

# **STEFFES**

## **Heating Systems**

*"Manufactured in North America"*

# **COMFORT PLUS COMMERCIAL FORCED AIR HEATING SYSTEM**

## *Owner's and Installer's Manual*



## **Model 6140**

*Applicable to Software Version 2.0X*

**NOTE** **IMPORTANT**

- ◆ The equipment described herein is intended for installation by a qualified technician in compliance with applicable local, state, and national codes and regulations.
- ◆ 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.

Steffes disclaims any responsibility or liability for mold/mildew growth and/or any damages caused by either which occur after the heating system is installed. We strongly recommend that the user follow the moisture, mold and mildew prevention guidelines of the Environmental Protection Agency (EPA), available at <http://www.epa.gov>.

**For Customer Use**

*Please record your model and serial number below. This number is found on the identification label located on the lower left side of the base. 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. DO NOT energize the system while disassembled or until system installation is complete.
2. DO NOT use or store materials that may produce explosive or flammable gases near the system.
3. DO NOT violate the placement and clearance requirements specified in this manual (Pages 3.02-3.03).
4. DO NOT place anything on top of the system.
5. Disconnect power to all circuits before servicing. This heating system may be connected to more than one branch circuit.
6. Installation of and/or service to this heating system should be performed by a qualified technician in compliance with information contained herein and with national, state, and local codes and regulations.
7. A repeated message of “CORE FAIL” indicates a need for service by a qualified technician.



### WARNING



**Hazardous Voltage: Risk of electric shock. Can cause 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 fire. Can cause injury or death. Violation of the clearance requirements can cause improper operation of the system. Maintain the placement and clearance requirements specified.**

## BUILT-IN SAFETY DEVICES

The Comfort Plus Commercial heating system incorporates safety devices to ensure normal operating temperatures are maintained. The chart below describes these safety devices.

| DEVICE NAME                                    | FUNCTION  | LOCATION ON SYSTEM   |
|--|---|--|
| Core Charging High Limit Switches (Auto Reset) | These limit switches monitor brick core charging and interrupt power to the heating elements if the normal operating temperature is exceeded.   | In the limit bar panel on the left side of the brick storage cavity. |
| Core Blower Limit Switch (Auto Reset)          | This limit switch monitors the discharge air temperature and interrupts power to the core blowers if the normal operating temperature is exceeded.<br><br>170°F / 77°C (nominal)                                | On the discharge air supply blower.                                  |
| Supply Air Blower Limit Switch (Manual Reset)  | This limit switch monitors the discharge air temperature and interrupts power to both the supply air blower and the core blowers if the normal operating temperature is exceeded.<br><br>190°F / 88°C (nominal) | On the discharge air supply blower.                                  |
| Base Temperature Limit Switch (Auto Reset)     | This limit switch monitors the temperature in the base of the system and interrupts power to the core blowers if the normal operating temperature is exceeded.<br><br>160°F / 71°C (nominal)                    | In the base of the system near the core blowers.                     |



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## Warranty

# 1

## Operation

### GENERAL OPERATION

The Steffes Comfort Plus Commercial heating system stores demand free and/or off-peak electricity in the form of heat. Off-peak electricity is available during times of the day or night when electricity is plentiful and the associated costs are low.

Operation of the heating system is automatic. During off-peak hours, the system converts electricity to heat which is then stored in its ceramic brick core. The amount of heat stored in the brick core varies in relation to outdoor temperature, current building load, utility peak conditions, and/or the heating requirements.

A heat call from the thermostat or main system control energizes the blowers in the system. The variable speed core blowers automatically adjust their speed to circulate air through the brick core. The supply air blower then delivers the heated air into the desired area through the duct system to maintain a constant, comfortable temperature.

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, Steffes 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 once the building is completed. A suitable alternative heating system must be used during the construction phase.

### SYSTEM START-UP

On start-up of the system, odors relating to first time operation of the heating components may be experienced. If not used for an extended period of time, dust may accumulate in the system. Allow the Comfort Plus Commercial heating system to charge to its maximum brick core charge level to expel odors in a timely manner.

As with most heating systems, air borne particles and odors in the room may be drawn in and oxidized. **Odors can be amplified; thus, it is not recommended to operate the system if odors such as those from paints, varnishes, or chemicals are present in the air.** Air borne particles, which have been oxidized, are expelled back into the room and may accumulate on air vents or other surfaces. Over time, these particles may appear as a black residue, commonly referred to as soot. High concentrations of air borne particles from aerosols, dust, candles, incense, pet hair, smoke, or cooking can contribute to poor indoor air quality and accelerate the sooting process.

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



Operation

## CONTROL PANEL

Operation of the Comfort Plus Commercial system is automatic. All operational function settings are stored in a microprocessor in factory preset locations. If necessary, the user or installer can adjust these locations settings through the control panel (Figure 1).

### Four-Digit LED Display

The four digit LED displays specific operating information. During an editing process, the function locations and the values set in these locations 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. With this module installed, the system displays time on AM/PM intervals and the corresponding light flashes. The system can be configured to display military time, in which case, both the AM and PM lights illuminate.

### M Mode (Edit) Button

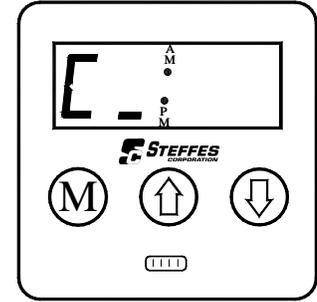
Activates the editing menu for changing the operating information of the system.

### Up and Down Arrow Buttons

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

### Interface Port

**FOR SERVICE USE ONLY!** Allows technician external access for updating software and troubleshooting.

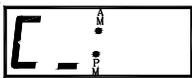


CONTROL PANEL  
FIGURE 1



## OPERATING STATUS (DIGITAL DISPLAY)

The Comfort Plus Commercial system is set to 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.

C = Off-Peak (Charge) Time  
P = On-Peak (Control) Time  
A = Anticipated Peak Time



**A bar illuminates on the lower portion of the display's second digit whenever the heating elements are energized.**



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



**Heat Call Status** - Indicates the current heat call status being received from the room thermostat. Refer to pages 3.11 and 3.12 for more information on heat call inputs.



**Brick Core Charge Level** - "CL" (charge level) followed by a number indicates the current percentage of heat stored in the brick core. "CL:\_" represents zero percent 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 a target level of zero percent 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 current demand of 750kW.

## TEMPERATURE CONTROL

Temperature set point is adjusted at the wall thermostat(s) or the main system control. If temperature in the area drops below the desired set point, a heat call is initiated and the blower is energized. The variable speed core blowers automatically adjust speed in relation to brick core temperature and duct temperature to circulate air through the brick core. The supply air blower then delivers the heated air into the desired area through the duct system to satisfy heating requirements.

When used to supplement a heat pump, the Comfort Plus Commercial system replaces resistance strip heat, which is typically required as a supplement or back-up to the heat pump. The discharge air sensor monitors the outlet air temperature. If the demand for heat is at a point where the heat pump alone cannot maintain the desired duct temperature, stored heat is used to supplement the heat pump and satisfy the heating requirements.

When the system receives a “G” call, the supply air blower is energized; however, no heat is delivered as this is a “fan only” call. When a “G” call is received with a “Y” call, the supply air blower is energized and the minimum discharge air temperature (as set in Location 48) is targeted.

Anytime the system receives a “W/Aux” call with any other call from the thermostat (except “O”) then the maximum discharge air temperature (as set in Location 49) is targeted. The maximum discharge air temperature is also targeted if the current outdoor temperature (shown in Location 109) is lower than the off-peak lock out temperature (set in Location 46) or the on-peak lockout temperature (set in Location 47). If an "O" call is received from the thermostat, the system will go into cooling and will not charge.



**Reference Supplemental Installer's Guide for more information on system operation.**

## BRICK CORE CHARGE CONTROL

The amount of heat stored in the brick core varies in relation to outdoor temperature, current building load, utility peak conditions, and/or the heating requirements. The outdoor sensor, if used in the application, monitors outdoor temperature and provides this information to the system. As the outdoor temperature decreases, heating requirements increase and the system stores more heat accordingly.



**The amount of heat stored in the system can also be regulated by a signal from a BACnet control, energy management system, or serial communication input.**

## CHARGE CONTROL OVERRIDE

If desired, the Comfort Plus Commercial 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 charging period. It continues to charge during uncontrolled 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.



**Charge control override does NOT override a peak or load management control signal.**

## MAINTENANCE AND CLEANING

The Comfort Plus Commercial heating system is easily maintained. The air filter in the return air duct of 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 Comfort Plus Commercial, the indoor coil of the device 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 Comfort Plus Commercial system is an Electric Thermal Storage (ETS) heating system using electricity to provide a low cost heating solution for commercial, industrial, and large residential applications. ETS equipment is designed to store electricity, as heat, during hours when energy costs are lower and kW demand charges are not incurred. The Comfort Plus Commercial's thermal mass consists of a high-density ceramic brick capable of vast heat storage. The system is designed to operate under various load management control strategies, some of which are listed below:

#### 1. BACNet Control

Steffes commercial heating furnaces are available with a BACNet control option. 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



Order Item #1301015

#### 2. On-Peak/Off-Peak Program

System responds to heat calls during the on-peak and off-peak periods; however, only energizes heating elements during the off-peak periods. The Comfort Plus Commercial system is controlled by an external control device such as a meter or time clock module.

#### 3. 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.

#### 4. Pulse Monitoring

- a) 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 entered into the Comfort Plus Commercial 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.
- b) External load management control modules are available when using pulse monitoring load control. Each module has eight (8) zones which can be controlled. The system must be configured to recognize the number of load management modules installed (maximum of two per system).

#### LOAD MANAGEMENT CONTROL MODULE



Order Item #1908140

### SINGLE FEED KIT (208/240V ONLY)

The Comfort Plus Commercial 6140 has built-in circuit breakers. They are factory configured to be field connected to multiple line voltage circuits. If single feed to the element and blowers/control circuits is desired, the single feed kit is available to allow the system to be powered with a one, larger line voltage circuit. Contact the factory for ordering details.



**277/480V and 347/600V systems are factory configured for single feed connections only. A step-down transformer is required for the control circuit in these systems.**

## SCR CONTROLLER

The Steffes SCR (Solid State Relay Panel) is an optional control device used with the Steffes ThermElect (8100 and 9100 Series) and Comfort Plus Commercial (6100 and 7100 Series) Heating Systems. It utilizes SCR 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 SCR optimizes a building's power quality and control.

The SCR 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 any building energy management system. With the 4 – 20mA or 1 – 5 volt DC signals, the SCR will provide an output directly proportional to the input signal. 4mA signal produces 0% output while 20mA signal products 100% output. With the utility pulse meter input, the SCR output percentage will automatically adjust to maintain a total maximum system load as dictated by the furnace's set-up. With a Bacnet, the furnace can be commanded to varying input levels remotely.

## SCR CONTROLLER



Order Item #1301016

## CONTROL CIRCUIT STEP-DOWN TRANSFORMER

The internal controls and motors of all Comfort Plus Forced Air Commercial 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.

| 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        |

Optional Accessories

## 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 Comfort Plus Commercial system monitors temperature at both the duct sensor and the output sensor during Y, W/Aux, or E calls from the thermostat.

If there is a Y and a G call from the thermostat, the system operates the core blowers at the required speed to maintain the minimum output temperature as set in Location 48 (L048) at the duct sensor. If there is only one call from Y, W/Aux, or E, then the system will operate the core blowers at the required speed to maintain the maximum output temperature as set in Location 49 (L049) at the duct sensor. The system is set to turn off the core blowers if the output temperature at the output sensor exceeds 150 degrees Fahrenheit.

## RETURN AIR PLENUM

An optional factory built return air plenum is available for the Comfort Plus Commercial system (Order Item #1041570). This plenum incorporates a tray for placement of a heating/cooling coil which must get set in the return ductwork when interfaced to a heat pump. The return air plenum connects directly to the system for either a right-to-left or left-to-right airflow pattern.

## DOWN FLOW KIT

The Comfort Plus Commercial system is designed for upflow supply air discharge. In applications where downflow air discharge is desired, Steffes offers a kit that provides the ability to connect the supply air plenum in a manner that directs the air downward. (Order Item # 1301578). In downflow configuration, the furnace must be installed in a fashion that allows access to the supply blower's plenum cover. It is recommended to elevate the furnace a minimum of 10" to achieve this access. An 18" elevation stand (Order Item #1301585) is available.

# 3

## Installation



### CAUTION

Risk of personal injury. Steel edges can cut. Use caution when installing or servicing this equipment.

### SHIPPING AND PACKAGING

The Comfort Plus Commercial system should always be transported in an upright position to avoid damage to internal components and insulation materials. The information below describes the items shipped with each system.

- ① **INFORMATION PACKAGE**  
(includes Owner's Manual and Warranty Registration Card)



(adhered to outer side of shipping box)

- ④ **HEATING ELEMENTS**



| MODEL | ELEMENTS |
|-------|----------|
| 6140  | 15       |

(shipped inside the base of the system)

- ② **ELEMENT SCREW KIT**



(shipped inside the electrical compartment)

- ⑤ **OUTDOOR TEMPERATURE SENSOR**



(shipped inside the electrical compartment)

- ③ **CERAMIC BRICK**



**Brick**  
(shipped separately and packaged 4 brick per box)



**Half Brick**  
(shipped with brick and packaged in a white box consisting of 6 half brick and 1 full brick)

- ⑥ **SUPPLY AIR BLOWER ASSEMBLY**

(shipped separately)



| MODEL | FULL BRICK | 1/2 BRICK |
|-------|------------|-----------|
| 6140  | 49 Boxes   | 2 Boxes   |

# PLACEMENT AND CLEARANCE REQUIREMENTS

The physical dimensions of the system, along with the clearances required, **MUST** be taken into consideration when choosing its location within a structure. (See Figures 2 and 3 for Clearance Requirements and System Dimensions.)

The best installation location for this 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. In situations where the system is not installed in an area it is intended to heat (i.e. storage room), it is important to account for the heat lost through static dissipation by making proper adjustments when sizing the system.

**The minimum area required for the installation of the system is 100 square feet. This area must remain free of debris and room air should be maintained at less than 85° Fahrenheit.** If the system is being installed in an area with less than 400 square feet, ventilation **MUST** be provided. To ventilate, a minimum of a 24" X 24" opening must be installed, if not already present, into the area where the furnace is located. In addition, a 6" X 6" non-closing type register must be cut into the return air duct of the furnace to minimize heat build-up in the room. This register must be installed in a manner that ensures the air drawn into the furnace passes through the filter first (See Figure 2).

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 best installation surface on which to place the system, 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 local, state, and national codes and regulations to ensure proper installation. An 18" stand (Order Item #1301585) is available to elevate the system.**

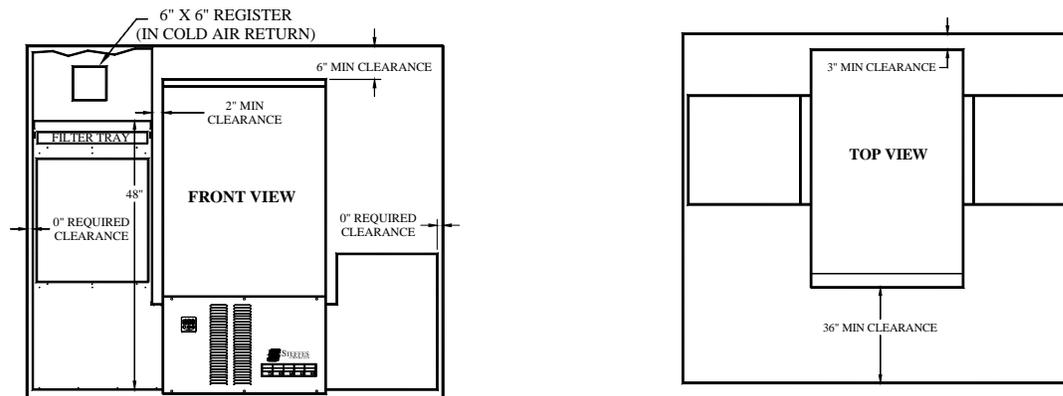
WARNING

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

- ◆ **Violation of the clearance requirements and/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.**
- ◆ **Failure to maintain room temperature in the mechanical room of 85°F or less may result in equipment damage. Thermostatically controlled ventilation should be provided if the temperature in this area exceeds 85°F.**
- ◆ **Moving the system after install may result in equipment damage. Do NOT move system from original installed location.**

## CLEARANCE REQUIREMENTS

FIGURE 2



- ◆ Back and Sides = 3 inches (from combustible material)
- ◆ Bottom = 0 clearance
- ◆ Top = 6 inches (from combustible material)
- ◆ Front = 36 inches (for ease in servicing)
- ◆ Between Duct and Left Side of System = 2 inches
- ◆ Between Duct and Right Side of System = 0 clearance
- ◆ Outer Sides of System Ducts (Return and Supply) = 0 clearance

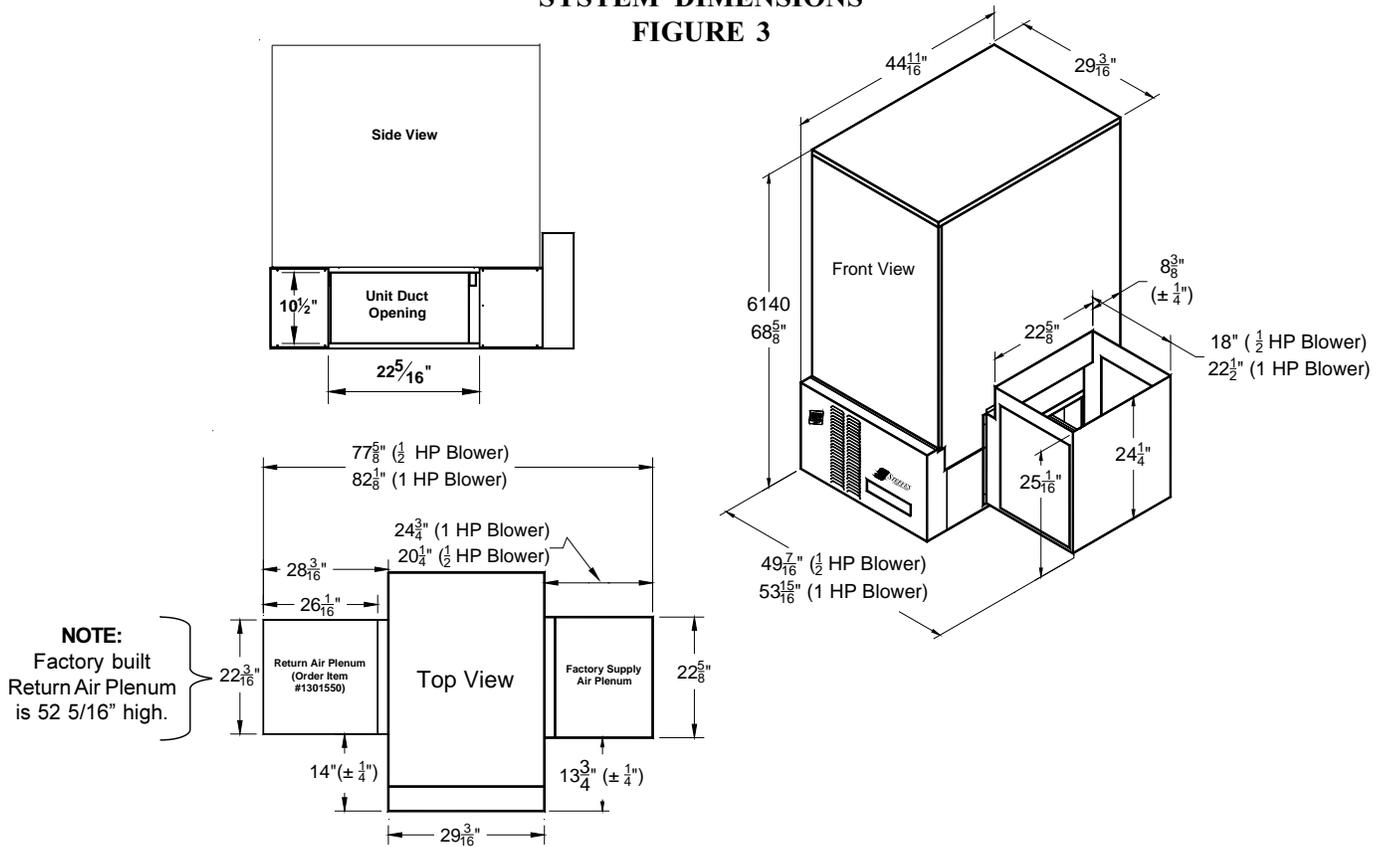


**Requirements of other codes and regulations may supersede the clearances listed.**

Installation

## SYSTEM DIMENSIONS

FIGURE 3



### INITIAL SET-UP

- Step 1** Remove the Information Package from the outside of the shipping box and unpackage the Comfort Plus Commercial heating system.
- Step 2** Remove the heating elements from inside the base of the system.
- Step 3** Move the system into its installation location. It is capable of fitting through a 30" doorway (minimum) without disassembling. If necessary, it can be disassembled for ease in moving. To disassemble the system, refer to the disassembly instructions (Page A.02) for more information.
- Step 4** Once in place, adjust the leveling legs on the bottom of the system as necessary to prevent rocking. If not placed properly the system may bend or twist during the brick loading process, making element and brick core temperature sensor installation difficult.
- Step 5** Remove the painted front panel of the brick storage cabinet by removing the sheet metal screws along the top, bottom, and sides of the panel. Detach by pulling the bottom of the panel forward and down.
- Step 6** Locate the element wiring harnesses and the brick core temperature sensors behind the front painted panel. Disconnect them from their shipping location. Carefully position them to avoid damage during the brick loading and wiring processes.

### CAUTION

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

- ♦ **DO NOT install the Comfort Plus Commercial system on its shipping pallet.**
- ♦ **DO NOT extend the leveling legs more than one inch.**
- ♦ **DO use and follow generally accepted safety practices when handling insulation material.**
- ♦ **DO have equipment installed by a qualified technician in compliance with all applicable codes and regulations.**



**The 6140 has three brick core temperature sensors.**

**Step 7** Remove the sheet metal screws around the outer edge of the galvanized front panel. Remove the panel and set it aside.

**Step 8** Starting at the bottom, carefully lift each of the insulation blankets and drape them over the top of the system.



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

**Step 9** Remove the front air channel by pulling out on the top of the air channel.

## BRICK LOADING

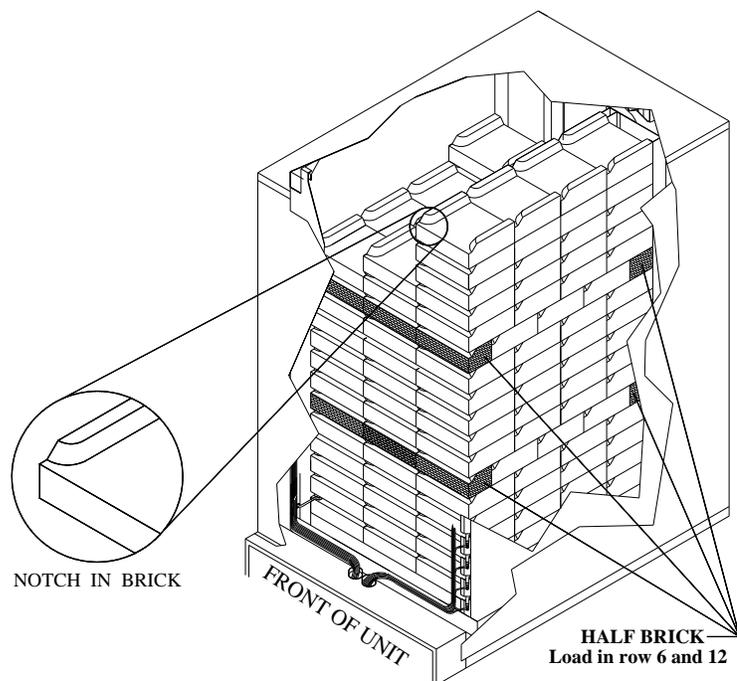
Load the brick, one row at a time, using a left side, right side, center pattern. Start at the back of the brick core and work forward. Make sure the brick are placed so the grooved side is facing up, the notch is facing forward, and the ridges are on the left and right (See Figure 4).

### 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 difficult.
- Brick rows **MUST** line up front to back and side to side.
- Half brick makes brick loading easier by evening out the stacks. Use the **HALF BRICK** (boxes marked) in the proper rows and in the correct positions as indicated in Figure 4. The back half of the brick **MUST** be installed in the back rows and the front half (the notched brick piece) **MUST** be installed in the front rows.



**BRICK LOADING  
FIGURE 4**



# HEATING ELEMENT AND AIR CHANNEL INSTALLATION

**Step 1** After all brick are loaded, insert the heating elements between the brick layers, sliding them in until the element ends embed into the side cutouts of the brick cavity.

The elements **MUST** be installed so their threaded screw tabs on the wire connection terminals point forward and down. If they are installed with the screw tabs pointing upward, element-to-wiring harness connections will be difficult. Elements must be slid into the brick core properly to ensure correct clearance between the terminal connections and any surfaces within the system. Refer to the required element connection clearance information in Figure 6.

**Step 2** Install the front air channel with the air deflectors (arrow shaped pieces) facing inward and with the narrow ends of the deflectors pointing up. Place bottom portion in first (Figure 5).

**Step 3** Lower the 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 elements to ensure maximum efficiency.

**Step 4** Reinstall the galvanized front panel and secure it to the system using the screws that were originally removed. Slide the bottom of this panel inside the lower lip of the brick cavity. The top rests on the outside of the cavity.

**Step 5** Remove the electrical panel cover and locate the element screw kit.

**Step 6** Carefully route wiring harnesses and connect them to the heating elements, using screws provided in the hardware package. Make connections with screw heads up and threads pointing down. Element screws should be tightened to 20 inch lbs. Refer to Element Installation (Figure 6) for proper positioning.

**Step 7** The brick core temperature sensor must be installed prior to putting the painted front panel in place.



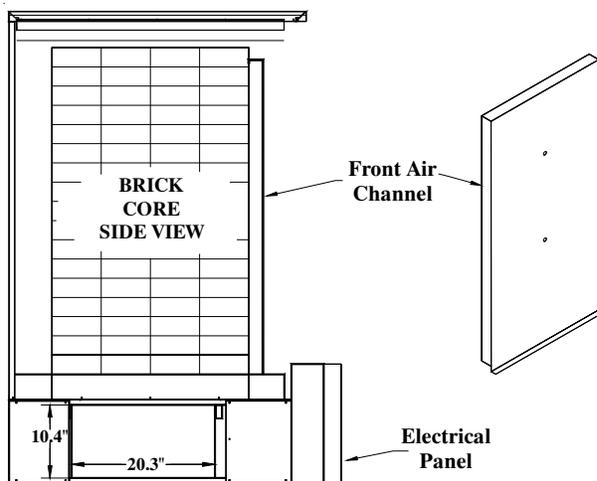
## WARNING

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

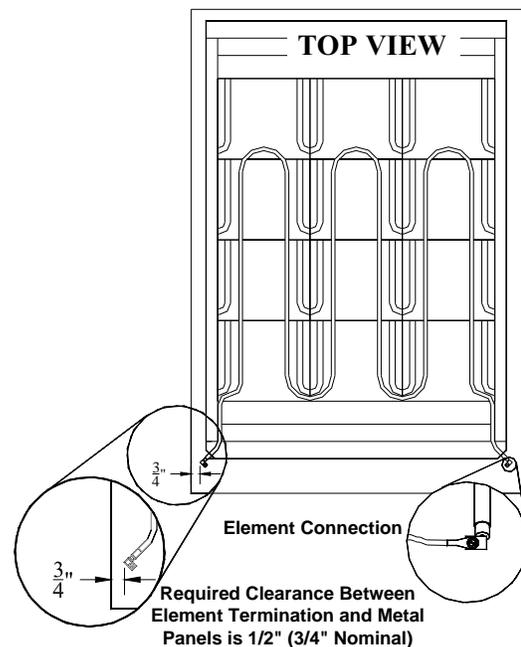
- ♦ **DO NOT** remove the electrical panel cover while system is energized.
- ♦ **Position** elements properly to avoid short circuiting them against metal surfaces.
- ♦ **Protect** element lead wires from front panel screws and any field installed screws to avoid short circuit.

**Installation**

**AIR CHANNEL PLACEMENT  
FIGURE 5**



**ELEMENT INSTALLATION  
FIGURE 6**



## BRICK CORE TEMPERATURE SENSOR INSTALLATION

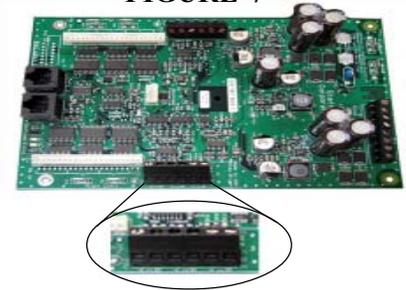
- Step 1** Remove the screws by the brick core temperature sensor holes in the galvanized front panel.
- Step 2** Insert the brick core temperature sensors through the holes in the galvanized front panel. Be sure the sensor marked "upper" is installed in the upper opening, the sensor marked "lower" is installed in the lower opening, and the sensor marked "middle" is installed in the center position (Figure 7). The sensor must pass through the blanket insulation and into the brick core. Holes have not been predrilled through the insulation. Use the sensors to aid in making a passageway by rotating them side-to-side while gently pushing inward.
- Step 3** Once the brick core sensors are installed, put the screws back into position in the galvanized front panel to hold the sensors in position and to provide the electrical ground.
- Step 4** Check the non-insulated element terminations to make sure they do not come within 1/2" of any surface area on the system.
- Step 5** Re-install painted front panel using previously removed screws.



### 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.**

FIGURE 7



## DUCTING

For air delivery, the Comfort Plus Commercial System is equipped with a variable speed supply air blower. When interfacing with a heat pump, the A-Coil MUST be placed on the return air side.

To maintain a room temperature of 85°F or less in the mechanical room, a 24" x 24" opening can be installed in the area or a 6" x 6" non-closing register can be cut into the return air duct. Refer to Placement and Clearance Requirements (Page 3.02-3.03) for more information.

The system is factory configured for a left-to-right or right-to-left airflow. In either airflow direction, the holes directly above the air outlet on the right side of the furnace MUST be contained in the duct system. (See Figure 8 for reference to these air holes.)

If a down flow configuration is desired, a down flow kit must be ordered from the factory (Order Item #1301578) and the system MUST be raised a minimum of 10" off the ground. An 18" pedestal is available (Order Item #1301585).

- Step 1** Unbox the supply air blower plenum assembly.
- Step 2** Remove and discard metal plate securing supply air blower to plenum assembly.

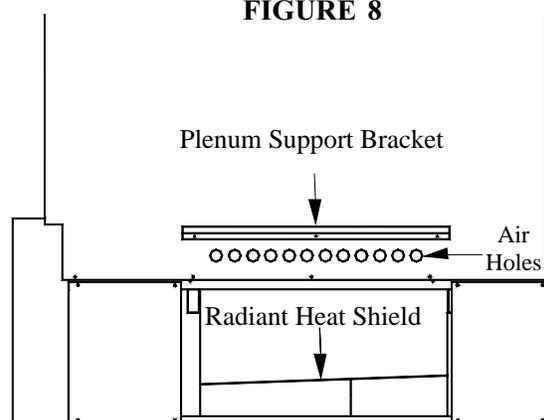


### WARNING

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

- ♦ Do install ducting before energizing the system.
- ♦ Do NOT operate the system without ducting installed to both the air inlet and outlet.
- ♦ Proper duct design and air flow are critical to achieve optimum system performance. A poorly designed duct system and/or improper air flow can cause system inefficiencies, air noise, and condensate drain problems. In applications where poor air flow conditions exist along with high humidity, it may be necessary to install a secondary condensate drain pan. (Order Item #1301576).

SUPPLY AIR PLENUM ATTACHMENT  
 FIGURE 8



**Step 3** Locate the plenum support bracket shipped in the plenum box. Attach the bracket to the supply air side using the blunt tip screws supplied in the plenum assembly hardware package. Refer to Figure 8 for proper positioning of the plenum support bracket.

**Step 4** Attach the supply blower wiring harness located in the base of the system to the blower using the connections located on the ends of the harness. Be sure to place any excess wiring in the base of the system below the radiant heat shield (Figure 8).

**Step 5** Verify that the blower is installed in the plenum with the motor facing away from the system (Figure 9).

**Step 6** Attach the supply air blower plenum to the Comfort Plus Commercial System by drilling two 1/8" holes per edge and using the self tapping screws supplied in the hardware package.

**Step 7** Connect both the return air and supply air ducting systems in the structure to the system. Be sure the air holes just above the air outlet on the right side are contained in the duct system. (See Figure 8 for reference to the location of these holes.)


CAUTION

**When routing the harness to the supply air blower, the harness must route to the side of the air deflector in the bottom of the supply air blower housing.**

**FIGURE 9**



**NOTE** If the system is installed in an enclosed area (less than 400 square feet), a minimum of a 24" x 24" opening must be installed into the area where the system is located. In addition, a 6" x 6" non-closing type register can be cut into the return air duct. Refer to Placement and Clearance Requirements section (Pages 3.02-3.03) for more information.

**Step 8** Connect the supply air duct in the structure directly to the system's air outlet located on the top panel.

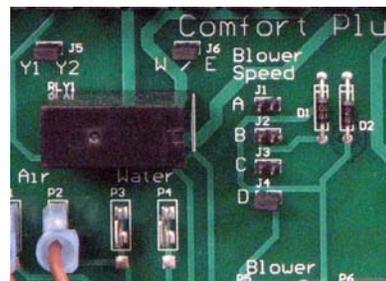
**Step 9** Blower speed selection is configured by moving the blower speed jumper (Figure 10) to the desired position. Reference the System Air Delivery Matrix for CFM information.

**Step 10** The W/E jumper (Figure 10) MUST be in the ON position or the blower will not operate with an E call from the thermostat.

**SYSTEM AIR DELIVERY MATRIX  
VARIABLE SPEED MOTOR**

| Jumper | ½ HP Variable Speed CFM | 1 HP Variable Speed CFM |
|--------|-------------------------|-------------------------|
| A      | 1000                    | 1200                    |
| B      | 1200                    | 1400                    |
| C      | 1400                    | 1600                    |
| D      | 1600                    | 2000                    |

**FIGURE 10**



- NOTE**
- ◆ External static pressure should not exceed .75 inches water column.
  - ◆ With 2 stage Heat Pump, a Stage 1 heat call results in 50% of selected CFM.
  - ◆ Generally, 400 CFM of air flow is recommended per ton of cooling. Therefore, a 3-ton heat pump or air conditioner would require 1200 CFM.

## AIR CONDITIONER/HEAT PUMP INTERFACE

When interfacing the Comfort Plus system with a heat pump, the indoor coil **MUST** be placed on the return side of the Comfort Plus system in a position that will provide even air flow through the coil. If using a factory supplied return air plenum, the plenum is configured to be the housing for the indoor coil. Remove the screws to the plenum's access cover and slide the coil into place inside the plenum. If not using a Steffes supplied return air plenum, the installer will need to make provisions in the plenum to accommodate the coil and air filter.

When interfacing a Comfort Plus system with an air conditioner, the indoor coil can be placed on either the supply air or the return air side of the system.

The condensate drain trap, in a heat pump or air conditioner installation, should be designed for the vacuum in which the system is operating. Typically, taller traps are better suited for these types of applications.

Refer to the Room Thermostat Connections Diagrams (Figures 14, 15 and 16) for more information on interfacing the Comfort Plus with a heat pump or air conditioner.



### WARNING

**Risk of fire. Any one ducting system MUST NOT contain more than one air handling (blower) system. If the application requires multiple Comfort Plus systems or it is necessary to have multiple air handlers share the same ductwork, you MUST contact Steffes Corporation. There are special installation requirements that MUST be performed in an application such as this.**

## LINE VOLTAGE ELECTRICAL CONNECTIONS



### WARNING

**HAZARDOUS VOLTAGE: Risk of electric shock. Can cause injury or death. Do not energize the system until installation is complete. Equipment MUST be installed by a qualified technician in compliance with all applicable local, state, and national codes and regulations.**

In standard configuration, the system is wired for connection to 240V; however, the element circuits can also be connected to 208V. A 208V connection derates the charging input of the system by 25%. If a system rated specifically for 208V is required, contact the factory. The controls circuit in the system **MUST** be connected to 240V/208V.



**277/480V and 347/600V Comfort Plus Commercial systems are configured to use single feed only.**



### IMPORTANT

- ♦ **To ensure proper operation and safety, all line voltage circuits must be segregated from low voltage wiring in the system.**
- ♦ **To reduce electro magnetic fields associated with electrical circuits and to avoid induced voltage on sensors and electronic devices, the circuit phases MUST be alternated as shown in Figure 12A.**

**208/240V System Connections Only:** The 60 amp breakers located in the electrical compartment feed the core charging (element) circuits. The 15 amp breaker feeds the controls and blowers circuit. All 240V/208V systems are factory configured to be field connected to multiple line voltage circuits. If a single feed line voltage circuit is desired, an optional single feed kit is available from the factory.

**277/480V and 347/600V System Connections Only:** The fuse block connection points and neutral connection block, located in the line voltage side of the electrical compartment, feed the core charging (heating element) circuits. This also provides power and the terminal block connections for the primary side of the optional control voltage step-down transformer. Adjacent to these terminals are the connection points for the transformer secondary. See Figure 12B.

To determine the correct wire size required for each circuit feeding the system, refer to the Specifications (Page A.01) and the system's identification label located on the lower left side of the system. (Reference Sample Label Figure 11.)

**Step 1** Route all line voltage wires through a knockout and into the electrical panel.

**Step 2** Make proper field wiring connections to the Comfort Plus Commercial breakers. Refer to the Line Voltage Wiring Diagrams (Pages A.03 - A.04) for more information on these connections.

# SAMPLE SYSTEM IDENTIFICATION LABEL

FIGURE 11

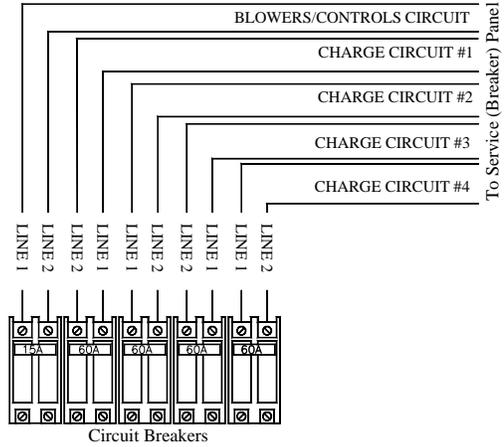
|   |       |                              |                     |  |                         |   |                 |
|---|-------|------------------------------|---------------------|--|-------------------------|---|-----------------|
| Manufactured in U.S.A.                                      |       | <b>STEFFES CORPORATION</b>   |                     | Electric Central Heating Furnace<br>SP99         |                         | <b>UL</b><br>LISTED   |                 |
| Model   | 6149  | S/N                          | 208076446013766 SCC | Option   | 201G                    | U.S. Patents- 5201024, 5086493  |                 |
| Maximum Discharge Air Temperature                           | 190F  | Max External Static Pressure |                     | 0.75   | inches H <sub>2</sub> O | Canadian Patents - 2059158, 2060881   |                 |
| Connections Required for Multi-Circuit Feed Control Circuit |       |                              |                     | Max Amps of Motors Included in Unit              |                         |   |                 |
| N/A   | Volts | N/A                          | Amps                | N/A  | Hz                      | Core Blower #1  | 1.1 Amps 0.1 HP |
| N/A   | Volts | N/A                          | Amps                | N/A  | Hz                      | Core Blower #2  | 1.1 Amps 0.1 HP |
| N/A   | Volts | N/A                          | Amps                | N/A  | Hz                      | House Blower  | 4.7 Amps 0.5 HP |
| Connections Required for Single Circuit Feed                |       |                              |                     | Unit Clearance Requirements (4100 / 6100 series) |                         |   |                 |
| 347/600   | Volts | 51                           | Amps                | 60   | Hz                      | Allow three (3) inches from back and sides, six (6) inches from top of unit to combustibles, and two (2) inches from left side of unit to ducting. Allow thirty-six (36) inches front clearance to provide space for servicing. No clearances are required from ducting or to floor services. |                 |
| N/A   | Volts | 63                           | Amps                | 3  | Phase                   |   |                 |
| N/A   | Volts | 80                           | Amps                |  | Wire                    |   |                 |

**277/480V AND  
347/600V  
THREE PHASE  
FIGURE 12B**



# 208/240 SINGLE PHASE CIRCUIT PHASING CONNECTIONS

FIGURE 12A



The 60 AMP breakers are for internal component protection only. Sizing of the field wire and breaker size **MUST** be in compliance with all applicable local, state, and national codes and regulations.

## LOW VOLTAGE ELECTRICAL CONNECTIONS - PEAK CONTROL

Steffes ETS heating equipment may be controlled by the Power Company via a peak control signal. This signal can be sent to the equipment using a Steffes Power Line Carrier control system, low voltage wiring, a Steffes Time Clock Module, or line voltage control. In applications utilizing automatic charge control, outdoor temperature information is required and can be received via an outdoor sensor or power line carrier control system.

The Comfort Plus Commercial system is factory configured for low voltage peak control and is set to charge when the utility peak control switch closes. Refer to the Configuration Menu (Pages 3.13-3.14) for information on configuring the system for the application.

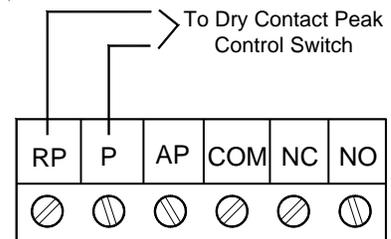
### LOW VOLTAGE (HARD WIRED) PEAK CONTROL

If using the low voltage peak control option, the Comfort Plus Commercial is direct wired to the power company's peak control switch. Field connections from the peak control switch are made to the low voltage terminal block through a low voltage knockout located on the left side of the electrical panel.

**NOTE IMPORTANT**

Low voltage wires **MUST** never enter any line voltage enclosure.

### PEAK CONTROL TERMINAL CONNECTIONS FIGURE 13



**6-Position Low Voltage Terminal Block Coding**

- RP = Peak Control Input Common
- P = Peak Control Input
- AP = Anticipated Peak (Pre-Peak) Control Input
- COM = Peak Control Output Common
- NC = Peak Control Output (Normally Closed)
- NO = Peak Control Output (Normally Open)

**Step 1** Route a low voltage circuit from the power company's load control or peak signaling device to the six (6) position low voltage terminal block inside the electrical compartment of the Comfort Plus Commercial system through one of its low voltage wire knockouts.

**Step 2** Connect the field wiring to positions "RP" and "P" on the six (6) position low voltage terminal block. (See Figure 13.)



To use the system to control other loads, refer to Auxiliary Load Control (Page 3.12).

Installation

### **POWER LINE CARRIER (PLC) PEAK CONTROL**

The Steffes Power Line Carrier (PLC) control system has the ability to communicate with the Comfort Plus Commercial system through the existing electrical circuits in the structure. With the power line carrier option, hard wired low voltage connections from the power company's peak signaling switch connect directly to the transmitting device. The switch signals peak control times to the transmitter, the transmitter sends the signals to the Comfort Plus Commercial system, which receives this information and responds accordingly.

In addition to providing peak control signals, the transmitter also provides outdoor temperature information for automatic charge control, room temperature set back, and anticipated peak utility control signals (if applicable).

The PLC control is optional and must be ordered separately. If utilizing a PLC system, refer to the owner's manual for information on the installation and operation of the PLC control system.

### **TIME CLOCK MODULE PEAK CONTROL**

The Steffes Time Clock Module is another option for providing a peak control signal to the Comfort Plus Commercial. It mounts inside the system's low voltage electrical compartment and interfaces with the relay board via an interface cable. Peak control times must be programmed into the system once the module is installed to enable the time clock feature. Refer to the instructions provided with the Time Clock Module for more information on the installation and operation of this device.

### **LINE VOLTAGE PEAK CONTROL**

Line voltage control is also an option, but is not the preferred method of control as it is usually more complex and expensive. If line voltage control is utilized, the controls circuit must be powered with an uninterrupted circuit. An external switching device, such as a relay panel, is necessary to directly control the heating element charging circuits. If relying on this method of control, the faceplate on the system **MUST** continuously display a brick core operating mode of "C" (charge) regardless of whether it is an off-peak or on-peak period.

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

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 heating requirements.

**Installation Methods:** Hard wired to system to the "OS" and "SC" terminals (default) **OR** connected to Power Line Carrier (PLC)

**Location of:** 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.

- Wiring:**
- Route low voltage wire from the outdoor sensor to the electrical compartment through one of the low voltage wire knockouts.
  - Connect to "Outdoor" terminals on the low voltage circuit board. (See Figures 14-16.)
  - If 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 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.

|   |                  |
|---|------------------|
|    | <b>IMPORTANT</b> |
| <ul style="list-style-type: none"><li>♦ <b>If connecting to a Steffes PLC system, follow the installation instructions in the PLC system's Owner's and Installer's Guide.</b></li><li>♦ <b>Outdoor sensor wire MUST NEVER be combined with other control wiring in a multi-conductor cable.</b></li></ul> |                  |

**Installation**

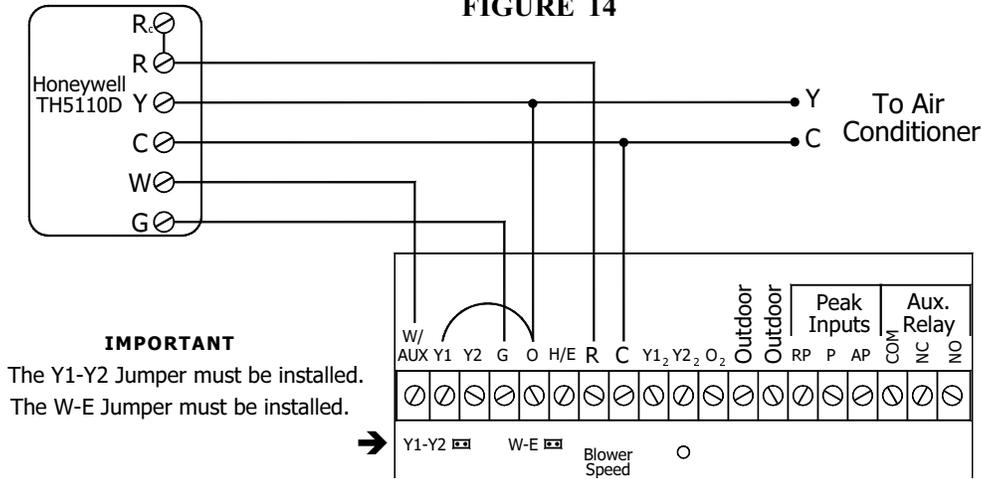
# LOW VOLTAGE ELECTRICAL CONNECTIONS - ROOM THERMOSTAT

A low voltage (24VAC) room thermostat can be used for room temperature control with the Comfort Plus Hydronic system. Steffes recommends using a digital thermostat. If utilizing a mechanical thermostat, a load resistor may be necessary due to the low current draw (.01 amps) on the heat call input circuit of the Comfort Plus system. Contact the factory for information on thermostats available from Steffes.

**NOTE IMPORTANT**  
 Low voltage wires **MUST** never enter any line voltage enclosure.

## STAND ALONE FURNACE APPLICATION WITH VARIABLE SPEED BLOWER CONNECTIONS SHOWN FOR SINGLE STAGE HEATING / SINGLE STAGE COOLING (UNCONTROLLED AIR CONDITIONING)

FIGURE 14



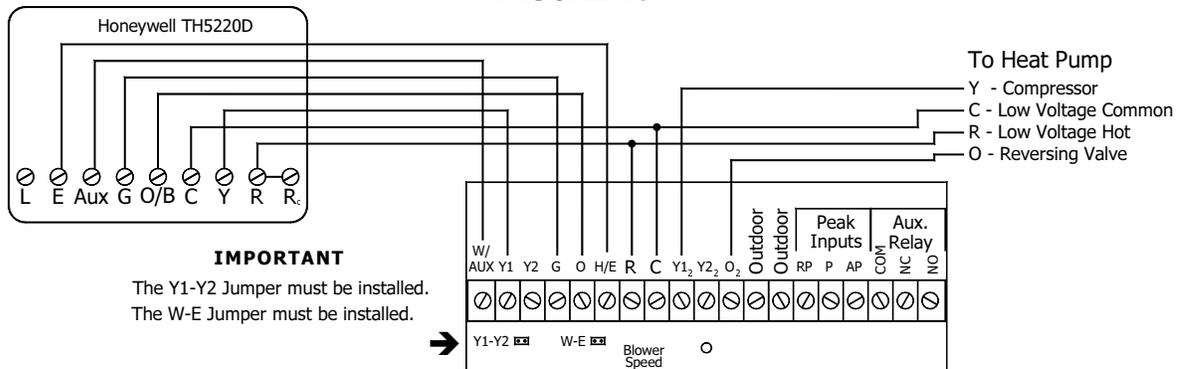
**IMPORTANT**  
 The Y1-Y2 Jumper must be installed.  
 The W-E Jumper must be installed.



If installing a mechanical thermostat or thermostat with anticipator, a resistor kit is required (Order Item #1190015).

## SINGLE STAGE HEAT PUMP APPLICATION WITH VARIABLE SPEED BLOWER

FIGURE 15



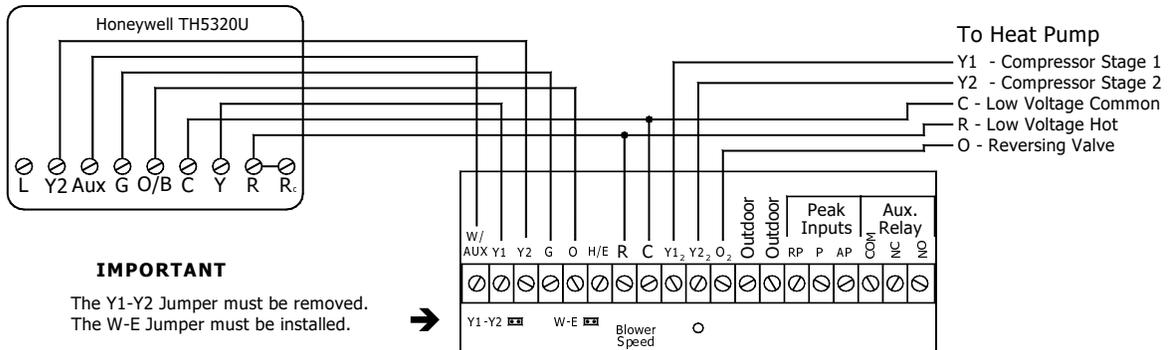
**IMPORTANT**  
 The Y1-Y2 Jumper must be installed.  
 The W-E Jumper must be installed.

| SINGLE STAGE HEAT PUMP |                   |                 |                   |                                     |                                  |
|------------------------|-------------------|-----------------|-------------------|-------------------------------------|----------------------------------|
| Thermostat Stage       | Thermostat Output | Heat Pump Stage | % of Selected CFM | Heat Call Status on Digital Display | Discharge Air Temperature Target |
| 1                      | Y1/G              | 1               | 100%              | HC1                                 | L048                             |
| 2                      | Aux/Y1/G          | 1               | 100%              | HC3                                 | L049                             |
| Fan                    | G                 | 0               | 400 cfm           | HCF                                 | N/A                              |
| Cool                   | Y1/G/O            | 1               | 100%              | COOL                                | N/A                              |
| Emergency Heat         | H/E               | N/A             | 100%              | HC3                                 | L049                             |

\*Contractor Use Only

Installation

## TWO STAGE HEAT PUMP APPLICATION WITH VARIABLE SPEED BLOWER FIGURE 16



| TWO STAGE HEAT PUMP |                   |                 |                   |                                     |                                  |
|---------------------|-------------------|-----------------|-------------------|-------------------------------------|----------------------------------|
| Thermostat Stage    | Thermostat Output | Heat Pump Stage | % of Selected CFM | Heat Call Status on Digital Display | Discharge Air Temperature Target |
| 1                   | Y1/G              | 1               | 50%               | HC1                                 | L048                             |
| 2                   | Y1/Y2/G           | 2               | 100%              | HC1                                 | L048                             |
| 3                   | Aux/Y1/Y2/G       | 2               | 100%              | HC3                                 | L049                             |
| Fan                 | G                 | 0               | 400 cfm           | HCF                                 | N/A                              |
| Cool 1              | Y1/G/O            | 1               | 50%               | COOL                                | N/A                              |
| Cool 2              | Y1/Y2/G/O         | 2               | 100%              | COOL                                | N/A                              |
| Emergency Heat      | H/E               | N/A             | 100%              | HC3                                 | L049                             |

\*Contractor Use Only

### AUXILIARY LOAD CONTROL

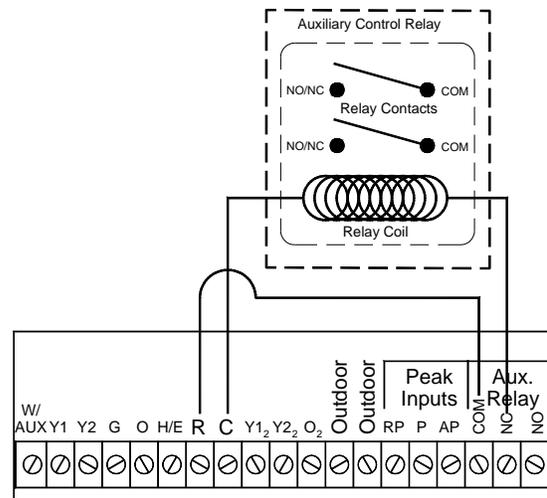
The Comfort Plus Commercial System can be used to provide control signals to other loads in the application. To do so, connect low voltage control wires to the "COM" and "NC" or the "COM" and "NO" positions of the low voltage terminal block in the electrical compartment of the system. (See Figure 17.) These contacts are rated for 30 volts, 3 amps maximum.

NOTE

IMPORTANT

**Maximum external load should not exceed 60 VA on the system's class II transformer.**

### TYPICAL AUXILIARY LOAD CONTROL FIGURE 17



**NOTE: During off-peak (charge) periods, the contact is closed between "COM" and "NC".**

### HUMIDIFIER/ELECTRONIC FILTER INSTALLATION

The Comfort Plus Commercial system is capable of being connected to a humidifier and/or an electronic air filter. If installing either of these devices, connections to the system are made to the bottom two relays on the base I/O relay board inside the system's electrical panel. Refer to the Line Voltage Wiring Diagrams (Pages A.03-A.04) for the location of these relays.

If installing a humidifier, connect it to the "HEAT CALL" relay. This relay closes during a heat call.

If installing an electronic air filter, connect it to the "FAN ON" relay. This relay closes during a fan call.

**Installation**

## CONFIGURATION MENU

The Comfort Plus Commercial heating system has a Configuration Menu, which allows the system to be customized to the power company and consumer's needs. This menu can be accessed on start-up and allows configuration settings to be easily adjusted.

To access the Configuration Menu:

- Step 1** Energize the system. Access to the Configuration Menu is allowed for the first two (2) minutes of operation. If the system has been energized for more than two (2) minutes, the 15 amp circuit breaker must be powered off and back on to gain access to this menu.
- Step 2** Press and release the **M** button until faceplate displays "CONF".
- Step 3** Press the up arrow once and the faceplate will display "C000". The faceplate will flash between "C000" and the corresponding configuration value.
- Step 4** If necessary, edit the configuration value by pressing and holding the **M** button while using the up or the down arrow button to change the value.
- Step 5** Once the value is correct, release the buttons and press the up arrow button to go to the next configuration (C001, C002, etc.).
- Step 6** Repeat steps 4 through 5 until all configuration settings have been adjusted to the desired values.
- Step 7** Once configured, use the down arrow to leave the Configuration Menu.



### IMPORTANT

If access to Configuration Menu times out, the 15 amp circuit breaker must be powered off and back on to re-enter the menu.

In most applications only a few, if any, configuration changes will be necessary. Following is a description of the configuration settings and their function:

**C000 Off-Peak Method of Charge Control** - Sets the method of brick core charging to be used during off-peak (charge) periods. From the factory the system is configured for automatic charge control which is a value of five (5).

**C001 Start Brick Core Charge Set Point** - If utilizing automatic charge control as set in C000, this value indicates the outdoor temperature at which the system will start charging.

**C002 Full Brick Core Charge Set Point** - If utilizing automatic charge control as set in C000, this value indicates the outdoor temperature at which the system will target a full core charge.

**C003 Power Line Carrier (PLC) Channel Selection** - If using PLC communication, this setting must match the channel setting in the Steffes PLC transmitting device. A value of zero indicates power line carrier communication is disabled.

#### C004 Optional Controls Configuration

| <u>Value</u> | <u>Configuration Description</u>       |
|--------------|--|
| 8            | No Outdoor Sensor/No Time Clock Module |
| 9            | Outdoor Sensor/No Time Clock Module    |
| 12           | No Outdoor Sensor/Time Clock Module    |
| 13           | Outdoor Sensor/Time Clock Module       |

**C005 Control Switch Configuration** - If utilizing power line carrier control, the Steffes Time Clock Module, line voltage peak control, or if the utility control switch opens for charging this value should be zero (0). For all other applications, this value should be one (1).

*Configuration Menu continued on next page...*

**C006 Output Control Configuration** - Configures the output controls of the Comfort Plus Commercial system. To determine the value, check the options desired from the list below. Then, add the numbers from the “*Value*” column and enter the sum into this location.

| <u>Value</u> | <u>Option Selected</u>  |
|--------------|---|
| 3            | All 6100 Series Systems.  |
| 8            | Enables compressor control if there is a "COOL" call during a peak (control) time.  |
| 32           | If it is a peak (control) period and the Comfort Plus Commercial receives a cooling call, the compressor will turn off and on in 20 minute intervals (off 20 minutes, on 20 minutes, off 20 minutes, etc.). |
| 128          | Interfaces Comfort Plus Commercial with a heat pump that has a reversing valve which is energized for heating.  |

**C007 Charge Factor** - This configuration should be set to a value of 30.



*C008 through C010 configurations are only applicable if the Comfort Plus Commercial system is being used in conjunction with a heat pump.*

**C008 Heat Pump Compressor Outdoor Lock-Out Temperature for Off-Peak or Anticipated Peak Modes** - Indicates the outdoor temperature at which the heat pump’s compressor is locked out and not allowed to operate during an off-peak or anticipated peak period.

**C009 Heat Pump Compressor Outdoor Lock-Out Temperature for On-Peak Mode** - Indicates the outdoor temperature at which the heat pump’s compressor is locked out and not allowed to operate during an on-peak period.

**C010 Minimum Discharge Air Temperature** - Sets the minimum discharge air temperature the system targets during a Stage 1 heat call.

**C011** Currently not utilized in the 6100 Comfort Plus Commercial systems.

**C012** Currently not utilized in the 6100 Comfort Plus Commercial systems.

**C013-C021 Time Clock Module Configuration** - These configuration settings are used to configure the peak control times when utilizing the optional Steffes Time Clock Module. Refer to the installation and configuration instructions included with the time clock module for more information.

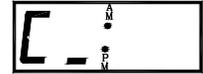
# INSTALLER'S FINAL CHECK-OUT PROCEDURE



## WARNING

**HAZARDOUS VOLTAGE:**  
**Risk of electric shock.**  
**Can cause injury or death. System may be connected to more than one branch circuit.**  
**Disconnect power to all circuits before servicing.**  
**Equipment must be serviced by a qualified technician.**

**Step 1** Verify that the operating mode displayed on the control panel corresponds with the power company's peak control signal. Refer to the Operating Status section (Page 1.02) for more information on the proper operating mode.



**Step 2** Press the up arrow one time and verify that the outdoor temperature information displayed on the control panel is approximately the same as the current outdoor temperature. Refer to the Operating Status section (Page 1.02) for more information on the outdoor temperature display.



**Step 3** Press the up arrow again and the current heat call status will be displayed on the control panel. Refer to the Operating Status section (Page 1.02) for more information on the heat call status display.



**Step 4** Initiate a heat call from the room thermostat and verify that the system recognizes the heat call. Refer to the Operating Status section (Page 1.02) for more information on the various heat call status displays. The supply air blower should operate. In an application interfacing the system with an air conditioner or heat pump, verify that this device is operating appropriately.

**Step 5** If applicable, initiate a cooling call from the room thermostat. Verify that the system recognizes the cooling call by displaying "COOL" on the control panel. The supply air blower should operate. In an application interfacing the system with an air conditioner or heat pump, verify that this device is operating appropriately.

**Step 6** Press the up arrow until the targeted brick core charge level is displayed on the control panel. With the system in an off-peak (charge) mode, initiate a charge control override. (See Page 1.03.) Once initiated, the target level of the system should be 100 percent and the control panel should display "tL: F". All of the elements should be energized.

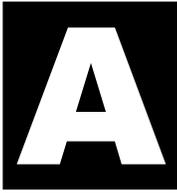
**Step 7** With an amp meter, verify that the amperage of the system is correct for the installation. Refer to the System Identification Label on the heating system for information regarding the proper amperage.

**Step 8** Cancel the charge control override and verify that all elements in the system de-energize. Refer to the Charge Control Override section (Page 1.03) for instructions on canceling the charge control override.

**Step 9** Verify, once again, that the Operating Mode displayed on the control panel corresponds with the power company's peak control signal.

**Step 10** In applications utilizing the Steffes Power Line Carrier control system, complete the Installer's Final Check-Out Procedure in the Owner's and Installer's Manual provided with that device.

**Step 11** Complete the manufacturer's warranty card and return promptly.



# Appendix

## SPECIFICATIONS

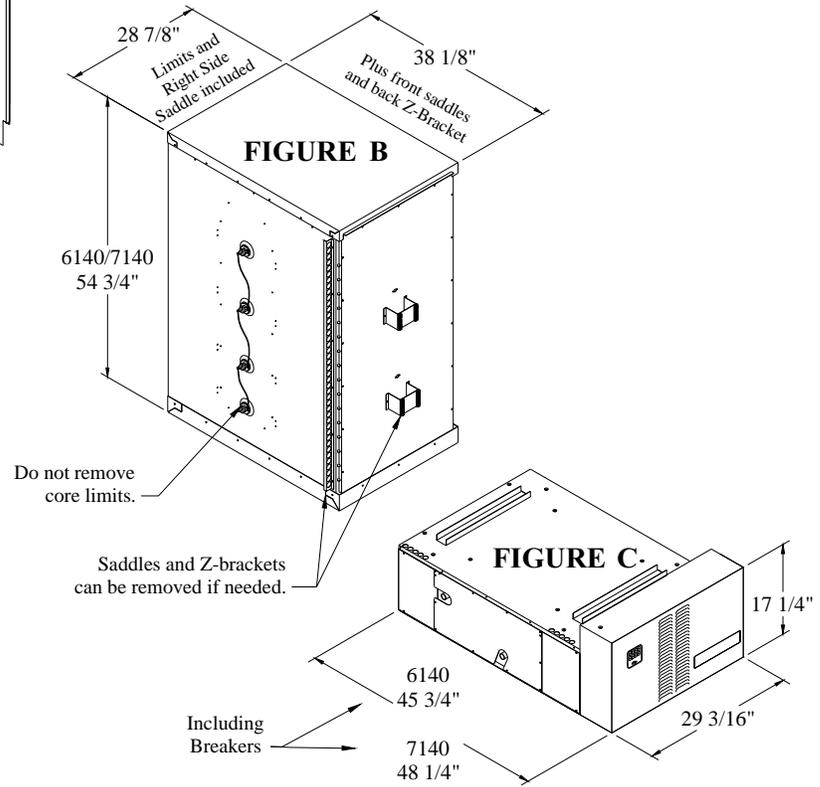
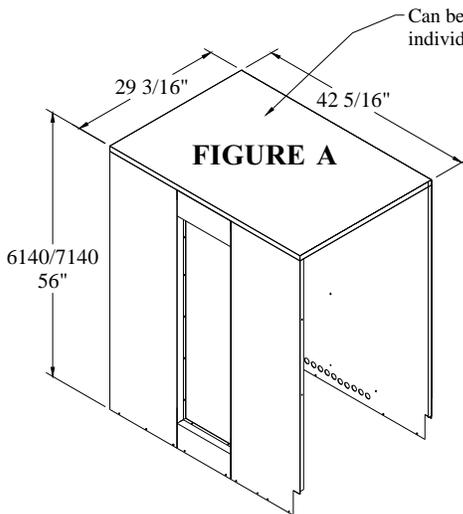
|  | Model 6140            |     |         |         |      |    |      |  |
|--|-----------------------|-----|---------|---------|------|----|------|--|
| Input Voltage  | 208                   | 240 | 277/480 | 347/600 |      |    |      |  |
| Phase  | Single                |     |         | Three   |      |    |      |  |
| Number of Wires - See Note 1                                 | 2                     |     |         | 4       |      |    |      |  |
| Charging Input (kW)  | 36                    | 36  | 42.75   | 38.4    | 46.5 | 36 | 46.5 |  |
| Element Current Draw (Amps)                                  | 174                   | 150 | 179     | 47      | 56   | 35 | 45   |  |
| Pump/Blower/Controls Max Circuit Required (Amps)             | 7 @ 240 Volts         |     |         |         |      |    |      |  |
| Single Feed Minimum Circuit Ampacity (Amps) - See Note 1 & 2 | 226                   | 197 | 232     | 63      | 75   | 47 | 60   |  |
| Blower/Controls Voltage (VAC) - See Note 2                   | 240/208               |     |         |         |      |    |      |  |
| Storage Capacity - See Note 3                                |                       |     |         |         |      |    |      |  |
| kWh  | 240                   |     |         |         |      |    |      |  |
| BTU  | 818,880               |     |         |         |      |    |      |  |
| Approximate Installed Weight (lbs)                           | 3,859                 |     |         |         |      |    |      |  |
| Max Coil Dimensions (W x D x H) - See Note 4                 | 26" x 22" x 30 15/16" |     |         |         |      |    |      |  |

- Note 1:** 208V or 240V systems are factory configured to be field connected to multiple, single phase line voltage circuits. If single feed to element and blowers/system controls circuit is desired, an optional single feed kit is available to order. Connection to 3-phase power is acceptable and can improve phase balancing.
- Note 2:** Because 277/480V and 347/600V systems are configured for single feed, three phase line voltage connections only, a step down transformer must be field installed.
- Note 3:** The size and heating ability of the system required for an installation is dependent on the heat loss of the area and hours available for charging. In addition, if the system is not installed within the heated area, heat lost statically must be taken into account when sizing. Contact Steffes Corporation for assistance in selecting an appropriately sized system.
- Note 4:** The indoor coil or outdoor compressor of an air conditioner or heat pump are not included with the furnace. A return air plenum for the 6140 is configured to house an indoor coil and can be ordered from the factory as an optional accessory. Dimensions listed are that of the inner coil area in the plenum. For larger coils, field provisions to the factory built plenums are necessary or one will need to be custom built by the installer. (In heat pump applications, the indoor coil MUST be placed on the return air side.)

Appendix

# DISASSEMBLING A COMFORT PLUS COMMERCIAL SYSTEM

- Step 1** Remove the painted front panel of the brick storage cabinet by removing the sheet metal screws along the top, bottom, and sides of the panel. Detach by pulling the bottom of the panel forward and down.
- Step 2** Remove the limit zone cover.
- Step 3** Remove the screws around the perimeter of the limit zone and around the bottom of the left side, right side, and back upper panels.
- Step 4** There are two white/blue wires which route from the limit zone through a knockout. These wires route into the electrical compartment through a romex connector. Loosen the romex connector.
- Step 5** Remove the electrical panel cover and locate the point where the white/blue wires connect to the black/yellow wires. Disconnect the white/blue wires and route them up through the romex connector.
- Step 6** Remove the one or two screws in the center of the upper right side panel. From the back of the system, lift and remove the painted panels (Figure A).
- Step 7** Locate the brick core temperature sensor(s) behind the front panel and disconnect them from their shipping position. Carefully lay the sensor(s) aside to avoid damaging them.
- Step 8** Rock the brick core (Figure B) to one side and lift top portion up and off the base (Figure C).
- Step 9** Move the heating system into the desired location, reassemble, and continue with the installation instructions in this manual.



Appendix



## WARNING

**HEAVY OBJECT WARNING:**  
Can cause muscle strain or back injury.

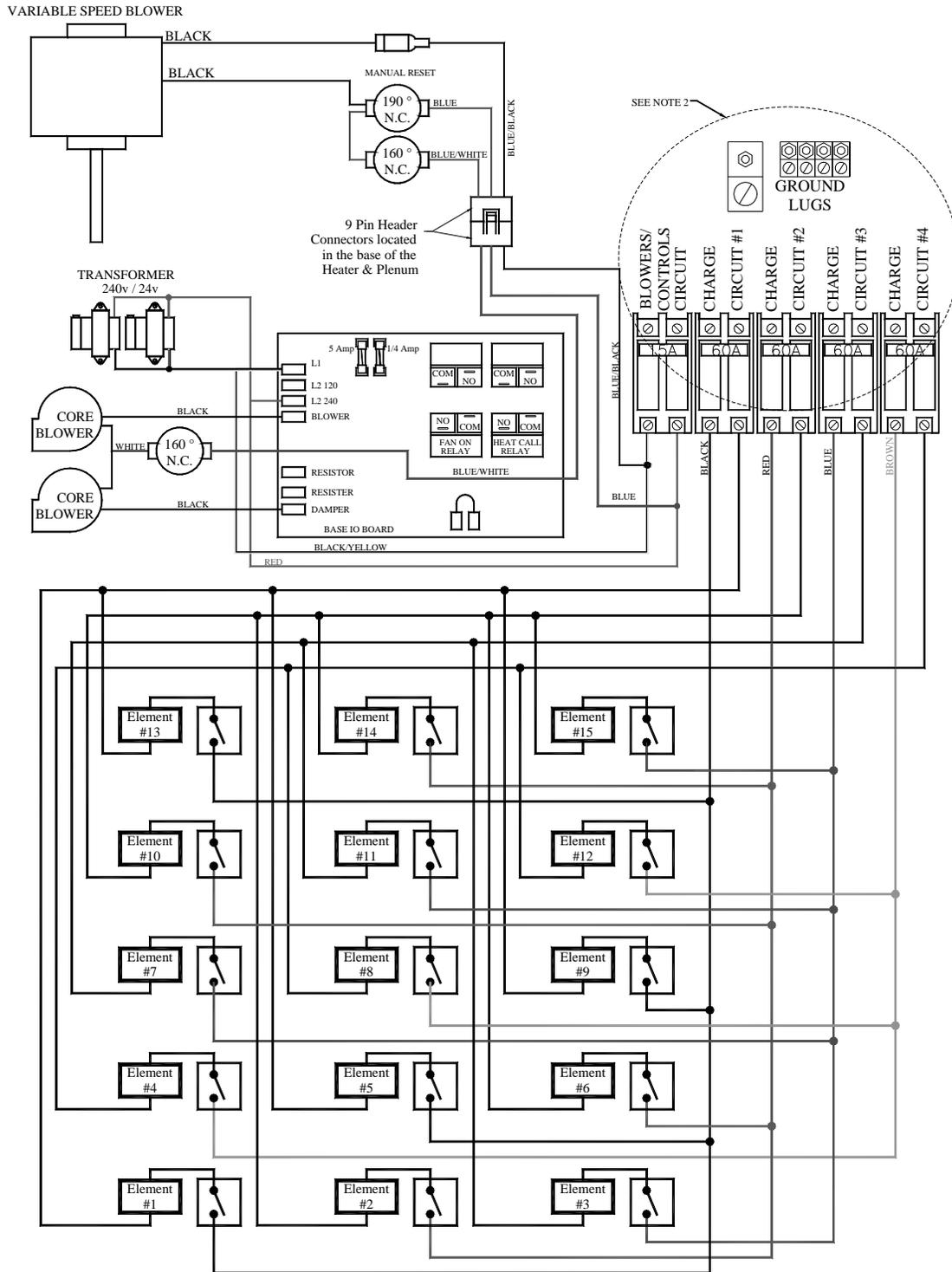
- ◆ Use lifting aids to move system into place.
- ◆ Do NOT place object, hands, and/or body parts under the system when lifting.
- ◆ Use care to keep objects, hands, and/or body parts clear of system when lifting.

# INTERNAL SYSTEM WIRING DIAGRAMS - LINE VOLTAGE

240V OR 208V SYSTEMS ONLY  
WITH VARIABLE SPEED



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



**NOTE:** Line Voltage Field Wiring Connections - See Figure 12A for information on circuit phasing connections.



# INTERNAL SYSTEM WIRING DIAGRAM - LOW VOLTAGE

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

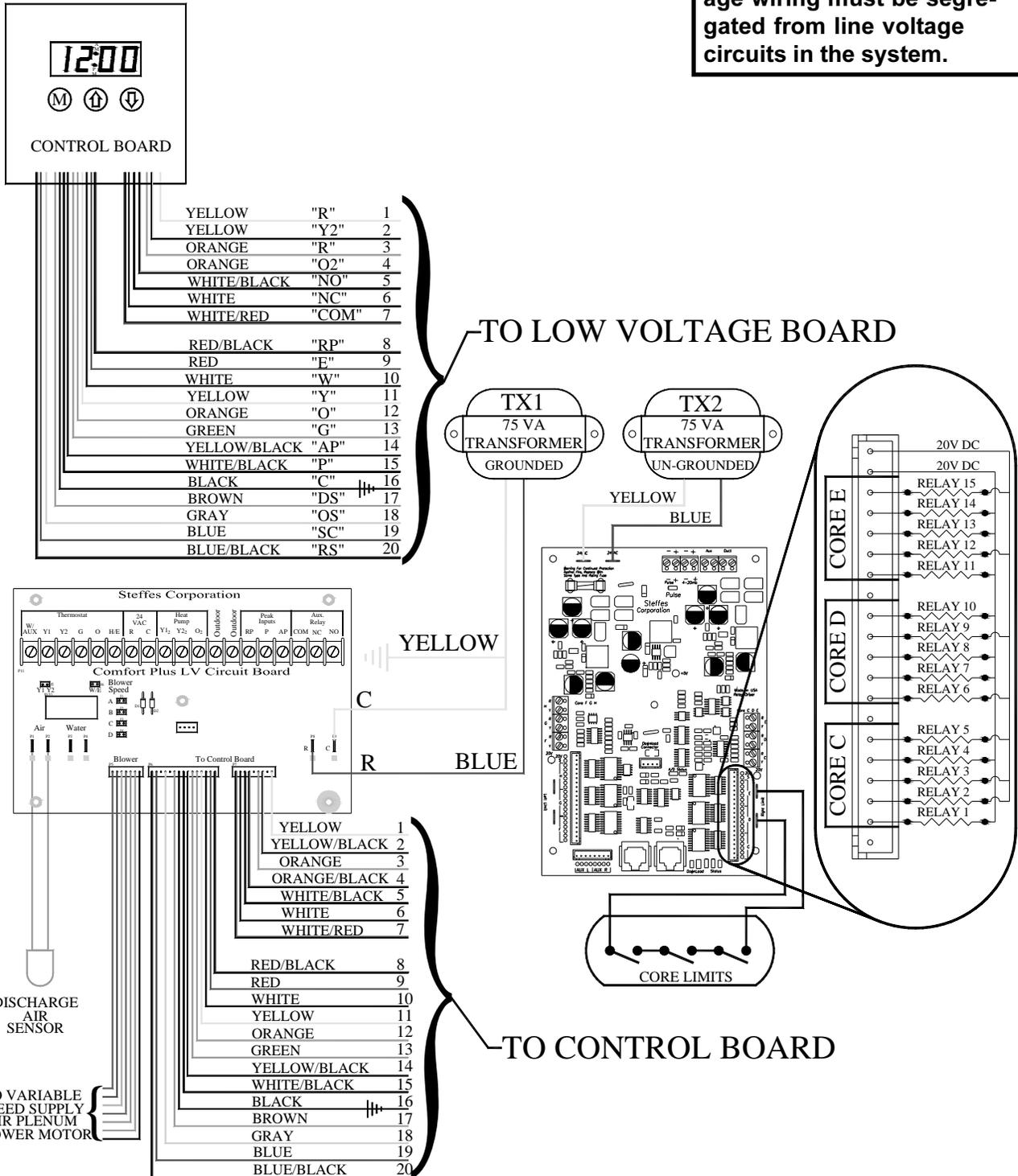
## System Low Voltage Wiring Diagram - With Variable Speed



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. Can cause injury or death. All low voltage wiring must be segregated from line voltage circuits in the system.**



## HELP MENU

The Comfort Plus Commercial 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> |
|-------------------|--------------------|
|-------------------|--------------------|

|    |   |
|----|---|
| 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. Verify that the supply air blower is connected to the supply blower wiring harness located in the base of the system. Compare the sensor reading to the value in L112 to verify proper calibration of the circuit board. <i>Approximate ohm readings are 70°F = 1,199 ohms; 80°F = 941 ohms; 95°F = 646 ohms.</i> |
|----|---|



| <b>Error Code</b> | <b>Description</b>  |
|-------------------|---|
| 05                | Outdoor sensor (direct wired) temperature reading is out of normal operating range. The sensor circuit may be open or shorted, the processor control board may be out of calibration, or there may be an incorrect value in L035. If using power line carrier control, make sure the values in L020 and L035 have been set appropriately. Otherwise, verify that the outdoor sensor is connected properly. Compare the sensor reading to the value in L113 to verify proper calibration of the circuit board. <i>Approximate ohm readings are 5°F = 7,646 ohms; 50°F = 2,024 ohms; 95°F = 646 ohms.</i> |
| 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. <i>Approximate ohm readings are 60°F = 1552 ohms; 70°F = 1199 ohms; 80°F = 941 ohms. Max 190°F, Min 0°</i>  |
| 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. Read mV DC across the thermocouple. Compare the thermocouple reading to the value in L136 to verify proper calibration of the circuit board. <i>Approximate DC mV readings are 200°F = 3.8 mV; 700°F = 15.2 mV; 1200°F = 27.0 mV. Max. 1700°F, min 0°F</i>   |
| 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. Read mV DC across the thermocouple. Compare the thermocouple reading to the value in L137 to verify proper calibration of the circuit board. <i>Approximate DC mV readings are 200°F = 3.8 mV; 700°F = 15.2 mV; 1200°F = 27.0 mV. Max. 1700°F, min 0°F</i>   |
| 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. Read mV DC across the thermocouple. Compare the thermocouple reading to the value in L138 to verify proper calibration of the circuit board. <i>Approximate DC mV readings are 200°F = 3.8 mV; 700°F = 15.2 mV; 1200°F = 27.0 mV. Max. 1700°F, min 0°F</i>   |
| 14-16             | Not used in Comfort Plus Commercial systems.  |
| 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 which is out of calibration. Take a mA reading across the input to ensure proper operation, check the wiring, and verify the value in L053. Compare the sensor reading to the value in L142 to verify proper calibration of the circuit board. All heating elements should be turned off. <i>Max. 25mA, min 2mA</i>   |
| 18                | Pulse reading is not functional. The pulse input reading is indicating 0 load even though there are elements, 2 minimum, turned on. All loads should be turned off.   |
| 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.  |

| <b>Error Code</b> | <b>Description</b>  |
|-------------------|---|
| 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 relay expansion board. The interface cable may be defective or the first expansion board may be unresponsive. Check the jumper configuration on the relay expansion board to ensure that J1 and J2 are both in the “OFF” position. Verify that the values in L090, L091, and L092 are correct for the application. |
| 22                | There is no communication occurring with the second relay expansion board. The interface cable may be defective or the second expansion board may be unresponsive. Check the jumper configuration on the expansion board and make sure J1 is “ON” and J2 is “OFF”. Verify that the values in L090, L091, and L092 are 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 and indicates that one of the sensors or the core thermocouple may be shorted to ground or the processor control board may be out of calibration.   |
| 25                | Power line carrier system is active; however, no good data has been received.   |
| 26                | Insufficient main control board memory. Contact a qualified service technician.   |
| 27                | Insufficient permanent memory. Contact a qualified service technician.  |
| 28                | Permanent memory change has been made. Press the <b>M</b> 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. Contact a qualified service technician.  |
| 30                | Base I/O relay board is in test mode. Check the jumper configuration on the circuit board.  |
| 31                | Relay expansion board(s) are in test mode. Check the jumper configuration.  |
| 39                | Indicates the value in Location 13 (L013) has been set to a value greater than the value in Location 12 (L012). The system will not charge until the value in L013 is set lower than L012.  |
| 40                | Location values are lost. The EPROM will be updated to the values saved in the main program. Clear error by touching the M button on the heater. If this will not clear the error, replace the processor control board.   |
| 41                | This error may appear when configuring the heater. Clear error by touching the M button on the heater. If this will not clear the error, replace the processor control board.   |
| 42                | Internal communication error. Reprogram or replace processor control board.   |
| 43                | An attempt to load configuration using LO 98 set to 20, 30, 40, or 50 has failed. All location values will need to be manually set.   |
| Cold Core         | Temperature of the brick core is below 40 degrees or the core sensing thermocouple may be open. Verify that the core thermocouple wiring is connected properly and that the values in L090, L091 and L092 are correct for the application. If the value in L110 is reading 30, then the thermocouple is open.   |
| Core Fail         | Core high limit switch may be open.   |
| PLC Fail          | The system is configured for power line carrier control; however, is not receiving a valid power line carrier communication signal.   |
| LoAd CAP          | All controllable loads have been shed and Maximum Load Capacity is still exceeded.  |

## GLOSSARY

**Anticipated Peak** ~ Used only by certain power companies as an alternative method of storing heat in the brick core. An "A" will illuminate on the control panel.

**Automatic Charge Control** ~ Method of brick core charge regulation where a sensor monitors outdoor temperature to automatically adjust the brick core temperature.

**Brick Core Charge Level** ~ The amount of heat that is stored in the brick core.

**Charge Period** ~ Off-peak time in which the system is allowed to store heat in its brick core. A "C" will illuminate on the control panel.

**Control Panel** ~ Contains the buttons to adjust and the display to indicate system functions.

**Control Period** ~ On-peak time in which the system is not allowed to store heat in its brick core. A "P" will illuminate on the control panel.

**Edit Mode** ~ Process of changing or viewing the values in a microprocessor location. This is accomplished with the use of the **M** (mode) button, the  $\uparrow$  (up arrow) button, and the  $\downarrow$  (down arrow) button.

**Location (Function)** ~ Where the specific operating information of the system is stored. These locations are part of the system microprocessor and are accessed through the control panel. Displayed as an "L" on the faceplate when in the edit mode.

**Location Value** ~ The specific information set and stored in a location on the microprocessor which defines system operation. A value for a specific location is accessed through the control panel.

**Manual Charge Control** ~ Method of brick core charge regulation where the owner must periodically adjust the brick core temperature setting in relation to the outdoor temperature.

**Microprocessor** ~ Device on the circuit board of the system which stores and processes the information for controlling the operation of the system.

**Off-peak** ~ The time during the day or night when the power company can supply electricity more economically and may offer a special incentive such as a reduced electric rate or billing credits for the electricity consumed during this time. Typically, electrical usage is not controlled during an off-peak time. (The system will provide heat to satisfy comfort requirements during this time as well as charge or store heat in its brick core.)

**On-peak** ~ The time during the day or night when the power company experiences a high demand for electricity. To limit demand, certain appliances are controlled to avoid usage by them and/or a premium for the electricity consumed during this time may be charged to discourage electrical usage. (The system is not allowed to charge or store heat in its brick core during peak periods. Heating requirements are satisfied by only the heat it has stored in its brick core.)

**Outdoor Sensor** ~ Device that senses outdoor air temperatures and communicates this information to the Comfort Plus for automatic charge control.

**Room Temperature Set Point** ~ The targeted room temperature the system is to maintain. If the room thermostat senses a temperature below this point, the heater's blower will come on and extract heat from the brick core.

# **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 (“Steffes”) warrants that the Steffes Electric Thermal Storage Heating Appliance is free from defects in materials and workmanship under normal use and service. Steffes’ obligation under this Warranty is limited to the repair or replacement of the appliance or parts only which prove to be defective under normal use within **two (2) years** of the date of installation and which Steffes’ examination of the returned appliance or part(s) shall verify to Steffes’ satisfaction that it is defective. Optional Steffes controls have a **three (3) year** warranty coverage period. The user shall be responsible for any labor costs associated with the repair or replacement of the appliance or part(s), including the cost of returning the defective appliance or part(s) to Steffes Corporation.

This Warranty is void if the heating appliance is moved from the premises in which it was originally installed. This Warranty shall not apply to an appliance 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 ABOVE WARRANTY BY STEFFES IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN OR ORAL, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

The buyer assumes all risk and liability whatsoever resulting from the use of this heating appliance. In no event shall Steffes be liable to purchaser 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 the heating appliance 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 the Comfort Plus and this manual. Enjoy your new purchase!*



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