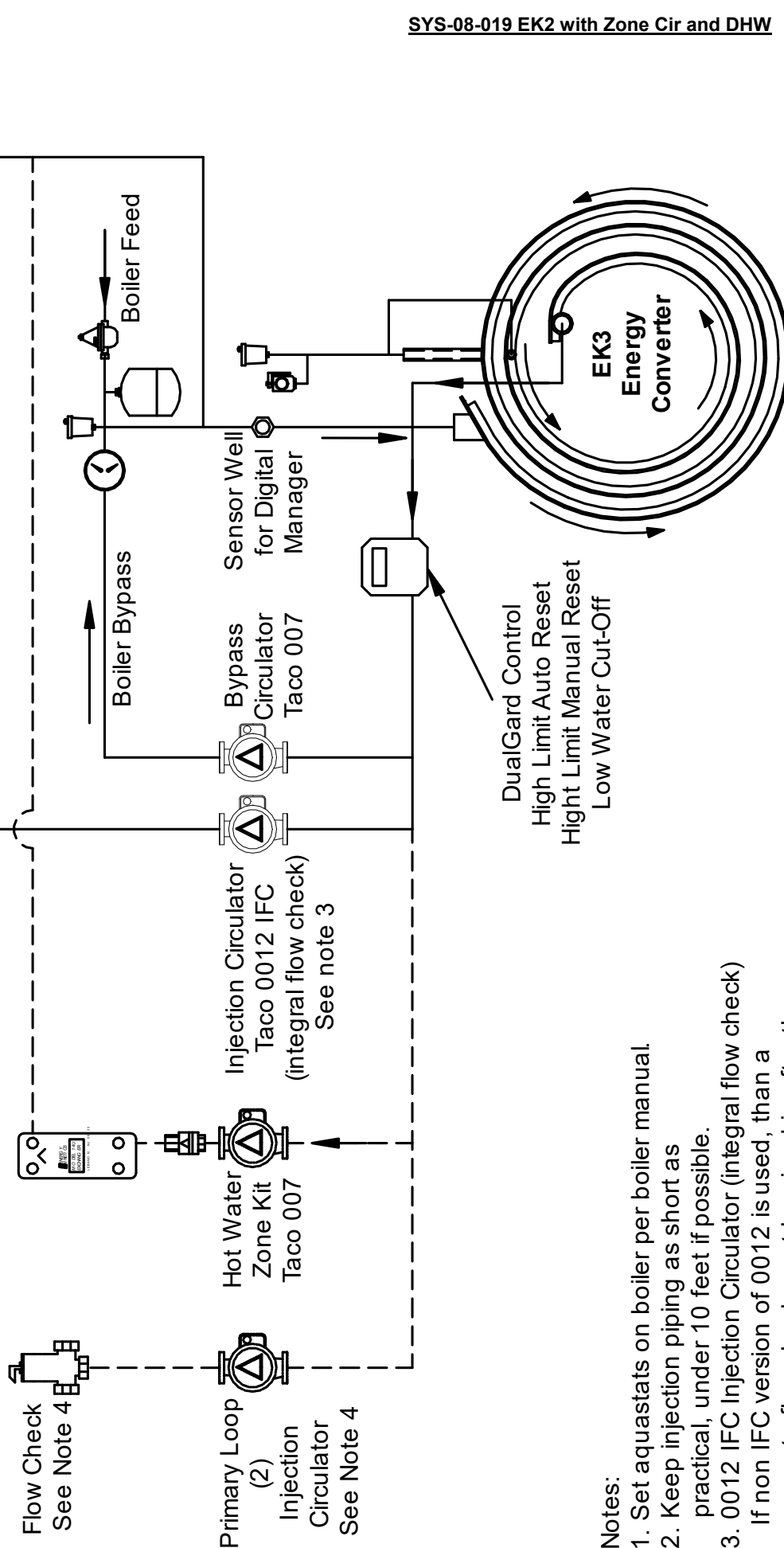
SYS-08-024

Primary Loop

Ø 2" Min

Injection Header

Ø 1-1/2" Min



Notes:

1. Set aquastats on boiler per boiler manual.
2. Keep injection piping as short as practical, under 10 feet if possible.
3. 0012 IFC Injection Circulator (integral flow check)
If non IFC version of 0012 is used, than a separate flow check must be piped in after the Injection Circulator.
4. If injecting into more than one loop, the injection circulator must have an integral flow check or a separate flow check piped in after the circulator.

SYS-08-019 EK2 with Zone Cir and DHW

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

EK3F with Zone Circulators and DHW

Sheet 2 of 2 Piping (See sheet 1 of 2 for wiring)

DWG. NO.

DATE:

5/10/05

REV

JS

DRAWN BY:

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



SYS-08-019

sys-08-019-rev08.dwg

GAS BURNER

From "CIRC" on output (right) side of System Manager and Zone valve end switches (See Low Voltage Wiring Sheets 2,3,4,5 & 6)

SYSTEM JUNCTION BOX

120 VAC POWER IN

NEUTRAL
GROUND
HOT

TRANSFORMER
POWERLENS

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#14 BLACK

#14 GREEN

BLACK

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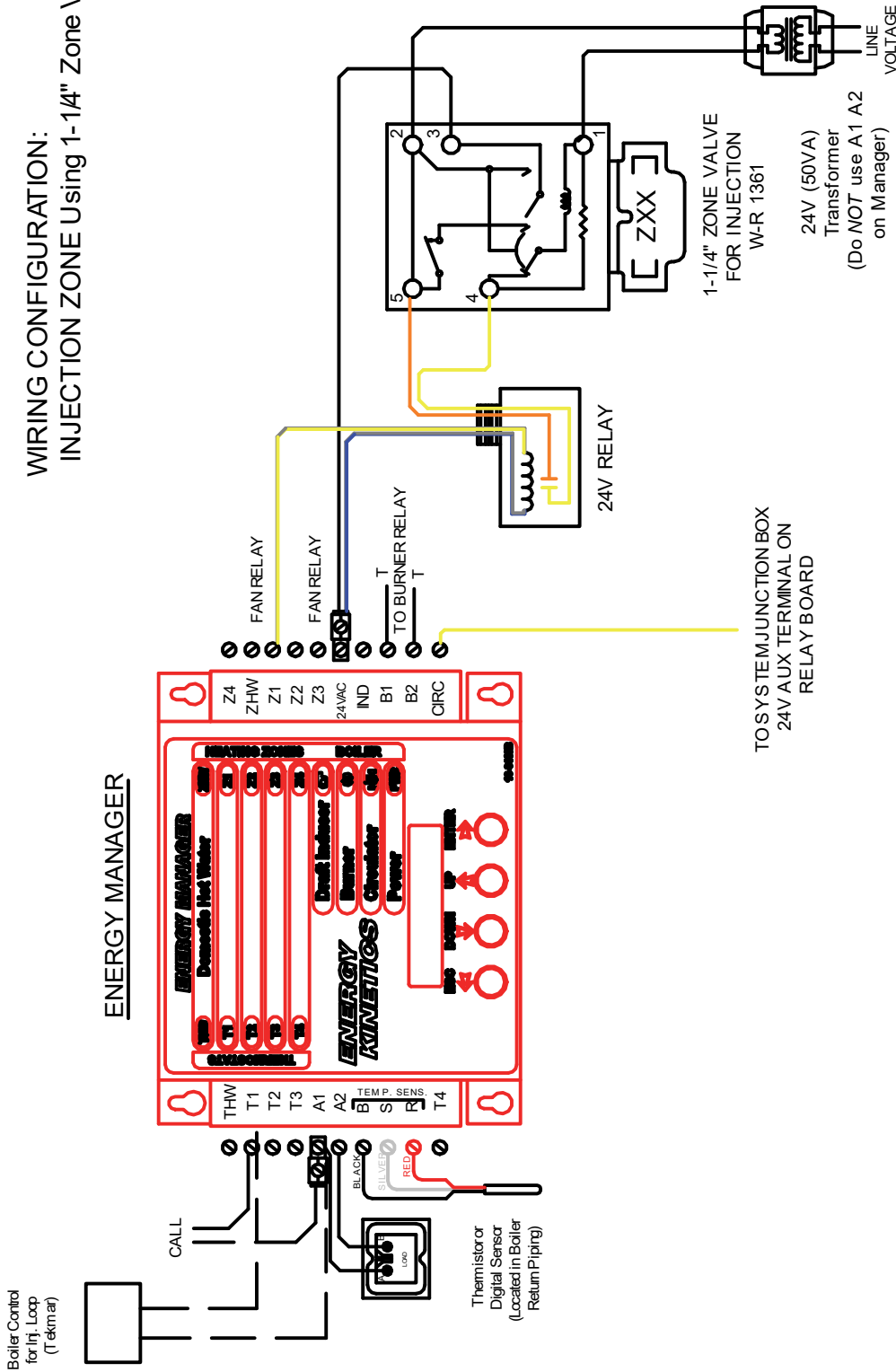
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WIRING CONFIGURATION:
INJECTION ZONE Using 1-1/4" Zone Valve.



Energy Kinetics Part Numbers:

1. 10-0412-RIB 24V Control Relay (HW R8225B).
2. 10-0152 Transformer 24V 50VA
3. 10-0156 1-1/4" Zone Valve w/End Switch

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

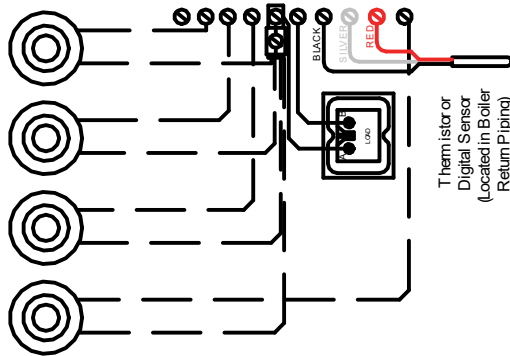
ENERGY KINETICS
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

EK3F with Heat & DHW & Injection
Sheet 3 of 8 Low Voltage Wiring, 1-1/4" Zone Valve for Injection

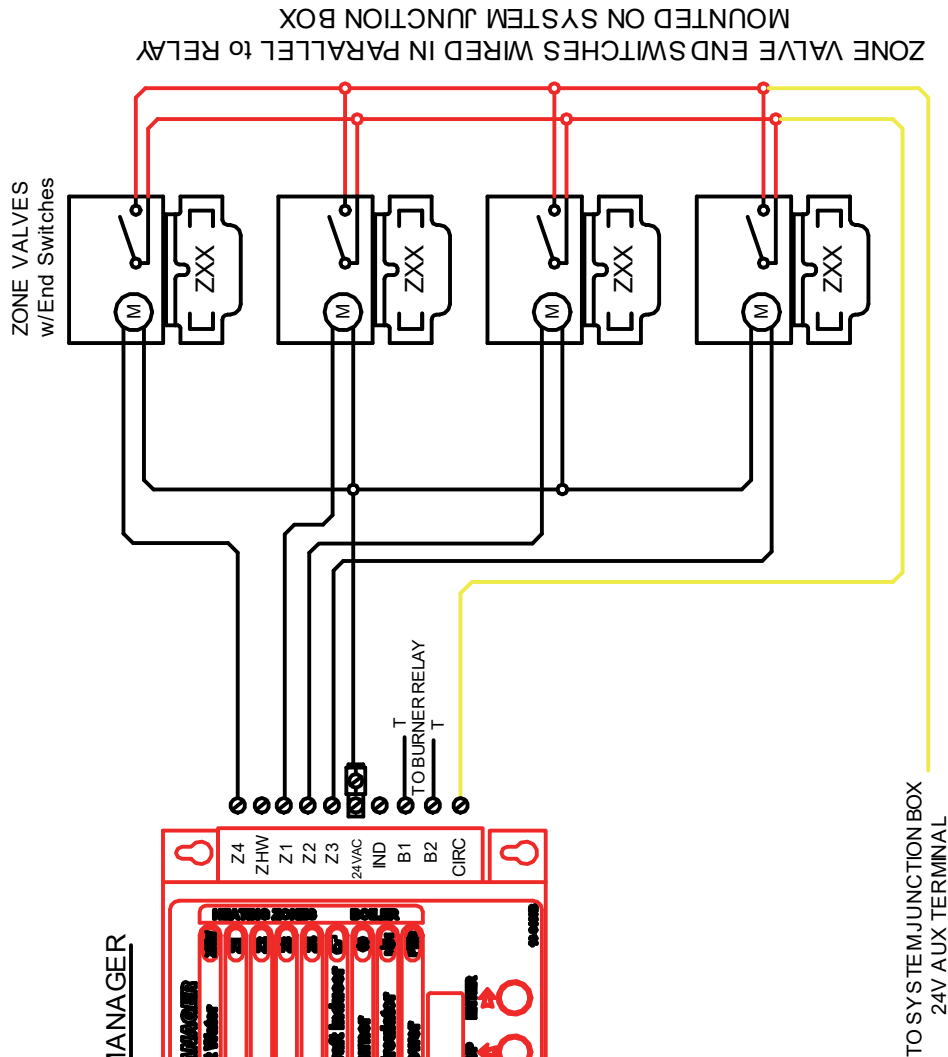
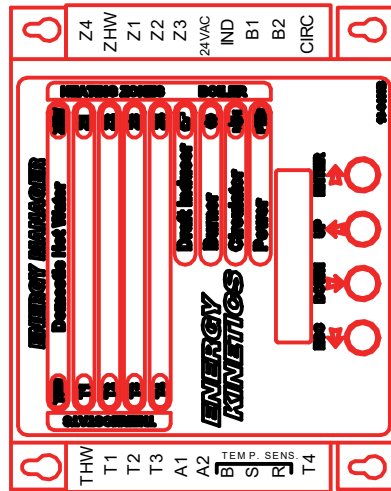
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REV: 5/10/05
DATE: 5/10/05
DWG NO. 5/10/05

sys-08-020-rev8.dwg
SYS-08-020

One Thermostat per Zone
Set Anticipators to 0.1



ENERGY MANAGER



TO SYSTEM JUNCTION BOX
24V AUX TERMINAL

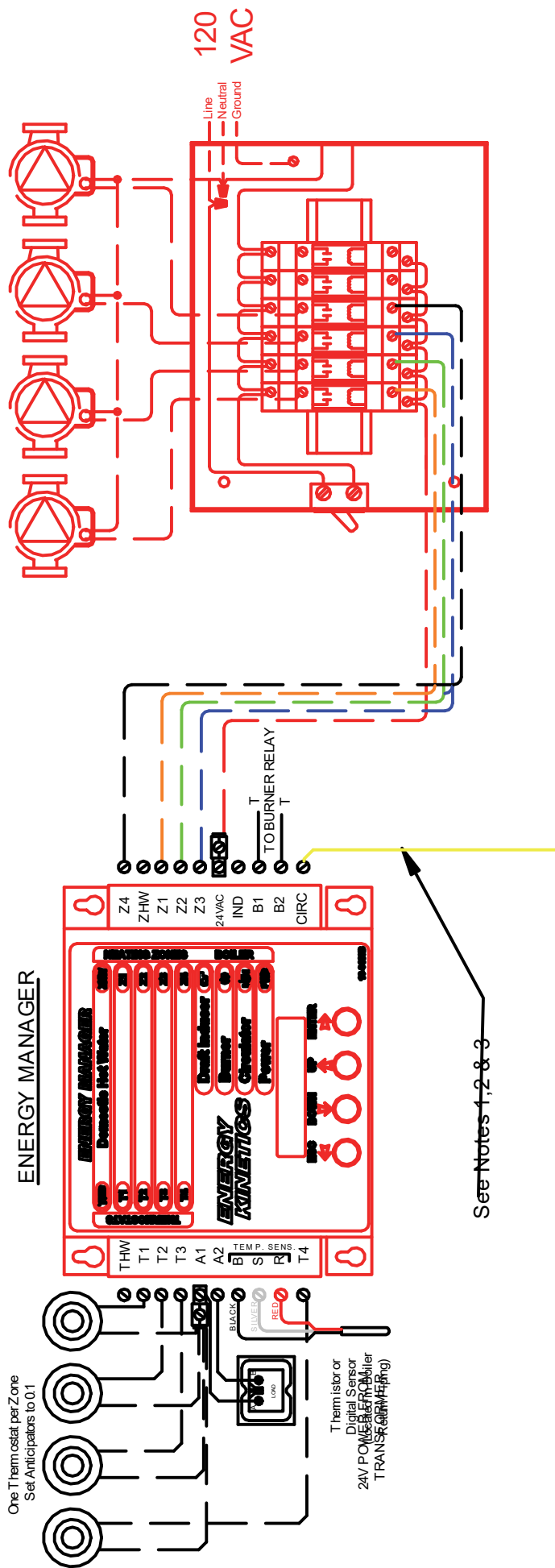
WIRING CONFIGURATIONS: ZONING with ZONE VALVES (Preferred Method)

- Energy Kinetics Part Numbers:
1. 10-0151-E 3/4" Zone Valve w/End Switches.
 2. 10-0152 Transformer 24V 50VA

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

EK3F with Heat & DHW & Injection		Sheet 4 of 8 Low Voltage Wiring, Zoning with Zone Valves	
DRAWN BY: JS	REV: A	DATE: 5/10/05	DWG. NO.
CAD FILENAME: sys-08-020-rev8.dwg		SYS-08-020	



WIRING CONFIGURATION: ZONING with CIRCULATORS (Alternate Method).

Notes:

1. When zoning with zone circulators, the 0012 Injection Circulator that comes with the EK3 Boiler can be either used as a zone circ (if it's the correct size for the zone) or just left disconnected.
2. If using the 0012 Injection Circulator as a Zone Circulator, connect the yellow wire to the corresponding zone output on the right hand side of the system manager.
3. If NOT using the 0012 Injection Circulator as a Zone Circulator, make sure the yellow wire on the relay is disconnected.

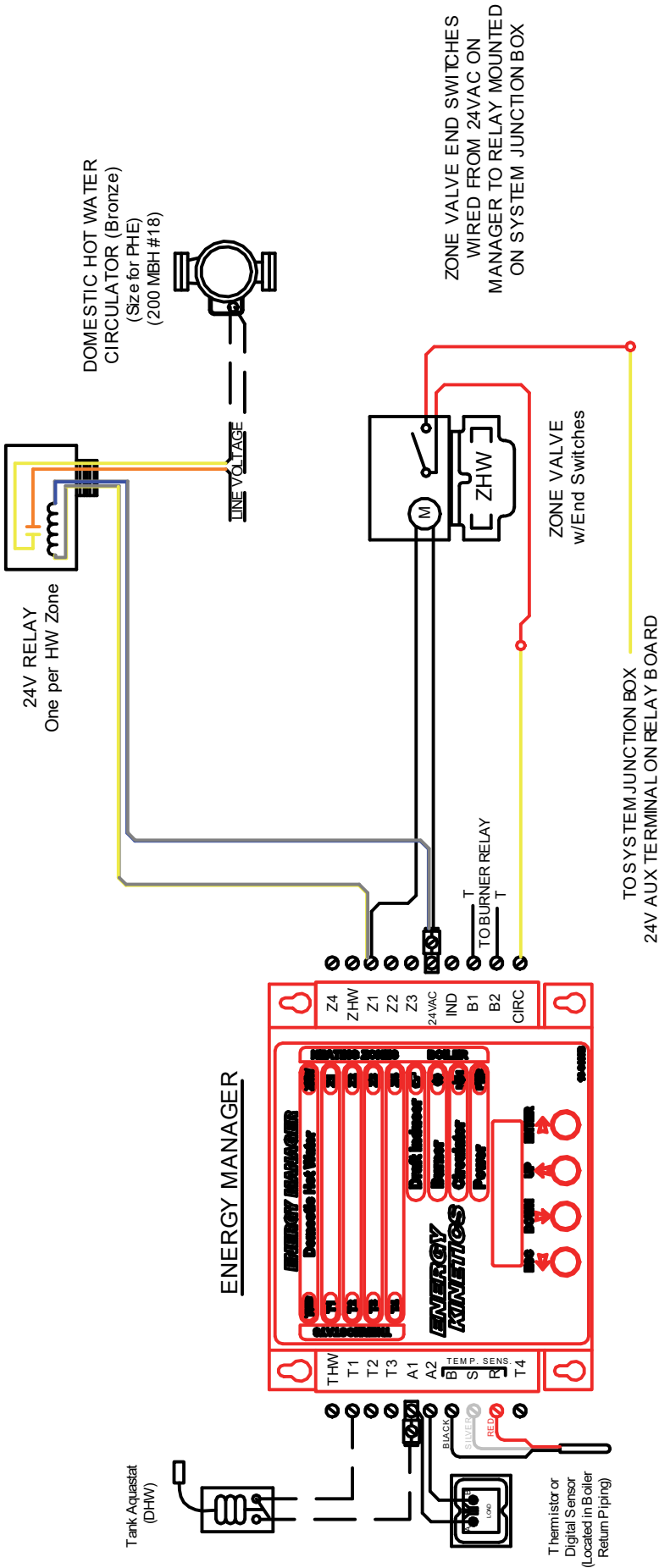
Energy Kinetics Part Numbers:

1. 10-0412-5 5 Zone Relay Kit (15 available)
2. 10-0152 Transformer 24V 50VA
3. 10-0430 Taco 006B-IFC -Brnz, Swt, 1/2", Integ Flw Chk
4. 10-0430CV Taco 006B-IFC Check valve (replacement part)
5. 10-0432 Taco 006B - Bronze, Threaded 3/4"
6. 10-0205 SmartPump Assembly, 006B-IFC, with harness
7. 10-0432T Taco 007 -Iron
8. 10-0432TB Taco 007 Bronze
9. 10-0444 Taco 009 -Iron
10. 10-0444B Taco 009 Bronze
11. 10-0438 Taco 0010 -Iron
12. 10-0439 Taco 0014 Bronze
13. 10-0440 Taco 0011 -Iron
14. 10-0432-8 Taco 008 -Iron w/ FLG
15. 10-0449F Taco 0012 IFC Iron w/1-1/2~ Flanges
16. 10-0449P Taco 0012 Iron w/1-1/2~ Flanges

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

EK3F with Heat & DHW & Injection
Sheet 5 of 8 Low Voltage Wiring, Zoning with Zone Circulators
DRAWN BY: JS
REV: 8
DATE: 5/10/05
DWG NO: 5/10/05
SYS-08-020-rev8.dwg
SYS-08-020



WIRING CONFIGURATIONS:

A. NON-PRIORITY ZONE(S) for DOMESTIC HOT WATER.

Note: set purge time to 5 minutes for zone(s) (Z1-Z4, Not ZHW) used.

Energy Kinetics Part Numbers:

- 10-0412-RIB 24V Control Relay (HW R8225C).
- 10-0151-E 3/4" Zone Valve w/End Switches.
- 10-0152 Transformer 24V 50VA
- 10-0430 Taco 006B-IFC, Bronze, Sweat, 1/2", Integral Flow Check
- 10-0432 Taco 006B, Bronze, Threaded, 3/4"
- 10-0205 Smart Pump Assy, 006B-IFC, with Harness

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

EK3F with Heat & DHW & Injection
Sheet 6 of 8 Low Voltage Wiring, Non Priority Zone for Domestic Hot Water

DWG. NO.

DATE:

REV:

JS

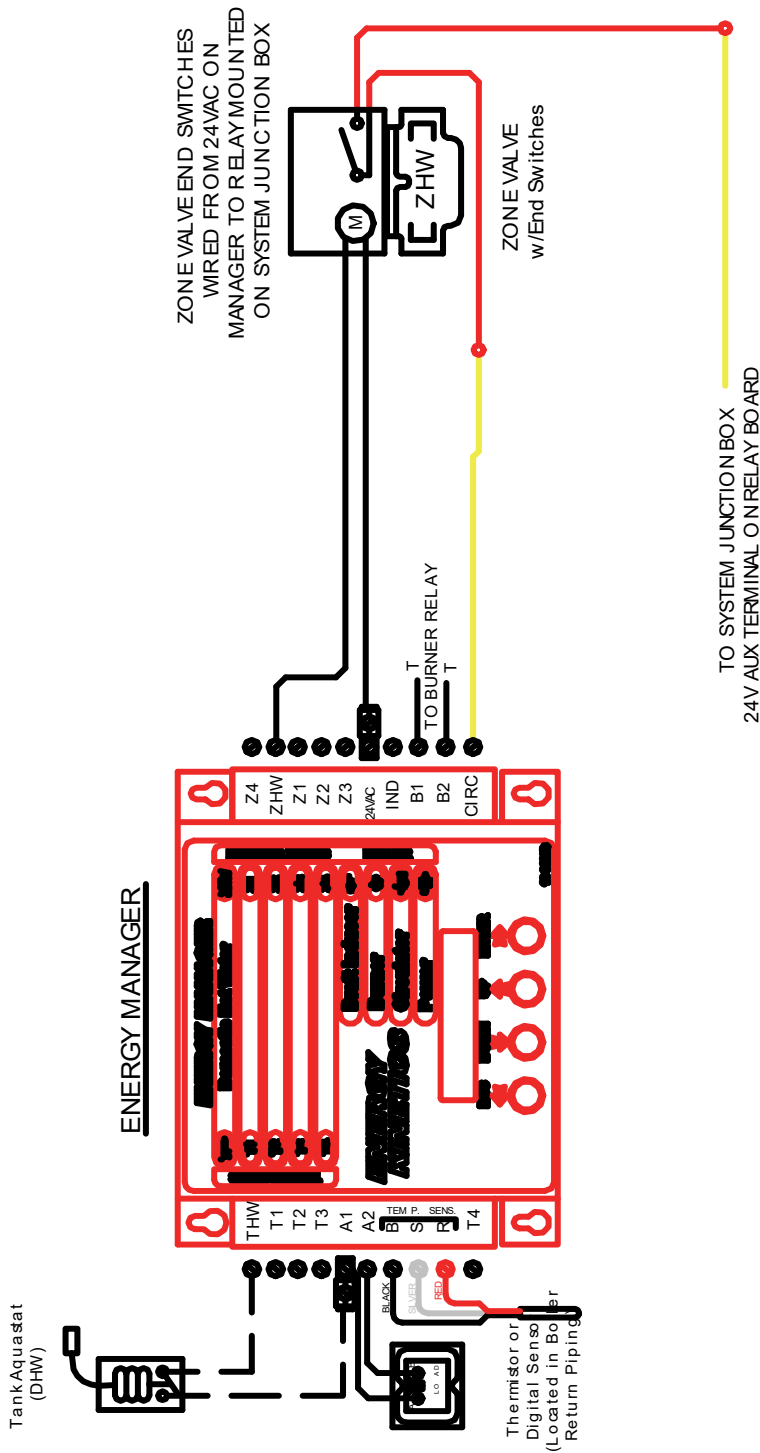
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CAD FILENAME:
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SYS-08-020



WIRING CONFIGURATION:
PRIORITY ZONE for DOMESTIC HOT WATER
 (Smart Pump powered by HWCirc Relay in System Junction Box).

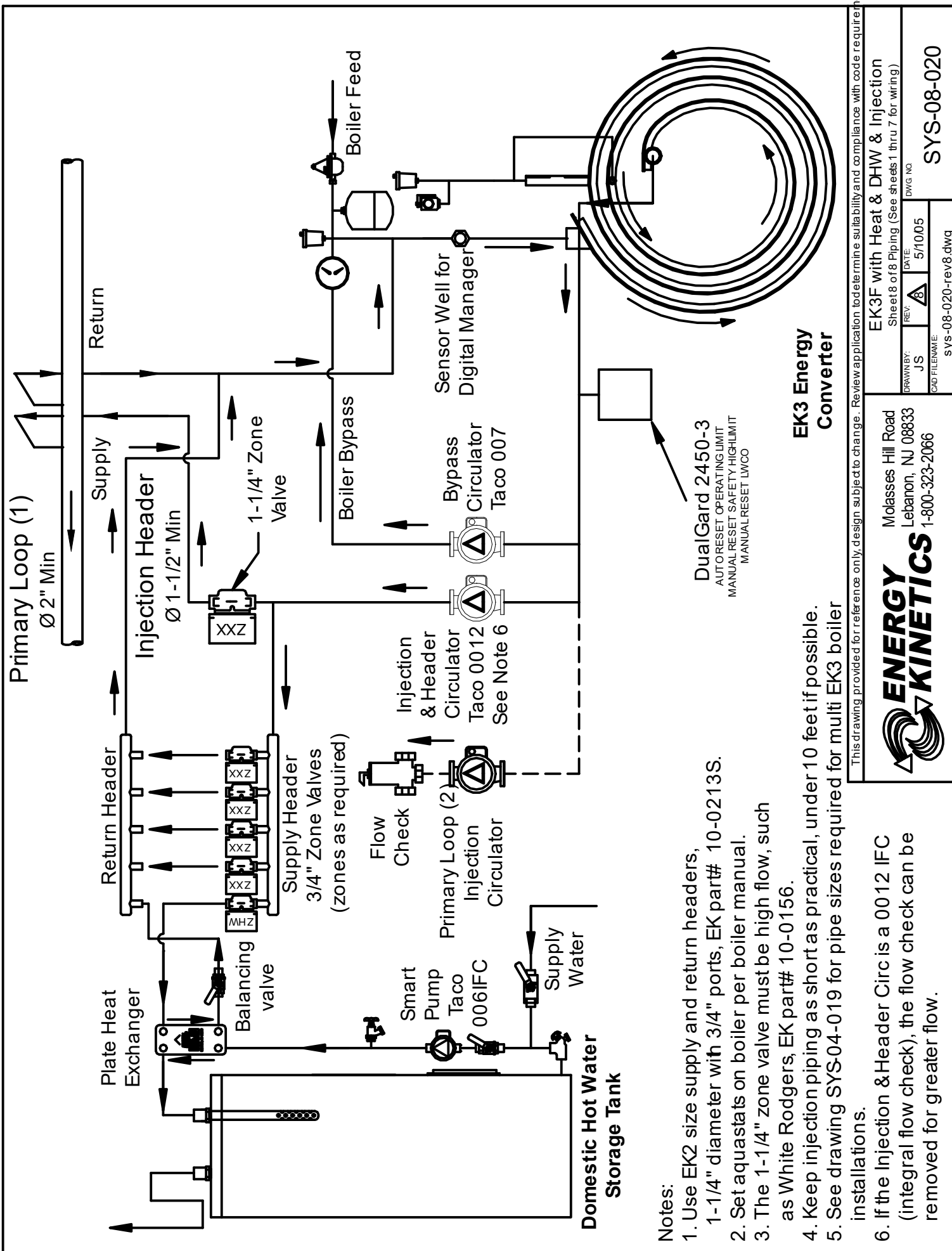
Energy Kinetics Part Numbers:

1. 10-0151-E 3/4" Zone Valve w/End Switches.
2. 10-0152 Transformer 24V50VA
3. 10-0430 Taco 006B-IFC, Bronze, Sweat, 1/2", Integral Flow Check.
4. 10-0432 Taco 006B, Bronze, Threaded, 3/4"
5. 10-0205 Smart Pump Assy, 006B-IFC, with Harness

FOR HOT WATER PRIORITY THE HOT WATER PRIORITY OPTION MUST BE SET TO "ON" USING THE MENU ON THE DISPLAY MANAGER MENU

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

		ENERGY KINETICS Molasses Hill Road Lebanon, NJ 08833 1-800-323-2066		EK3F with Heat & DHW & Injection Sheet 7 of 8 Low Voltage Wiring, Priority Zone for Domestic Hot Water DWG. NO.	
		DRAWN BY: JS REV: 1 DATE: 5/10/05 FILE NAME: sys-08-020-rev8.dwg		SYS-08-020	

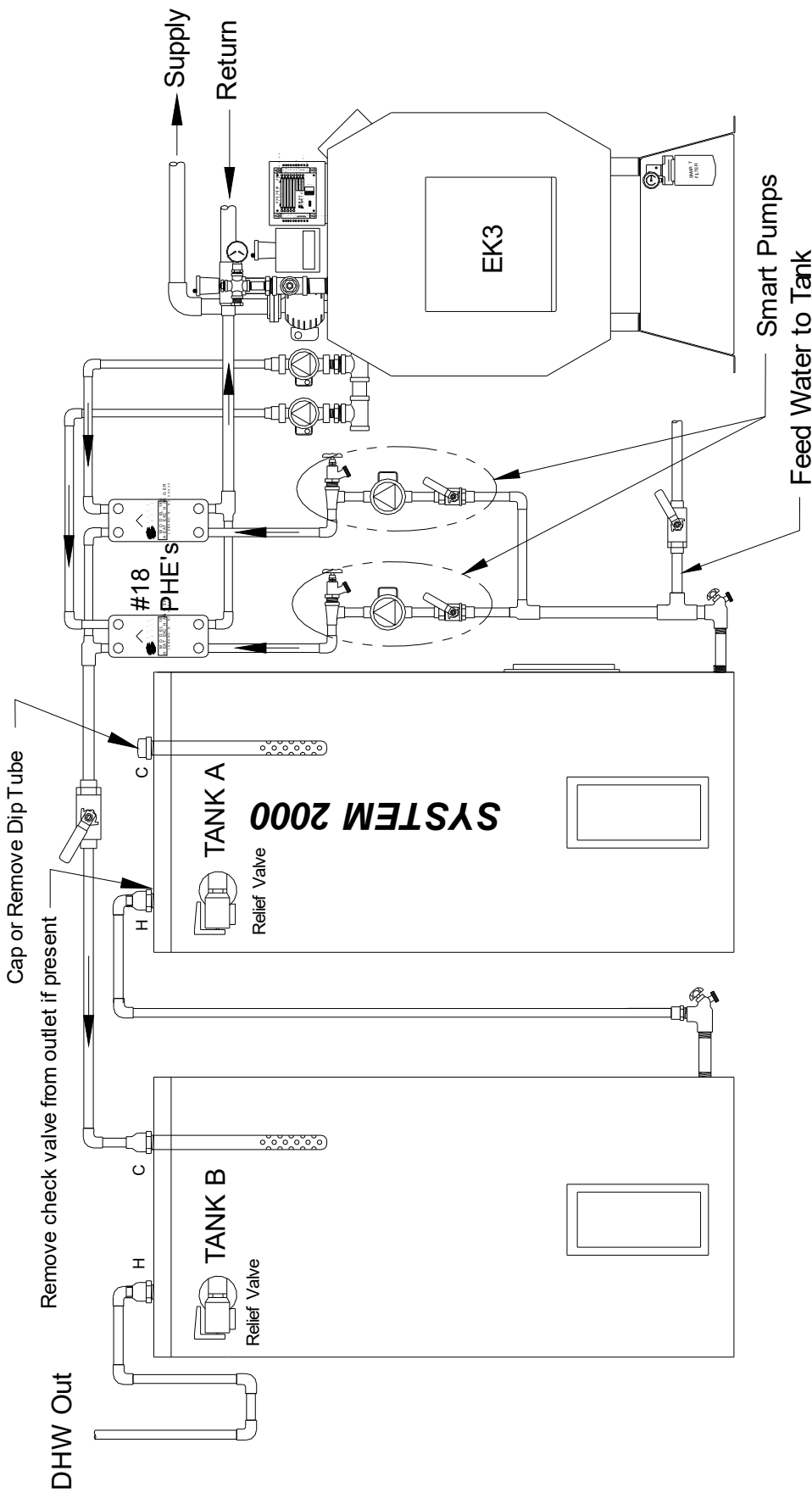


This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.

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

EK3F with Heat & DHW & Injection
Sheet 8 of 8 Piping (See sheets 1 thru 7 for wiring)

DRAWN BY: JS	REV: A	DATE: 5/10/05	DWG NO. SYS-08-020
CAD FILENAME: sys-08-020-rev8.dwg			



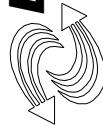
Application:

Use in systems requiring large hot water storage volume and rapid recovery. Requires Two EK3 Hot Water Zone Kits pn: 10-0216. Storage Tanks are piped in series refer to SYS-02-015.

Description of Operation:

A call from the aquastat in tank A will call input Tx (1,2,3...) on the System Manager which will start zone circ Zx and its 006 Smart Pump (standard Hot Water Zone Kit installation). A call for heat from the aquastat in tank B will call the input THW on the System Manager. A fan relay (EK# 10-0412) wired to the zone output Zx (1,2,3...) on the System Manager will start zone circ Zx and its 006 Smart Pump. Both hot water zones will run during high hot water demand (both aquastats calling). Post purge for second DHW zone, Zx should be set to 5 Minutes. Hot water priority should be disabled with this configuration.

Refer to Sheet 2 for wiring info.



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

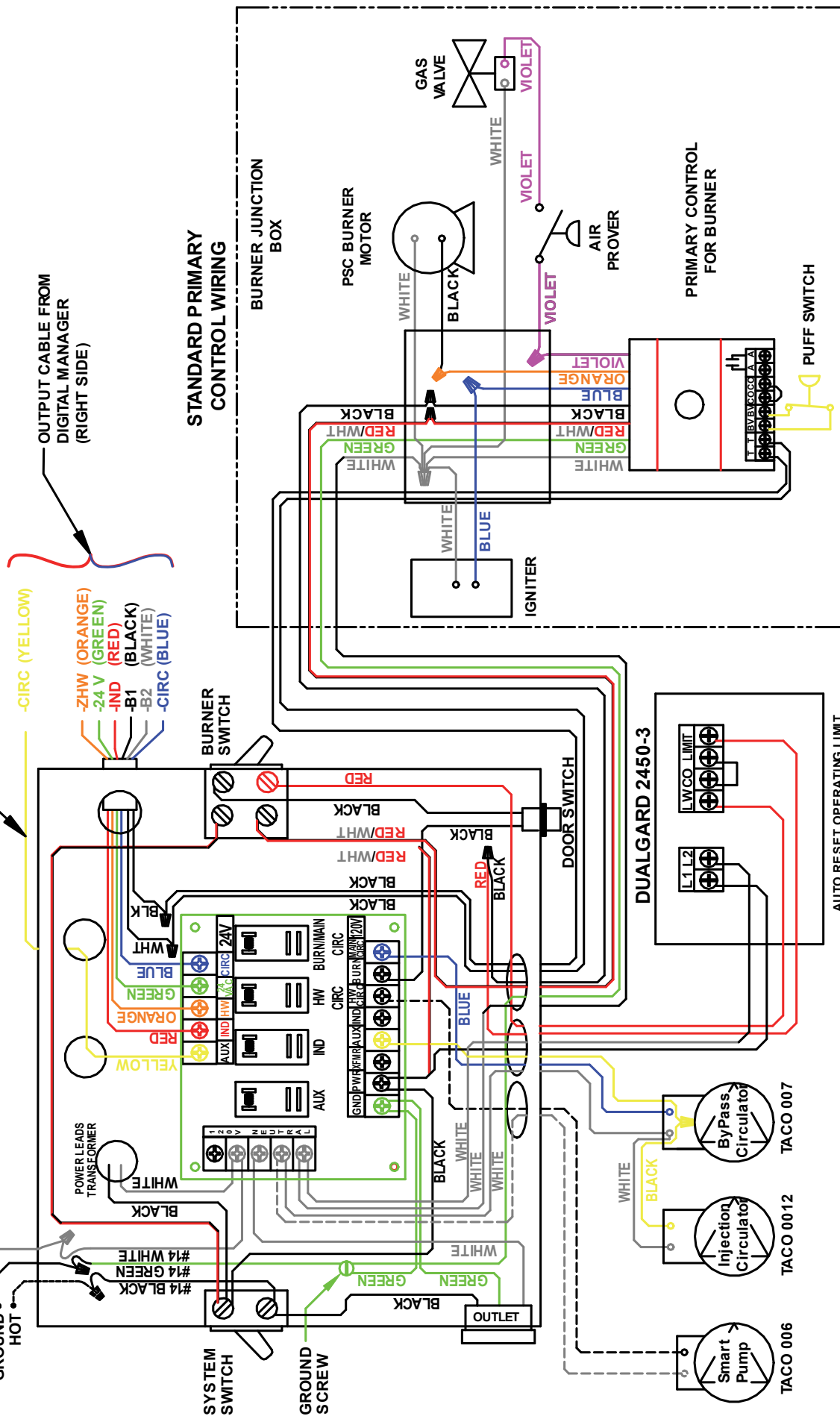
This drawing provided for reference only, design subject to change. Review application to determine suitability and compliance with code requirements.

Large DHW Storage Volume & Rapid Recovery Piping (Sheet 1 of 2)		
DRAWN BY: JS	REV /3	DATE: 07/18/05
CAD FILENAME sys-02-023-rev3.dwg		DWG. NO. SYS-02-023

GAS BURNER

SYSTEM JUNCTION BOX

From "CIRC" on output (right) side of System Manager and Zone valve end switches (See Low Voltage Wiring Sheets 2, 3, 4, 5 & 6)



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

ENERGY KINETICS

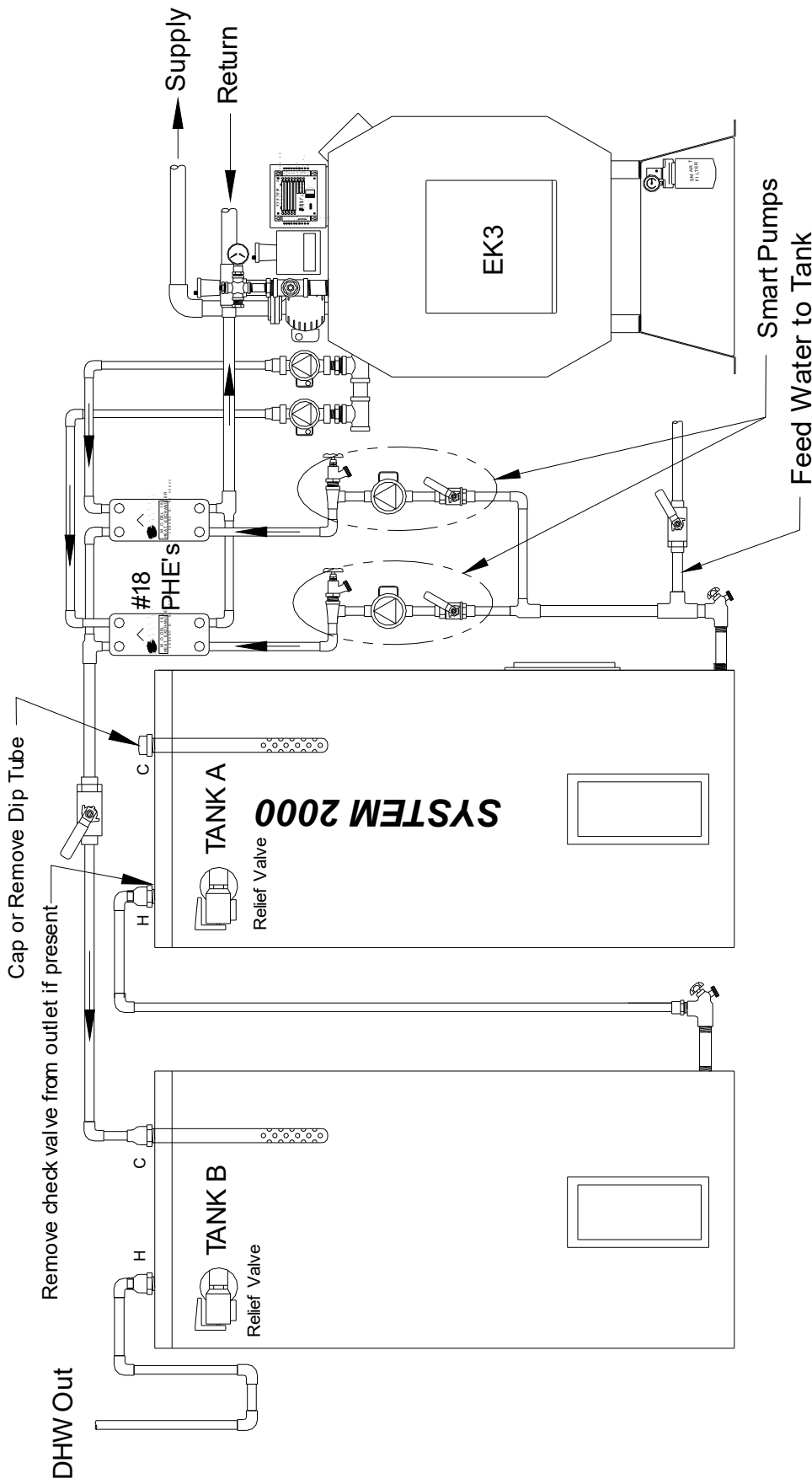
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

EK3F with Heat & DHW

Sheet 2 of 4 Line Voltage Wiring for Gas Burner

DRAWN BY: JS
REV: A
DATE: 01/04/05
DWG. NO. SYS-08-023

CAD FILENAME: sys-08-023-rev4.dwg



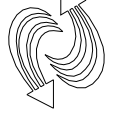
Application:

Use in systems requiring large hot water storage volume and rapid recovery. Requires Two EK3 Hot Water Zone Kits pn: 10-0216. Storage Tanks are piped in series refer to SYS-02-015.

Description of Operation:

A call from the aquastat in tank A will call input Tx (1,2,3,...) on the System Manager which will start zone circ Zx and its 006 Smart Pump (standard Hot Water Zone Kit installation). A call for heat from the aquastat in tank B will call the input THW on the System Manager. A fan relay (EK# 10-0412) wired to the zone output Zx (1,2,3,...) on the System Manager will start zone circ Zx and its 006 Smart Pump. Both hot water zones will run during high hot water demand (both aquastats calling). Post purge for second DHW zone, Zx should be set to 5 Minutes. Hot water priority should be disabled with this configuration.

Refer to Sheet 2 for wiring info.



Molasses Hill Road
Lebanon, NJ 08839
1-800-323-2066

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

Large DHW Storage Volume & Rapid Recovery

Piping (Sheet 1 of 2)

DWG. NO.

DATE

07/18/05

REV.

3

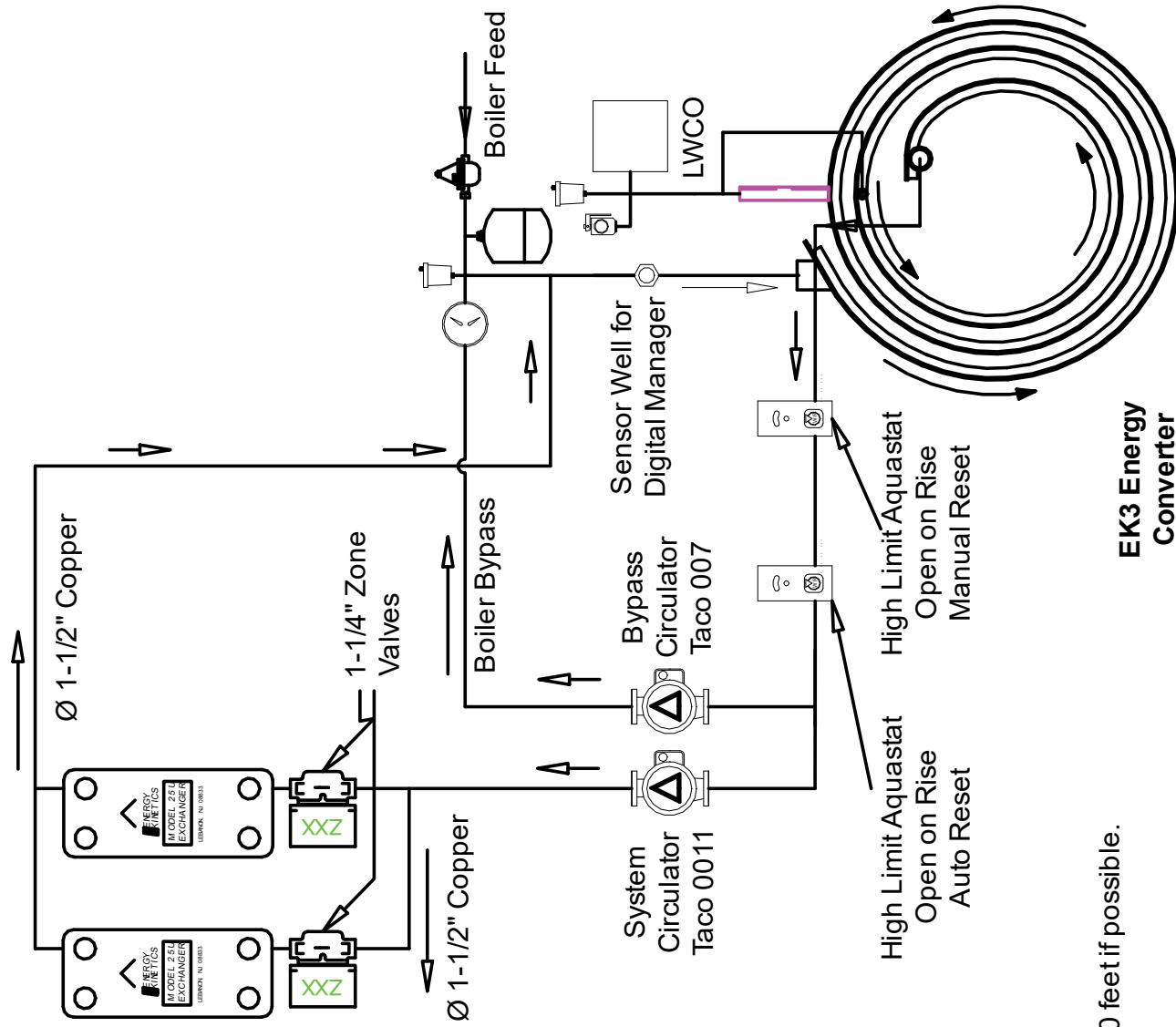
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SYS-02-023

Boiler Side Piping



Notes:

1. Use 1-1/2" Copper to pipe supply and return.
2. Set aquastats on boiler per boiler manual.
3. The 1-1/4" zone valve must be high flow, such as White Rodgers, EK part# 10-0156.
4. Keep injection piping as short as practical, under 10 feet if possible.

**EK3 Energy
Converter**

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



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

EK3 with Digital Mgr, with (2) #25 PHE

For Heating Two Pools

DRAWN BY: JS

REV: Δ

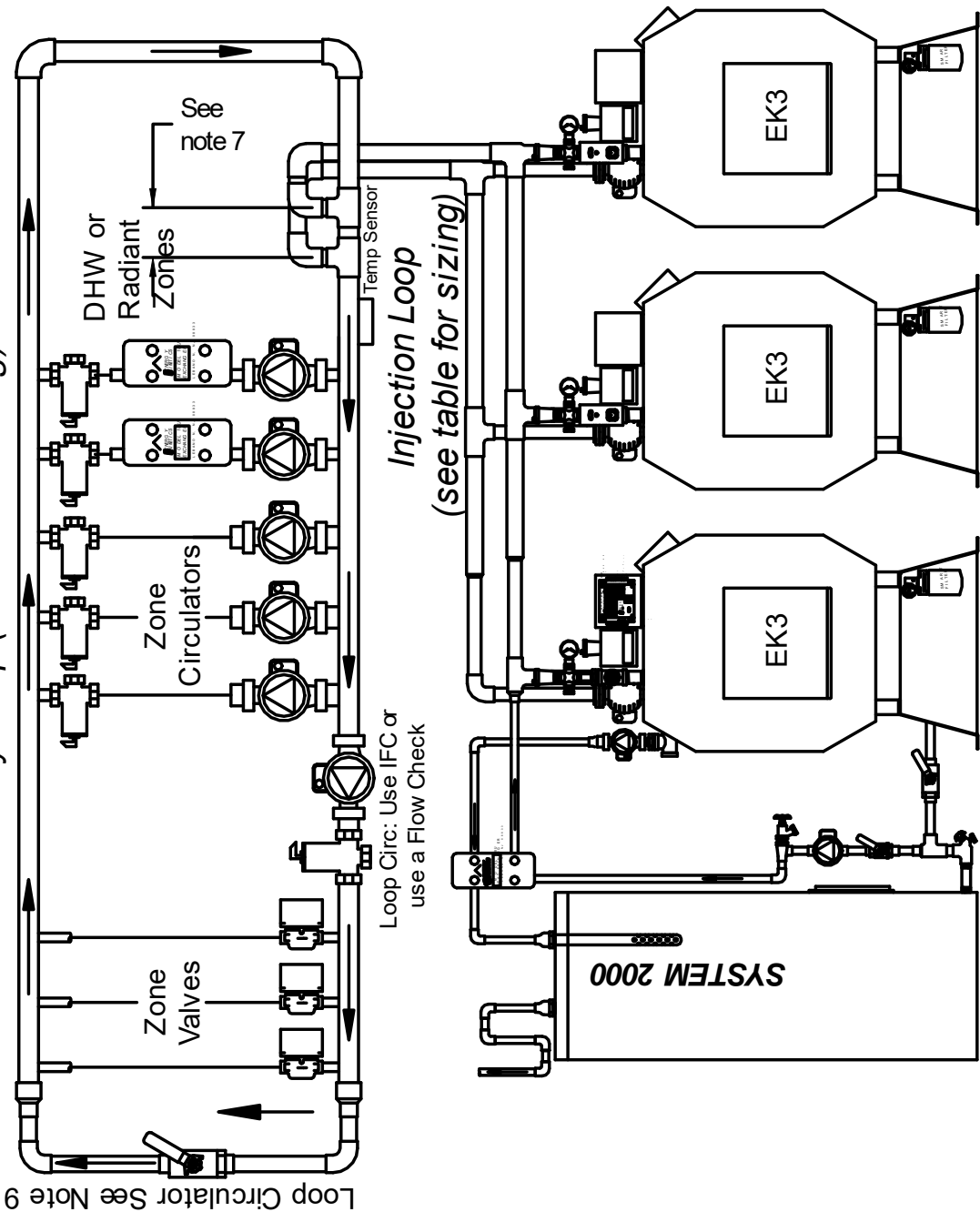
DATE: 5/10/06

DWG. NO.

CAD FILENAME: sys-02-024-rev1.dwg

SYS-02-024

Primary Loop (see table for sizing)



Notes:

1. Pipe sizing is based on using EK3 boilers at maximum firing rate of 3 gph, with 20 degree drop through primary loop zones and 40 degree rise through the boilers.
2. If Primary Loop is located below the Secondary Loops, flow checks should be installed to prevent thermosiphoning. If Primary Loop uses high temperature water, a second flow check may be required.
3. Each boiler has an expansion tank and relief valve.
4. Additional expansion tank capacity may be required for large systems.
5. Each boiler must be piped for make-up water.
6. A multi boiler control (Tekmar) is suggested.
7. A short length of pipe between the supply & return tees reduces head loss and pressure difference between them. The center to center dimension of the tees should not exceed 4 times the diameter of the primary loop piping.
8. For loops greater than 100 ft, increase to next larger pipe size.
9. When using Zone Valves, locate Loop Circulator ahead of the Zone Valves but after any Zone or DHW Circs. Add a 1/2" copper Bypass with a ball valve for balancing between the supply and return header.
10. Loop Circ should be located after any Zone or DHW circs. This will allow DHW production during warm weather shut down of the Primary Loop.
11. DHW Circ should be located first on primary loop, as close to the injection tees as possible but after the loop temp sensor. This will keep the amount of loop heated to a minimum during warm weather shut down.
12. When using DHW zones off of primary loop, DHW priority is handled by the Tekmar.

Number of Boilers	Gross Output (BTU)	Primary Loop Size	Injection Loop Size	GPM
1	357,000	2"	36 1-1/2"	18
2	714,000	3"	70 2"	35
3	1,071,000	3-1/2"	110 2-1/2"	55
4	1,428,000	4"	140 3"	70
5	1,785,000	5"	180 3"	90
6	2,142,000	5"	210 3-1/2"	105

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ENERGY KINETICS

Molasses Hill Road
Lebanon, NJ 08839
1-800-323-2066

Multiple EK3 Boiler Installation

Primary, Secondary Loop Sheet 1 of 4

DATE: 05/19/05

REV: JS

CAD FILE NAME: sys-04-019-rev3.dwg

SYS-04-019

Zoning with Energy Recovery (Post Purge to last Zone Calling)

Wiring using Energy Kinetics Energy Recovery Control, Tekmar 264 Four Boiler Control, and the Plate Heat Exchanger is installed as a local zone, with domestic hot water priority controlled by Digital Manager. Refer to Installation Instructions for Energy Recovery Control & Zone Relay Kits. Consult Factory for a recommendation of the best Kit for your application.

Domestic Hot Water Wiring:

Storage Tank: Tank 1 Aquastat is wired to THW, A1 on Boiler Digital Manager.
Dual Storage Tanks: Tank 1 Aquastat is wired to THW, A1 on Boiler Digital Manager.
Tank 2 Aquastat is wired in parallel with Tank 2 Aquastat and connected to THW, A1 on Boiler Digital Manager.

Line voltage to Smart Pump and to 007 HW Zone Circ supplied from HW Circ lug on terminal block located in Boiler Junction Box.

Refer to Line Voltage and Low Voltage wiring diagrams in System Installation Manual.

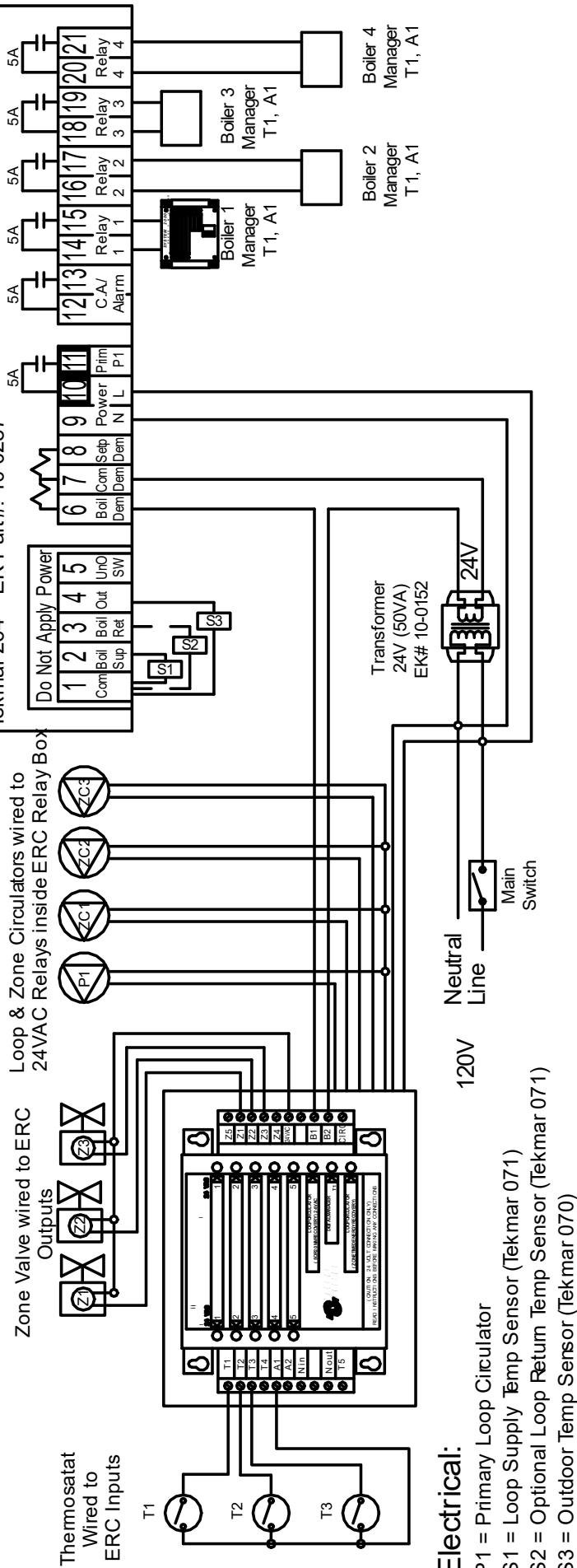


Plate Heat Exchanger Location, Pro's & Con's

Primary Loop:

It allows the use of the larger #23 & #25 Plate Heat Exchangers (PHE) taking advantage of the combined boiler output.

Allows the use of FMC controlled boilers and still have the capability of Domestic Hot Water Priority. 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.

Local Zone:

When Digital Manager controlled boilers are used, the Plate Heat Exchangers can be installed as a zone right off the boiler using a hot water zone kit.

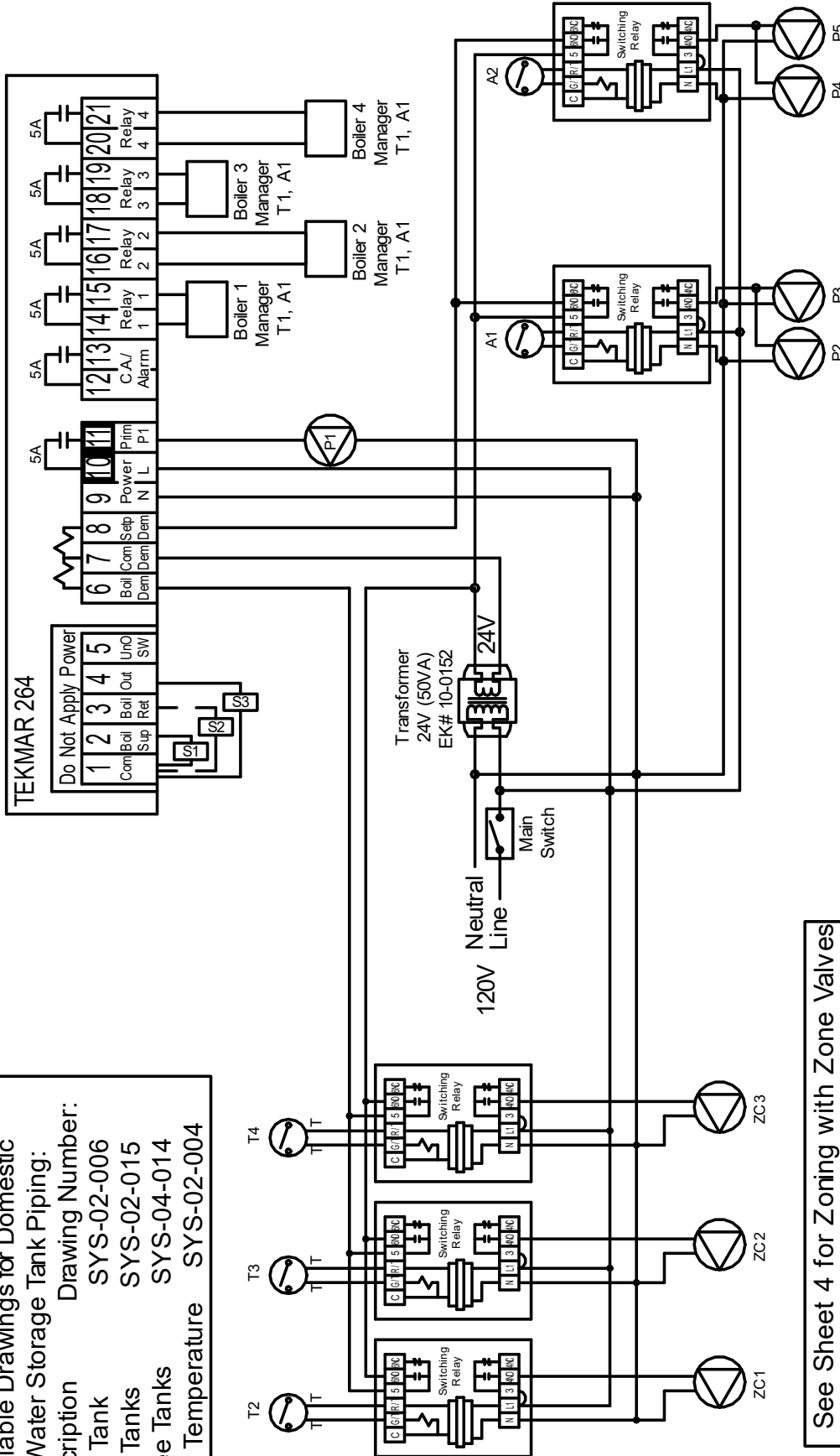
Calls for DHW and DHW Priority (if desired) are handled by the Digital Manager.

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. One PHE can be installed as a local zone on each boiler.

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

		Multiple EK3 Boiler Installation Primary, Secondary Loop Sheet 2 of 4	
		DRAWN BY: J. Szwed REV: 05/19/05 DATE: 05/19/05 DWG. NO. sys-04-019rev3.dwg	SYS-04-019

Available Drawings for Domestic
Hot Water Storage Tank Piping:
Description Drawing Number:
One Tank SYS-02-006
Two Tanks SYS-02-015
Three Tanks SYS-04-014
Dual Temperature SYS-02-004



See Sheet 4 for Zoning with Zone Valves

Domestic Hot Water Zone 1

Domestic Hot Water Zone 2

Wiring with the Tekmar 264 Four Boiler Control when the Plate Heat Exchanger is installed as a zone on the Primary Loop.

Tekmar 264 = EK Part #: 10-0287

Electrical:

- A1, A2 = Domestic Hot Water Aquastat(s)
- D1 = Optional Remote Display (Tekmar 040)
- P1 = Primary Loop Circulator
- P2, P4 = Smart Pump(s) (DHW Storage Circulator)
- P3, P5 = DHW Zone Circulator(s) (For PHE on Primary Loop)
- S1 = Loop Supply Temp Sensor (Tekmar 071)
- S2 = Optional Loop Return Temp Sensor (Tekmar 071)
- S2 = Outdoor Temp Sensor (Tekmar 070)
- T2-4, ... = Thermostats
- U1 = Optional Timer (Tekmar 031)
- ZC1-ZC3, ... = Zone Circs
- Switching Relays = Erie SR-100 or Equivalent

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

Multiple EK3 Boiler Installation
Primary, Secondary Loop Sheet 3 of 4

DATE: 05/19/05
REV: J. Szwed
DWG. NO. SYS-04-019

FILENAME: sys-04-019-rev3.dwg

Wiring with the Tekmar 264 Four Boiler Control when the Plate Heat Exchanger is installed as a local zone, with domestic hot water priority controlled by System Manager.

Domestic Hot Water Wiring:

Storage Tank: Tank 1 Aquastat is wired to THW, A1 on Boiler Digital Manager.
Dual Storage Tanks: Tank 1 Aquastat is wired to THW, A1 on Boiler Digital Manager.
Tank 2 Aquastat is wired in parallel with Tank 2 Aquastat and connected to THW, A1 on Boiler Digital Manager.

Line voltage to Smart Pump and to 007 HW Zone Circ supplied from HW Circ lug on terminal block located in Boiler Junction Box.

Refer to Line Voltage and Low Voltage wiring diagrams in System Installation Manual.

Tekmar 264 = EK Part #: 10-0287

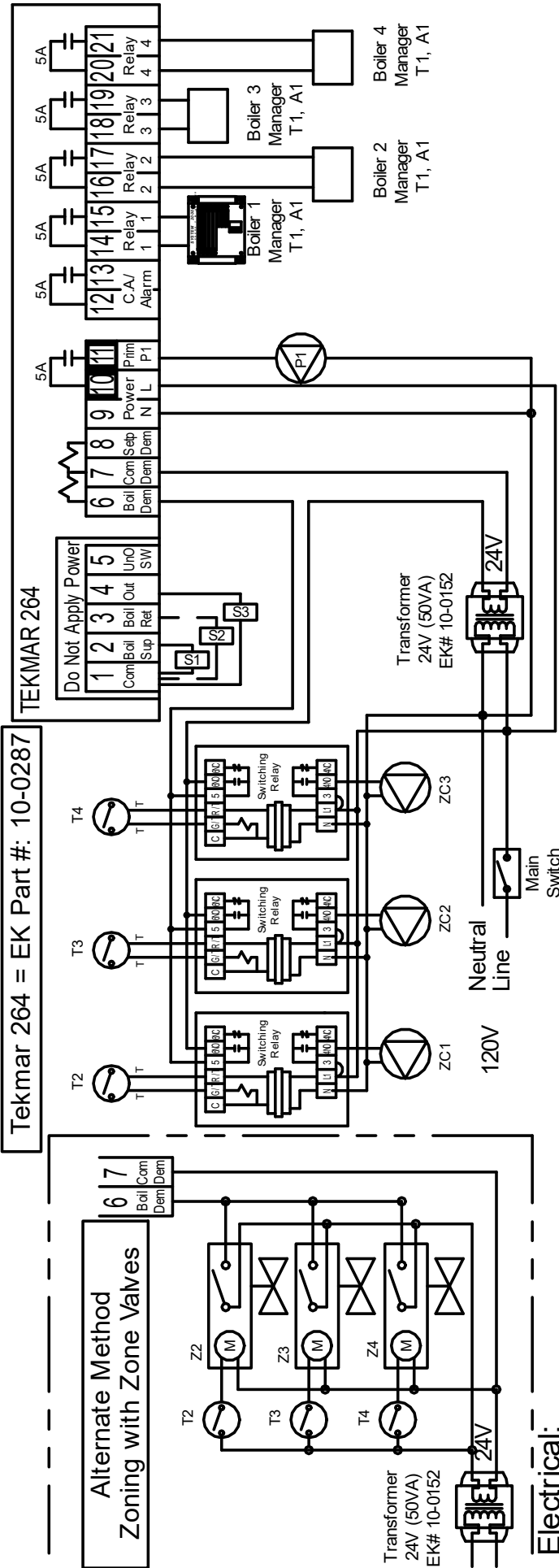


Plate Heat Exchanger Location, Pro's & Con's

Primary Loop:

It allows the use of the larger #23 & #25 Plate Heat Exchangers (PHE) taking advantage of the combined boiler output.

Allows the use of FMC controlled boilers and still have the capability of Domestic Hot Water Priority. 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.

Local Zone:

When Digital Manager controlled boilers are used, the Plate Heat Exchangers can be installed 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 shut down 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.

One PHE can be installed as a local zone on each boiler.

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



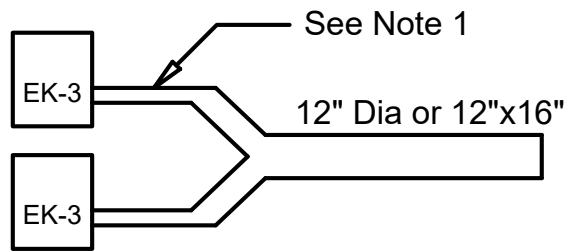
Molasses Hill Road
Lebanon, NJ 08833
1-800-323-2066

Multiple EK3 Boiler Installation

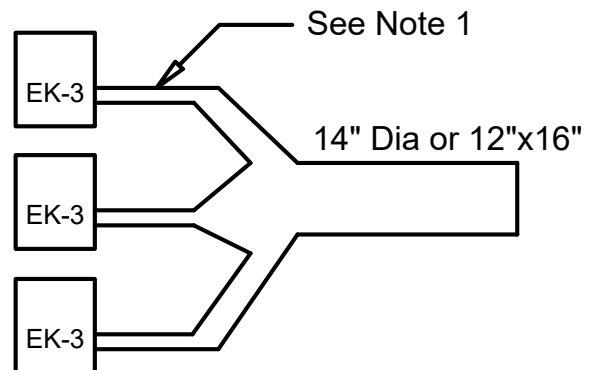
Primary, Secondary Loop Sheet 4 of 4

DESIGNED BY	DATE	REV	DWG. NO.
J. Szwed	05/19/05	3	SYS-04-019
CAD FILE NAME	sys-04-019rev3.dwg		

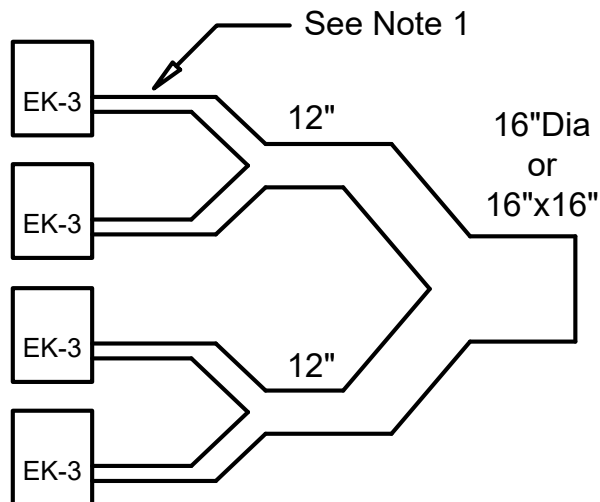
Common Flue Pipe Sizing



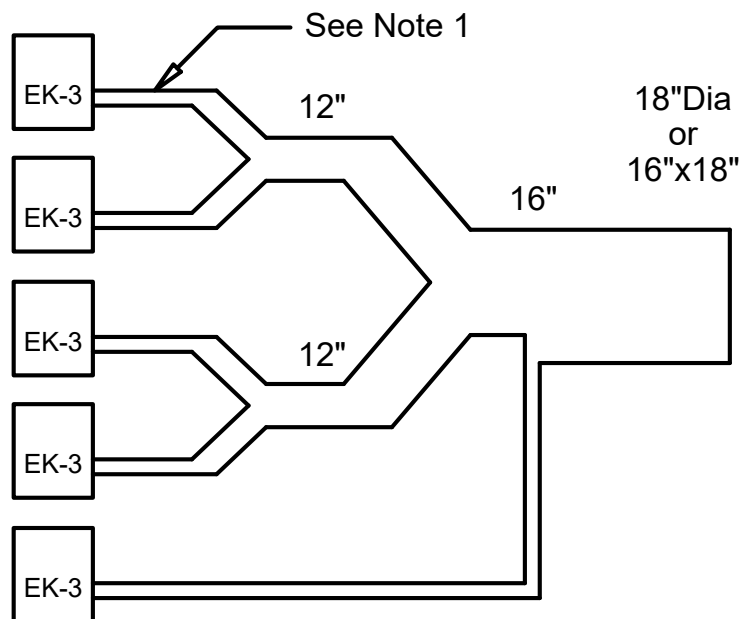
Two Boiler Flue Pipe Sizing



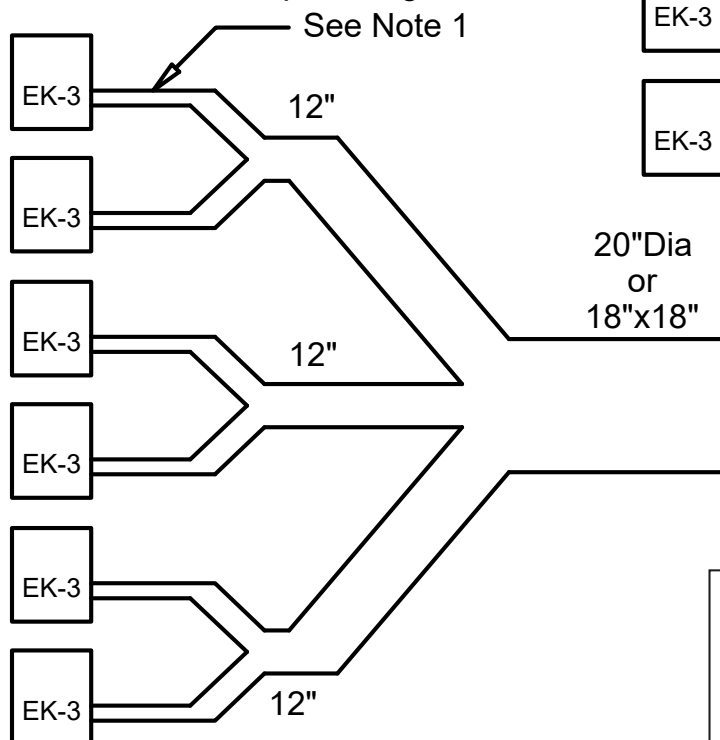
Three Boiler Flue Pipe Sizing



Four Boiler Flue Pipe Sizing



Five Boiler Flue Pipe Sizing



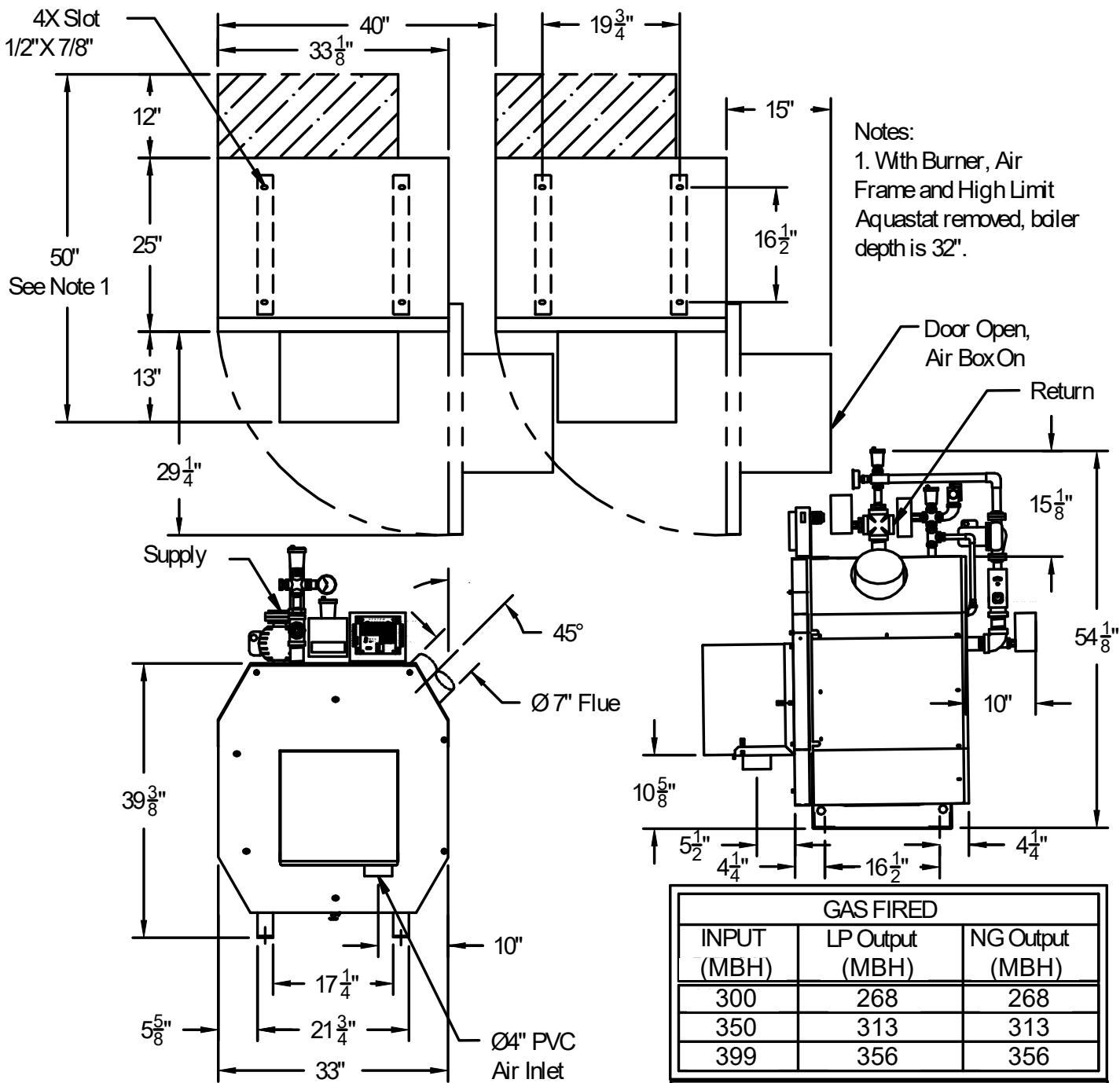
Six Boiler Flue Pipe Sizing

Notes:

1. Boiler Flue Size: Ø7"
2. Pipe each boiler's air intake separately.
3. Use schedule 40 PVC for intake piping.

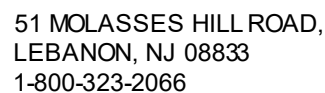
ENERGY KINETICS SYSTEM 2000 SPECIFICATIONS

EK-3 FRONTIER BOILER

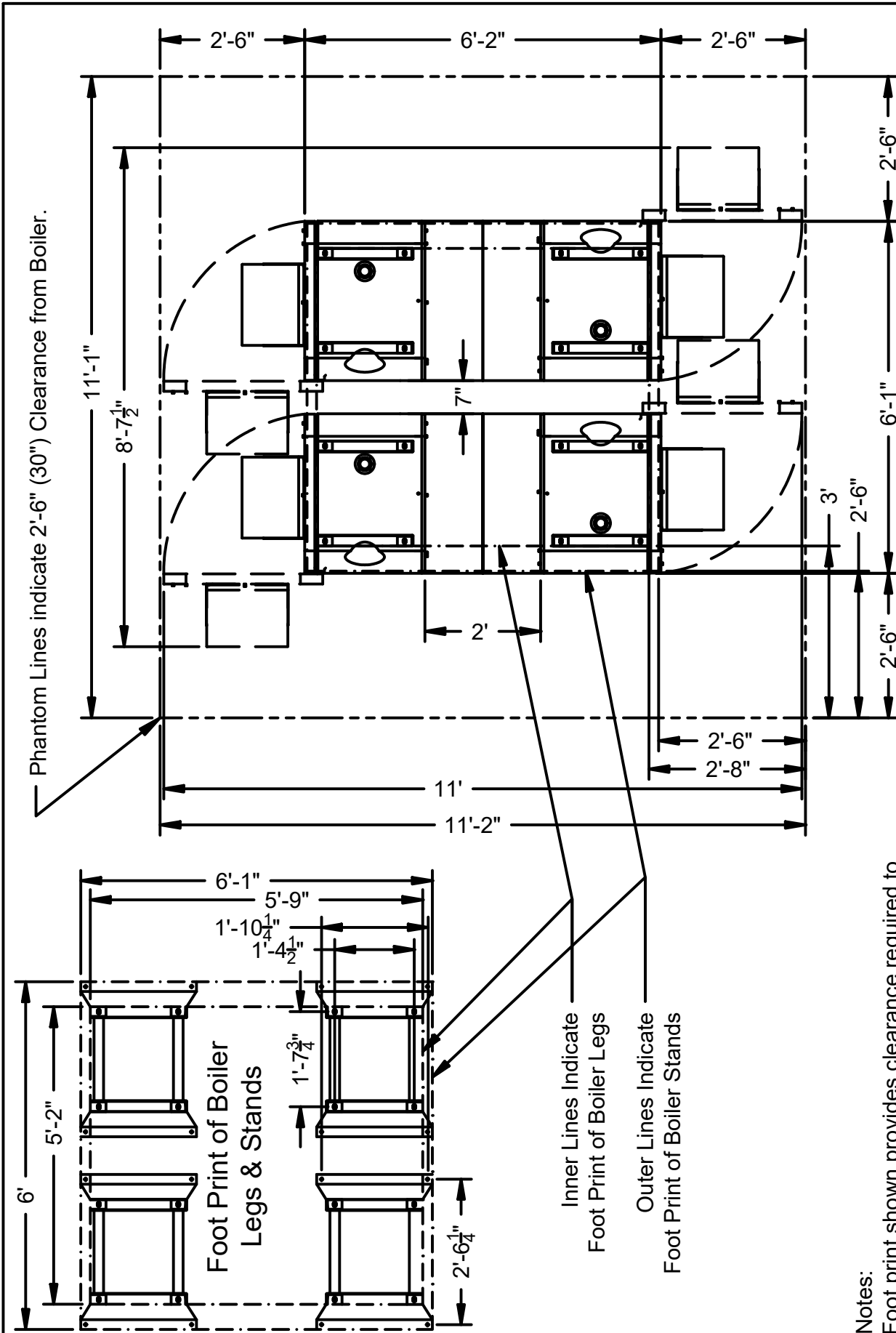


GAS FIRED		
INPUT (MBH)	LP Output (MBH)	NG Output (MBH)
300	268	268
350	313	313
399	356	356



OIL FIRED		
INPUT Gal/Hr	Nozzle @ PUMP, PSI	OUTPUT (BTU/HR)
2.25	2.00 45P @ 130	272,000
2.60	2.25 45P @ 135	313,000
3.00	2.50 45P @ 145	357,000



January 2024



Notes:
Foot print shown provides clearance required to service units plus an additional 30" clearance as required by some codes.

 Molasses Hill Road Lebanon, NJ 08833 1-800-323-2066		Foot Print Drawing 4 EK3 Boilers	
		DRAWN BY: JS REV: 	DATE: 09/27/05 DWG. NO.
		SYS-04-020	

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

sys-04-020-rev1.dwg

RATINGS

Boiler Model EK3 Frontier Gas	Burner Input (MBH)	Thermal Efficiency	Gross Output (MBH)^[1]
EK3F-300	300	89.4%	268
EK3F	350	89.3%	313
EK3F-399	399	89.1%	356

1. MBH refers to thousand BTU per hour.

ENERGY KINETICS, INC.
Limited (Five-Year) Warranty for
Commercial/Industrial Boilers

LIMITED WARRANTY

A Commercial/Industrial unit is considered to be any unit, EK-1, EK-2 or EK3, which is installed in any building not a residence or in a residence in which the boiler services more than two family units.

Energy Kinetics, Inc., Lebanon, NJ ("Energy Kinetics") hereby warrants to the original consumer purchaser ("purchaser") that the pressure vessel of its EK-1, EK-2 or EK3 boilers are free from defects in materials and workmanship, and if such pressure vessel proves to be so defective within five (5) years of the date of installation, Energy Kinetics shall, at its option, furnish a replacement for, or repair such pressure vessel, provided Energy Kinetics, is notified of the defect within thirty (30) days of the discovery of such defect. Purchaser's remedy shall be limited to such repair or replacement. Adjustment Policy: In the event that a pressure vessel is found to be defective one year or more following installation and is replaced by Energy Kinetics, the purchaser shall pay a proportionate charge for the time the defective pressure vessel has been in service based upon a percentage of the list price of such vessel at the time Energy Kinetics is notified of the defect as follows: 2nd year - 30%, 3rd year - 40%, 4th year - 50%, and 5th year - 60%.

THIS SHALL BE THE BUYERS EXCLUSIVE REMEDY.

ENERGY KINETICS SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM BREACH OF THIS OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.

This warranty is applicable only to the pressure vessel of those models of EK-1, EK-2 and EK3 boilers specified above that are installed in accordance with the basic BOCA Building Code and local statutes or ordinances, whichever shall be more restrictive and accepted good industry practice. This warranty does not cover components that are part of the heating system but which were not furnished by Energy Kinetics.

This warranty does not cover the workmanship of any installer of Energy Kinetics Commercial/Industrial boiler. In addition, it does not assume any liability of any nature for unsatisfactory performance caused by improper installation.

This warranty does not cover improper burner adjustments, control settings, care or maintenance.

This warranty does not cover any labor for removal or reinstallation of the alleged defective part, transportation to Energy Kinetics if necessary and other materials necessary to perform the exchange.

This warranty does not cover failure of the pressure vessel other than defects in material or workmanship and shall specifically exclude any other reason including but not limited to (a) lack of water (b) freezing (c) excessive pressure (d) floods (e) fire (f) acts of God (g) corrosion of internal or fireside surfaces (h) improper water conditioning (i) improper maintenance of external fireside surfaces (j) operation with defective fuels or other additives which cause deposits to collect or corrosion to occur in or on the pressure vessel.

Systems installed with chimneyless, through the wall venting option may have less than complete or poor combustion which may cause sooty fumes, odors or gradual discoloration of the area near the vent (exhaust) outlet. Poor combustion is generally the result of a burner being out of adjustment for a number of reasons, including but not limited to fuel quality and combustion air supply.

Energy Kinetics does not guarantee nor warranty that at all times the exhaust contents will be without a trace of soot or odor for reasons described above. Periodic cleaning or repainting of the area around the vent hood may be required if the appearance is objectionable in the view of the purchaser. Such cleaning or repainting is not the responsibility of the service company, installer or Energy Kinetics.

For prompt warranty service, notify the installer who in turn will notify Energy Kinetics that purchaser believes there is a defect in material or workmanship covered by this warranty.

If within 30 days of the discovery, this action does not produce a prompt response, notify Energy Kinetics Inc., Molasses Hill Rd., Lebanon, New Jersey 08833, in writing with details to support the warranty claim.

The purchaser is required to make available for inspection by Energy Kinetics or its representative, the parts claimed to be defective and, if requested by Energy Kinetics, to ship such parts prepaid to Energy Kinetics at the above address for inspection or repair. In addition, the purchaser agrees to make all reasonable efforts to settle any disagreement arising in connection with his claim before resorting to legal remedies in the courts.

This Warranty gives you specific legal rights and you may have, also, other rights which vary from state to state.



Energy Kinetics Inc.
51 Molasses Hill Rd.
Lebanon, NJ 08833
Phone: 800-323-2066
Fax: 800-735-2068