

# THERM ELECT Hydronic

## OWNER'S AND INSTALLER'S MANUAL



**Models: 9150, 9180**

*Applicable to Software Version 2.XX*

**NOTE** **IMPORTANT**

- ◆ The equipment described herein is intended for installation by a qualified technician in accordance with applicable local, state, and national codes and requirements.
- ◆ To insure proper installation and operation of this product, completely read all instructions prior to attempting to assemble, install, operate, maintain or repair this product. Upon unpacking of the system, inspect all parts for damage prior to installation and start-up.
- ◆ This manual should be retained by the owner upon completion of the installation and made available to service personnel as required.
- ◆ **Disclaimer:** In compiling this manual, Steffes Corporation has used its best judgement based upon information available, but disclaims any responsibility or liability for any errors or miscalculations contained herein, or any revisions hereof, or which result, in whole or in part, from the use of this manual or any revisions hereof.

**For Customer Use**

*Please record your model and serial number below. This number is found on the identification labels located on the front of and inside the electrical panel. Retain this information for future reference.*

**Model No.** \_\_\_\_\_

**Serial No.** \_\_\_\_\_



**RECOGNIZE THESE SYMBOLS AS SAFETY PRECAUTIONS**

**It is important, both for your personal safety and to avoid possible damage to the equipment and your property, that you observe the safety instructions given following these symbols.**

## SAFETY PRECAUTIONS

1. Fully assemble the system and load ceramic heat storage brick prior to energizing the system.
2. Pressure relief valve must be installed prior to operation of the system.
3. Use or storage of explosive or flammable gasses or liquids within close proximity of the system presents a hazard.
4. Clearance requirements are critical to safe operation of the system. Follow all requirements specified in this manual (Page 3.03).
5. Keep the top of system clear.
6. Use caution when working around the heating system as inlet and outlet piping can be very hot.
7. De-energize all branch circuits before servicing. This heating system may be connected to more than one branch circuit.
8. Installation of and/or service to this heating system should be performed by a qualified technician in accordance with information contained herein and with national, state, and local codes and requirements.
9. Repeated error codes on the system display (pages A.10 – A.13) indicate a need for service by a qualified technician.
10. Special requirements must be considered if placing the system in a garage or other area where combustible vapors may be present. Consult local, state and national codes and regulations to ensure proper installation.

## WARNING



**Hazardous Voltage: Risk of electric shock, injury, or death. This system may be connected to more than one branch circuit. Disconnect power to all circuits before installing or servicing. Installation of and/or service to this equipment MUST be performed by a qualified technician.**



**Risk of explosion. Operating the system without the pressure relief valve properly installed can cause an explosion. Connect the pressure relief valve in a vertical, upright position with the supplied fittings. DO NOT modify this assembly. DO NOT cap, plug, or otherwise obstruct the outlet of the pressure relief valve.**



**Risk of fire. Violation of the clearance requirements can cause improper operation of the equipment. Maintain the placement and clearance requirements specified.**



**Hot Surface. Plumbing and other surfaces can be hot. Use caution when working near the system.**

## BUILT-IN SAFETY DEVICES

The ThermElect Hydronic heating system incorporates safety devices to ensure normal operating temperatures are maintained. The chart below describes these safety devices.

DEVICE	FUNCTION	LOCATION ON SYSTEM
Core Charging High Limit Switches (Auto Reset)	These limit switches monitor the core and top temperatures. If normal operating temperatures are exceeded, the system will display "CORE FAIL" and the elements will not be allowed to operate.	Right side of system.
Heat Exchanger Limit Switch (Manual Reset)	This linear limit switch monitors the temperature of the water in the exchanger and interrupts power to the core blower if a water temperature of 250°F/121°C is exceeded. If this limit switch opens, contact a qualified service technician.	Behind front lower painted panel. Reset button visible in lower right front corner.
Outlet Water Temperature Limit Switch (Auto Reset)	This linear limit switch monitors the temperature of the water in the exchanger and interrupts power to the core blower if a water temperature of 225°F/107°C is exceeded.	Behind front lower painted panel.
Pressure Relief Valve	If the water pressure exceeds maximum psig, the pressure relief valve opens. Once water pressure of less than maximum psig is achieved, the valve closes.	Factory provided, field installed to outlet of heat exchanger.



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## Warranty

# 1

## Operation

### GENERAL OPERATION

The ThermElect Hydronic heating system stores demand off-peak electricity in the form of heat.

Operation of the heating system is automatic. During hours when energy costs are lower the system converts electricity to heat which is then stored in its ceramic brick core. The amount of heat stored in the brick core of the system varies in relation to outdoor temperature, utility peak conditions, and/or the heating requirements.

A heat call from the thermostat or main system control energizes the primary water loop pump. The variable speed core blower automatically adjusts its speed to achieve the desired outlet water temperature. The heated water is then pumped to the area (zone) from which the heat call originated.

The versatility of this system allows it to fit many applications. The system is designed for use as either a sole heating source (“stand alone” furnace) for make up air heating or as a supplement to another ducted heating system such as a heat pump.

### SYSTEM USE DURING CONSTRUCTION PHASE

Like most heating equipment manufacturers, Stefes strongly recommends that “Construction Heating Units” be used instead of the permanent heating system during the construction phase. Use of the permanent heating system during this phase may contaminate the duct system and/or internal areas of the heating system. This may cause poor indoor air quality issues and/or improper system operation or equipment damage.

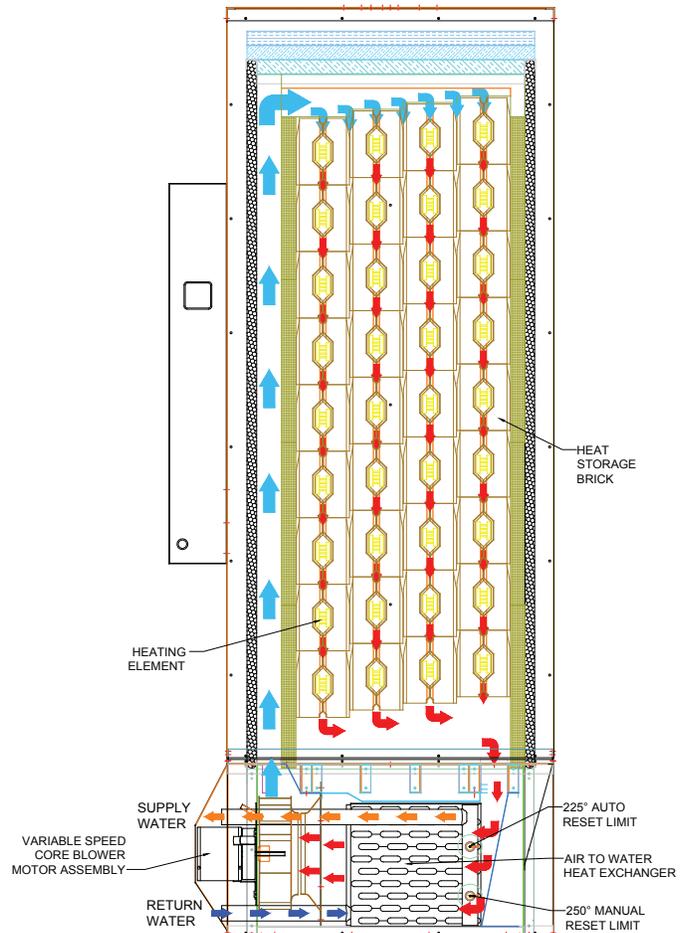
### SYSTEM START-UP

On start-up of the ThermElect Hydronic system, odors relating to first time operation of the heating components may be experienced. Allow the system to charge to its maximum brick core charge level, on start-up, to expel these odors. If the system has not been used for an extended period of time, dust may accumulate in the system. Upon restart, there may also be an odor as these dust particles are expelled.

During operation, the system may produce minor expansion noises. These noises are the result of the internal components reacting to the temperature changes.

### TURNING SYSTEM "OFF" AND "ON"

The system is fully automatic and does not need to be manually disabled. Talk to your installer or energy management person for additional information.



## CONTROL PANEL

Operation of the ThermElect Hydronic system is automatic. All operational functions are stored in its microprocessor in function locations and are factory preset. If necessary, the installer can adjust them through the control panel. (See Figure 1.)

### Four-Digit LED Display

The four digit LED displays specific operating information. During the configuration process, the configuration number and the values set in these configurations are displayed for viewing and adjusting purposes.

### AM and PM Indicator Lights

The AM and PM indicator lights are only utilized if the Steffes Time Clock Module is being installed and using 12 hour time display. With this module installed, the system displays time on AM/PM intervals. The light flashes next to the active designator/symbol. The system can be configured to display military time, in which case both the AM and PM lights illuminate.

### (M) Mode (Edit) Button

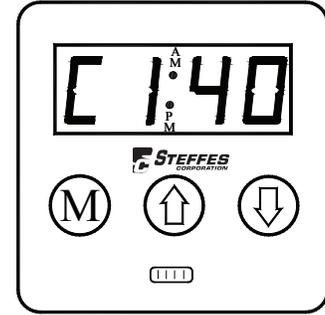
Used to access menus on the system (i.e. Help Menu or Configuration Menu) and to allow modifying of configuration settings.

### (↑) Up and (↓) Down Arrow Buttons

Used to scroll up or down when viewing or modifying operating functions.

### Interface Port

Allows technician external access for advanced operating modes, updating software, and troubleshooting.



CONTROL PANEL  
FIGURE 1



## CAUTION

Editing configuration information may alter the performance and operation of the system.

## OPERATING STATUS

The four digit LED will display various operating information as described below. Press and release the up arrow to view this data.



**Operating Mode** - Indicates the current operating mode of the system followed by the outlet water temperature.

C = Off-Peak (Charge) Time

P = On-Peak (Control) Time

A = Anticipated Peak Time



**Outdoor Temperature** - "O" followed by a number indicates current outdoor temperature.



**Heat Call Status** - indicates the current heat call status as determined by the room thermostat(s). The faceplate displays the highest heat call value present. If receiving a Stage 1 Forced Air Heat Call and a Hydronic Heat Call, the display will read "HC\_3".



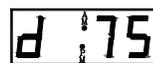
**A bar illuminates on the lower portion of the display's third digit whenever one or more heating elements are energized.**



**Brick Core Charge Level** - "CL" (charge level) followed by a number indicates the current percentage of heat stored in the brick core. "CL:\_" indicates the core is below minimum charge level and "CL: F" represents a full core charge level.



**Targeted Brick Core Charge Level** - "tL" (target level) followed by a number indicates the current percentage of brick core charge being targeted by the system. A display of "tL:\_" indicates charging is not allowed and "tL: F" indicates a full core charge target level.



**Load Control** - Current demand (kW) divided by 10. A value of "d 75" is equal to a demand of 750kW.

## DISCHARGE AIR/WATER SYSTEM

The 9100 Series heating systems can be used as straight hydronic heating appliances or as a combination hydronic and forced air system with the addition of a field supplied air handler, water coil, and duct sensor. In all systems, to deliver stored heat, the 9100 Series needs to receive a signal from a thermostat, BACNet system, energy management system, or serial communication input. This signal will initiate one of several levels of heat call.

When a heat call is initiated, the system displays the type of heat call on the status screen of the control panel, the primary loop pump is energized, and the outlet water temperature is monitored. The desired discharge water temperature is regulated based off of the target temperature (L127) established.

## BRICK CORE CHARGE CONTROL

Steffes heating systems are capable of providing a wide variety of heating options for various applications. The heating system's primary function is to store energy in the form of heat. Because the system is operated with microprocessor based control, it is very flexible in meeting the demands of the application. The rate at which energy is stored can be controlled with BACNET, 4-20, or pulse inputs.

The amount of energy stored is based on the target level which is determined by outdoor temperature, utility peak conditions, building automation system, and/or the heating requirements. Sensors monitor the brick core temperature and communicate this information to the processor control board. If the current charge level is lower than the target level of any core, elements will be energized as allowed by the load management system.

## CHARGE CONTROL OVERRIDE

If desired, the ThermElect Hydronic system can be programmed to allow a charge control override. This override allows the user to force the system to target a full core charge level and can be initiated or cancelled at any time. If an override is initiated, the system targets a full core charge level during the next off-peak period. It continues to charge during off-peak hours until it achieves full (maximum) core charge or until the override is cancelled. Once full charge is achieved or the override is cancelled, the system charges according to the standard configuration.

## MAINTENANCE AND CLEANING

Any air filter(s) in the system should be replaced on a regular basis to ensure proper operation and to maintain overall efficiencies. No additional routine maintenance is required.

If utilizing a heat pump or air conditioning system with the ThermElect Hydronic system, the indoor coil should be cleaned periodically as dirt accumulation may reduce system efficiency. It is important to follow the manufacturer's maintenance and cleaning recommendations for these devices.

# 2

## Optional Accessories

### LOAD MANAGEMENT CONTROL

The system is designed to operate under one of many load management control strategies.

#### 1. BACNet Control

Steffes commercial heating furnaces are available with a BACNet control option (Order Item #1301013 or #1301015). This device is easily integrated into most building automation systems to provide building managers full control and visibility of the heating system's operation. BACNet allows the following functions to be monitored with simple, twisted pair communication:

- Real time system monitoring
- Full thermostat control
- Monitoring of heat storage levels in the brick and all system temperatures
- Remote configuration, testing and adjustment
- Service requirement alerts

BACNET



#### 2. 4-20 Milliamp Control (1-5 volt DC)

System receives a signal from an external load control device such as a building load management system. This external signal dictates the maximum amount of energy which can be consumed during a preset time interval.

#### 3. Pulse Monitoring

System monitors pulse outputs from the power company's electric meter. Program parameters such as desired maximum building kW and pulse ratios for the metering system being used are programmed into the ThermElect system. The system then charges proportionally when demand free power is available. This keeps the total building kW usage at or below the desired level.

#### 4. Conventional Peak Control

The ThermElect Hydronic system responds to heat calls during the on-peak and off-peak periods; however, only consumes energy (energize heating elements) during the off-peak periods. The ThermElect Hydronic system is controlled by an external control device such as a meter, time clock module, or BACNet control.

LIFTING HANDLES

### LIFTING HANDLES

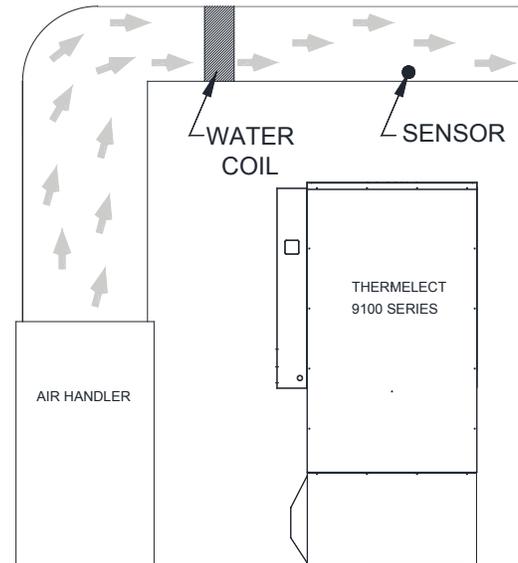
Optional lifting handles (Order Item #1302120) are available to aid in moving the ThermElect Hydronic system into its final location.



## EXTERNAL DUCT SENSOR

The optional external duct sensor (Order Item #1041536) provides the ability to monitor the duct temperature at an area beyond fresh air makeup and/or beyond other devices and regulate the discharge air temperature accordingly.

The duct sensor feature is enabled if the 4 bit is set in Location 53 (L053). Once enabled, the ThermElect Hydronic system monitors temperature at both the duct sensor and the output sensor during Y, W, or E calls from the thermostat.



## STATIC HEAT RECOVERY UNIT

During operation of the ThermElect Hydronic, there is some static dissipation that comes off of the warm outer panels. The Static Heat Recovery unit (Order Item #1302110) moves this heat from the ThermElect Hydronic system to an area requiring heat. Utilizing this option can maximize efficiency when the system is installed in an unheated area.

With the Static Heat Recovery unit installed, the ThermElect Hydronic system can be set up to monitor temperature at the control board and/or in the brick core. If either of these temperatures reach a point greater than the preset point, the blower in the Static Heat Recovery unit is energized and draws heat from inside the painted outer panels of the ThermElect Hydronic system and delivers it to the desired area of the structure.

## SSR CONTROLLER

The Steffes SSR (Solid State Relay Panel) is an optional control device used with the Steffes ThermElect 9100 Series and Comfort Plus Commercial (6100 and 7100 Series) Heating Systems (Order Item #1301016). Refer to the Owner's and Installer's Manual to verify compatibility for the application.

It utilizes SSR technology to enable more precise balancing of a building's overall electric load by varying the amount of total element input that can be energized in a Steffes furnace at any given time in relation to the maximum allowable building load. The Steffes SSR optimizes a building's power quality and control.

The SSR Controller can only accept input signals from the Steffes furnace; but, it can respond to all types of control inputs to include 4 – 20 Milliamp, 1 – 5 Volt DC, electric meter pulsing, BACnet or other building energy management system. With the 4 – 20mA or 1 – 5 volt DC signals, the SSR will provide an output directly proportional to the input signal. 4mA signal produces 0% output while a 20mA signal produces 100% output. With the utility pulse meter input, the SSR output percentage will automatically adjust to maintain a total maximum system load as dictated by the furnace's set-up.

### SSR CONTROLLER



## CONTROL CIRCUIT STEP-DOWN TRANSFORMER

The internal controls and motors of all ThermElect systems operate at 240 volts (two wire). In systems with 277/480 or 347/600 volt element circuits, a transformer must be installed per the installation instructions to supply this voltage to the system's controls. This transformer can be purchased as an optional device from Steffes Corporation or sourced from your local electrical supply outlet. See the matrix below for proper sizing. load as dictated by the furnace's set-up. With a Bacnet, the furnace can be commanded to varying input levels remotely.

Model	Primary Voltage	Secondary Voltage	KVA	Hevi Duty Item #	Steffes Item #
277/480V	480	240	2	HS1F1BS or equal	1017082
347/600V	600	240	2	HS10F2AS or equal	1017080

# 3

## Installation

### SHIPPING AND PACKAGING

The ThermElect Hydronic system should always be transported in an upright position to avoid damage to internal components and insulation materials. The left and right side panels and the top panel should not be removed from the Storage Module. The information below describes the items shipped with each system.

#### ① STORAGE MODULE



MODEL	INPUT
9150	53kW
9180	80kW

#### ② BASE



#### ③ PRESSURE RELIEF VALVE



*(shipped behind the exchanger access panel)  
Refer to Page 3.09*

#### ④ ELECTRICAL PANEL

*(includes electrical panel mounting screws, romex connectors, and wiring schematic)*



208/240V shown

#### ⑤ INFORMATION PACKAGE

*(includes Owner's Manual and Warranty Registration Card)*



*(included on pallet with the electrical panel)*

#### ⑥ HEATING ELEMENTS WITH CERAMIC INSULATORS



MODEL	ELEMENTS
9150	12 (2 boxes of 6)
9180	18 (3 boxes of 6)

*(shipped separately)*

#### ⑦ INSTALLATION HARDWARE KIT



*(shipped inside the electrical panel)*

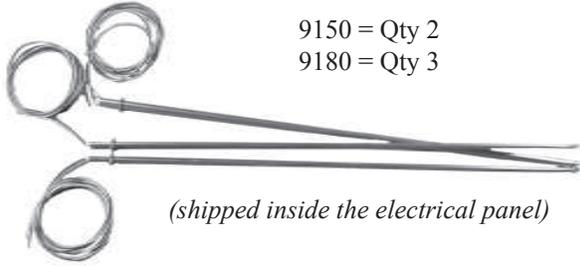
#### ⑧ SEAM TRIM

*(shipped inside brick storage module)*



# SHIPPING AND PACKAGING CONTINUED...

## 9 CORE THERMOCOUPLES



9150 = Qty 2  
9180 = Qty 3

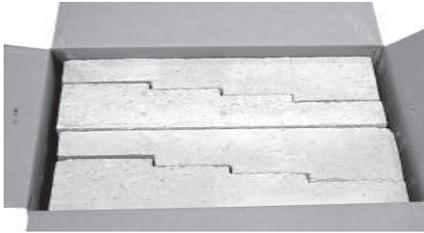
*(shipped inside the electrical panel)*

## 12 OUTDOOR TEMPERATURE SENSOR



*(shipped inside the electrical panel)*

## 10 TOP AIR CHANNEL BLOCK



*(shipped separately)*

## 13 TRANSFORMER CONDUIT ASSEMBLY (277V & 347V SYSTEMS ONLY)



*(shipped inside the electrical panel)*

## 11 CERAMIC BRICK



MODEL	BRICK	LBS	PALLETS
9150	192	3,360	2
9180	288	5,040	3

96 brick per pallet *(shipped separately)*

## PLACEMENT AND CLEARANCE REQUIREMENTS

The system dimensions and required clearances **MUST** be taken into consideration when choosing its location within a structure. (See Figure 2 for dimensions and clearance requirements.)

The best installation location for the system is in a space requiring heat so some amount of the heating requirements can be satisfied through static dissipation from the warm outer panels of the ThermElect Hydronic system. In situations where the system is not installed in an area it is intended to heat (i.e. garage or storage area), it is important to account for the heat lost through static dissipation by making proper adjustments when sizing the system.

**This area must remain free of debris and most importantly the room air should be maintained at less than 85° Fahrenheit.** Area may require ventilation. Refer to Specifications (Pages A.01-A.02). It is the responsibility of the installer and system designer to provide this ventilation.

In addition to the physical space requirements, the weight of the system must also be taken into consideration when selecting the installation surface. A level concrete floor is the designed installation surface, but most well supported surfaces are acceptable. If unsure of floor load capacity, consult a building contractor or architect.



**Special requirements must be considered if placing the system in a garage or other area where combustible vapors may be present. Consult electrical, building, and fire prevention codes.**

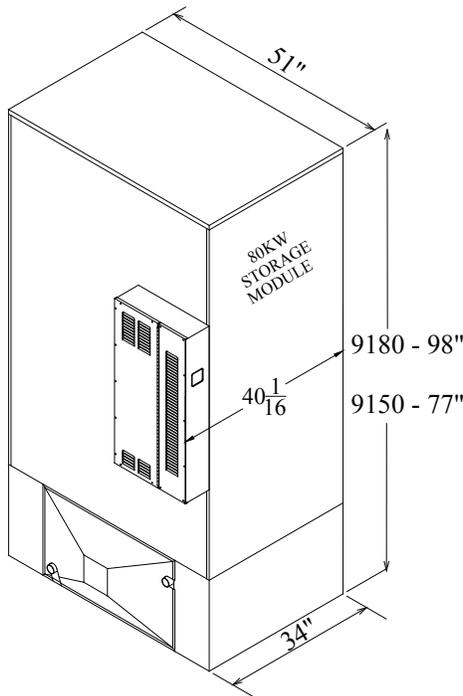
**WARNING**

**Risk of fire. Can cause injury or death.**

- **Violation of the clearance requirements or failure to provide proper ventilation can cause improper operation of the system. Maintain the placement and clearance requirements as specified and provide ventilation as necessary.**
- **Moving the system after install may result in equipment damage. Do NOT move system from original installed location.**

### SYSTEM REQUIREMENTS FIGURE 2

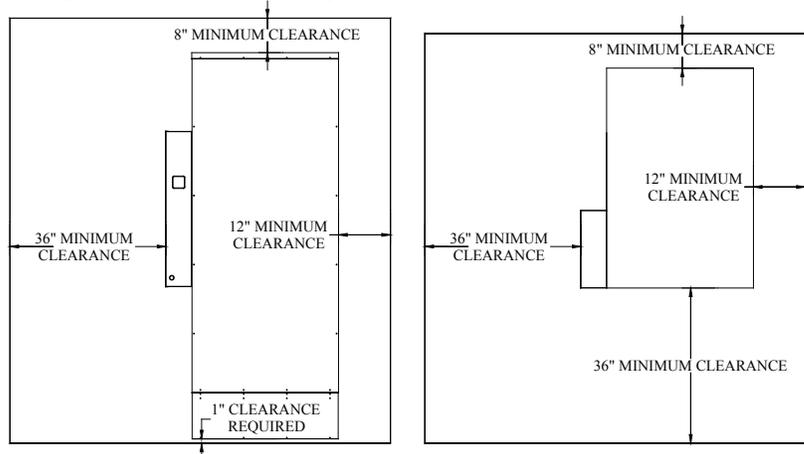
#### DIMENSIONS



#### CLEARANCES

- ◆ Back = 8 inches
- ◆ Bottom = 1 inch (from combustible material)
- ◆ Right Side = 12 inches
- ◆ Top = 8 inches (from combustible material)
- ◆ Left Side & Front = 36 inches (for ease in servicing)

Adhere to clearances and provide appropriate ventilation to maintain no greater than 85°F air temperature in area where system is installed.



**Some electrical codes may require a greater front and/or left side clearances depending on operating voltages and other factors.**

## INITIAL SET-UP

- Step 1** Remove the Information Package from the outside of the electrical panel and unpackage the storage module and base.
- Step 2** Move the base of the ThermElect system into location.
- Step 3** Level the base ensuring the leveling legs are in full contact with the floor so the base does not rock. The legs cannot extend more than 1".
- Step 4** Remove the painted front and back panels of the storage module. The right and left sides and the top panels should not be removed from the storage module
- Step 5** Position the brick storage module onto the base, making sure the square holes (front) in the base line up with the square holes of the storage module.



Optional lifting handles are available from Steffes (Order Item #1302120).

- Step 6** Reinstall painted back panel and attach right and back side seam trim using hardware provided.



## WARNING

**HEAVY OBJECT WARNING:**  
Risk of personal injury, or death. ThermElect Hydronic systems are heavy. Use lifting aids to move system into place.

- ◆ Do not place object, hands, and/or body parts under the system when lifting.
- ◆ Do use care to keep objects, hands, and/or body parts clear of system when lifting.

## CAUTION

Risk of improper operation or equipment damage. Read and follow installation instructions carefully.

- Remove system from shipping pallet prior to final placement.
- Ensure that leveling legs make solid contact with flooring and do not extend more than 1 inch.
- Use and follow generally accepted safety practices when handling insulation materials.
- Equipment **MUST** be installed by a qualified technician in accordance with all applicable codes and regulations.

## ELECTRICAL PANEL INSTALLATION

- Step 1** Remove the electrical panel front cover and locate the installation hardware package.
- Step 2** Remove 1" trade size knockouts from the electrical panel and the ThermElect Hydronic's left side panel to allow routing of element harnesses. **DO NOT remove any unneeded knockouts.**
- Step 3** Remove 1/2" trade size knockout for routing of control wiring.
- Step 4** Secure the electrical panel to the left side of the system with the 8 x 3/4" sheet metal screws supplied in the electrical panel.



**Knockouts must be effectively sealed by connectors.**

## BRICK LOADING

- Step 1** Remove the seam trim from inside the storage module and set aside.
- Step 2** Remove the sheet metal screws around the outer edge of the galvanized front panel. Remove the panel and set it aside.
- Step 3** Starting at the bottom, carefully lift the insulation blankets and drape them over the top of the system.



**Use and follow generally accepted safety practices when handling insulation materials.**

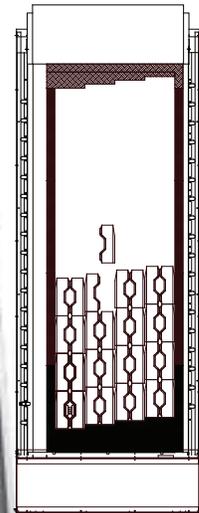
- Step 4** Cut banding and remove the two packages of rigid insulation from inside the storage module. One of the packages contains the back rigid insulation (no holes) and one package contains the front rigid insulation (with holes).



## CAUTION

**Risk of equipment damage or personal injury.** Insulation boards located behind the insulation blankets may fall out when blankets are lifted. Use caution when lifting insulation blankets to avoid personal injury or damage to the insulation boards.

FIGURE 3



**Step 5** Locate and install the back rigid insulation inside the brick storage module. It will be placed on top of the existing rigid insulation at the back of the module. The angled edge will line up with the existing rigid insulation.

**Step 6** Load the brick, one row at a time, starting at the back of the brick core and working forward. Load bricks as shown in Figure 3. Make certain brick debris does not interfere with brick alignment front to back.

**Step 7** Install top air channel block by sliding it up and back into place on top of the bricks. (See Figure 4.)

FIGURE 4



**NOTE** For ease of installation, install top block while loading bricks.

**Step 8** Install the front rigid insulation (with holes) in front of the bricks. Again, the existing angled rigid insulation will line up with the front angled rigid insulation.

**NOTE** The holes in the rigid insulation board MUST line up with the brick openings so elements can be installed.

**BRICK INSTALLATION TIPS:**

- Install bricks carefully to avoid damage to the insulation panels.
- Remove loose brick debris to prevent uneven stacking of brick as this can make installation of the elements and the brick core temperature sensor(s) difficult.
- Brick rows MUST line up front to back and top to bottom.

**WARNING**

**Risk of fire. Can cause personal injury or death. DO NOT operate the Comfort Plus Hydronic system if damage to the insulation panels on the inner sides of the brick core occurs.**

**HEATING ELEMENT INSTALLATION**

Proper heating element installation is important to operation of the system. Reference the "Useful Tools" section of the Heating Element Service and Repair Guide included with the heating elements for more information.

**Step 1** After all bricks are loaded and rigid insulation boards are in place, insert the heating elements through the insulation, sliding them in until the cement side rails are flush with the front side of the ceramic brick.

**NOTE** Make sure the elements designated as "outer" elements are installed on the electrical panel side of the system with the shortest lead in the left most brick position.

**Step 2** Route the element termination lead with ceramic insulator to the appropriate side of the system. Insert the lead into position as shown in Figure 5.

**NOTE** Element leads must never cross each other.

**WARNING**

**HAZARDOUS VOLTAGE: Risk of electric shock. Can cause injury or death.**

- ♦ DO NOT remove the electrical panel cover while system is energized.
- ♦ Elements MUST be positioned properly to avoid short circuiting against any surfaces within the system.

FIGURE 5

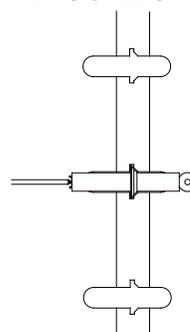


FIGURE 6



**Step 3** Install element lead insulators. These ceramic insulators MUST maintain lead wire spacings as shown in Figure 6.

**Installation**

**Step 4** Lower insulation blankets back into position, one at a time. Carefully tuck the sides of the insulation into the edges, corners, and around the exposed portions of the heating element to ensure maximum efficiency.



**Use face mask, gloves, and long sleeved garments when handling insulation materials in accordance with generally accepted safety practices.**

**Step 5** Reinstall the galvanized front panel and secure it to the system using the screws originally removed.

**Step 6** Route element harnesses through connectors, using one connector/harness until tape is centered.

**Step 7** Attach element lead wires to element terminals. Start at the top using the appropriate color chart below. Repeat pattern as necessary. The neutral white wires are jumpered together in sets of three.

<b>277/347V</b>	= Black (Top)	<b>208/240V</b>	= Black (Top)	<b>240V</b>	= Black (Top)
<b>Systems</b>	White	<b>3phase</b>	Red	<b>1phase</b>	Red
	Red	<b>Systems</b>	Blue	<b>Systems</b>	Black
	White		Black		Red
	Blue		Red		
	White		Blue		

**Step 8** Route the orange wire to the electrical compartment. Cut the wire and crimp ends (found on orange/black wires in electrical compartment). Connect the orange wires to the orange/black wires.

**Step 9** Remove the blower access cover from the base left side. Locate the blue core blower wires and purple (violet) water temperature sensor wires.

**Step 10** Route the wires through the flanged hole at the front left corner of the base. Continue routing up to the electrical compartment through 1/2" knockout. Connect the blue core blower wires to black and the blue wires. Connect the two purple (violet) wires to the two purple wires..

## BRICK CORE TEMPERATURE SENSOR INSTALLATION



### CAUTION

**Risk of improper operation.** Proper installation of the brick core temperature sensor is critical to the operation of the heating system. Read and follow installation instructions carefully.

**Step 1** Remove the screw(s) by the brick core temperature sensor connector holes in the galvanized front panel.

**Step 2** Route the brick core sensors through the 1/2" knockout up to the relay driver board. The yellow wire from each sensor must be connected to the Y terminal of the proper sensor connection terminal block, and red to R. **Polarity of sensors is critical.**

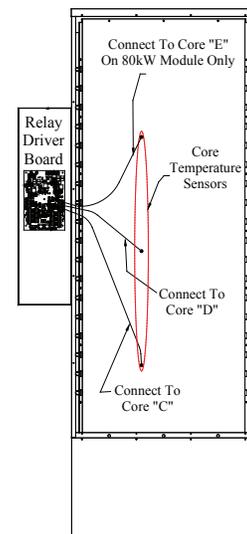
Sensor connections **MUST** be installed as follows:

- **Single Module - 9150 or 9180 (Figure 7)**
  - Bottom sensor to core C
  - Second sensor to core D
  - Third (if equipped) to core E

**Step 3** Insert the brick core temperature sensors through the holes in the galvanized front panel. The sensors must pass through the blanket and board insulation and into the brick core. Use the sensors to aid in making a passageway by rotating the sensors while gently pushing inward.

**Step 4** Once brick core sensors are installed, re-install sensor mounting screws to secure and ground the sensors.

**CORE TEMPERATURE SENSOR CONNECTIONS**  
**FIGURE 7**



# LINE VOLTAGE ELECTRICAL CONNECTIONS

To determine the correct wire size required for the circuit feeding the system, refer to the Specifications (Page A.01-A.02) and the system's identification label located on the cover of the electrical panel (Figure 8).

**Step 1** Remove the electrical panel cover if not already removed.

**Step 2** **277/347 only.** Mount the dry type enclosed transformer below the electrical panel on the system's painted left side. Use a 1/2" knockout from the bottom left side of the electrical panel.

**NOTE** Install only the proper size and type fuses in the factory supplied fuse block.

**Step 3** Route all supply circuit field installed conductors through a knockout and into the electrical panel.

**NOTE** Use copper or aluminum conductors rated at 75°C or higher for line voltage field connection of this device.

**Step 4** Make line voltage connections to lugs of single feed bus and ground lug. Refer to the Line Voltage Wiring Diagrams (Pages A.07 - A.08) for more information on these connections.



## WARNING

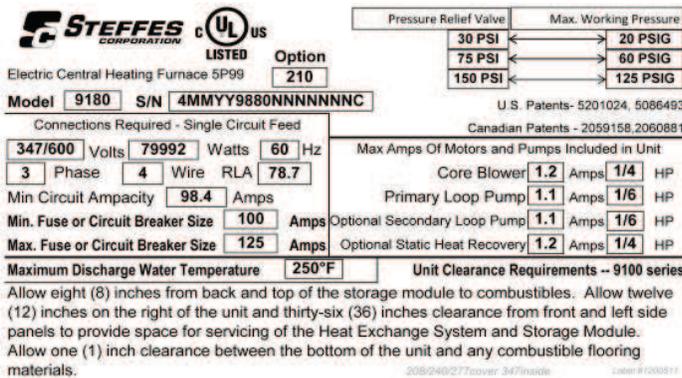
- ◆ **HAZARDOUS VOLTAGE:** Risk of electric shock, injury or death. Do not energize the system until installation is complete. Equipment **MUST** be installed by a qualified technician in accordance with all applicable local, state, national codes and regulations.
- ◆ Risk of equipment damage, personal injury or fire. Do **NOT** install any wiring in line voltage compartment unless rated for line voltage. To ensure proper operation and safety, all wiring in the line voltage compartment **MUST** be rated for line voltage.

## CONNECTION OF PRIMARY LOOP PUMP

In 277/347 volt installations, a 120 or 240V single phase pump can be used. Connect the pump only to terminals inside the electrical panel marked for connection of the primary loop pump as shown in Figure 9B.

- A 240V pump is required for 208/240V applications (Figure 9A) as no neutral terminal is provided.
- Do not use pumps with relay outputs or electronics
- Total rating of all connected pumps cannot exceed 1.2 amps on each pump output.
- Make wiring connections according to manufacturer's instructions and appropriate line voltage wiring diagram.

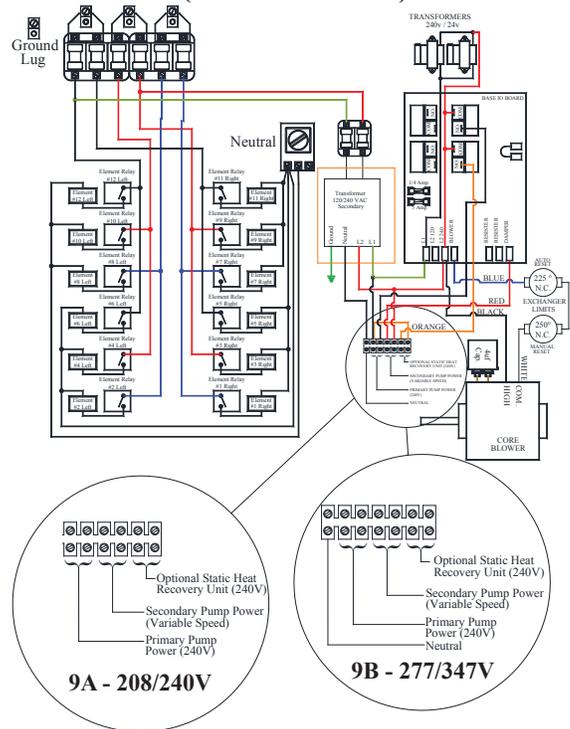
**SAMPLE SYSTEM IDENTIFICATION LABEL**  
**FIGURE 8**



<b>STEFFES CORPORATION</b>		LISTED <b>Option</b>	
Electric Central Heating Furnace 5P99		210	
Model <b>9180</b>	S/N <b>4MMYY9880NNNNNNNC</b>	U.S. Patents - 5201024, 5086493	
Connections Required - Single Circuit Feed		Canadian Patents - 2059158, 2060881	
347/600 Volts	79992 Watts	60 Hz	
3 Phase	4 Wire	RLA 78.7	
Min. Circuit Ampacity	98.4 Amps		
Min. Fuse or Circuit Breaker Size	100 Amps		
Max. Fuse or Circuit Breaker Size	125 Amps		
Maximum Discharge Water Temperature	250°F	Unit Clearance Requirements -- 9100 series	
Pressure Relief Valve		Max. Working Pressure	
30 PSI		20 PSIG	
75 PSI		60 PSIG	
150 PSI		125 PSIG	
Max Amps Of Motors and Pumps Included in Unit			
Core Blower	1.2 Amps	1/4	HP
Primary Loop Pump	1.1 Amps	1/6	HP
Optional Secondary Loop Pump	1.1 Amps	1/6	HP
Optional Static Heat Recovery	1.2 Amps	1/4	HP

Allow eight (8) inches from back and top of the storage module to combustibles. Allow twelve (12) inches on the right of the unit and thirty-six (36) inches clearance from front and left side panels to provide space for servicing of the Heat Exchange System and Storage Module. Allow one (1) inch clearance between the bottom of the unit and any combustible flooring materials.

**FIGURE 9**  
**(277/347V Shown)**



**Installation**

# LOW VOLTAGE ELECTRICAL CONNECTIONS - OUTDOOR TEMPERATURE SENSOR (OPTIONAL)



- If using BACNet control, the outdoor temperature sensor may not be used. Follow the instructions included with the BACNet Controller.
- If connecting to the Steffes power line carrier (PLC) system, follow the installation instructions in the PLC system's Owner's and Installer's Guide.
- Outdoor sensor wire **MUST NEVER** be combined with other control wiring in a multi-conductor cable.

**Theory of Operation:** The outdoor sensor monitors outdoor temperature and provides this information to the system. The system responds by automatically storing heat in its brick core according to outdoor temperature and the heating requirements.

**Location of:** The outdoor sensor must be placed in a location where it can accurately sense outdoor temperature and is not affected by direct sunlight or other abnormal temperature conditions.

**Installation Methods:** A) Hard wired to Steffes heating system "OS" and "SC" terminals (default)  
OR  
B) Connected to Power Line Carrier (PLC)

- Wiring:**
- Route low voltage wire from the outdoor sensor to the electrical compartment through one of the low voltage wire knockouts.
  - Connect to "OS" and "SC" as shown in Figure 10.
  - If the sensor wiring is routed through an external wall, the opening through which the wire is routed **MUST** be sealed. Failure to do so may affect the accuracy of the outdoor temperature sensor.
  - The outdoor sensor is supplied with a lead length of 40 ft. If a greater wire length is needed, it can be extended to a total of 250 ft.
  - No other loads can be controlled or supplied through this cable. It is for connection of the outdoor sensor **ONLY**.
  - This low voltage cable **MUST** not enter any line voltage enclosure.
  - Unshielded Class II (thermostat) wire can be used as extension wire provided it is segregated from any line voltage cabling.

Installation

# LOW VOLTAGE ELECTRICAL CONNECTIONS - ROOM THERMOSTAT (OPTIONAL)

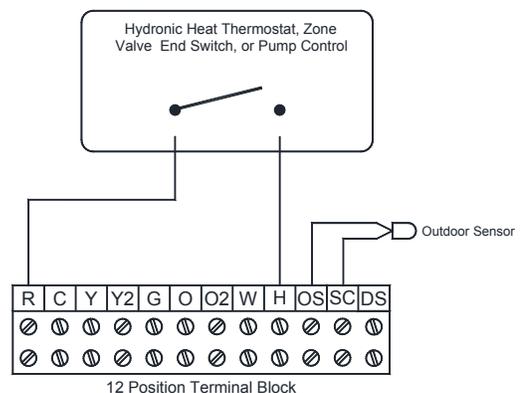
A low voltage (24VAC) room thermostat can be used for room temperature control with the ThermElect Hydronic system. If so, Steffes recommends using a digital thermostat. To initiate a heat call, the system needs a switch closure from R to H. This energizes the primary loop pump outputs.

## 12-Position Low Voltage Terminal Block Coding

- R = Low Voltage Hot
- C = Low Voltage Common
- Y = Compressor/Stage 1 Heat Call
- W = Stage 2 Heat Call
- Y2 = Compressor Output
- G = Fan Call
- O = Reversing Valve Input
- O2 = Reversing Valve Output
- H = Hydronic Heat
- OS = Outdoor Temperature Sensor
- SC = Temperature Sensor Common
- DS = Duct Temperature Sensor

## LOW VOLTAGE CONNECTIONS HYDRONIC HEATING SINGLE ZONE SYSTEM

FIGURE 10



# AIR CONDITIONER/HEAT PUMP INTERFACE

The ThermElect Hydronic system can be used in conjunction with an air conditioner or a heat pump. Contact Steffes Corporation for more information.

## PRESSURE RELIEF VALVE INSTALLATION



### WARNING

**Risk of explosion. Can cause injury or death. The factory supplied pressure relief valve **MUST** be connected to the system with the supplied fittings.**

- ♦ **DO NOT modify this assembly.**
- ♦ **DO NOT cap, plug, or otherwise obstruct the outlet of the pressure relief valve.**
- ♦ **DO mount the pressure relief valve in a vertical, upright position.**
- ♦ **This pressure relief valve is sized to service the needs of the ThermElect Hydronic heating system. If multiple heating systems are being used, pressure relief valving for the other system **MUST** be provided separately.**



**Step 1** Remove the exchanger access panel and locate the pressure relief valve assembly.

**Step 2** Connect the pressure relief valve to the outlet water port on the left side of the ThermElect Hydronic. It is extremely important that the following conditions for installation of this part are met:

- Insure all connections, including the valve inlet are clean and free from any foreign material.
- Use pipe compound sparingly, or tape on external threads only.
- Mount the pressure relief valve in a vertical, upright, position directly to the outlet water port of the system. Under no circumstances should there be a flow restriction or valve of any type between the safety relief valve and the pressure vessel.

**Step 3** Use schedule 40 pipe to install a discharge line for the pressure relief valve. This discharge line **MUST**:

- be connected from the valve outlet with no intervening valve and directed downward to a safe point of discharge.
- allow complete drainage of both the valve and the discharge line.
- be independently supported and securely anchored to avoid applied stress on the valve.
- be as short and straight as possible.
- terminate freely to atmosphere where any discharge is clearly visible and is at no risk of freezing.
- terminate with a plain end that is not threaded.
- be constructed of a material suitable for exposure to temperatures of 375°F or greater.
- be, over its entire length, of a pipe size equal to or greater than that of the valve outlet.

Available Pressure Relief Valves	Minimum BTU Rating	Maximum Operating Pressure	Order Item #
30 PSI	400,000	20 PSI	1100104
75 PSI	500,000	60 PSI	1100105
150 PSI	500,000	125 PSI	1100106

*Note: 9100 Series Systems are shipped with 75 PSI pressure relief valves. If a different valve is required order the item number listed above.*



### CAUTION

**Risk of injury or property damage. During operation, the pressure relief valve may discharge large amounts of steam and/or hot water. To reduce the potential for bodily injury or property damage, install a discharge line.**

- ♦ **DO use schedule 40 pipe for the discharge line.**
- ♦ **DO NOT use schedule 80, extra strong pipe or connections on the discharge line.**
- ♦ **DO NOT cap, plug, or otherwise obstruct the discharge pipe outlet.**
- ♦ **DO follow all local, state, and national codes and regulations.**

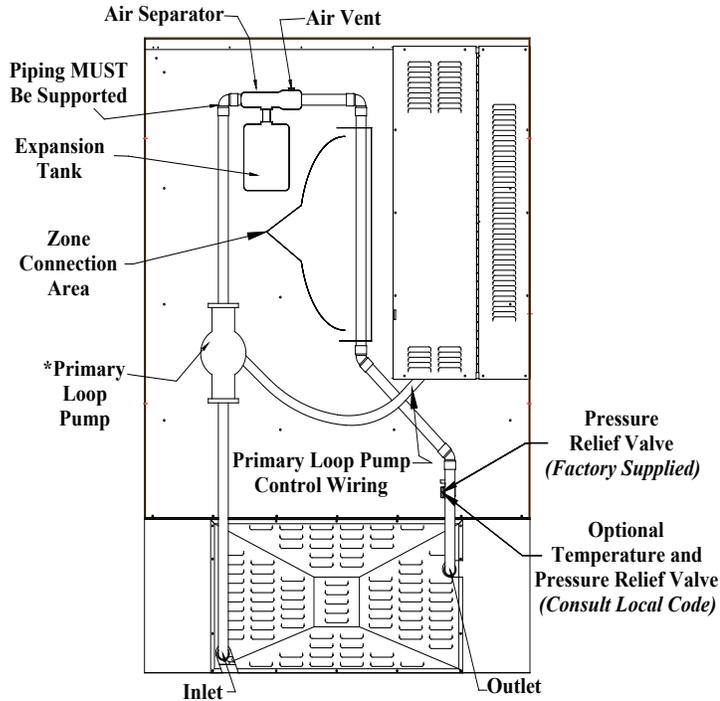
# PLUMBING

The ThermElect Hydronic system should be plumbed with a primary loop and secondary (zone) loops. The primary loop needs to consist of a minimum of 12' of 1.25" pipe. The heat exchanger inlet and outlet are 1.5" diameter, reducers will be required if 1.25" pipe is elected for the primary loop. The secondary (zone) loops require additional pump(s) to operate effectively. Refer to Typical Primary Loop and the Typical System Plumbing Diagrams below for installation information.

The primary loop serves to regulate heat transfer from the system's heat exchanger. The primary loop pump should be powered by ThermElect Hydronic control system as shown in Figure 11. If using other control method, flow MUST continue for at least 30 seconds at the end of a heat call.

**TYPICAL PRIMARY LOOP**

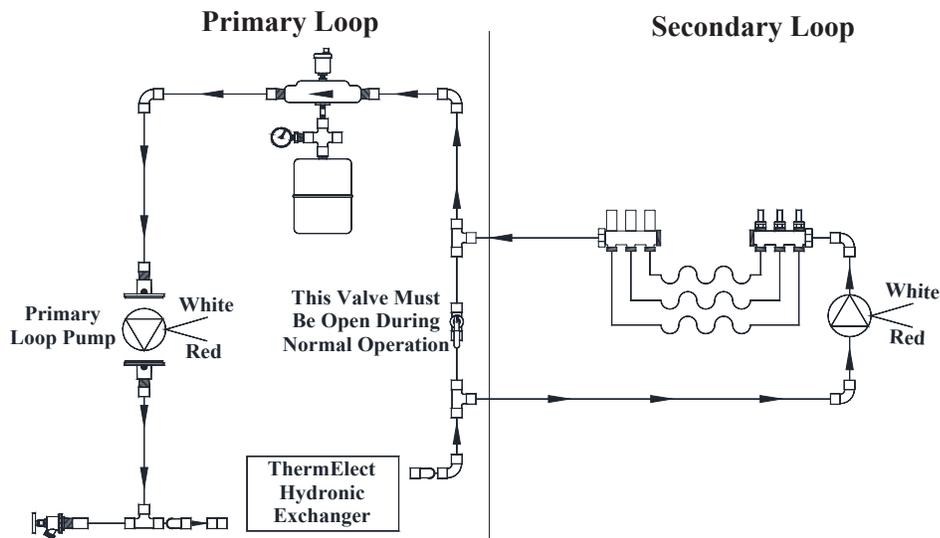
**FIGURE 11**



**TYPICAL SYSTEM PLUMBING SINGLE TEMPERATURE ZONES**

**FIGURE 12**

**Single Temperature Zone**



**NOTE:** There are many additional ways to connect plumbing and regulate temperature from the primary loop onward.

**Installation**

### Heat Exchanger Flow and Restriction Properties

GPM	Velocity (Feet/Sec)	Restriction 150° Water (Feet of Head)	Restriction 80° 50% Propylene Glycol (Feet of Head)
5	0.6	0.1	0.2
10	1.2	0.3	0.6
15	1.8	0.7	1.3
20	2.4	1.2	2.1
24.5	3	1.7	3.1
25	3.1	1.7	3.2
30	3.7	2.4	4.5

HEAT EXCHANGER SPECIFICATION	
Capacity	3.4 Gallons
Maximum Flow	30 GPM
Tubing Material	Copper
Maximum Outlet Water Set Temperature	180°F

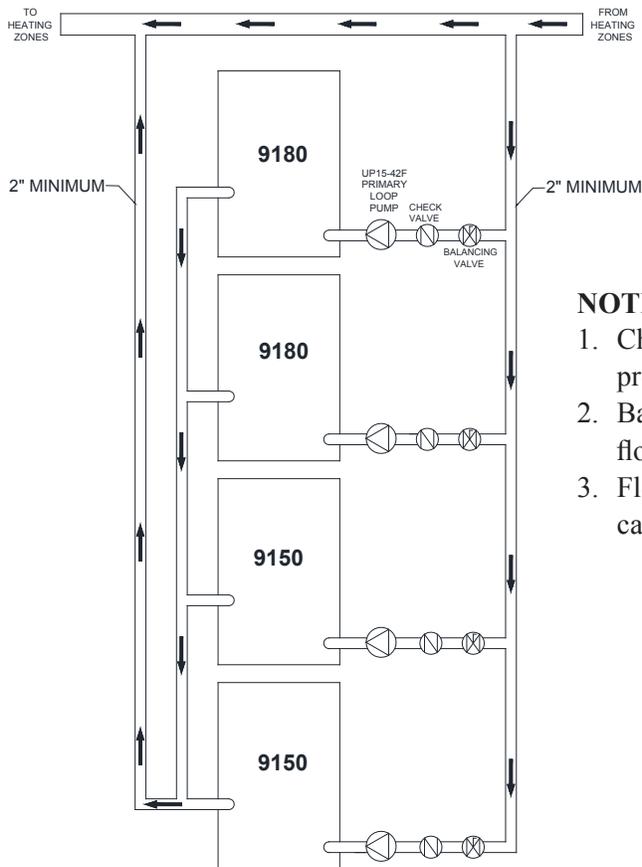


## CAUTION

**FREEZE PROTECTION:** Risk of property damage. Hydronic heating system freeze-ups WILL cause extensive damage to the entire heating system and/or property. It is the responsibility of the installer to provide protection against freezing.

**PIPING SUPPORT:** Risk of equipment damage or personal injury. DO NOT use the exchanger as support for piping. Support brackets should be in place to ensure proper operation of the system and to keep pressure off the inlet and outlet piping.

**MULTIPLE UNITS SYSTEM PLUMBING WITH MASTER LOOP**  
**FIGURE 13**



**NOTES:**

1. Check valves on the return side are recommended to prevent back flow into the furnace.
2. Balancing valves are recommended to provide an even flow of water between all units.
3. Flow must continue for a minimum of 30 seconds after call for heat ends.

**Installation**



# Appendix

## SPECIFICATIONS

### MODEL 9150 (53kW Storage Module)

Input Voltage	240	120/208	120/240	277/480	347/600
Phase	1	3	3	3	3
Number of Wires	2	3	3	4	4
Charging Input (kW)	53.3	48	53.3	50.4	53.3
Elements - Quantity	12	12	12	12	12
Elements - Watts Each	4,444	4,000	4,444	4,200	4,444
Amps – Core Charging	222.2	133.39	128.44	60.65	51.23
Maximum Pump & Blower Load (AMPS)	4.6	4.6	4.6	2.3	1.9
Minimum Circuit Ampacity	283.5	172.49	166.3	78.69	66.41
Minimum Fuse Size	300	175	175	80	70
Maximum Fuse Size	300	200	200	100	100
Blowers/System Control Voltage*	240V/208V				
Storage Capacity – kWh***	290				
Storage Capacity - BTU	989,480				
Pipe Size (Inlet/Outlet)	1 ½"				
Required Primary Loop	Minimum of 12' of 1 ½" pipe required in primary loop plumbing				
Output Water Temperature (selection range)	50°F to 185°F				
Maximum Working Pressure	20 PSIG requires 30 PSI Pressure Relief Valve 60 PSIG requires 75 PSI Pressure Relief Valve (Standard) 125 PSIG requires 150 PSI Pressure Relief Valve				
Minimum Flow Rate (Primary Loop)	1 GPM per 10,000 BTU of required output at 20°F Temperature Rise (30 GPM maximum)				
Internal Pressure Drop (assuming 50% glycol mix)	.7 ft @ 15 GPM 1.8 ft @ 25 GPM 1.2 ft @ 20 GPM 2.5 ft @ 30 GPM				
Maximum Static Dissipation (Watts)	3,000				
Approximate Heater Module Weight (lbs)	900				
Approximate Insulation Block / Elements / Other Weight (lbs)	330				
Approximate Brick Weight (lbs)	3,440				

\* Supply via stepdown transformer - field installed.

\*\* Add approximately 500 lbs to arrive at shipping weight.

\*\*\* Storage capacity is based on maximum core temperature of 1400 degrees Fahrenheit.

## MODEL 9180 (80kW Storage Module)

Input Voltage	240	120/208	120/240	277/480	347/600
Phase	1	3	3	3	3
Number of Wires	2	3	3	4	4
Charging Input (kW)	80.0	72.0	80.0	75.6	80.0
Elements - Quantity	18	18	18	18	18
Elements - Watts Each	4,444	4,000	4,444	4,200	4,444
Amps – Core Charging	333.30	200.09	192.66	90.97	76.84
Maximum Pump & Blower Load (AMPS)	4.6	4.6	4.6	2.3	1.9
Minimum Circuit Ampacity	422.38	255.86	246.57	116.59	98.43
Minimum Fuse Size	450	300	250	125	100
Maximum Fuse Size	450	300	300	150	125
Blowers/System Control Voltage*	240V/208V				
Storage Capacity – kWh***	440				
Storage Capacity - BTU	1,501,280				
Pipe Size (Inlet/Outlet)	1 ½"				
Required Primary Loop	Minimum of 12' of 1 ½" pipe required in primary loop plumbing				
Output Water Temperature (selection range)	50°F to 185°F				
Maximum Working Pressure	20 PSIG requires 30 PSI Pressure Relief Valve 60 PSIG requires 75 PSI Pressure Relief Valve (Standard) 125 PSIG requires 150 PSI Pressure Relief Valve				
Minimum Flow Rate (Primary Loop)	1 GPM per 10,000 BTU of required output at 20°F Temperature Rise (30 GPM maximum)				
Internal Pressure Drop (assuming 50% glycol mix)	.7 ft @ 15 GPM 1.8 ft @ 25 GPM 1.2 ft @ 20 GPM 2.5 ft @ 30 GPM				
Maximum Static Dissipation (Watts)	4,500				
Approximate Heater Module Weight (lbs)	970				
Approximate Insulation Block / Elements / Other Weight (lbs)	400				
Approximate Brick Weight (lbs)	5,160				

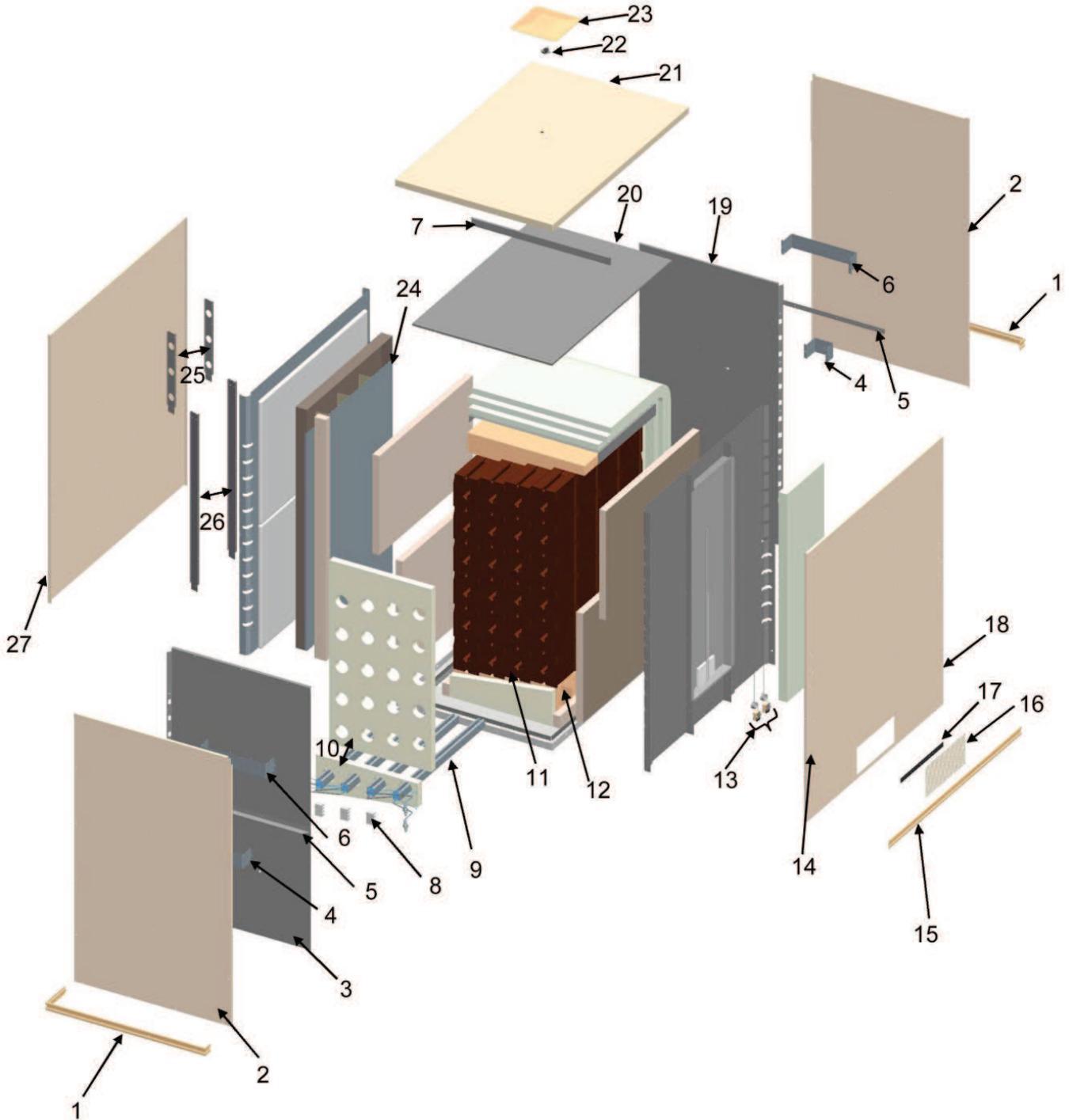
\* Supply via stepdown transformer - field installed.

\*\* Add approximately 500 lbs to arrive at shipping weight.

\*\*\* Storage capacity is based on maximum core temperature of 1400 degrees Fahrenheit.

# EXPLODED VIEW DIAGRAM - 50KW STORAGE MODULE

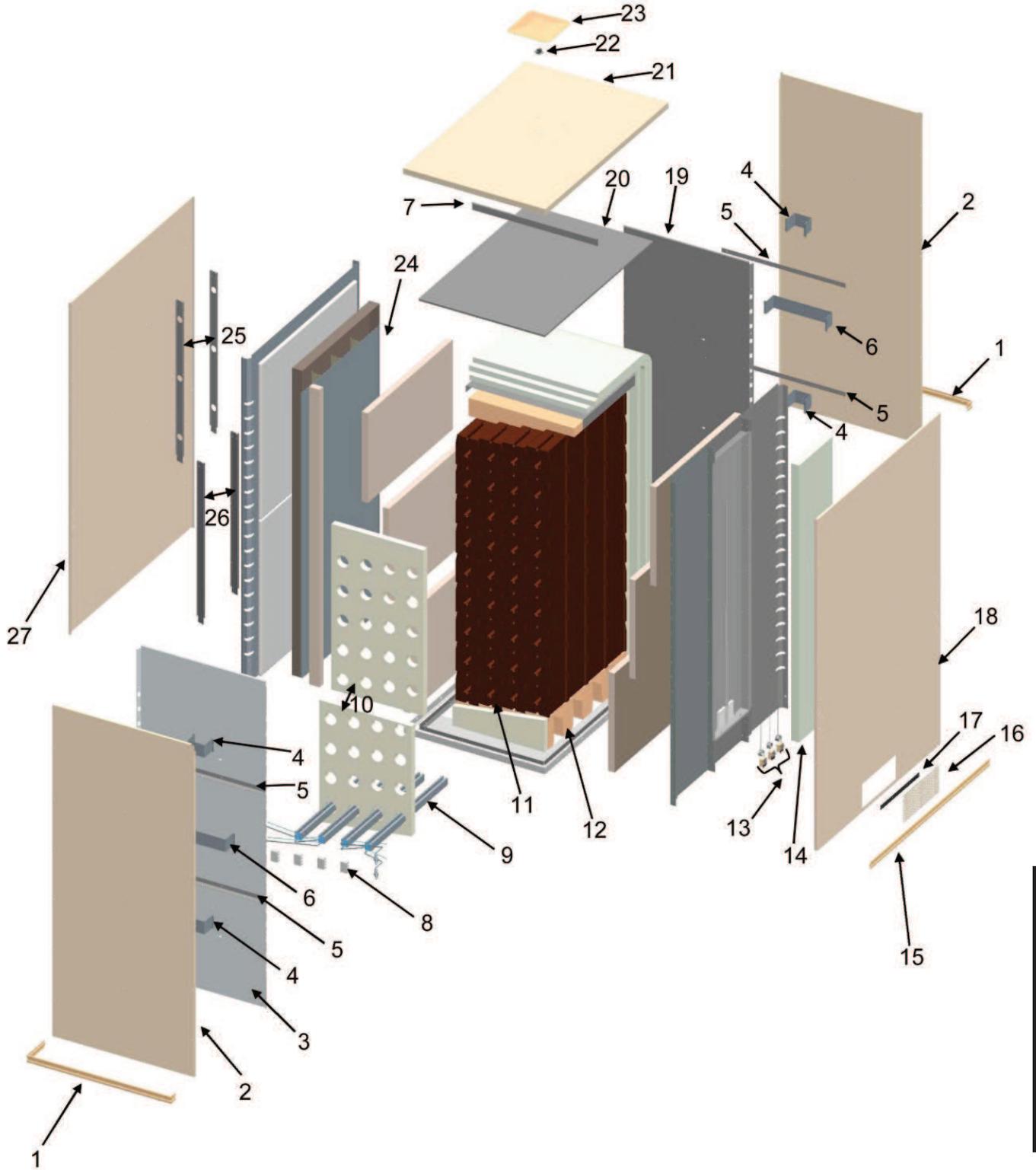
The exploded view diagram is for reference only. The ThermElect storage module should not be disassembled.



Appendix

# EXPLODED VIEW DIAGRAM - 80KW STORAGE MODULE

The exploded view diagram is for reference only. The ThermElect storage module should not be disassembled.

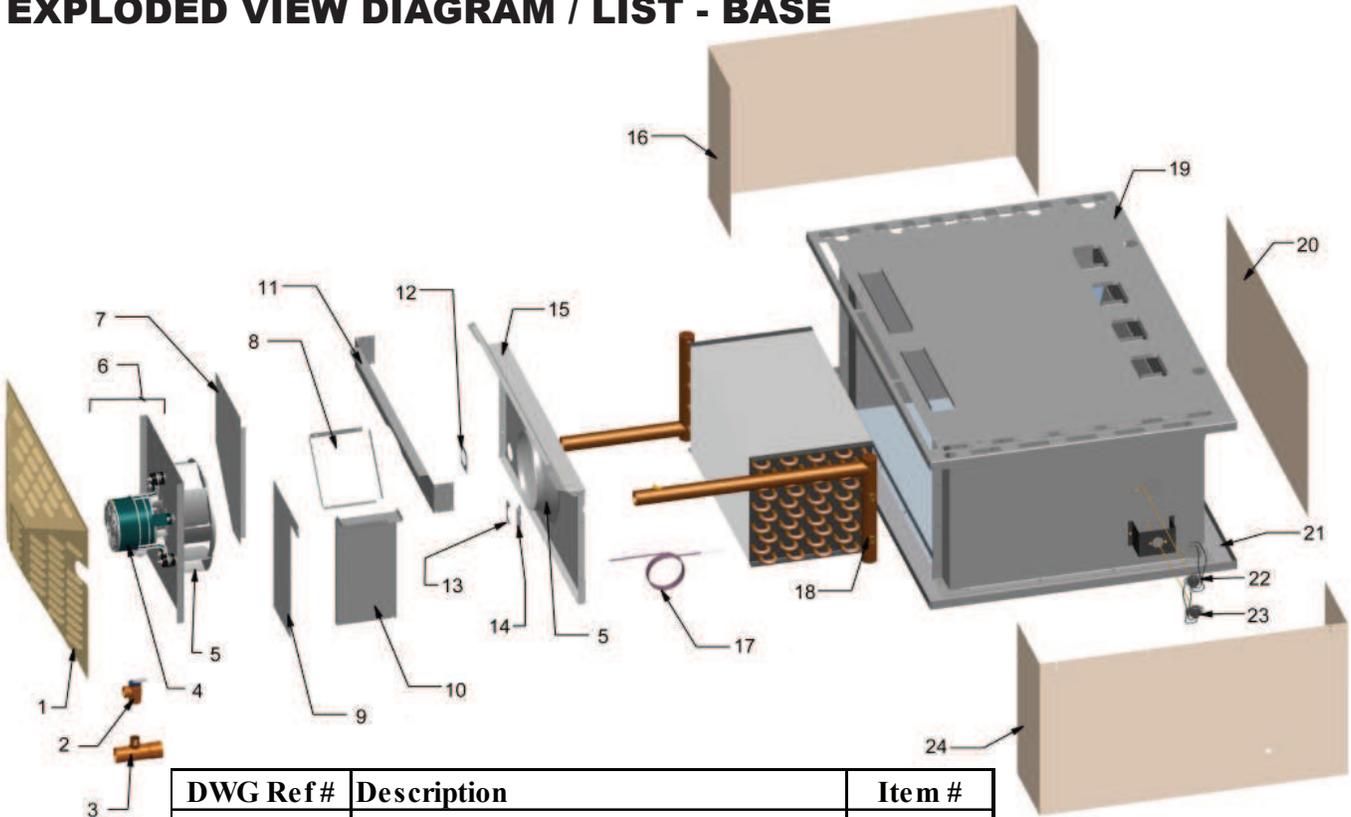


Appendix

## PARTS LIST - STORAGE MODULE

DWG Ref #	Description	50kW Item #	80kW Item #
1	Seam Trim Front/Back	5948303	5948303
2	Front/Back Panel, Painted	5948316	5948324
3	Core Panel, Front	5948172	5948174
4	Front/Back Core Standoff, Small	5948208	5948208
5	Mounting Bracket Front & Back	5948152	5948152
6	Front/Back Core Standoff, Center	5948210	5948210
7	Core Support Bracket, Top	5948194	5948194
8	Insulator Ceramic Element Lead	1015057	1015057
9	Heating Elements	Contact Factory for Ordering Information	
10	Insulation Block Kit, Front <i>(2010 and Newer)</i>	1040221	1040221
"	Insulation Block Kit, Back <i>(2010 and Newer)</i>	1040222	1040222
"	Insulation Block Kit, Front <i>(2009 and Older)</i>	1040219	1040219
11	Brick Each (96 Brick per Pallet)	5903017	5903017
12	Cast Block Bottom	1056501	1056501
13	Limit Switch EGO 575Deg	1013026	1013026
14	Insulation Blanket 2" 4# - 15"	1056042	1056042
15	Seam Trim Side	5948302	5948302
16	Limit Access Cover Panel, Painted	5948608	5948608
17	Core Limit Mounting Bracket	5948202	5948202
18	Cabinet Panel Air Handler Side, Painted	5948310	5948318
19	Core Panel, Back	5948170	5948176
20	Core Panel, Top	5948188	5948188
21	Top Panel, Painted	5948328	5948328
22	Limit Switch 290D 25A60TX11 6 DIFF	1012019	1012019
23	Limit Cover Panel Top, Painted	5948190	5948190
24	Air Channel Assembly Right	5948164	5948168
25	Core Bracket Stiffener Right Side, Upper	5948214	5948213
26	Core Bracket Stiffener Right Side, Lower	5948212	5948212
27	Cabinet Panel Non-Air Handler Side, Painted	5948312	5948320

# EXPLODED VIEW DIAGRAM / LIST - BASE

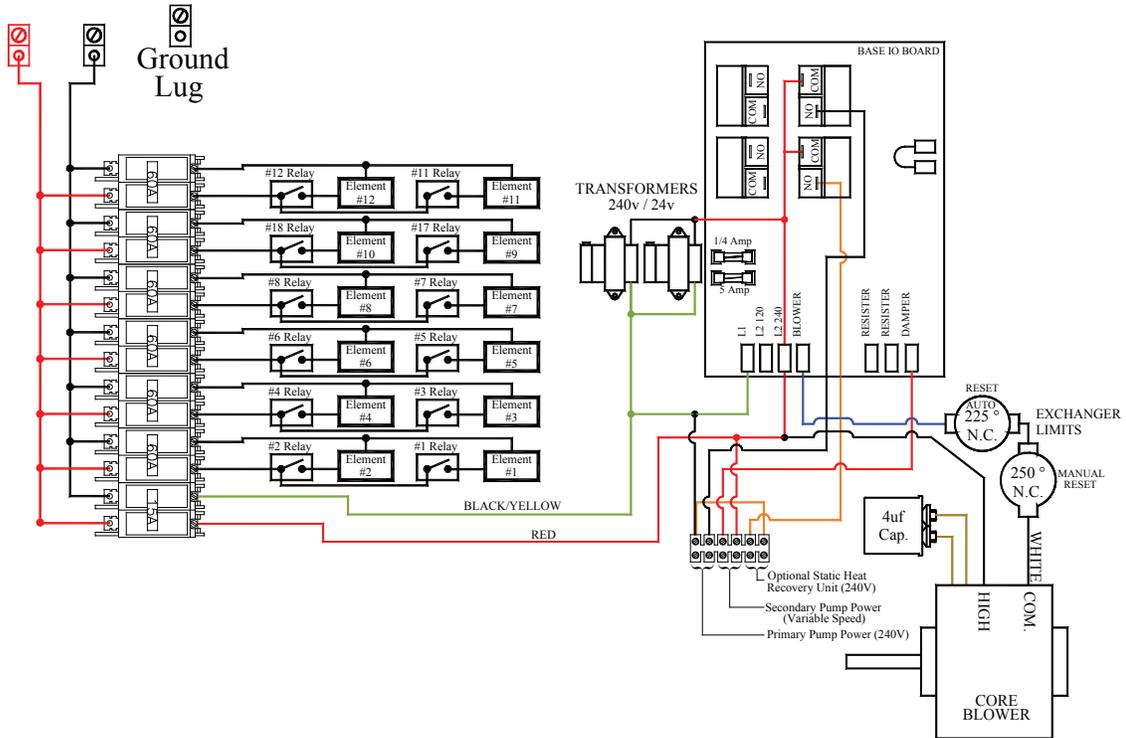


DWG Ref #	Description	Item #
1	Motor Access Cover	5948606
2	Pressure Relief Valve, 75 PSI	1100105
"	Pressure Relief Valve, 150 PSI	1100106
3	Pressure Relief Adapter Fitting	1100131
4	Motor, 1/4 HP, 1700 RPM**	1020009R
5	Core Blower Wheel**	1021007R
6	Core Blower Assembly**	1041960R
7	Rear Core Blower Air Box Panel	5948536
8	Rear Inlet Channel	5948530
9	Front Core Blower Air Box Panel	5948534
10	Front Outlet Channel	5948528
11	Top Air Box Flange	5948532
12	Inlet Pipe Cover	5948526
13	Outlet Pipe Cover - Left Half	5948525
14	Outlet Pipe Cover - Right Half	5948527
15	Left Side Exchanger Panel	5948524
16	Base Panel Rear, Painted	5948602
17	Supply Water Temperature Sensor	1041748
18	Heat Exchanger	1100107R
19	Base Panel, Top	5948144
20	Base Panel Right, Painted	5948604
21	Base Panel, Bottom	5948140
22	Limit Switch 225 Degree, Auto Reset	1012029
23	Limit Switch 250 Degree, Manual Reset	1012025
24	Base Panel Front, Painted	5948600

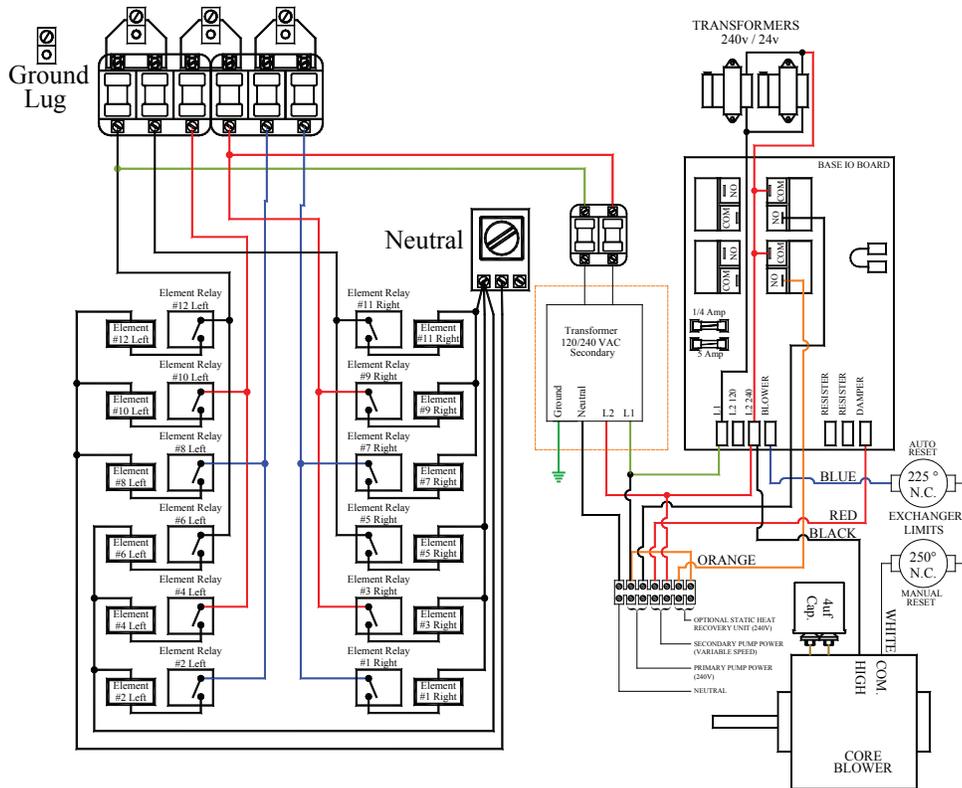
\*\* Systems manufactured prior to July 2009 require the entire assembly replaced. For systems manufactured after July 2009 order individual parts required.

# Typical System Line Voltage Wiring Diagram

9150 APPLICATION  
240V 1-PHASE 2 WIRE



9150 APPLICATION  
277/347 3-PHASE 3 WIRE



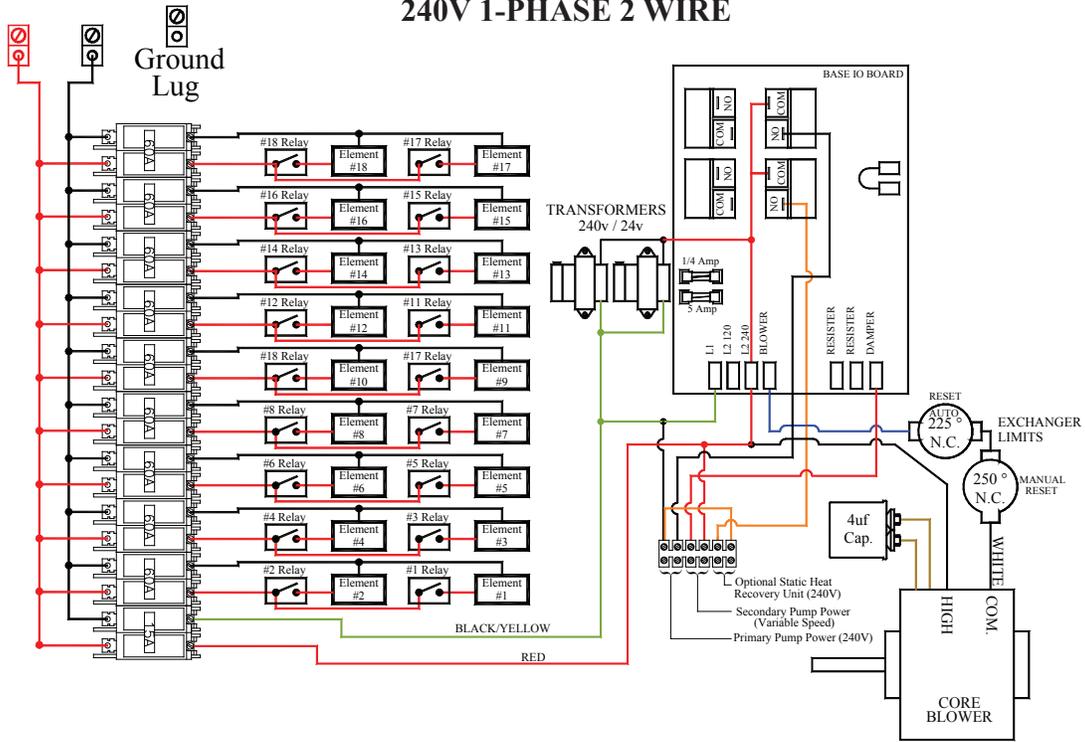
Appendix



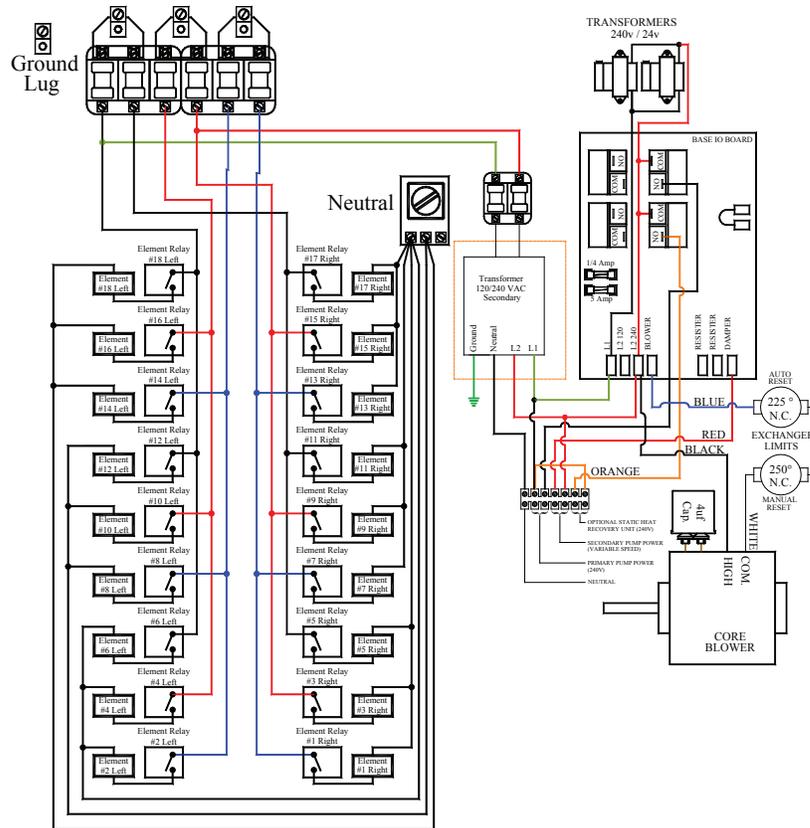
Use copper or aluminum conductors rated for 75°C or higher for field connection of this device.

# Typical System Line Voltage Wiring Diagram

## 9180 APPLICATION 240V 1-PHASE 2 WIRE



## 9180 APPLICATION 277/347 3-PHASE 3 WIRE



Use copper or aluminum conductors rated for 75°C or higher for field connection of this device.

Appendix

# INTERNAL SYSTEM WIRING DIAGRAM - LOW VOLTAGE

The outdoor temperature sensor, room thermostat, and peak control device are connected via low voltage wiring.

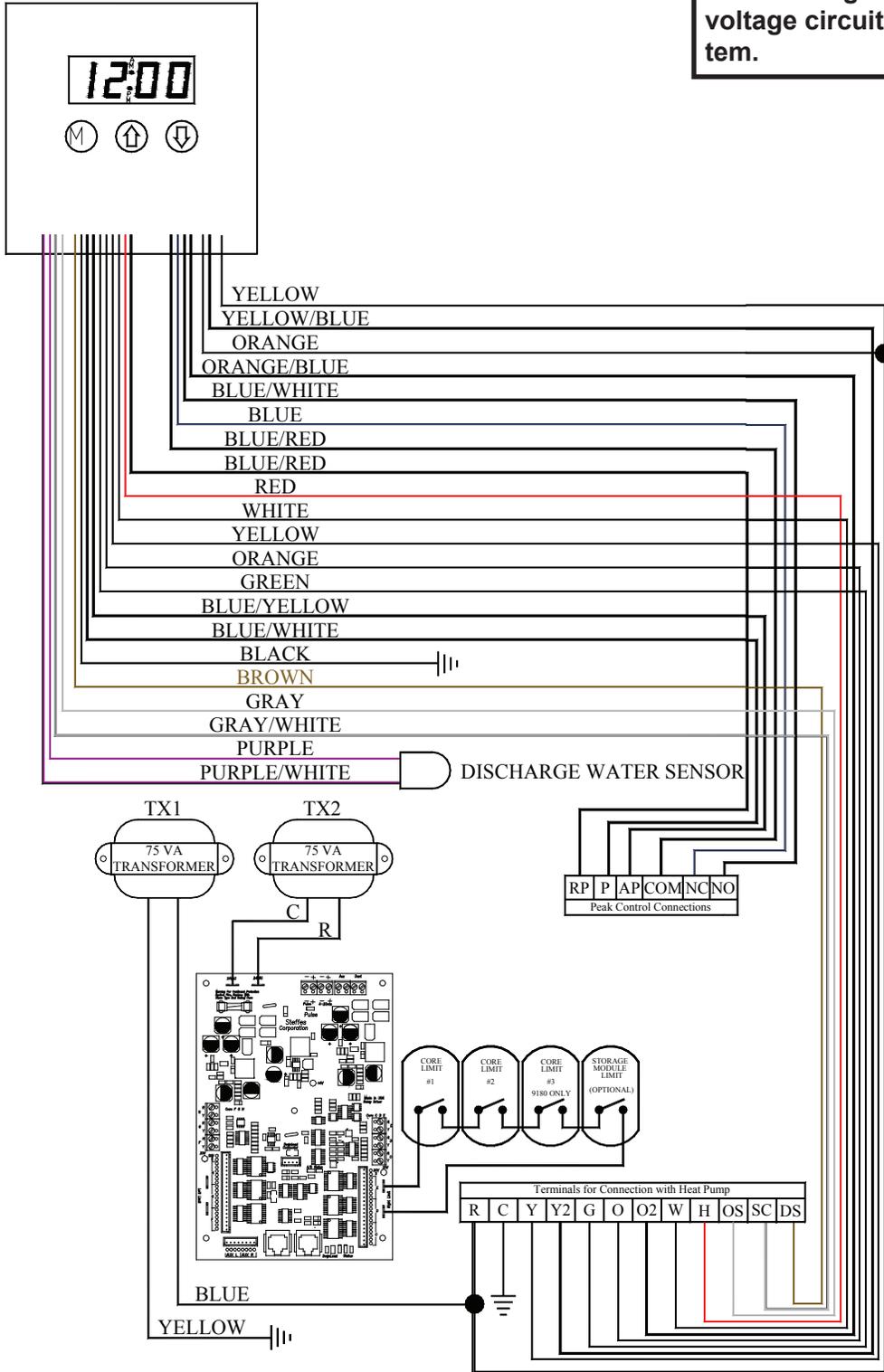
## System Low Voltage Wiring Diagram



The "R" and "C" positions in the low voltage terminal strip may be used as a source of 24 VAC for powering external low voltage devices (60 VA maximum).

### WARNING

**HAZARDOUS VOLTAGE:** Risk of electric shock, injury, or death. All low voltage wiring must be segregated from line voltage circuits in the system.



Appendix

## HELP MENU

The system contains a Help Menu which may be accessed through the control panel. To access the Help Menu, press and release the **M** button until the faceplate displays “HELP”. Scroll through the menu by pressing either the up or the down arrow button.

### Display

<u>Reading</u>	<u>Description</u>
Fxxx	Firmware Version Number - Indicates the version of software installed.
O xx	Outdoor Temperature - Indicates current outdoor temperature as recognized by the system.
tL:xx	Target Level - Indicates the percentage of brick core charge level the system is targeting. During peak periods the value displays as "tL_".
CL:xx	Charge Level - Indicates the percentage of heat storage currently in the brick core.
HE x	Heating Elements Active - Indicates the total number of heating elements currently energized.
PC x	Power Line Carrier Channel - Indicates the channel on which the system is set to receive PLC communication signal.
P x	Power Line Carrier Net Hit Rate Percentage - Indicates the percentage of "GOOD" communication packets received by the system from the PLC transmitter system.
PS x	Indicates which Specialty Timer the system is currently using. The value displayed will be zero if the Specialty Timer is not being utilized.
CC_x	Charge Mode Operation - Indicates the charge control method being utilized during off-peak periods.
CA_x	A-Peak Mode Operation - Indicates the charge control method being utilized during anticipated peak periods.
C1_x	Specialty Timer #1 Charge Mode - Specialty Applications Only.
C2_x	Specialty Timer #2 Charge Mode - Specialty Applications Only.
HUxx	Heat Usage - Indicates the amount of input being dissipated by the system.
A_xx	Target Discharge Air Temperature - Indicates the discharge air temperature that the system is targeting.
cxxx	Compressor Output Relay Delay Timer - Indicates time remaining before heat pump compressor is energized. "c ON" indicates the heat pump is energized.

## ERROR CODES

The system has an on-board diagnostic system to monitor various operating conditions. If operating conditions move outside the normal operating range, an error code is displayed on the faceplate. If there are multiple errors simultaneously, only the highest priority error code appears. Once corrected, the next highest priority code will be displayed on the faceplate as “Er—” (i.e., Er05).

<u>Error Code</u>	<u>Description</u>
01	Currently not utilized.
02	Currently not utilized.
03	Er03 is an error message which will not generally appear on the 5100, 7100, or 9100 Series Steffes heating systems. If an Er03 is displayed, check the value in Location 35 (L035) to verify that the 2 bit has not been enabled.



**Error Code****Description**

- 04 Discharge air sensor temperature is out of normal operating range. This can indicate an open sensor, a short in the wiring, or a circuit board which is out of calibration. Take an ohm reading across the sensor to ensure proper operation, check the wiring, and verify the value in L035. Compare the sensor reading to the value in L112 to verify proper calibration of the circuit board. *Approximate ohm readings are 70° F = 1,199 ohms; 80° F = 941 ohms; 95° F = 646 ohms.*
- 05 Outdoor sensor (direct wired) temperature reading is out of normal operating range. The sensor circuit may be open or shorted, or the processor control board may be out of calibration. Otherwise, verify that the outdoor sensor is connected to OS and SC on the 12-position terminal block. Compare the sensor reading to the value in L113 to verify proper calibration of the circuit board. *Approximate ohm readings are 5° F = 7,646 ohms; 50° F = 2,024 ohms; 95° F = 646 ohms.*
- 06 Outdoor temperature reading from the transmitting device (PLC system) is out of normal operating range. Check the outdoor sensor attached to the transmitting device and the transmitter for proper operation.
- 07 Main processor control board temperature sensor is out of normal operating range. Verify that none of the clearances have been violated and inspect the condition of the processor control board.
- 08 External duct sensor temperature is out of normal operating range. This can indicate an open sensor, a short in the wiring, or the relay driver board is out of calibration. Take an ohm reading across the sensor to ensure proper operation, check the wiring, and verify the value in L053. Compare the sensor reading to the value in L144 to verify proper calibration of the circuit board. *Approximate ohm readings are 60° F = 1552 ohms; 70° F = 1199 ohms; 80° F = 941 ohms. Max 190°F, Min 0°*
- 09 Auxiliary analog input is out of normal operating range. Currently not used.
- 10 Discharge air temperature has exceeded maximum standard operating temperatures.
- 11 Core C thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L136 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. Max. 1720°F, min 0°F*
- 12 Core D thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L137 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1720°F, min 0°F*
- 13 Core E thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L138 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1720°F, min 0°F*
- 14 Core F thermocouple temperature is out of normal operating range. Not used in 9100 Series.
- 15 Core G thermocouple temperature is out of normal operating range. Not used in 9100 Series.
- 16 Core H thermocouple temperature is out of normal operating range. Not used in 9100 Series.

**Error Code****Description**

- 17 Load control device (4-20mA) is out of normal range. This can indicate an open sensor, a short in the wiring, or a relay driver board is out of calibration. Take a DC voltage reading across the input to ensure proper operation reading should be between .5vDC and 6.25vDC. Check wiring, and verify the value in L053 is correct for the application. Compare the input reading to the value in L145 to verify proper calibration of the circuit board. 1vDC=0%, 3vDC=50%, 5vDC=100%.
- 19 There is no communication occurring with the relay driver board. The interface cable may be defective or the relay driver board may be unresponsive. Verify that the values in L090, L091, and L092 are correct for the application.
- 20 There is no communication occurring between the base I/O board and the processor control board. A defective board interface cable or an unresponsive base I/O board can cause this.
- 21 There is no communication occurring with the first Energy Management Controller. If installed, the interface cable may be defective or the Energy Management Controller may be unresponsive. Check the jumper configuration on the Energy Management Controller to ensure that J1 and J2 are both in the "OFF" position. Verify that the value in L053 is correct for the application.
- 22 There is no communication occurring with the second relay Energy Management Controller. If installed, the interface cable may be defective or the Energy Management Controller may be unresponsive. Check the jumper configuration on the Energy Management Controller and make sure J1 is "ON" and J2 is "OFF". Verify that the value in L053 is correct for the application.
- 23 There is no communication occurring with the Steffes Time Clock Module. If this module is installed, verify the value in L035. If correct, the interface cable or the time clock module may be defective.
- 24 Temperature sensor offset/reference is out of range. A sensor or brick core thermocouple may be shorted to ground or the processor control board may be defective.
- 25 The heater is configured for power line carrier; however, is not receiving a valid power line carrier communication signal. This will display as error 25 when using BACNet and PLC fail on the system display.
- 26 Insufficient main control board memory (RAM). Contact a qualified service technician.
- 27 Insufficient permanent memory. Contact a qualified service technician.
- 28 Permanent memory change has been made. Press the M button to accept. This error message indicates a change has been made to the software program; therefore, it is important to verify that all location settings are correct for the application.
- 29 On-board communication system is not fully operable.
- 30 Base I/O relay board is in test mode. Check that both jumpers on the board are in the "OFF" position.
- 31 Energy Management Controller(s) are in test mode. Check the jumper configuration.
- 39 If the value in Location 13 (L013) is set to a value greater than the value in Location 12 (L012), error 39 (Er 39) is displayed and the system space heats only until the values are corrected.
- 40 Indicates memory corruption has occurred. Replace the processor control board.
- 41 You have attempted to write to the Flash memory a second time which is not permitted. You may only write to the Flash memory one time after reprogramming. If you need to write to the Flash memory again, reprogram the heating system with ETS208 software or greater and then reconfigure. Reference Locations 98 and 99 (L098 and L099).

<b><u>Error Code</u></b>	<b><u>Description</u></b>
42	If the check sum fails in the Flash copy of the settings or if the initial write to the Flash fails, Er42 is displayed. Reprogram the heating system or replace the processor control board.
43	An attempt to load a saved configuration by setting Location 98 (L098) to a value of 20, 30, 40, or 50 has failed. Any changes to location values will need to be manually set. Press and release the “M” button to clear the error. Er43 is only applicable to processor control boards with a revision level of G or lower only.
44	The check sum of the entire Flash is corrupt. Reprogram the heating system or replace the processor control board.
45	An attempt was made to load memory from an unsaved location in L098. Applicable to processor control boards with a revision level of H or higher only.
46	MA command or Pulse Width Modulation has timed out. No input has been received for 30 minutes. If the MA command or Pulse Width Modulation are not being used, verify that Location 53 (L053) and/or Location 55 (L055) are set correctly for the application.
Cold Core	The sensed temperature of the brick core is below 40 degrees. This may be an actual condition, a defective thermocouple, reversed polarity of thermocouple wiring coupled with a core temperature between 150°F (65°C) and 300°F (148°C), or a circuit board which is out of calibration can cause this. Verify that the core thermocouple wiring is connected properly and that the values in L090, L091 and L092 are correct for the application.
Core Fail	One of the core high limit switches may be open (also see error 38).
PLC Fail	The heater is configured for power line carrier; however, is not receiving a valid power line carrier communication signal. This will display as error 25 when using BACNet and PLC fail on the system display.
LoAd CAP	All controllable loads have been shed and Maximum Load Capacity is still exceeded. This is not necessarily an error but merely an indication of the current condition of the application. Example: If 4-20mA control is being used and comfort override or freeze protection brings on elements, this error code may be displayed.



# **W** Warranty

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Registering your purchase is an essential step to ensure warranty coverage. A Warranty Registration card is included with the Owner's Manual. Simply complete, detach the bottom portion, and return the card today. Retain the top portion of the card for your files.

## **WARRANTY STATEMENT**

Steffes Corporation warrants for a period of two (2) years following delivery, limited to three (3) years from date of manufacture, of any goods provided under this Agreement that the goods purchased hereunder will be of merchantable quality, free from defects in material and workmanship, and that the goods provided will be new and conform to the mechanical and performance specifications referenced in any drawings provided by Steffes Corporation. Customer shall promptly provide notice to Steffes Corporation of any goods which do not comply with such warranty.

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If the goods fail to meet the warranty requirements set forth herein, as mutually agreed by both Parties, excluding goods which have been subject to misuse, abuse, negligence, accident, improper maintenance or improper operations, Steffes Corporation shall: repair or replace the product or part(s) only which prove to be defective under normal use. The Customer shall be responsible for any labor costs associated with the repair or replacement of the product or part(s), including the cost of returning the defective product or part(s) to Steffes Corporation. This Warranty is void if the product is moved from the premises in which it was originally installed. This Warranty shall not apply to any product or part which has been altered in any respect, or improperly installed, serviced or used, or has been subject to accident, negligence, abuse or misuse.

The Customer assumes all risk and liability whatsoever resulting from the use of this device. In no event shall Steffes be liable for any indirect, special or consequential damages or lost profits.

This Limited Warranty contains the complete and exclusive statement of Steffes' obligations with respect to this device and any parts thereof. The provisions hereof may not be modified in any respect except in writing signed by a duly authorized officer of Steffes.

*Thank you for purchasing Steffes ETS heating equipment. We welcome your comments relating to this manual. Enjoy your new purchase!*



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