V3

THERM ELECT

OWNER'S AND INSTALLER'S MANUAL

Models: 8150, 8155, 8180, 8185, 8188

Applicable to Software Version 2.0

STEFFES CORPORATION

c UL us LISTED

IMPORTANT

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

  Steffes disclaims any responsibility or liability for mold/mildew growth and/or any damages caused by either. We strongly recommend that the user follow the moisture, mold and mildew prevention guidelines prescribed by local or national protection agencies.

For Customer Use

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

Model No. _____

Serial No. _____

RECOGNIZE THESE SYMBOLS AS SAFETY PRECAUTIONS

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

SAFETY PRECAUTIONS

1. DO NOT energize the system while disassembled or without ceramic heat storage brick in place.
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. (Page 3.03)
4. DO NOT place anything on top of the Storage Module(s).
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 accordance with information contained herein and with national, state, and local codes and requirements.
7. A repeated message of “CORE FAIL” indicates a need for service by a qualified technician.

WARNING

- **Hazardous Voltage: Risk of electric shock, injury, or death. This system may be connected to more than one branch circuit. Disconnect power to all circuits before installing or servicing. Installation of and/or service to this equipment MUST be performed by a qualified technician.**
- **Risk of injury or fire. Violation of the clearance requirements can cause improper operation of the equipment. Maintain the placement and clearance requirements specified.**

BUILT-IN SAFETY DEVICES

The ThermElect 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 the core and top temperatures. If normal operating temperatures are exceeded, the system will display "CORE FAIL" and the elements will not be allowed to operate.	Air handler side of each storage module and storage module top panel.
Core Blower Limit Switch (Auto Reset)	This limit switch monitors the discharge air temperature and interrupts power to the core blower if the normal operating temperature is exceeded: 160°F / 71°C (nominal)	Mounted on limit bracket at discharge air outlet.
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 blower if the normal operating temperature is exceeded: 190°F / 88°C (nominal)	Mounted on limit bracket at discharge air outlet.
Core Blower Housing Temperature Limit Switch (Auto Reset)	This limit switch monitors the temperature in the base of the air handler and interrupts power to the core blower if the normal operating temperature is exceeded: 160°F / 71°C (nominal)	In the base of the air handler near the core blower.

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1 Operation

GENERAL OPERATION

The ThermElect heating system stores 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 of the Storage Module(s) 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 blower automatically adjusts its 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 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 or equipment damage.

SYSTEM START-UP

On start-up of the system, odors relating to first time operation of the heating components may be experienced. Also, if not used for an extended period of time, dust may accumulate in the system. Allow the 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 may be drawn into the system 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.

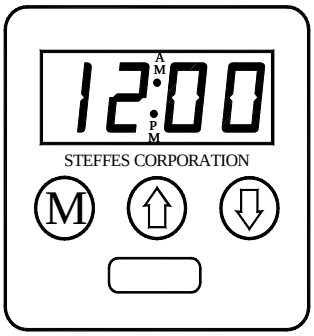
During operation, the heating system may produce minor expansion noises. These noises are the result of the internal components reacting to temperature changes.

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.

CONTROL PANEL

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



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.

Ⓜ 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.

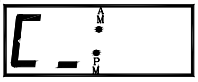
CAUTION

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

▭ Interface Port
FOR SERVICE USE ONLY! Allows technician external access for updating software and troubleshooting.

OPERATING STATUS

The ThermElect 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

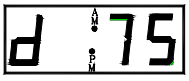
NOTE **A bar illuminates on the lower portion of the display's second digit whenever one or more heating elements are energized.**

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.
HC_0 = No Heat Call ***HC_1*** = Stage 1 Heat Call
HC_2 = Stage 2 Heat Call ***HC_3*** = Emergency Heat
COOL = Cooling/Air Conditioning Call

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 in the ThermElect system is energized. The variable speed core blower automatically adjusts 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 heat pump systems, the ThermElect system replaces resistance strip heat, which is typically required as a supplement or back-up to the heat pump system. The outlet sensor monitors the discharge 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 ThermElect 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 ThermElect system receives a “W” 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).

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

BRICK CORE CHARGE CONTROL

The amount of heat stored in the brick core of the Storage Module(s) varies in relation to outdoor temperature, current building load, utility peak conditions, and/or the heating requirements. The outdoor sensor, supplied with the system, 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.

CHARGE CONTROL OVERRIDE

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

MAINTENANCE AND CLEANING

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

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

2 Optional Accessories

LOAD MANAGEMENT CONTROL

The ThermElect is a commercial Electric Thermal Storage (ETS) heating system. It uses Demand Free, Off-Peak 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 ThermElect's thermal mass consists of a high-density ceramic brick capable of vast heat storage.

The ThermElect system is designed to operate under one of three different load management control strategies.

1. On-Peak/Off-Peak Program

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

b) The ThermElect system also offers on-peak control of external loads by utilizing the dry contacts provided on the relay driver board.

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

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

b) Other external loads would generally be controlled through the building's load management control system.

3. Pulse Monitoring

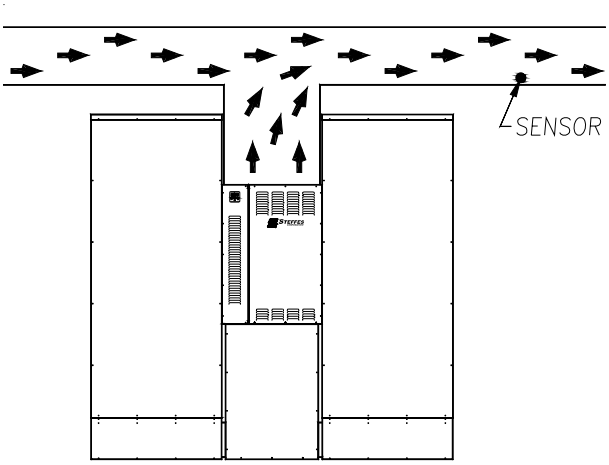
a) The ThermElect system monitors pulse outputs from the power company's electric meter. Program parameters such as desired maximum building kW and pulse ratios for the metering system being used are entered into the ThermElect system. The system then changes proportionally when demand free power is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

b) External load management control modules (Order Item # 1908410) are available when using pulse monitoring load control. Each module has eight (8) zones which can be controlled. The ThermElect system must be configured to recongnize the number of load management modules installed (maximum of two per ThermElect system).

Reference the Load Management Section of this manual for more specific information on the individual methods of control.

EXTERNAL DUCT SENSOR

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



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

If there is a Y and a G call from the thermostat, the ThermElect system operates the core blower 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, or E, then the system will operate the core blower 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 blower if the output temperature at the output sensor exceeds 150 degrees Fahrenheit.

LIFTING HANDLES

Optional lifting handles are available (Order Item #1302120) to aid in moving the ThermElect Storage Module(s) into their final location. It is extremely important to use caution when lifting a Storage Module. Instruct workers to NOT walk under or place any body parts under the Storage Module when lifting and/or moving.

WARNING

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

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

3 Installation

SHIPPING AND PACKAGING

The ThermElect Storage Module(s) 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 STORAGE MODULE(S)

	MODULES	
MODEL	53kW	80kW
8150	1	0
8155	2	0
8180	0	1
8185	1	1
8188	0	2

② AIR HANDLER

2000 CFM - Standard
3000 CFM - Optional
(shipped separately)

③ ELECTRICAL PANEL

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

(shipped separately)

208/240V shown

④ INFORMATION PACKAGE

(includes Owner's Manual and Warranty Registration Card)

(included on pallet with the electrical panel)

⑤ HEATING ELEMENTS WITH CERAMIC INSULATORS

MODULE	ELEMENTS
53kW	12 (2 boxes of 6)
80kW	18 (3 boxes of 6)

(shipped separately)

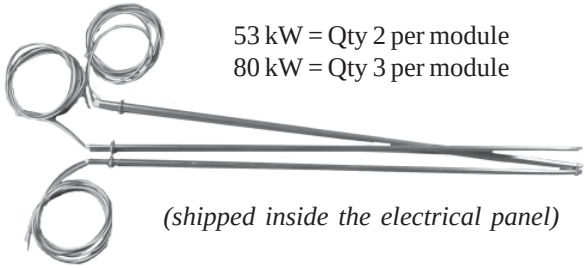
⑥ ELEMENT SCREW KIT & INSTALLATION HARDWARE KIT

(shipped inside the electrical panel)

⑦ SEAM WRAP

(shipped inside brick storage cavity)

⑧ CORE THERMOCOUPLE WITH 6' CLEAR PLASTIC TUBE

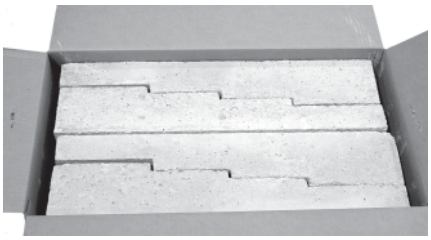


53 kW = Qty 2 per module
80 kW = Qty 3 per module

(shipped inside the electrical panel)

⑨ TOP AIR CHANNEL BLOCK

1 box of 4 per Storage Module



(shipped separately)

⑩ CERAMIC BRICK

MODULE	BRICK	LBS
53kW	192	3,360
80kW	288	5,040

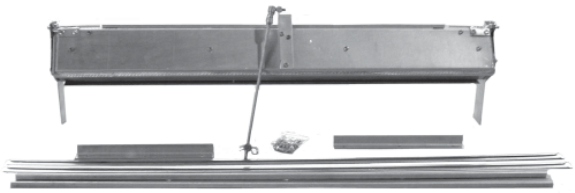
96 brick per pallet
(shipped separately)

⑪ OUTDOOR TEMPERATURE SENSOR

(shipped inside the electrical panel)

⑫ OUTLET DAMPER KIT

1 per Storage Module
(includes Damper Assembly, Damper Linkage, 2 - L Brackets, 2 - C Clip Drive Brackets, 2 - C Drives, Hardware Screw Kit)



(shipped separately)

⑬ HIGH VOLTAGE KIT (277V & 347V SYSTEMS ONLY)

Sized for Air Handler
(includes fuses and transformers)

(shipped separately)

⑭ TRANSFORMER WIRING HARNESS (277V & 347V SYSTEMS ONLY)

(shipped in electrical panel)

PLACEMENT AND CLEARANCE REQUIREMENTS

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

WARNING

Risk of injury or fire. 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.

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

The minimum area required for the installation of the system is 100 square feet per Storage Module. **This area must remain free of debris and room air should be maintained at less than 85° Fahrenheit.** Ventilation MUST be provided if the system is being installed in an area with less than 600 square feet. It is the responsibility of the installer and system designer to provide this ventilation.

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

NOTE **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.**

SYSTEM REQUIREMENTS
FIGURE 2

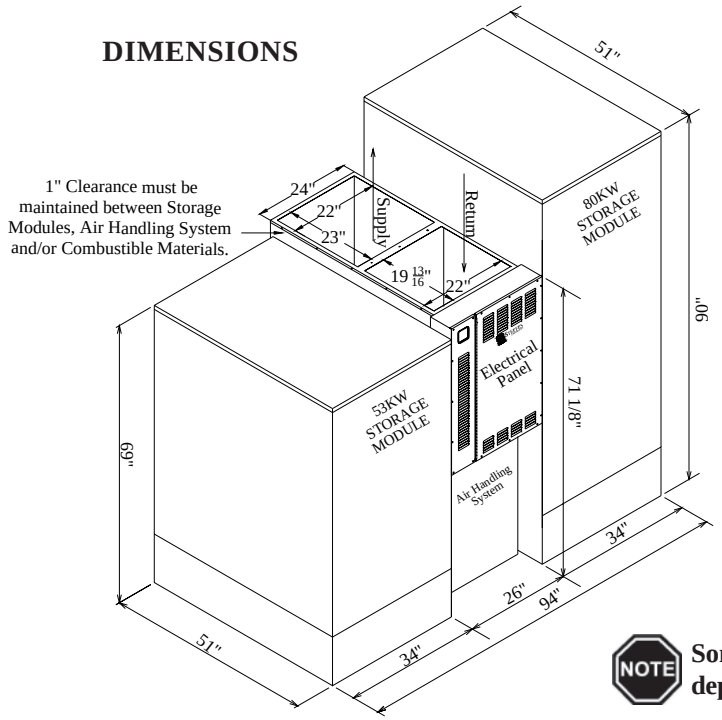
Storage Module (53kW and 80kW)

- Back = 8 inches
- Bottom = 1 inch (from combustible material)
- Sides = 8 inches
- Top = 8 inches (from combustible material)
- Front = 36 inches (for ease in servicing)

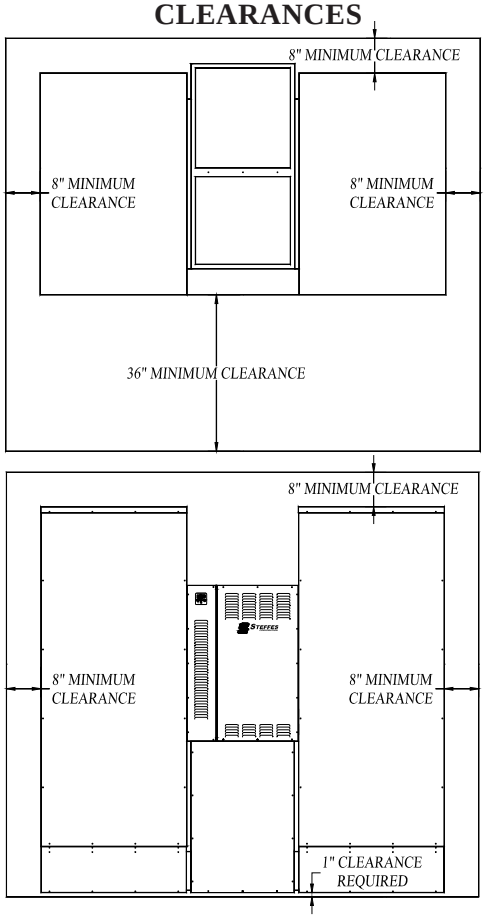
Air Handler (2000 and 3000 CFM)

- Back = 1 inch clearance
- Bottom = 1 inch (from combustible material)
- Sides = 1 inch clearance
- Top = 0 inches (from combustible material)
- Front = 36 inches (for ease in servicing)

DIMENSIONS



CLEARANCES



NOTE **Some electrical codes may require a greater front clearance depending on operating voltages and other factors.**

Installation

INITIAL SET-UP

Step 1 Remove the Information Package from the outside of the electrical panel and unpackage the Storage Module(s) and Air Handler.

Step 2 Move the system into its installation location. Optional liftting handles are available from the factory. (Order Item #1302120).

If using Steffes lifting handles, remove painted front and back panels from brick storage cavity.

WARNING

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

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

CAUTION

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

- DO NOT install the 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 materials.
- Equipment MUST be installed by qualified technician in accordance with all applicable codes and regulations.

ATTACHING STORAGE MODULE(S) TO AIR HANDLER

Each side of the Air Handler has a Storage Module Inlet/Outlet Opening, Limit Access Panel and knockout. If using only one Storage Module follow the instructions below for the side of the Air Handler where the Storage Module will be attached.

Step 1 Remove the screws around the Storage Module Inlet/Outlet Opening(s) on the side of the Air Handler where the Storage Module will be placed. (See Figure 3.)

Step 2 Remove the front painted panel from the Air Handler and set aside.

Step 3 Lift the Storage Module Inlet/Outlet Opening cover(s) out through the front of the Air Handler.

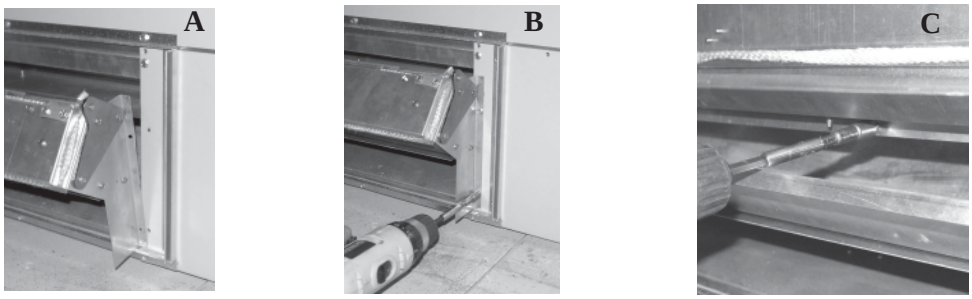
Step 4 Attach the top and bottom C-clip drive brackets and the side L brackets to the Air Handler. (See Figure 3.)

When attaching the top C-clip drive bracket, use the top row of screw holes.

FIGURE 3

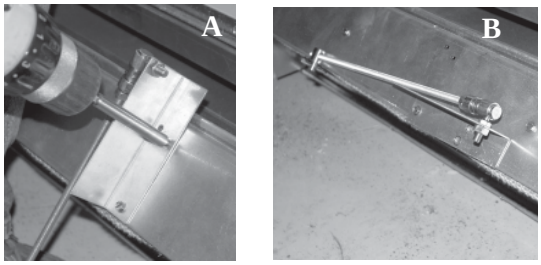
Step 5 Securely mount the damper(s) to the Storage Module(s) using the screws provided in the outlet damper kit. Two screws are required for each side of the damper assembly (Figures 4A and 4B); four screws are inserted along the top and four screws are inserted along the bottom of the damper. To insert the top screws, open the damper as shown in Figure 4C.

FIGURE 4



Step 6 Remove the top two screws from the damper bracket at the center of the damper assembly (Figure 5A). Rotate the damper actuator assembly 90 degrees (Figure 5B) to keep it out of the way when attaching the Storage Module(s) to the Air Handler.

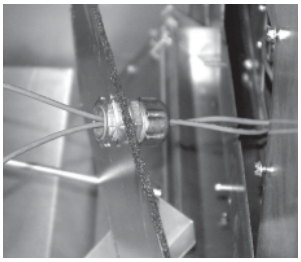
FIGURE 5



Step 7 Remove the 7/8" (inner) knockout on the limit access panel (Figure 3) on the side(s) of the Air Handler where the Storage Module(s) will be attached.

Step 8 Move the Storage Module(s) within 6" of final position to Air Handler. Once in place, adjust the leveling legs on the bottom of the Storage Module(s) as necessary to prevent rocking. If not placed properly the system may bend or twist during the brick loading process, causing alignment problems during re-assembly.

FIGURE 6



NOTE **DO NOT extend the leveling legs more than 1".**

Step 9 Locate the orange limit switch wires in the limit area of the Storage Module(s). Secure the connector located on these limit switch wires into the knockout on the limit access panel (Figure 6).

Step 10 Making certain that the orange limit switch wires between the Air Handler and Storage Module(s) are routed properly, move the Storage Module(s) into their final location next to the Air Handler. The edge of the side L brackets on the Air Handler MUST fit inside the S-Clip brackets on the side(s) of the Storage Module(s). (See Figures 7 and 8.)

FIGURE 7

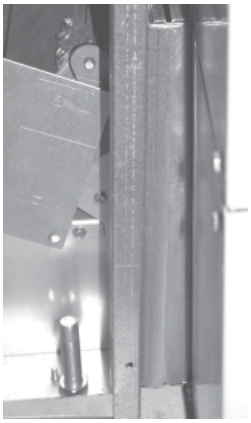


FIGURE 8

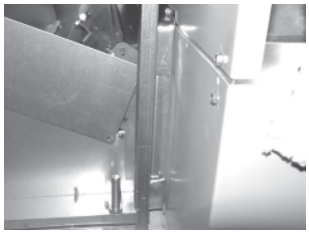
CAUTION

Risk of Improper Operation and Equipment Damage. Improper routing of the limit switch wires can result in improper operation or equipment damage. DO NOT physically damage or route the limit switch wires near high temperature areas. When attaching the Storage Module to the Air Handler make sure the limit switch wires are not pinched or cut. When routing the limt switch wires inside the Air Handler, make sure they are routed through the pre-installed plastic cable ties.

Step 11 Attach the Storage Module(s) to the Air Handler using the C-drives provided (Figure 9). Bend excess length of drives over to seal the damper area (Figure 10).

FIGURE 9

FIGURE 10



Step 12 Route the orange limit switch wires through the pre-installed plastic cable ties on the inside of the Air Handler.

Step 13 Connect the orange limit switch wires from the Storage Module(s) to the orange wires from the electrical panel. When installing dual Storage Modules it is important to connect the wires from the left side of the electrical panel to the left Storage Module and the wires from the right side of the electrical panel to the right Storage Module.

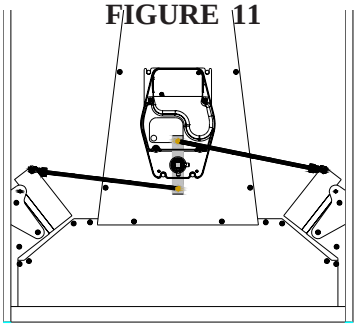
WARNING

Risk of fire and/or equipment damage. When installing dual Storage Modules it is important to connect the orange/black wires from the left side of the electrical panel to the left Storage Module and the right side wires to the right Storage Module.

Step 14 Secure the damper actuator linkage(s) to the damper actuator arm(s) inserting the supplied spring clips through the hole in the pivot connector. The top hole in the actuator arm MUST be used for the right side damper. (See Figure 11.)

NOTE **The upper pivot hole on the actuator arm is for the right side Storage Module. The lower pivot hole on the actuator arm is for the left side Storage Module.**

AIR HANDLER DAMPER LINKAGE FIGURE 11



Step 15 Adjust damper linkage length(s) appropriately to ensure the damper(s) fully close. Check the ball end linkage connector on the damper. The nut side MUST be facing the front of the system. If not, it MUST be inverted.

Step 16 With the system de-energized, adjust the linkage by rotating the quick disconnect end of the linkage until the damper is pressed firmly in the closed position.

ELECTRICAL PANEL INSTALLATION

Step 1 Reinstall the painted front panel on the Air Handler to aid in installation of the electrical panel.

Step 2 Remove the electrical panel front cover and locate the installation hardware package.

Step 3 Remove 1/2" knockout and 1" knockout from sides of electrical panel and Storage Module(s) to allow connection. **DO NOT remove any uneeded knockouts.**

Step 4 Lift the electrical panel onto the support bend of the Air Handler's painted front panel.

Step 5 Secure the electrical panel to the Air Handler with the five 8 x 3/4" sheet metal screws shipped with the outlet damper kit.

Step 6 Remove the lower painted front panel of the Air Handler.

Step 7 Connect the 9-pin blower harness from the Air Handler to the harness from the electrical panel.

NOTE **Knockout must be effectively sealed by connector.**

Step 8 **277/347 only**. Remove one 1/2" knockout from lower left hand bottom panel and connect straight seal-tite connector on conduit to bottom of electrical panel. Connect the other end of the conduit to dry type enclosed transformer. Mount the transformer to the Air Handler's painted front panel. Make connections according to instructions with transformer.

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

BRICK LOADING

Step 1 Remove the painted front panel of the brick Storage Module(s) 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 sheet metal screws around the outer edge of the galvanized front panel. Remove the panel and set it aside.

Step 3 Starting at the bottom, carefully lift each of the insulation blankets and drape them over the top of the Storage Module(s).

CAUTION

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

Step 4 Remove the rigid insulation boards and place to the side in the order removed.

Step 5 Load the brick, one row at a time, starting at the back of the brick core and working forward. Load bricks as shown in Figure 12. Make certain brick debris does not interfere with brick alignment front to back.

Step 6 Install top air channel block by sliding it up and back into place on top of the bricks. (See Figure 13)

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

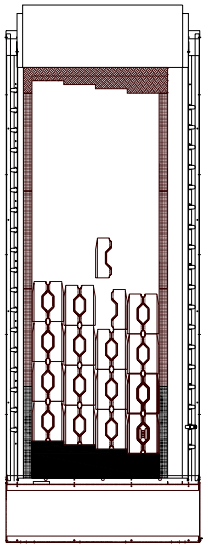
Step 7 Install rigid insulation boards into the Storage Module(s) in the order they were removed in Step 4.

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

BRICK INSTALLATION TIPS:

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

BRICK LOADING
FIGURE 12



WARNING

Risk of injury or fire. DO NOT operate the system if damage to the insulation panels on the inner sides of the brick core occurs.

FIGURE 13

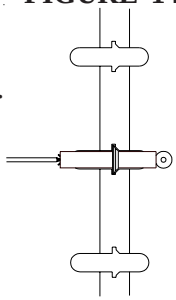
Installation

HEATING ELEMENT INSTALLATION

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

NOTE **Make sure the elements designated as Air Handler side elements are installed on the Air Handler side of the Storage Module(s).**

FIGURE 14



Step 2 Route the element termination head with ceramic insulator to the appropriate side of the Storage Module(s). Insert the lead into position as shown in Figure 14.

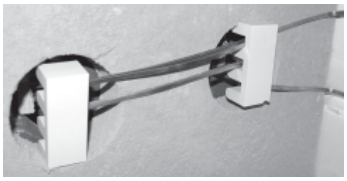
NOTE **Element leads must never cross each other.**

Step 3 Install element lead insulators. These ceramic insulators MUST maintain lead wire spacings as shown in Figure 15.

WARNING

- **HAZARDOUS VOLTAGE: Risk of electric shock, injury, or death.**
  - **DO NOT remove the electrical panel cover while system is energized.**
  - **Elements MUST be positioned properly to avoid short circuiting against any surfaces within the system.**
- **Risk of improper operation or equipment damage. On Dual Storage Module systems, it is critical to route the correct harness to each of the Storage Modules. Mis-routing of harness will result in improper operation and equipment damage. Make certain the harness connected to the right side relay bank in the electrical panel is routed to the right side Storage Module.**

FIGURE 15



Step 4 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 element to ensure maximum efficiency.

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

Step 6 Route element harnesses through connectors, using one connector/harness until tape is centered in connector. If installing two Storage Modules, use left hand bank of relays for left hand and right hand for right hand. One harness per module is shorter and must be used for inside element connections.

Step 7 Attach element lead wires to element terminals. Start at the top using the appropriate color chart below. Repeat pattern as necessary.

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

BRICK CORE TEMPERATURE SENSOR INSTALLATION

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

Step 2 Route the brick core temperature sensors through the clear plastic tube until within six inches of the relay driver board. Cut tube and sensor wires to length as needed. The yellow wire from each sensor must be connected to the Y terminal of the proper sensor connection terminal block, and red to R. **Polarity of sensors is critical.**

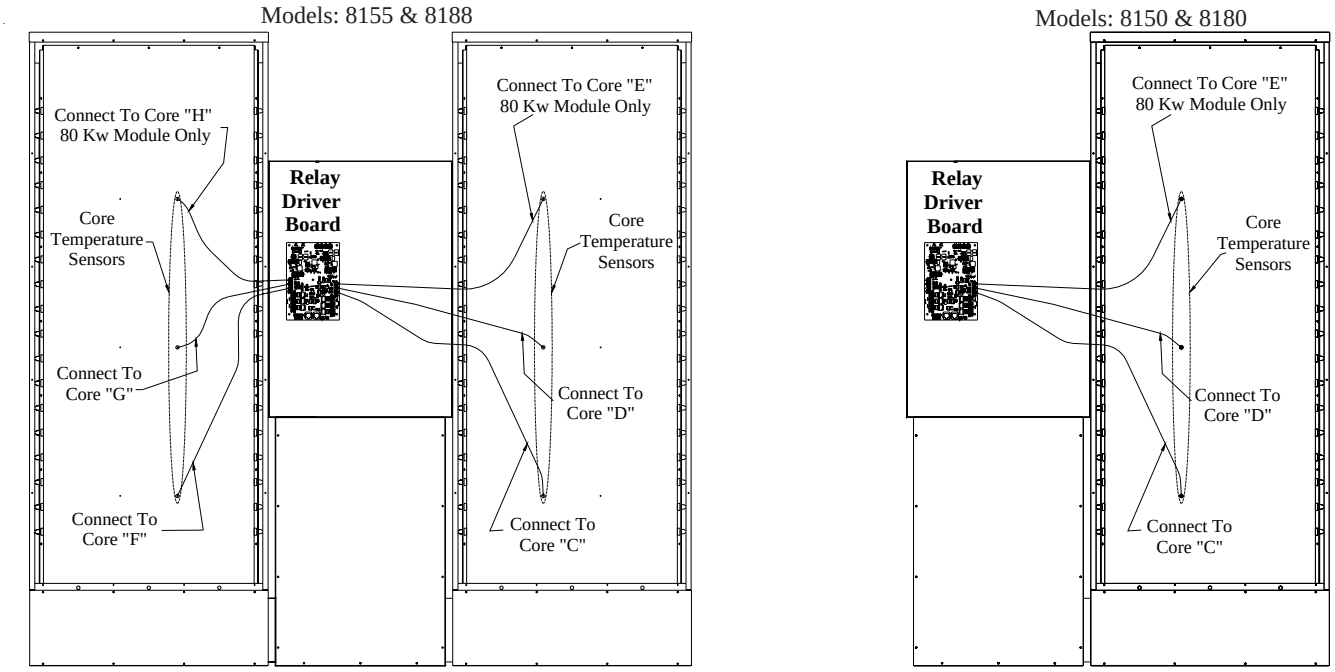
Sensor connections MUST be installed as follows:

- **Single Module - 8150 or 8180 (Figure 16)**
  - Bottom sensor to core C
  - Second sensor to core D
  - Third (if equipped) to core E
- **Dual Module - 8155, 8185, and 8188 (Figure 16)**
  - Left module
    - Bottom sensor to core F
    - Second sensor to core G
    - Third (if equipped) to core H
  - Right module
    - Bottom sensor to core C
    - Second sensor to core D
    - Third (if equipped) to core E

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.

CORE TEMPERATURE SENSOR CONNECTIONS
FIGURE 16



NOTE **In systems using both an 80kW and 53kW Storage Module, the 53kW Storage Module must be installed on the left side of the Air Handler.**

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

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

Step 5 Re-install the painted front panel, using previously removed screws.

AIR CONDITIONER/HEAT PUMP INTERFACE

The system can accommodate most heat pump or air conditioner indoor coils up to a 7.5-ton capacity provided the heat pump or air conditioner is sized in accordance to supply air delivery rates of the system. Refer to the System Air Delivery Matrix for information on air delivery rates of the supply air blower with regard to the blower's speed, To ensure that adequate air flow is provided for the heat pump or air conditioner system being installed.

WARNING

Risk of fire. Any one ducting system MUST NOT contain more than one air handling (blower) system. If the application requires multiple 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.

When interfacing the system with a heat pump, the indoor coil MUST be placed on the return side of the system in a position that provides even air flow through the coil. The installer needs to make provisions in the plenum to accommodate the coil and air filter. When interfacing with an air conditioner, the indoor coil can be placed on either the supply air or return air side. 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 for more information on interfacing the system with a heat pump or air conditioner. Refer to Location 46 and 47 in the Supplemental Installer's Guide for information on compressor control from the ThermElect system using outdoor temperature lockout.

DUCTING

SUPPLY AIR BLOWER SPEED

For air delivery, the system is equipped with a 2000 CFM Air Handler containing a 3-speed supply air blower. The system is factory wired to operate in medium speed for "heating" and in high speed for "cooling" or a "fan only" thermostat setting.

Blower speed selection is made at the supply air blower. To change blower speed for either "heating" or "cooling" modes, detach the quick disconnect terminals at the supply air blower. Select the blower speed and connect the corresponding wires.

NOTE **When interfacing the system with a heat pump, the blower speed connected to the high speed relay is used for both heating and cooling.**

WARNING

- **HAZARDOUS VOLTAGE: Risk of electric shock, injury or death. DO NOT operate the system without ducting installed to both the air inlet and outlet.**
- **EQUIPMENT DAMAGE: Risk of equipment damage or improper operation. On 3000 CFM systems where there are multiple supply air blowers, both blowers MUST be connected to the same blower speed to avoid equipment damage.**

Installation

SYSTEM AIR DELIVERY MATRIX

Supply Air Blower Speed	(External static pressure should not exceed .75 inches water column for all models)					
	.25"		.50"		.75"	
	2000	3000*	2000	3000*	2000	3000*
High (CFM)	2050	2950	1900	2490	1540	2160
Medium High (CFM)	1990	2850	1890	2350	1535	1980
Medium Low (CFM)	1870	2520	1670	2270	1450	N/A
Low (CFM)	N/A	1920	N/A	N/A	N/A	N/A

** An optional 3000 CFM Air Handler is available. The 3000 CFM Air Handler is equipped with two 4-speed supply air blowers.*

LINE VOLTAGE ELECTRICAL CONNECTIONS

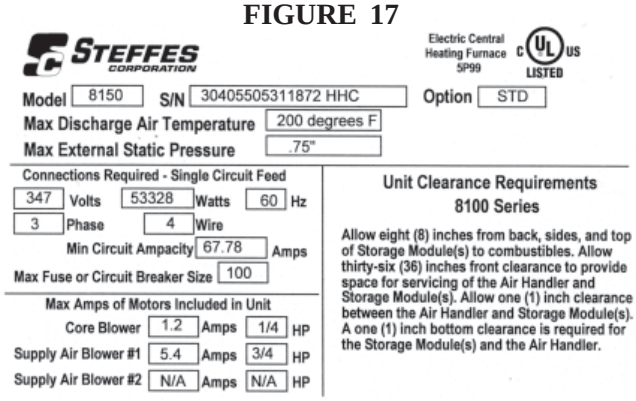
To determine the correct wire size required for the circuit feeding the system, refer to the Specifications (Page A.01-A.03) and the system's identification label located on the front of the electrical panel (Figure 17).

Step 1 Remove the electrical panel cover.

Step 2 Route all line voltage wires through a knockout and into the electrical panel.

Step 3 Make line voltage connections (See Page 3.10) to lugs of single feed bus and ground lug. Refer to the Line Voltage Wiring Diagrams (Pages A.04 - A.05) for more information on these connections.

SAMPLE SYSTEM IDENTIFICATION LABEL
FIGURE 17



WARNING

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

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

OUTDOOR TEMPERATURE SENSOR INSTALLATION

An outdoor temperature sensor, shipped in the electrical compartment, is required to be installed with the system. This sensor monitors outdoor temperature and provides this information to the system. The system responds by automatically storing heat in its brick core(s) according to the outdoor temperature and the heating requirements.

The outdoor temperature sensor can be installed in one of two ways: direct wired to the system or wired to the Steffes power line carrier system. **All 208/240V systems are factory configured for automatic charge control with a direct wired outdoor sensor.**

NOTE
- **If connecting to the Steffes power line carrier (PLC) system, follow the installation instructions in the PLC system's Owner's and Installer's Guide.**
- **Outdoor sensor wire MUST NEVER be combined with other control wiring in a multi-conductor cable.**

INSTALLING THE OUTDOOR SENSOR

Step 1 The outdoor sensor must be placed in a location where it can accurately sense outdoor temperature and is not affected by direct sunlight or other abnormal temperature conditions. Select a location and mount the sensor.

Step 2 Route low voltage wire from the outdoor sensor to the electrical compartment through one of the low voltage wire knockouts.

- If the sensor wiring is routed through an external wall, the opening through which the wire is routed MUST be sealed. Failure to do so may affect the accuracy of the outdoor temperature sensor.
- The outdoor sensor is supplied with a lead length of 40 ft. If a greater wire length is needed, it can be extended to a total of 250 ft. No other loads can be controlled or supplied through this cable. It is for connection of the outdoor sensor ONLY. This low voltage cable should 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.

Step 3 Connect the outdoor sensor wires to the "OS" and "SC" positions of the twelve (12) position low voltage terminal block located inside the electrical compartment.

Refer to Location 10 (L010) of the Supplemental Installer's Guide to select the desired method of charge control.

THERMOSTAT CONNECTIONS

A low voltage room thermostat is required for room temperature control with the system. Any room thermostat used with this system must be 24 VAC. (Contact the factory for more information on the thermostats available from Steffes.)

INSTALLING THE THERMOSTAT

Step 1 Disconnect power to the system and route low voltage wire between the thermostat and the system.

Step 2 Insulate the wall opening through which the thermostat wires run. Failure to do so may affect the accuracy of the thermostat.

Step 3 Attach the thermostat to a wall. If installing a mechanical thermostat or thermostat with anticipator, a resistor kit is required (Order Item #1190015).

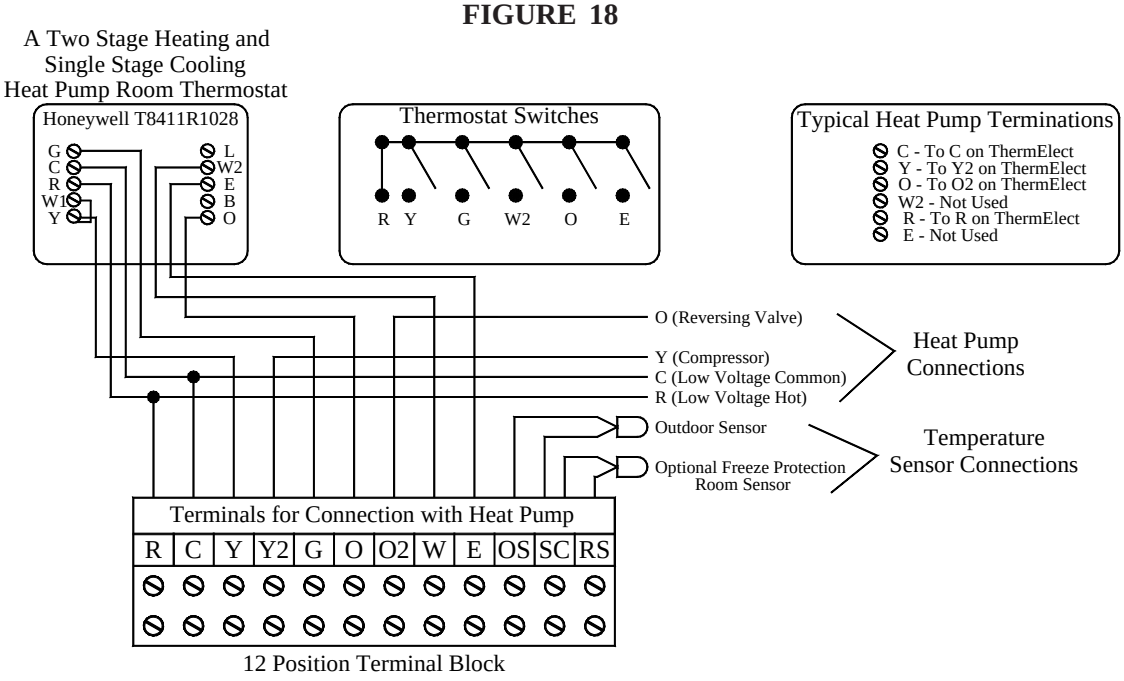
Step 4 Route the low voltage wire into the electrical compartment of the system through one of its low voltage wire knockouts and to the system's twelve (12) position low voltage terminal block.

Never install any wiring in the line voltage compartment of the system unless it is rated for line voltage.

Step 5 Refer to the Room Thermostat Connections Diagrams (Figures 18 and 19) in this manual for proper connections with regard to the application.

Refer to Temperature Control in the Operation Section of this manual for specific operation information.

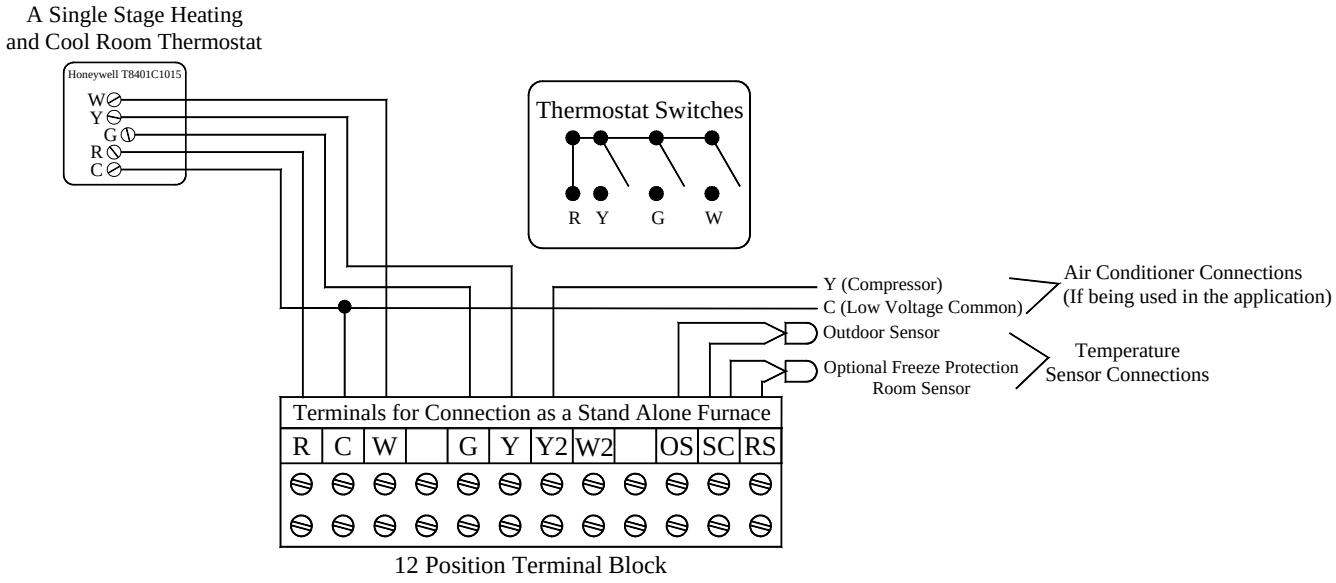
THERMOSTAT CONNECTIONS (Heat Pump Applications)
FIGURE 18



12-Position Low Voltage Terminal Block Coding

R	= Low Voltage Hot	O	= Reversing Valve Input
C	= Low Voltage Common	O2	= Reversing Valve Output
Y	= Compressor/Stage 1 Heat Call	E	= Emergency Heat
W	= Stage 2 Heat Call	OS	= Outdoor Temperature Sensor
Y2	= Compressor Output	SC	= Outdoor Temperature Sensor Common
G	= Fan Call	RS	= Freeze Protection Room Temperature Sensor

THERMOSTAT CONNECTIONS (Stand Alone Furnace Application)
FIGURE 19



ELECTRONIC AIR FILTER INSTALLATION

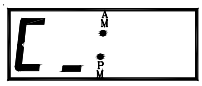
The ThermElect system is capable of being connected to an electronic air filter. Connections to the ThermElect system are made to the bottom left relay (FAN ON) on the Base IO Relay Board inside the system's electrical panel. This relay closes during a fan call. Refer to the Line Voltage Wiring Diagrams (Page A.04-A.05) for the location of this relay.

INSTALLER'S FINAL CHECK-OUT PROCEDURE

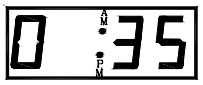
WARNING

HAZARDOUS VOLTAGE: Risk of electric shock, 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 Initiate a cooling call from the room thermostat, if applicable, and verify that the system recognizes the "COOL" call. 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 all heating elements operating, disconnect the orange/black wire located at the air outlet, above the damper assembly of each Storage Module. When this wire is disconnected, all heating elements of that Storage Module should turn off. Repeat this step on the second Storage Module (if equipped).

NOTE **Ensuring that all heating elements turn off when the core limit(s) open is important. Make sure Step 7 of the Installer's Final Check-Out Procedure is completed.**

Step 8 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 9 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 10 Verify, once again, that the Operating Mode displayed on the control panel corresponds with the power company's peak control signal.

Step 11 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 12 Complete the manufacturer's warranty card and return promptly.

4 LOAD MANAGEMENT

The ThermElect is a commercial Electric Thermal Storage (ETS) heating system. It is generally signaled to use demand free, off-peak 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 ThermElect's thermal mass consists of a high-density ceramic brick capable of vast heat storage.

The ThermElect system is designed to operate under one of three different load management control strategies.

ON-PEAK/OFF-PEAK PROGRAM

The ThermElect system responds to heat calls during the on-peak and off-peak periods; however, only consumes energy (energize heating elements) during the off-peak periods. The ThermElect system is controlled by an external control device such as a meter or time clock module and also offers on-peak control of external loads by utilizing the dry contacts provided on the relay driver board.

NOTE **Never install any wiring in a line voltage compartment of the system unless it is rated for line voltage.**

The ThermElect system may be controlled by the Power Company via a peak control signal. This signal can be sent to the equipment using low voltage wiring, a Steffes Time Clock Module, or a Steffes Power Line Carrier control system (208 and 240V applications only). 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 heating system is factory configured for low voltage wire control and is set to charge when the utility peak control switch closes.

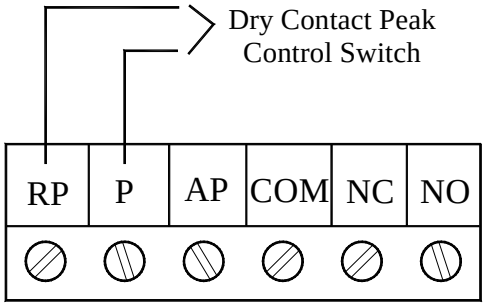
LOW VOLTAGE (DIRECT WIRED) PEAK CONTROL

If using the low voltage peak control option, the system 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 electrical panel.

Step 1 Route a low voltage circuit from the power company's load control or peak signaling device to the six (6) position terminal block (Figure 20) inside the electrical compartment.

Step 2 Connect the field wiring to positions "RP" and "P" on the six (6) position low voltage terminal block. (See Figure 20.)

PEAK CONTROL TERMINAL CONNECTIONS
FIGURE 20



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)

TIME CLOCK MODULE PEAK CONTROL

The Steffes Time Clock Module is another option for providing a peak control signal to the system. The optional time clock module mounts inside the line 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.

POWER LINE CARRIER (PLC) PEAK CONTROL

NOTE Power Line Carrier (PLC) control is only available in 208/240V applications.

The Steffes Power Line Carrier (PLC) control system has the ability to communicate with the system through the existing electrical circuits in the structure. With the power line carrier option, direct 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 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 system is optional and must be ordered separately. If utilizing a PLC system, an Owner's and Installer's manual will accompany the transmitting device. Refer to this manual for information on the installation and operation of the power line carrier control system.

4-20 MILLIAMP CONTROL (1-5 VOLT DC)

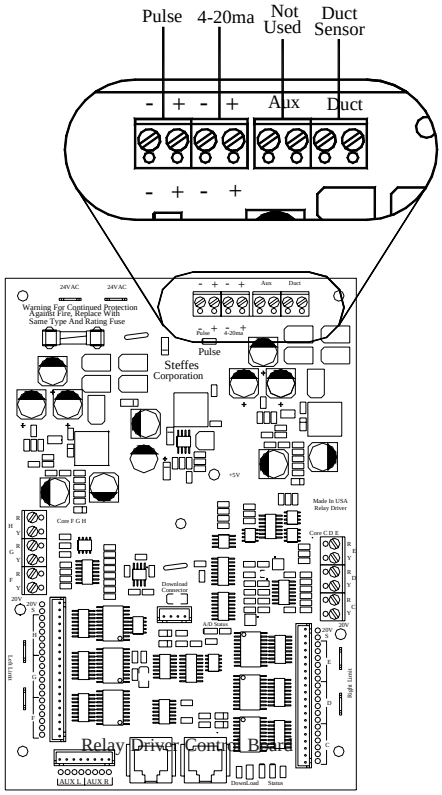
The ThermElect system receives a signal from an external load control device such as a building load management system. This external signal dictates to the ThermElect the maximum amount of energy which can be consumed during a preset time interval. This value is recalculated automatically every 15 minutes.

To enable the 4-20 milliamp control, the one (1) bit must be added to the current value of Location 53 (L053). Once enabled, the ThermElect system will continually monitor the current loop input and randomly shed elements as needed to remain within the maximum load desired by the load management system. Elements will be shed from the hottest core first.

The building's load management system is connected to the ThermElect system with low voltage wire. The wires are routed into the electrical panel and connected to the terminals for 4-20ma on the relay driver board (Figure 21).

Other external loads are generally controlled through the building's load management control system.

4-20 MILLI-AMP OR PULSE MONITORING CONNECTIONS FIGURE 21



PULSE MONITORING

The ThermElect 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 ThermElect system. The system then changes proportionally when demand free power is available. This keeps the total building kW usage at or below the desired level.

To enable pulse monitoring, the 2 bit must be set in Location 53 (L053). Location 54 (L054) needs to be configured for the maximum load (load that can not be exceeded). This value is input as kW/10; therefore, if the maximum load is 1500 kW, the value in L054 would be set to 150. Location 56 (L056) needs to be configured for the input of a single heating element. For example, if the system is using 4,400 watt heating elements a value of 44 would be set in L056 (kW x 10).

To set the number of pulses per kWh, access the ELOC locations and set “E000” to the correct value. Input is registered as (# of pulses/kWh) X 10.

The pulse monitoring device is connected to the ThermElect system with low voltage wire. The wires are routed into the electrical panel and connected to the “pulse” terminals on the relay driver board (Figure 21).

With pulse monitoring, there are many options available for load control. The ThermElect system may be the only load being controlled with the pulse monitoring or other loads can be controlled by the relay driver board or up to two (2) external load management control modules (Order Item #1908410) can be added. Each module has eight (8) zones which can be controlled, for a total of sixteen (16). Configuration of the locations values and the ELOC locations will vary depending on the application and controls utilized. For more information on the proper settings, reference the Supplemental Installer’s Guide or contact Steffes Technical Support at 1-888-783-3337.

A Appendix

SPECIFICATIONS

MODEL 8150

Input Voltage	**240**	**120/208**	**120/240**	**277/480**	**347/600**
Phase	**1**	**3**	**3**	**3**	**3**
Number of Wires	2	3	3	4	4
Charging Input (kW)	53.3	48.0	53.3	50.4	53.3
Elements - Quantity	12	12	12	12	12
Elements - Watts Each	4,444	4,000	4,444	4,200	4,444
Amps – Core Charging	222.20	133.39	128.44	60.65	51.23
Max. Core & Blower Load (AMPS)	3.0	7.4	7.4	2.3	3.0
Minimum Circuit Ampacity	281.50	175.99	169.80	78.69	67.78
Blowers/System Control Voltage	240V/208V	240V/208V	240V/208V	240V/208V	240V/208V
Storage Capacity - kWh	320				
Storage Capacity - BTU	1,091,840				
Approximate Storage Module Weight (lbs)	770				
Approximate Insulation Block, Air Handler, Elements & Other Weight (lbs)	330 (utilizing 2000 CFM Air Handler)*				
Approximate Brick Weight (lbs)	3,440				
Approximate Installed Weight (lbs)	4,540 (add approx. 500 lbs to arrive at shipping weight)				
Number of Brick	192				

MODEL 8155

Input Voltage	**240**	**120/208**	**120/240**	**277/480**	**347/600**
Phase	**1**	**3**	**3**	**3**	**3**
Number of Wires	2	3	3	4	4
Charging Input (kW)	106.6	96.0	106.6	100.8	106.6
Elements - Quantity	24	24	24	24	24
Elements - Watts Each	4,444	4,000	4,444	4,200	4,444
Amps – Core Charging	444.40	266.79	256.88	121.30	102.46
Max. Core & Blower Load (AMPS)	3.0	7.4	7.4	2.3	3.0
Minimum Circuit Ampacity	559.25	342.73	330.35	154.50	131.82
Blowers/System Control Voltage	240V/208V	240V/208V	240V/208V	240V/208V	240V/208V
Storage Capacity - kWh	640				
Storage Capacity - BTU	2,183,680				
Approximate Storage Module Weight (lbs)	770 per module = 1,540 Total				
Approximate Insulation Block, Air Handler, Elements & Other Weight (lbs)	610 (utilizing 2000 CFM Air Handler)*				
Approximate Brick Weight (lbs)	3,440 per module = 6,880 Total				
Approximate Installed Weight (lbs)	9,030 (add approx. 600 lbs to arrive at shipping weight)				
Number of Brick	192 per module = 384 Total				

* Optional 3000 CFM Air Handler increases approximate installed weight by 40 pounds.

MODEL 8180

Input Voltage	**240**	**120/208**	**120/240**	**277/480**	**347/600**
Phase	**1**	**3**	**3**	**3**	**3**
Number of Wires	2	3	3	4	4
Charging Input (kW)	80.0	72.0	80.0	75.6	80.0
Elements - Quantity	18	18	18	18	18
Elements - Watts Each	4,444	4,000	4,444	4,200	4,444
Amps – Core Charging	333.30	200.09	192.66	90.97	76.84
Max. Core & Blower Load (AMPS)	3.0	7.4	7.4	2.3	3.0
Minimum Circuit Ampacity	420.38	259.36	250.07	116.59	99.80
Blowers/System Control Voltage	240V/208V	240V/208V	240V/208V	240V/208V	240V/208V
Storage Capacity - kWh	480				
Storage Capacity - BTU	1,637,760				
Approximate Storage Module Weight (lbs)	840				
Approximate Insulation Block, Air Handler, Elements & Other Weight (lbs)	400 (utilizing 2000 CFM Air Handler)*				
Approximate Brick Weight (lbs)	5,160				
Approximate Installed Weight (lbs)	6,400 (add approx. 600 lbs to arrive at shipping weight)				
Number of Brick	288				

MODEL 8185

Voltage	**120/208**	**120/240**	**277/480**	**347/600**
Phase	**3**	**3**	**3**	**3**
Number of Wires	3	3	4	4
Charging Input (kW)	120.0	133.3	126.0	133.3
Elements - Quantity	30	30	30	30
Elements - Watts Each	4,000	4,444	4,200	4,444
Amps – Core Charging	333.48	321.10	151.62	128.07
Max. Core & Blower Load (AMPS)	7.4	7.4	2.3	3.0
Minimum Circuit Ampacity	426.10	410.62	192.41	163.84
Blowers/System Control Voltage	240V/208V	240V/208V	240V/208V	240V/208V
Storage Capacity - kWh	800			
Storage Capacity - BTU	2,729,600			
Approximate Storage Module Weight (lbs)	770 (53kW) + 840 (80kW) = 1,610 Total			
Approximate Insulation Block, Air Handler, Elements & Other Weight (lbs)	730 (utilizing 2000 CFM Air Handler)*			
Approximate Brick Weight (lbs)	8,600			
Approximate Installed Weight (lbs)	10,940 (add approx. 650 lbs to arrive at shipping weight)			
Number of Brick	192 (53kW) + 288 (80kW) = 480 Total			

* Optional 3000 CFM Air Handler increases approximate installed weight by 40 pounds.

MODEL 8188

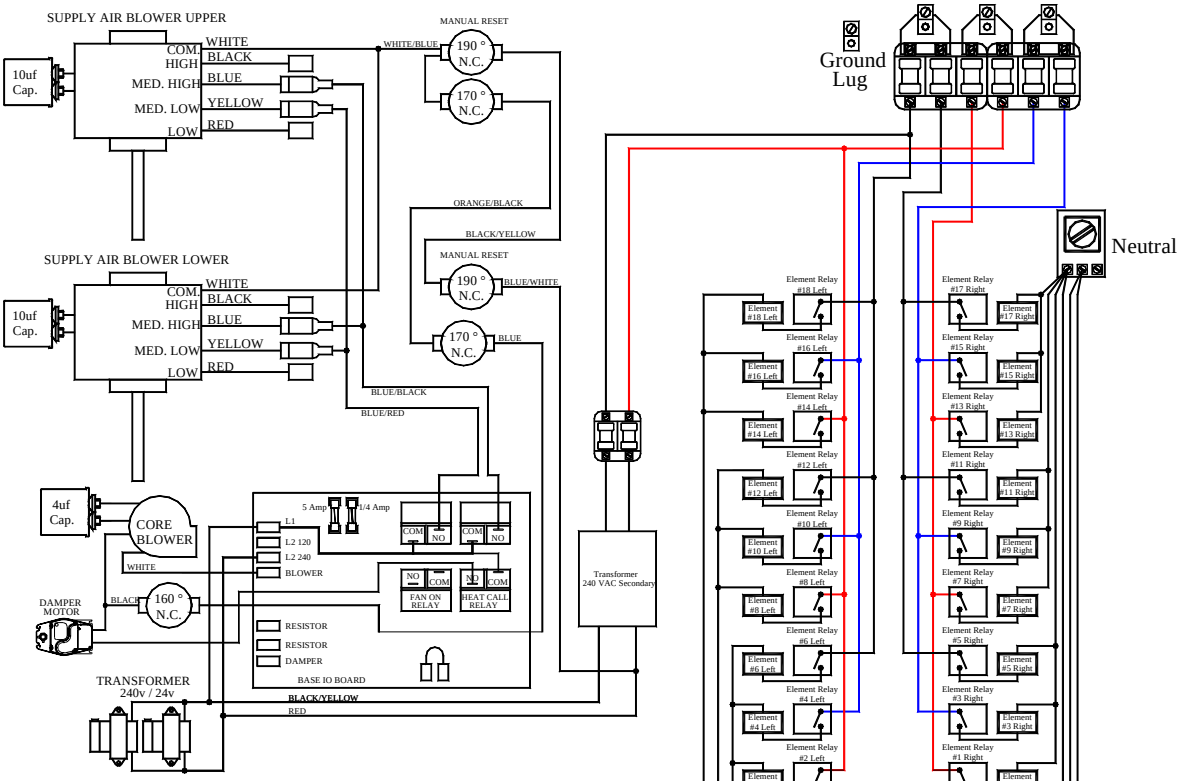
Input Voltage	**120/208**	**120/240**	**277/480**	**347/600**
Phase	**3**	**3**	**3**	**3**
Number of Wires	3	3	4	4
Charging Input (kW)	144.0	159.9	151.2	159.9
Elements - Quantity	36	36	36	36
Elements - Watts Each	4,000	4,444	4,200	4,444
Amps – Core Charging	400.18	385.32	181.95	153.68
Max. Core & Blower Load (AMPS)	7.4	7.4	2.3	3.0
Minimum Circuit Ampacity	509.47	490.90	230.31	195.85
Blowers/System Control Voltage	240V/208V	240V/208V	240V/208V	240V/208V
Storage Capacity - kWh	960			
Storage Capacity - BTU	3,275,520			
Approximate Storage Module Weight (lbs)	840 per module = 1,680 total			
Approximate Insulation Block, Air Handler, Elements & Other Weight (lbs)	760 (utilizing 2000 CFM Air Handler)*			
Approximate Brick Weight (lbs)	10,320 Total			
Approximate Installed Weight (lbs)	12,760 (add approx. 700 lbs to arrive at shipping weight)			
Number of Brick	288 per module = 576 Total			

* Optional 3000 CFM Air Handler increases approximate installed weight by 40 pounds.

Typical System Line Voltage Wiring Diagram

277/347 3 Phase 4 Wire - 3000 CFM

8180 APPLICATION

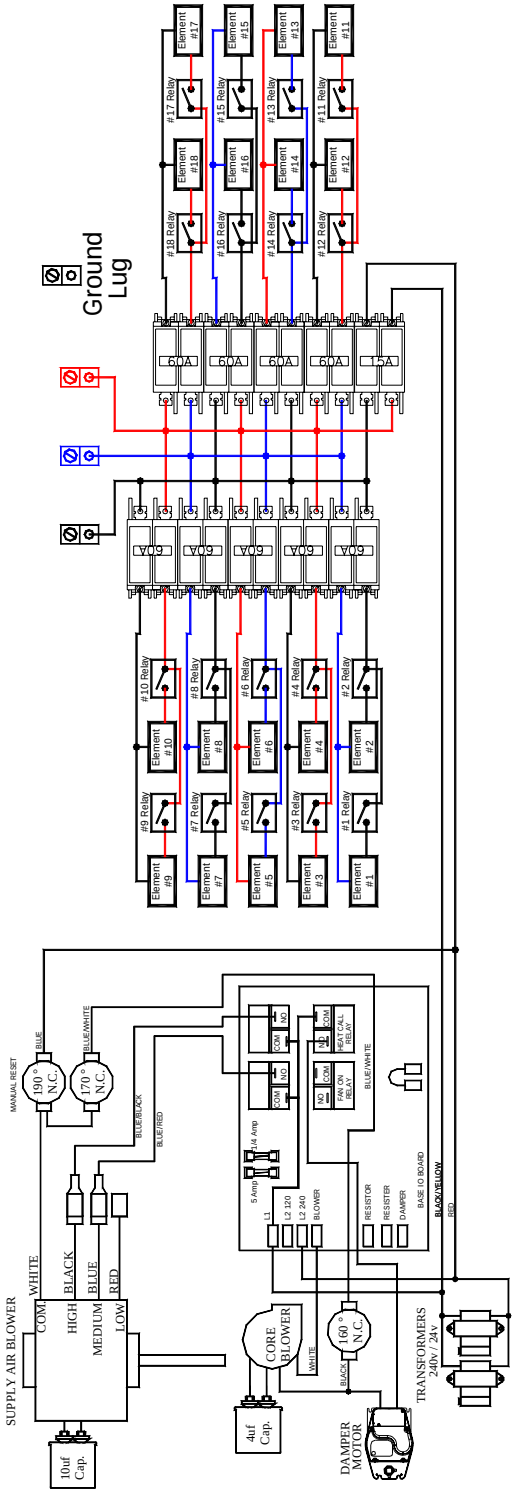


Use copper or aluminum conductors rated for 75ºC or higher for field connection of this device.

Typical System Line Voltage Wiring Diagram

208/240 3 Phase 3 Wire - 2000 CFM

8180 APPLICATION



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

Appendix

INTERNAL SYSTEM WIRING DIAGRAM - LOW VOLTAGE

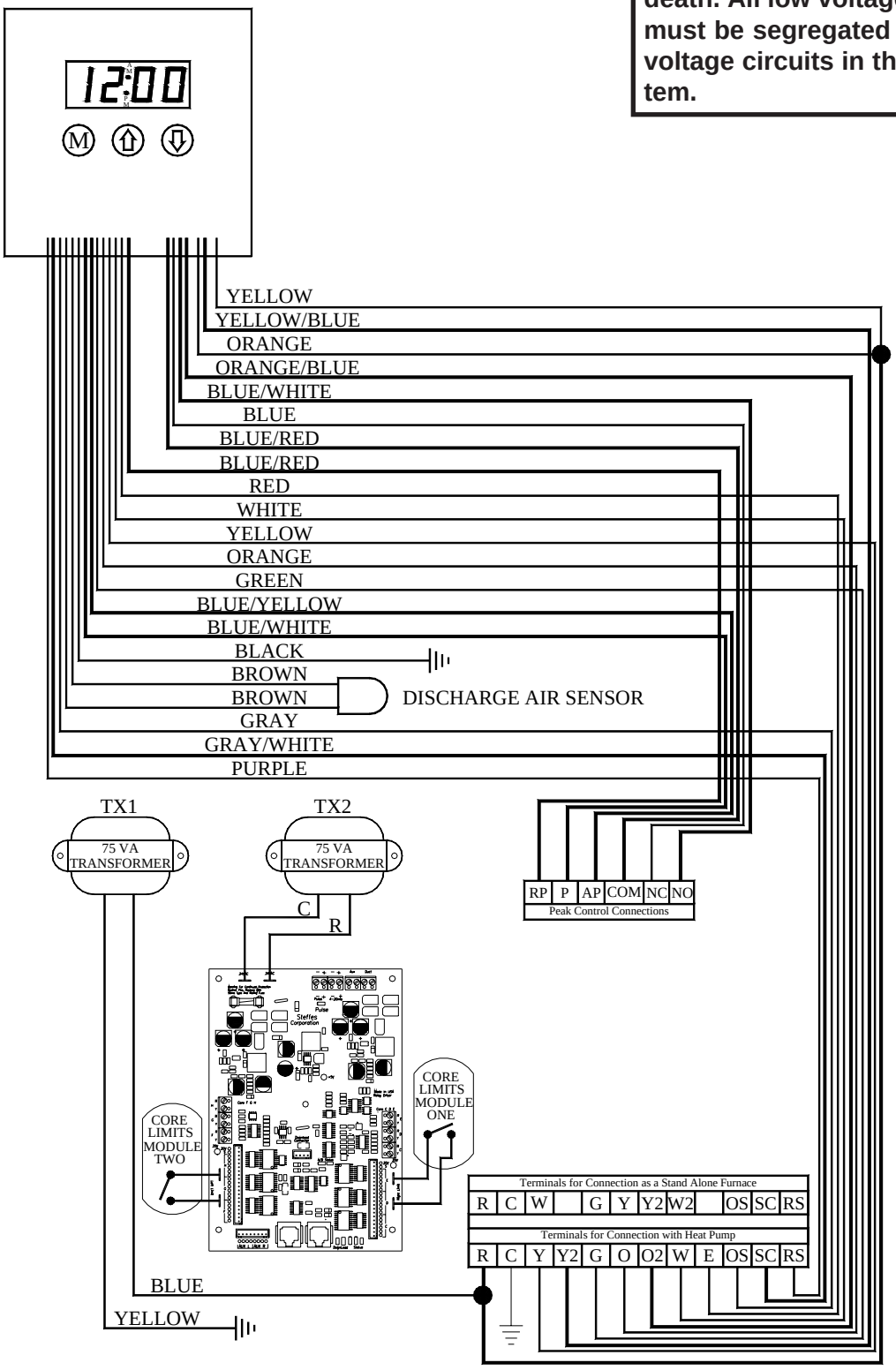
The outdoor temperature sensor, room thermostat, and peak control device are connected via low voltage wiring.

System Low Voltage Wiring Diagram

The "R" and "C" positions in the low voltage terminal strip may be used as a source of 24 VAC for powering external low voltage devices (30 VA maximum).

WARNING

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



Appendix

HELP MENU

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

Display Reading	Description
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.

WARNING

HAZARDOUS VOLTAGE: Risk of electric shock, 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.

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).

Error Code #	Description
01	Currently not utilized.
02	Currently not utilized.
03	Currently not utilized.
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. *Approximate ohm readings are 70° F = 1,199 ohms; 80° F = 941 ohms; 95° F = 646 ohms.*
05	Outdoor sensor (direct wired) temperature reading is out of normal operating range. The sensor circuit may be open or shorted, 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 to OS and SC on the 12-position terminal block. Compare the sensor reading to the value in L113 to verify proper calibration of the circuit board. *Approximate ohm readings are 5° F = 7,646 ohms; 50° F = 2,024 ohms; 95° F = 646 ohms.*

Error Code #	Description
06	Outdoor temperature reading from the transmitting device (PLC system) is out of normal operating range. Check the outdoor sensor attached to the transmitting device and the transmitter for proper operation.
07	Main processor control board temperature sensor is out of normal operating range. Verify that none of the clearances have been violated and inspect the condition of the processor control board.
08	External duct sensor temperature is out of normal operating range. This can indicate an open sensor, a short in the wiring, or the relay driver board is out of calibration. Take an ohm reading across the sensor to ensure proper operation, check the wiring, and verify the value in L053. Compare the sensor reading to the value in L144 to verify proper calibration of the circuit board. *Approximate ohm readings are 60° F = 1552 ohms; 70° F = 1199 ohms; 80° F = 941 ohms. Max 190°F, Min 0°*
09	Aux. Analog input is out of normal operating range. Currently not used.
10	Discharge air temperature has exceeded maximum standard operating temperatures.
11	Core C thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L136 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. Max. 1700°F, min 0°F*
12	Core D thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L137 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1700°F, min 0°F*
13	Core E thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L138 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1700°F, min 0°F*
14	Core F thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L139 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1700°F, min 0°F*
15	Core G thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L140 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1700°F, min 0°F*
16	Core H thermocouple temperature is out of normal operating range. An open, shorted, or otherwise defective thermocouple or a circuit board which is out of calibration can cause this. Check the thermocouple by taking a millivolt reading of the thermocouple. Compare the thermocouple reading to the value in L141 to verify proper calibration of the circuit board. *Approximate DC mV readings are 200° F = 3.8 mV; 700° F = 15.2 mV; 1200° F = 27.0 mV. . Max. 1700°F, min 0°F*
17	Load Control Device (4-20mA) is out of normal range. This can indicate an open sensor, a short in the wiring, or a relay driver board is out of calibration. Take a 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. *Max. 25mA, min 2mA*
18	Pulse reading is not functional. The pulse input is 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.

Error Code #	Description
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 **M** button to accept. This error message indicates a change has been made to the software program; therefore, it is important to verify that all location settings are correct for the application.
29	On-board communication system is not fully operable. Contact a qualified service technician.
30	Base control 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 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 board.
42	Internal communication error. Reprogram or replace processor circuit board.
43	An attempt to load configuration using LO 98 set to 20, 30, 40, or 50 has failed. Each 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.

Warranty

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. 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, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

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

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

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

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