A Division of Steffes Corporation

OWNER'S & INSTALLER'S MANUAL

for

Electric Thermal Storage Heat Pump Boosters

UL C UL LISTED

Models: HPB11B, HPB15B, & HPB22B

U.S. Pat. # 5086493
Can. Pat. # 2059158

1. GENERAL INFORMATION

Steffes ETS Heat Pump Boosters (HPB) operate on the principle of utilizing off-peak electricity, available at preferential rates, to heat the structures they serve.

When off-peak rates are available (up to several hours each day), the HPB converts electricity to heat which is then stored in its ceramic brick core. This stored heat becomes available for space heating needs as determined by a room thermostat strategically located in the living space.

As its name implies, the HPB has been developed to supplement the heat output of a dwelling's central heat pump system. Although noted for efficient performance, air-to-air heat systems may suffer diminished capacity during colder times of the year when heating requirements are most critical. Resistance strip heat has been used to bolster heating output during those periods but is a costly solution from an operational cost standpoint. Heat provided by the HPB is much less costly and is provided at temperatures leading to significantly improved comfort.

Flexibility is also an inherent feature of the HPB. Configured much the same as a small storage furnace and equipped with an adaptable control package, the HPB can be utilized as a central furnace for small homes and condominiums or serve to supplement existing heating systems. Proposed applications must always be tested against dwelling heat loss versus unit heating capacity and space available for installation.

2. OPERATION

A. CONTROL SEQUENCE

•SPACE TEMPERATURE CONTROL

In its primary application, supplementing the output of a heat pump, the HPB is normally installed closely adjacent to and downstream from the heat pump air handler. Installation ducting *(see INSTALLATION section)* allows the HPB to draw off a portion of the supply air leaving the heat pump air handler, heat this air as required, and return it to the supply duct downstream from the HPB. This ensures comfort while utilizing the efficiency of the heat pump.

•CORE CHARGING

The SFIII circuit board, serving as the master controller with its sensor in the outdoor air, normally determines what level of charge is suitable for prevailing climatic conditions. Upon receipt of the utility off-peak signal, the master controller operating in conjunction with a core temperature controller, initiates the appropriate core charge level. These levels are determined in accordance with the following schedule:

CORE CHARGING SCHEDULE
(TABLE 1)

During core charging, heating elements are staged on and off in 7.3 kW increments (maximum).

SUMMER/WINTER SWITCH POSITION	OUTDOOR AIR TEMP. (°F)	CHARGE LEVEL	kW INPUT FOR HPB (MAX)			CORE TEMP. °F (Nominal)
			11	15	22	
Winter	45	1	7.3	7.3	11.0	500
Winter	35	2	11.0	14.7	22.0	900
Winter	25	3	11.0	14.7	22.0	1350
Summer	35	1	7.3	7.3	11.0	500
Summer	25	3	11.0	14.7	22.0	1350

•SUMMER/WINTER SWITCHING

Heat calls are unlikely during summer months; but, for those owners interested in maintaining a reduced heating capacity during off-season periods, a SUMMER/WINTER switch is provided *(See Figure 1)*. Core charge levels will vary according to the switch position *(See Table 1)*.

Alternatively, owners may choose to simply turn the booster off during off-season periods by moving all 60 AMP core charging circuit breakers to their off (down) position. The 15 AMP circuit breaker must be left in the on (up) position for proper operation of other heating and controlled devices *(See Figure 2)*.

•AUTOMATIC CONTROL SEQUENCE

Supply air tempering by the HPB is a function of temperature conditions being sensed by the space thermostat and controllers provided with the booster. The space thermostat provided with the heat pump incorporates Stage 1, Stage 2, and Emergency Heat control points. The effect of these control points, core charging requirements, and on-peak/off-peak periods are summarized in Table 2, Table 3, and Table 4.

•OUTDOOR AIR SENSOR OVERRIDES

Manual Override

Core charge levels are normally determined by the master controller's outdoor air temperature sensor. This unit comes equipped with a switch that can be used to override the outdoor air temperature sensor *(See Figure 1).* This override switch has three positions: AUTO, HIGH, LOW.

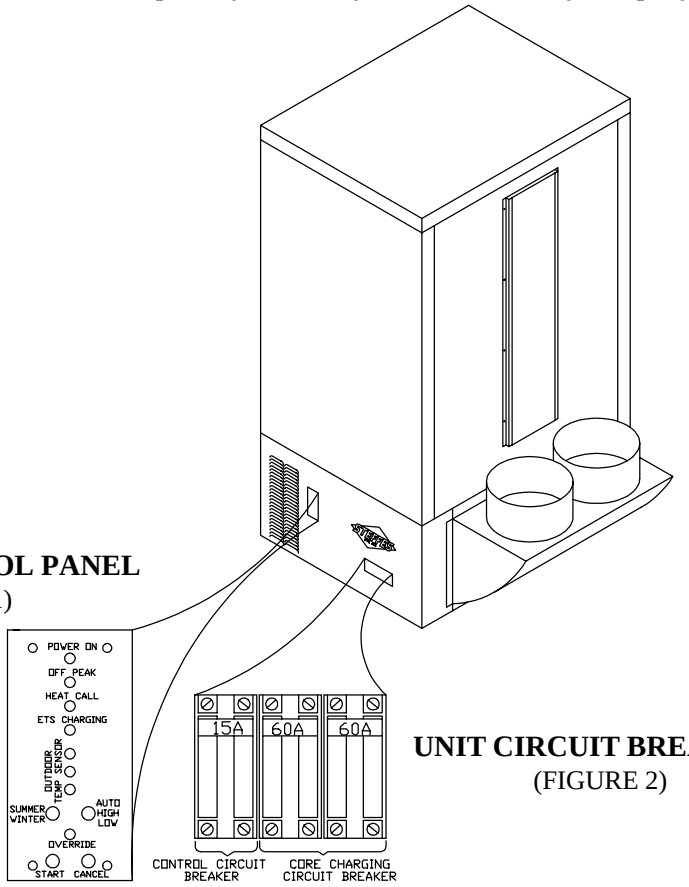
-**AUTO** - core charging is controlled by the outdoor air temperature sensor *(See Table 1).*

-**HIGH** - core will take on a Level 3 charge during off-peak periods regardless of outdoor air temperature.

-**LOW** - core will take on a Level 1 charge minimum during off-peak periods regardless of outdoor air temperature.

Single Cycle On-Peak Override (Utility Regulations Permitting)

When permitted, a single cycle override is provided for use during on-peak hours, enabling a Level 1 core charge. The override is initiated by the "START" toggle switch of the override switch pair *(See Figure 1)* and may be cancelled by the "CANCEL" toggle switch. The override function will automatically cancel when the control period ends. *(For further information on this override capability, contact your electric utility company.)*



CHARGE CONTROL PANEL
(FIGURE 1)

UNIT CIRCUIT BREAKERS
(FIGURE 2)

B. MAINTENANCE/CLEANING

General cleaning of the booster's sheet metal cabinet should be conducted at the owner's discretion. No other routine maintenance is required.

CAUTION: As is true with all heating appliances, materials that may produce explosive or flammable gases MUST NOT BE USED OR STORED NEAR THE BOOSTER.

C. HPB CONTROL DEVICES & SAFETY LIMIT DEVICES

(TABLE 2)

CATEGORY	DEVICE NAME	LOCATION	CONDITION MONITORED	ACTION
Control Devices:	Outdoor Air Temperature Sensor	Outside in a protected location providing representative outdoor air temperatures. (See Outdoor Sensor Placement in Installation Section)	Outdoor Air Temperature	Signals to the charge control system to set core charge level in relation to outdoor temperatures *(SeeTable1)*.
	Charge Control Thermostat	HPB Electrical Section	Core Temperature	Maintains core temperature level in response to the outdoor air temperature sensor.
	Low Temperature Duct Sensor	Supply Duct (minimum of 3' downstream from HPB supply discharge)	Supply Air Temperature	Modulates HPB mixing damper to maintain comfortable supply air temperature (Stage 1 heat call).
	Air Discharge Controller	Air Discharge Outlet Port	HPB Discharge Air Temperature	Modulates HPB mixing damper to maintain maximum HPB discharge air temperature (Stage 2 heat call).
	130° Low Core Temperature Switch	See Figure 10	Core Temperature	De-energizes HPB blower below preset temperature *(See Table 3)*.
Safety Devices:	Core Charging High Limit Switches: (3) each HPB11B (4) each HPB15B (6) each HPB22B	HPB Limit Bar (See Figure 9)	Core Temperature	De-energizes HPB resistance heating elements.
	Air Discharge High Limit	Air Discharge Outlet Port	HPB Air Discharge Temperature	De-energizes HPB blower when discharge air exceeds 190° F.
	Slam Gate	Air Discharge Outlet Port	HPB Air Discharge Temperature	At air discharge temperature of 212° F, fusible melt link releases slam gate, positively blocking discharge air. All HPB electrical functions de-energized.

D. HPB AIR DELIVERY CONTROL STRATEGY

(TABLE 3)

MODE	STAGE 1 HEAT CALL	STAGE 2 HEAT CALL (EMERGENCY HEAT)	AIR CONDITIONING CALL
On-peak without compressor control	• HPB core blower energized. • Supply air temperature maintained at pre-set comfort level. • If core temperature is below the preset minimum temperature, HPB will not respond.	• HPB core blower energized. • HPB air discharge temperature maintained at 160° F. • 130° low core temperature switch bypassed.	• HPB core blower de-energized. • Heat pump air handler blower energized. • Heat pump compressor energized.
Off-peak without compressor control	• HPB core blower energized. • Supply air temperature maintained at pre-set comfort level. • If core temperature is below the preset minimum temperature, HPB will not respond.	• HPB core blower energized. • HPB air discharge temperature maintained at 160° F. • 130° low core temperature switch bypassed.	• HPB core blower de-energized. • Heat pump air handler blower energized. • Heat pump compressor energized.
On-peak with compressor control	• HPB core blower energized. • Supply air temperature maintained at pre-set comfort level. • 130° low core temperature switch bypassed.	• HPB core blower energized. • HPB air discharge temperature maintained at 160° F. • 130° low core temperature switch bypassed.	• HPB core blower de-energized. • Heat pump air handler blower energized. • Heat pump compressor de-energized.
Off-peak with compressor control	• HPB core blower energized. • Supply air temperature maintained at pre-set comfort level. • If core temperature is below the preset minimum temperature, HPB will not respond.	• HPB core blower energized. • HPB air discharge temperature maintained at 160° F. • 130° low core temperature switch bypassed.	• HPB core blower de-energized. • Heat pump air handler blower energized. • Heat pump compressor energized.

E. HPB CORE CHARGING CONTROL STRATEGY

(TABLE 4)

MODE	STAGE 1 HEAT CALL	STAGE 2 HEAT CALL (EMERGENCY HEAT)	AIR CONDITIONING CALL
On-peak without compressor control (above 45° F outdoor air temperature)	No core charging.	No core charging unless override activated, then Level 1 core charge.	No provision for core charging.
Off-peak without compressor control (above 45° F outdoor air temperature)	No core charging.	Core heating elements activated to provide Level 1 charge.	No provision for core charging.
On-peak without compressor control (above 45° F outdoor air temperature)	Core heating elements energized to provide Level 1 charge only if override activated.	Core heating elements energized to provide Level 1 charge only if override activated.	No provision for core charging.
Off-peak with compressor control (above 45°F outdoor air temperature)	Core heating elements energized to provide Level 1 charge.	Core heating elements energized to provide Level 1 charge.	No provision for core charging.
On-peak (any outdoor air temperature below 45° F)	Core heating elements energized to provide Level 1 charge, with or without heat call; but, only if on-peak override activated. Charge input of the HPB11 and HPB15 is limited to 7.3 kW. Charge input of the HPB22 is limited to 10.9 kW.		
Off-peak (outdoor air temperature of 45° F)	Core heating elements energized to provide Level 1 charge, with or withour heat call.		
Off-peak (outdoor air temperature of 35° F)	Core heating elements energized to provide Level 2 core charge, with or without heat call. All core heating elements energized.		
Off-peak (outdoor air temperature of 25° F)	Core heating elements energized to provide Level 3 core charge, with or without heat call. All core heating elements energized.		

3. INSTALLATION

A. SHIPPING

Steffes ETS Heat Pump Boosters are shipped in modular fashion for ease of handling. *(See Shipping Data Sheet in Appendix)*. Following delivery of the booster to its installation site, merely remove the packaging materials; and, the unit is ready for installation.

B. UNIT PLACEMENT

The weight of the unit must be taken into consideration when selecting the installation surface. A level concrete floor is the best surface on which to place the Heat Pump Booster, but most well supported surfaces are acceptable.

CAUTION: Consult a building contractor or architect if in doubt about floor load capacity. See unit specifications in the Appendix for size and weight of unit being installed.

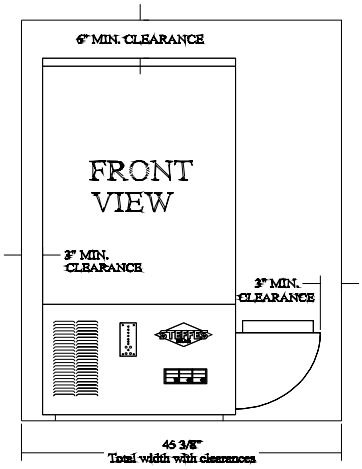
Locating the Heat Pump Booster directly adjacent to the home's heat pump is most desirable, but any suitable location within twenty (20) feet of the heat pump's warm air plenum is acceptable. Consult factory on locations of greater distances.

C. CLEARANCE REQUIREMENTS

Allow clearance of three (3) inches from back and sides, six (6) inches top clearance, and a minimum of thirty-six (36) inches from the front of the unit to allow for servicing. This clearance area must be kept open and free of debris. Do not place anything on top of unit or allow objects to fall between the booster and adjoining walls. A minimum of one (1) inch and zero (0) inches to a combustible floor surface must be maintained between the duct and the booster.

Small enclosed areas where units are to be installed must be well ventilated. A minimum of sixty-four (64) square feet is required with a minimum 24" X 24" door louvre.

CLEARANCE DIAGRAM
(FIGURE 3)



D. SET-UP AND BRICK LOADING PROCEDURE

GENERAL NOTES:

A. See Shipping Data Sheet in Appendix for components included with unit in shipment.
B. For cross reference to number coded components, see Figure 10.

INSTALLATION TIPS:

a. Remove loose brick materials during loading phase to prevent uneven stacking of bricks.
b. See Figure 4 for installation of the last middle brick.
c. To ensure adequate room for brickloading, the top or bottom 1' X 4' core spacer piece can be used to hold the inner brick cavity wells apart.

1. Lift carton off storage cabinet.

   (CAUTION: Do not install unit on its shipping pallet!)

2. Move unit to position and adjust leveling legs (23).

   (CAUTION: Leveling legs must not be extended more than one (1) inch.)

3. After the unit is set and leveled, brick loading may begin.

   (NOTE: Once bricks are loaded, the booster can no longer be moved.)

4. Remove sheet metal screws on the lower edge of the cabinet's painted front panel (33).

5. Pull painted front panel (33) out at bottom edge to detach.

6. Remove sheet metal screws around outer edge of the inner galvanized front cover panel (13) and set aside.

7. Carefully lift the three insulation blankets (8, 9, and 10) one at a time and drape them over the top of the unit.

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

8. Remove the stainless steel panel (2) by pulling out at the top.

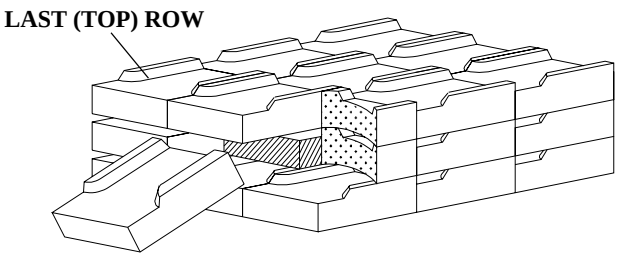
9. Remove heating elements (18) and packing material from core cavity.

10. Load brick (19) one row at a time starting at the lower back working forward *(See Installation Tips under Figure 5).*

11. For installation of last middle brick, refer to Figure 4; or, a shim may be used to hold upper brick in place.

    (NOTE: The second to last row, front, middle brick must be the last brick installed. This is most easily done by leaving the middle brick in the second to last row pulled about 4" forward from its intended position. This acts as a support for the front middle brick of the last (top) row. When installing the front, middle brick of the second to last row push brick in which will at the same time push the middle brick that was left forward into place. This procedure is often referred to as the "Last Brick Trick.")

LAST BRICK INSTALLATION
(FIGURE 4)



12. Insert heating elements (18) between brick layers with cold pins facing up. *(See Figure 5 detail).*

13. Make heating element (18) connections.

    (NOTE: Use two 3/8" wrenches to ensure tight connections and to avoid twisting the threaded element cold pins.)

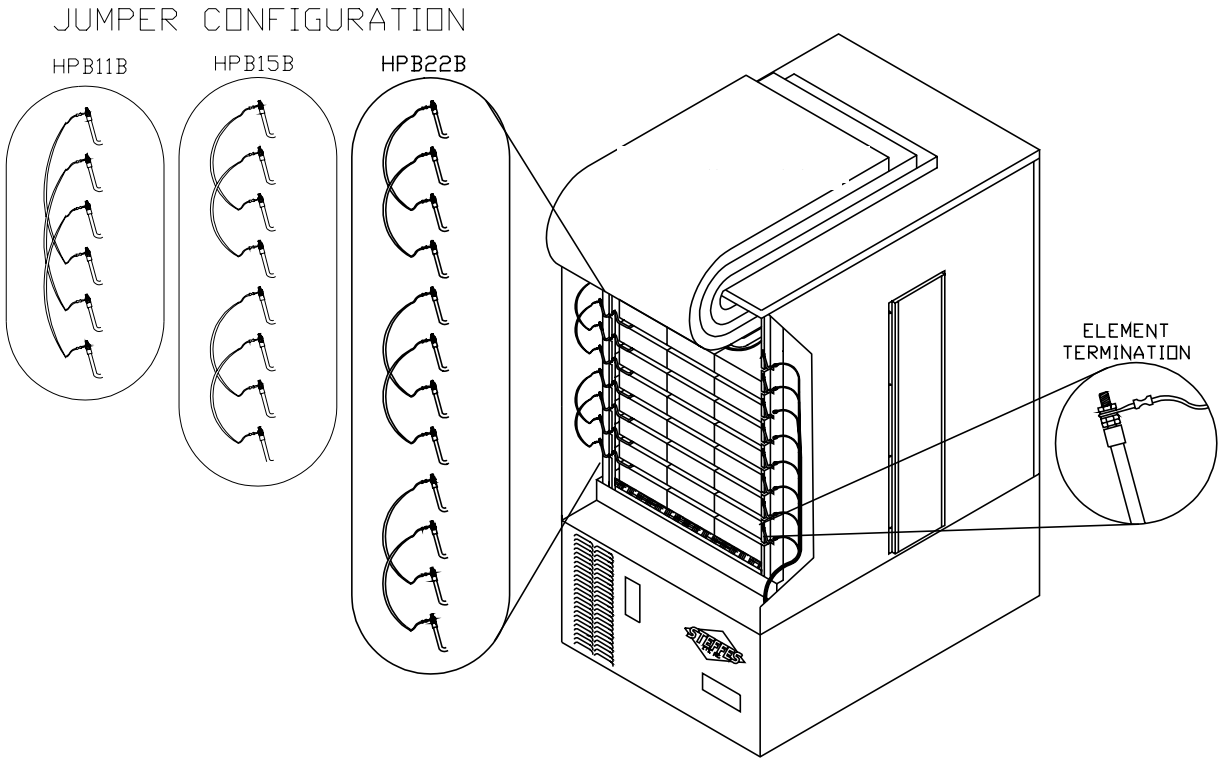
14. Replace stainless steel panel (2).

15. Lower insulation blankets (8, 9, and 10) back into position one at a time. Carefully tuck sides of blanket into edges, corners, and around exposed portion of heating elements (18).

16. Replace galvanized front cover (13) utilizing #8 X 1" sheet metal screws.

17. Replace painted front panel (23) using blunt tip screws only.

BRICK LOADING AND
ELEMENT/JUMPER CONNECTIONS
(FIGURE 5)



E. DUCTING

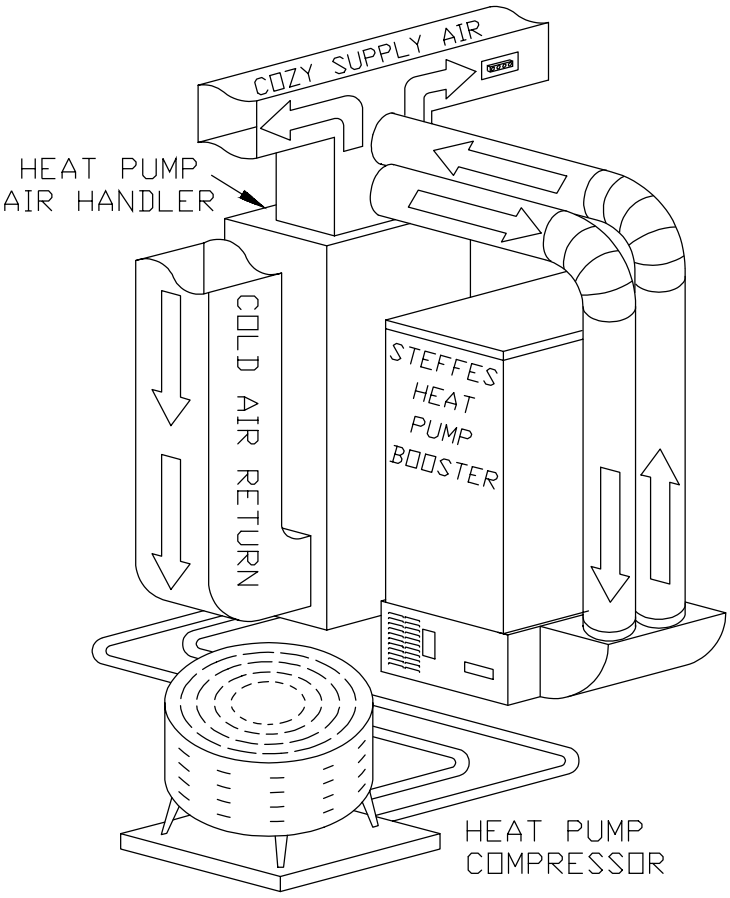
Both inlet and outlet ports must be connected to the heat pump's air delivery plenum downstream of the heat pump's A-coil(s). *(See Figures 6 and 7, for proper connection arrangements.)*

CAUTION:	**IN NO CASES shall either HPB inlet or outlet ports be connected to the heat pump's return air duct or be connected to the inlet side of an A-coil.**

For optimum performance, 10" steel duct pipe is recommended. To minimize possible sound transfer from the heat pump booster, canvas connections should be used at the inlet and outlet port connections. Insulated or uninsulated flex duct may be used, but caution must be taken to minimize sharp or excessive bends which could result in inadequate airflow.

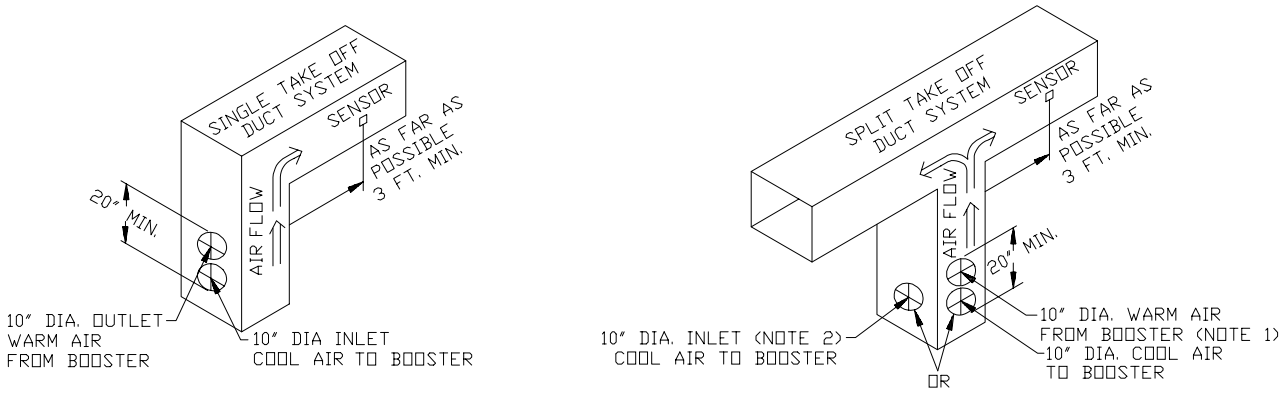
MECHANICAL CONNECTION OVERVIEW

(FIGURE 6)



TYPICAL BOOSTER MECHANICAL CONNECTIONS

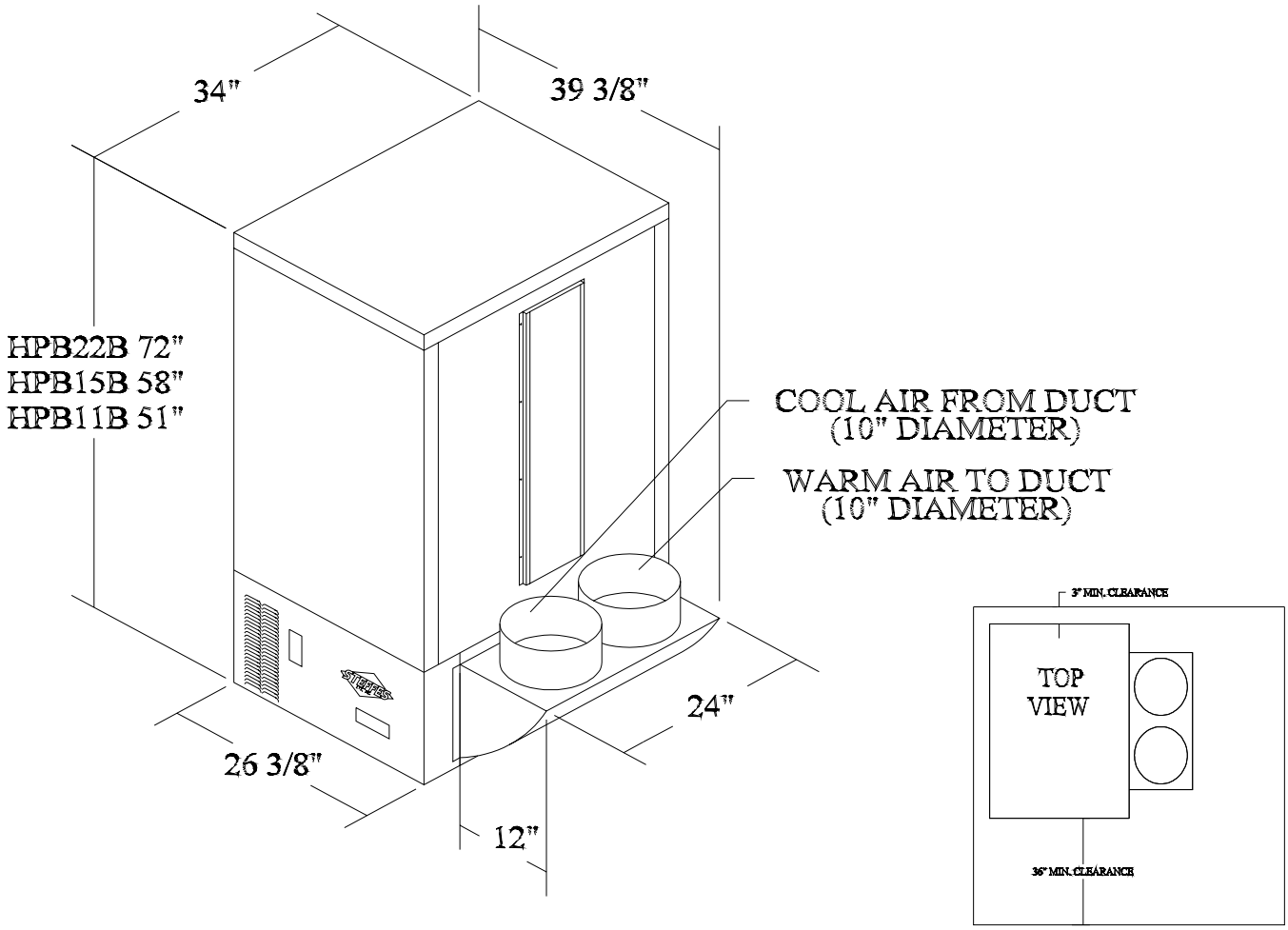
(FIGURE 7)



NOTES:

1. Both inlet and outlets of the HPB unit must be connected to the supply side of the duct system.
2. With a split take off duct system the warm air duct from the booster must be placed to ensure even discharge of heat to both sides of the duct system. (Warm air duct from HPB should be centered on the plenum.)

DUCT AND UNIT DIMENSIONS
(FIGURE 8)



F. SENSOR PLACEMENT

•DUCT SENSOR

Booster performance and homeowner comfort is critically dependent upon proper placement of the supply air temperature duct sensor. For guidelines, refer to Figure 7.

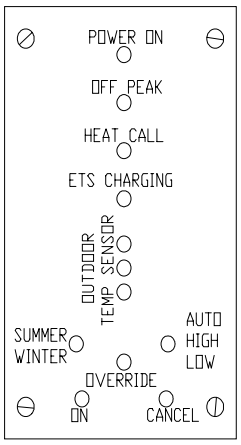
•OUTDOOR AIR TEMPERATURE SENSOR

The outdoor air temperature sensor assembly *(See Table 2)* is housed in a rectangular aluminum box complete with mounting flanges and is to be installed on an exterior surface:

- •approximately 8' above ground level
- •protected from direct sunlight
- •in a location affected by neither artificial heat sources nor cold sources.

G. FINAL TEST PROCEDURE

CHARGE CONTROL CIRCUIT BOARD PANEL
(FIGURE 9)



TEST EQUIPMENT NEEDED:

1. Digital Volt-Ohm meter.
2. Clamp-on Amp meter.

1. Check all electrical connections for proper termination placement, and that they have been tightened properly.

2. Energize electrical circuits.

(See Figure 9 for switch positions on steps 3, 4, and 5)

3. In the off-peak mode and with the outdoor air sensor disconnected, jumper sensor connection terminals "W" & "R" of the charge control circuit board together and perform the following tests:

   A. Set selector switches to SUMMER and AUTO positions. One outdoor sensor light should be on. Next, check unit's charging circuit amperages. On 240V systems, this should read:
   HPB11B =30.5 Amp HPB15B =30.5 Amp HPB22B =46 Amp

   B. Set selector switches to WINTER and AUTO positions. Two outdoor sensor lights should be on, and unit amperage on 240V systems should read:
   HPB11B = 46 Amp HPB15B =61 Amp HPB22B = 91.5 Amp

   C. Set selector switches to WINTER and HIGH position. Three outdoor sensor lights should be on, and unit amperage on 240V systems should read:
   HPB11B = 46 Amp HPB15B =61 Amp HPB22B =91.5 Amp

   Simulate an on-peak period by changing the status of the blue and blue/white wires. All heating elements should cycle off.

4. With unit in the on-peak mode, depress the override "START" switch; and, observe the indicator light. Light should be illuminated.

   (NOTE: This step may be ignored if the on-peak override feature is not authorized by the electrical utility.)

5. Remove outdoor sensor jumpers and reconnect outdoor air temperature sensor. Set selector switches to "AUTO" and "WINTER" positions.

6. With unit in the off-peak mode, initiate a Stage 2 heat call or jumper from "R" to "W" on the boosters interface board. The unit's blower should energize and damper motor should drive in a CCW direction. This movement is quite slow. (90°F takes about three minutes.)

7. Stop the heat call. Watch for the blower to de-energize and the damper motor to return to it's clockwise position.

8. Replace electrical box cover and check for proper electrical panel circuit labeling.

9. Present owners manual and warranty card to owner.

4. APPENDIX

A. SHIPPING DATA SHEET

HPB11B

1 - Brick Pallet with 14 Boxes Brick @ 62 Pounds Each (3 Bricks/Box)

1 - Storage Cabinet on Pallet with:
- 6 - Elements
- 1 - Outdoor Air Temperature Sensor Assembly
- 1 - Hardware Package

1 - Box with Intake/Discharge Plenum

HPB15B

1 - Brick Pallet with 18 Boxes Brick @ 62 Pounds Each (3 Bricks/Box)

1 - Storage Cabinet on Pallet with:
- 8 - Elements
- 1 - Outdoor Air Temperature Sensor Assembly
- 1 - Hardware Package
- 1 - Intake/Discharge Plenum

HPB22B

1 - Brick Pallet with 26 Boxes Brick @ 62 Pounds Each (3 Bricks/Box)

1 - Storage Cabinet on Pallet with:
- 12 - Elements
- 1 - Outdoor Air Temperature Sensor Assembly
- 1 - Hardware Package
- 1 - Intake/Discharge Plenum

SHIPPING WEIGHTS

MODEL	HEATER WEIGHT	BRICK WEIGHT	TOTAL
HPB11B	410	860	1270
HPB15B	445	1100	1545
HPB22B	550	1600	2150

B. UNIT SPECIFICATIONS

MODEL: HPB11B	
•**MINIMUM CHARGING CIRCUIT SERVICE ENTRANCE PANEL**	60 Amps (240V systems) (46 Amps x 1.25 = 57 Amps)
•**MAXIMUM BLOWER LOAD**	2 Amps (240V systems)
•**CHARGING INPUT**	11.0 kW
•**kWh STORAGE**	75 kWh
•**HEATING ELEMENTS**	6 - 1830W Incoloy Sheathed
•**STORAGE BRICK** (Magnetite)	861 LBS
•**APPROXIMATE INSTALLED WEIGHT**	1200 LBS
•**UNIT SIZE** (Height-Length-Depth)	51" X 26.5" X 34.5"
•**MAXIMUM DELIVERABLE kWh/24 HOURS**	
8 Hour Charge	88 kWh = 300,256 BTU
12 Hour Charge	132 kWh = 450,384 BTU

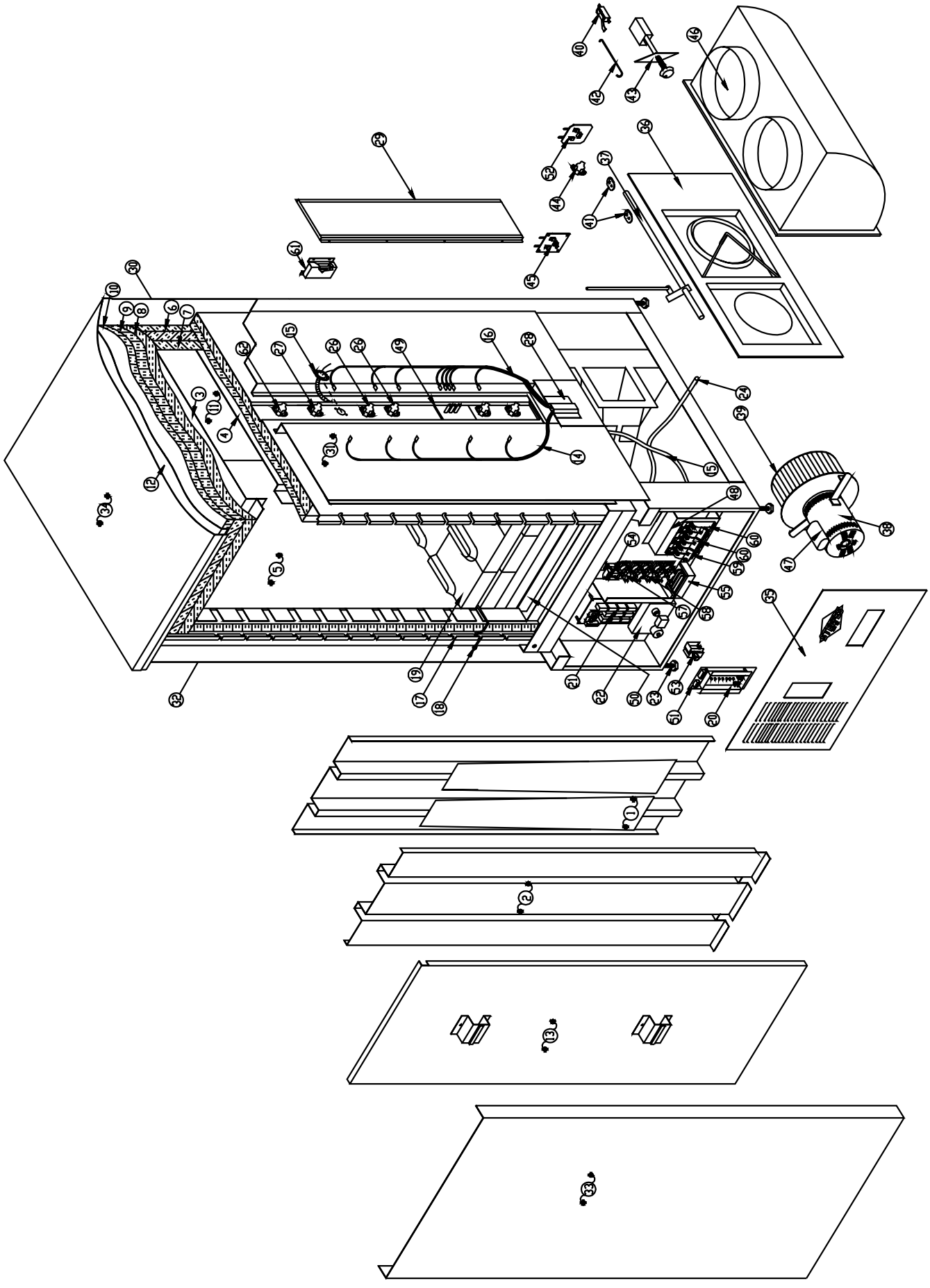
MODEL: HPB15B	
•**MINIMUM CHARGING CIRCUIT SERVICE ENTRANCE PANEL**	80 Amps (240V systems) (62 Amps X 1.25 = 77 Amps)
•**MAXIMUM BLOWER LOAD**	2 Amps (240V systems)
•**CHARGING INPUT**	14.7 kW
•**kWh STORAGE**	100 kWh
•**HEATING ELEMENTS**	8 - 1830W Incoloy Sheathed
•**STORAGE BRICK** (Magnetite)	1107 LBS
•**APPROXIMATE INSTALLED WEIGHT**	1500 LBS
•**UNIT SIZE** (Height-Length-Depth)	58" X 26.5 X 34.5"
•**MAXIMUM DELIVERABLE kWh/24 HOURS**	
8 Hour Charge	117 kWh = 399,204 BTU
12 Hour Charge	176 kWh = 600,512 BTU

MODEL: HPB22B	
•**MINIMUM CHARGING CIRCUIT SERVICE ENTRANCE PANEL**	125 Amps (240V systems) (92 Amps X 1.25 = 115 Amps)
•**MAXIMUM BLOWER LOAD**	2 Amps (240V systems)
•**CHARGING INPUT**	22 kW
•**kWh STORAGE**	135 kWh
•**HEATING ELEMENTS**	12 - 1830W Incoloy Sheathed
•**STORAGE BRICK** (Magnetite)	1600 LBS
•**APPROXIMATE INSTALLED WEIGHT**	2100 LBS
•**UNIT SIZE** (Height-Length-Depth)	72" X 26.5 X 34.5"
•**MAXIMUM DELIVERABLE kWh/24 HOURS**	
8 Hour Charge	176 kWh = 600,512 BTU
12 Hour Charge	264 kWh = 900,768 BTU

1 kW = 3412 BTU/HR 1 kWh = 3412 BTU

C. EXPLODED VIEW DIAGRAM

(FIGURE 10)



D. HPB PARTS LIST

(NOTE: ***When ordering replacement parts, please include unit model number and serial number.)***

DWG. REF. NO.	DESCRIPTION	HPB11 ITEM NO.	HPB15 ITEM NO.	HPB22 ITEM NO.
1.	Stainless Steel Panel, Back	1140098	1140099	1140388
2.	Stainless Steel Panel, Front	1140128	1140129	1140380
3.	Aluminized Steel Panel, Top	1140085	1140085	1140085
4.	Aluminized Steel Panel, Right	1140142	1140141	1140384
5.	Aluminized Steel Panel, Left	1140089	1140088	1140392
6.	2" Blanket Insulation, Back & Sides (Outer)	1050050	1050055	1050035
7.	2" Blanket Insulation, Back & Sides (Inner)	1050051	1050056	1050041
8.	2" Blanket Insulation, Top & Front (Inner)	1050052	1050057	1050047
9.	2" Blanket Insulation, Top & Front (Middle)	1050053	1050058	1040048
10.	1" Blanket Insulation, Top & Front (Outer)	1050054	1050059	1050049
11.	Galvanized Steel Panel, Back	1140087	1140097	1140396
"	Galvanized Steel Panel, Right	1140087	1140097	1190395
"	Galvanized Steel Panel, Left	1140087	1140097	1140397
12.	Galvanized Steel Panel, Top	1140084	1140084	1140084
13.	Galvanized Steel Panel, Front	1140086	1140093	1140400
14.	Element Wiring Harness	1040017	1040019	1040246
15.	Core Temperature Sensor	1040020	1040020	1040020
16.	Main Wiring Harness	1040016	1040018	1040244
17.	Element Jumpers	1040014	1040015	1040037
18.	Heating Element (277 V, 1830W)	1014022R	1014022R	1014022R
	Heating Element (208V, 1830W)	1014013R	1014013R	1014013R
	Heating Element (240V, 1830W)	1014014R	1014014R	1014014R
19.	Heat Storage Brick	1903004	1903004	1903004
20.	Control Board Mounting Plate	1140140	1140140	1140140
21.	Relay Interface Board (SFIII)	1023007R	1023007R	1023007R
22.	Damper Motor	1021003R	1021003R	1021003R
23.	Leveling Legs	1159004	1159004	1159004
24.	Fan Wiring Harness	1040013	1040013	1040013
25.	Base Assembly	1141132	1141132	1141132
26.	Core Charging High Limit Switch Assembly	1040011R	1040011R	1040011R
27.	130° F Low Core Temperature Switch	1040007R	1040007R	1040007R
28.	Limit Bar Channeling Plate	1140070	1140070	1140070
29.	Limit Bar Louvre Panel	1140077	1140136	1140136
30.	Painted Panel, Back	1140100	1140101	1140364
31.	Painted Panel, Right	1140147	1140148	1140356
32.	Painted Panel, Left	1140081	1140137	1140376
33.	Painted Panel, Front	1140090	1140102	1140372
34.	Painted Panel, Top	1140074	1140074	1140074
35.	Electrical Panel Cover	1140095	1140080	1140080
36.	Air Delivery Damper Assembly	1140111	1140111	1140111
37.	Core Damper Linkage Assembly	1141129	1141129	1141129
38.	Core Blower Motor (1/3 HP, 1625 RPM)	1040084	1040084	1040084
39.	Core Blower Wheel	1020002R	1020002R	1020002R

D. HPB PARTS LIST *(Continued)*

(NOTE: ***When ordering replacement parts, please include unit model number and serial number.)***

DWG. REF. NO.	DESCRIPTION	HPB11 ITEMNO.	HPB15 ITEMNO.	HPB22 ITEMNO.
40.	Slam Gate Interlock Switch	1024004	1024004	1024004
41.	Slam Gate Melt Link	1159005	1159005	1159005
42.	Slam Gate Melt Link Linkage	1140236	1140236	1140236
43.	Slam Gate Actuator Complete	1141131	1141131	1141131
44.	Air Discharge High Limit	1012012R	1012012R	1012012R
45.	Air Discharge Controller	1040053R	1040053R	1040053R
46.	Inlet/Outlet Plenum Assembly	1190004	1190004	1190004
47.	Motor Run Capacitor	1018017	1018017	1018017
48.	Circuit Breaker Standoff	1140139	1140139	1140139
49.	Charge Control Resistor	1017027	1017027	1017027
50.	Hardboard Base Insulation	1050060	1050061	1050061
51.	Charge Control Circuit Board (SFIII)	1023005	1023005	1023005
52.	Low Temperature Duct Sensor	1040054R	1040054R	1040054R
53.	Charge Control Thermostat Assembly	1040033R	1040033R	1040033R
54.	Fan Relay	1018008	1018008	1018008
55.	40VA Control Transformer	1017034	1017034	1017034
56.	Electrical Panel	1140072	1140072	1140072
57.	Stage 2 Time Delay Sequencer	1019000R	1019000R	1019000R
58.	Charging Sequencers	1019002R	1019002R	1019002R
59.	15 Amp Circuit Breaker - Siemens Brand*	1024000R	1024000R	1024000R
"	15 Amp Circuit Breaker - GE Brand*	1024012R	1024012R	1024012R
60.	60 Amp Circuit Breaker (208/240V)-Siemens Brand*	1024002R	1024002R	1024002R
"	60 Amp Circuit Breaker (208/240V) - GE Brand*	1024013R	1024013R	1024013R
"	60 Amp Circuit Breaker (277V) - GE Brand*	1024014	1024014	1024014
61.	Outdoor Air Temperature Sensor Assembly	1040032	1040032	1040032
62.	285° Core Temperature Control	N/A	N/A	1040039

*** When replacing breakers in a Steffes heating system, it is important to replace with like brand heaters.**

E. TERMINAL DESIGNATION ON HEAT PUMP DEVICES FOR VARIOUS MANUFACTURERS

(The small number coded as a superscript next to certain terminal connections refer to Terminal Designation Notes on the next page.)

	24 Volt (Pos)	Common Low Voltage	Compressor Low Voltage	Blower Relay	2nd Stage Heat	Emergency Heat	Switch-over Valve	Therm-istor
Steffes	R	C	Y	-	W	E	O	-
Amana	R	C or X1	W1	G	W2	E	Y[5]	-
Bard	R	C[9]	W1	G	W2	E	Y[5]	-
Bryant	R	C	Y	G	W1[2]	E	O	T
Carrier	R	C	Y	G	W2	E	O	-
Carrier 38BQ	R	C	W1	G	W2[6]	E [4]	Y[5]	-
Century	R	C	W1	G	W2	E	Y1	X[7]
Coleman	R	C	W1	G	W2	A	Y[5]	X[7]
ComfortMaker	R	C	Y	G	W1	E [8]	O	T
Friedrich	R	5	Y	F	W1	W2	O	-
G.E. Trane	R	B	Y	G	W	X2	O	T
Lennox - Old	V	X	M	F	Y	E	R	A
Lennox - New	R	C	Y	G	W1	E	O	A
Range Aire	R	-	W1	G	W1	Y	O	-
RHEEM	R	X	Y	G	W2	E	B[12]	-
Rudd	R	C[9]	Y	G	W2	E	B	L[7]
Westinghouse	R	B	W1	G	W2	E	Y[5]	X[7]
Whirlpool	R	C[3]	Y	G	W[10]	E	O	T
York	R	B	Y	G	W	E [8]	O	X[7]
Econ Air	R	X	Y	G	W2	E	O	-
Command-Aire SWPR	R	C	Y2	F	W1	W2	O[11]	-
Water Furnace WX	R-6	C-1	Y-4	G-3	W1	E	O-2	-
Water Furnace TF	R-7	C-10	Y-4	G-3	W1-8	W2-9	O-6	-
HP5738B or HP5052A	R	C	Y	G	W	E	O	T

This matrix represents the best interpretation of other wire color codes by Electro Industries of Monticello, MN. This does not represent an official list from the above manufacturers. Please use only as a guide.

TERMINAL DESIGNATION NOTES

(These numbered notes refer to the chart on the previous page.)

1. Some manufacturers have additional wires. If these extra wires do not effect on/off control of the compressor, blower, or electric elements, leave wires as is. Example: Carrier-P, GE-U & F, etc.

2. Bryant may also have a "W2" wire which would be the same "W1".

3. Common can be X, B, C, or V.

4. If emergency heat switch is on "Quik Box", an internal modification may be required to route switch through "E" terminals.

5. Connect EL unit "O" to bottom tab "A" and bottom tab "F" to compressor "Y".

6. "A2" has to be controlled.

7. Used for a light on thermostat.

8. May not have an "E".

9. May be "X" for common.

10. May not have "W2".

11. The wire code shown, assume this control is between the room stat and the strip heater unit. If there is no strip heater, this is "Y1".

12. Water Furnace uses different connections for manual as shown. Deluxe setback will change wire positions.

(Chart and notes are courtesy of Electro Industries, Monticello, MN)

F. ELECTRICAL CONNECTIONS

Circuit breakers located in the line voltage compartment (lower right front side of unit) are set up for multi-feed installations *(See Figures 12 and 13)*. For circuit sizing, see Unit Specifications in Appendix. If single feed is desired, order Steffes Single Feed Kit, Item #1309000.

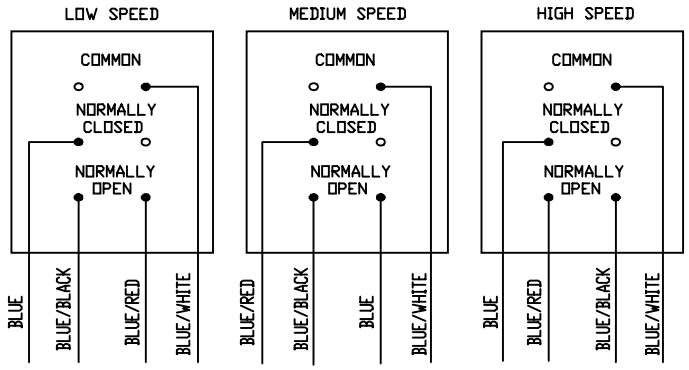
Due to different utility strategies, the fan control circuit can either be a separate feed or common to circuit breaker #1.

HPB's are equipped with 3-speed blowers, factory wired for high speed. For lower output requirements, motor speed may be adjusted *(See Figure 11)*.

Supply air temperature is monitored by a duct sensor which regulates HPB output through control of the unit's mixing damper. This sensor, remotely mounted in the main supply air duct *(See Figure 7)*, is connected to the HPB control panel with 18/4 bell wire. Installer(s) need only follow connection block color coding.

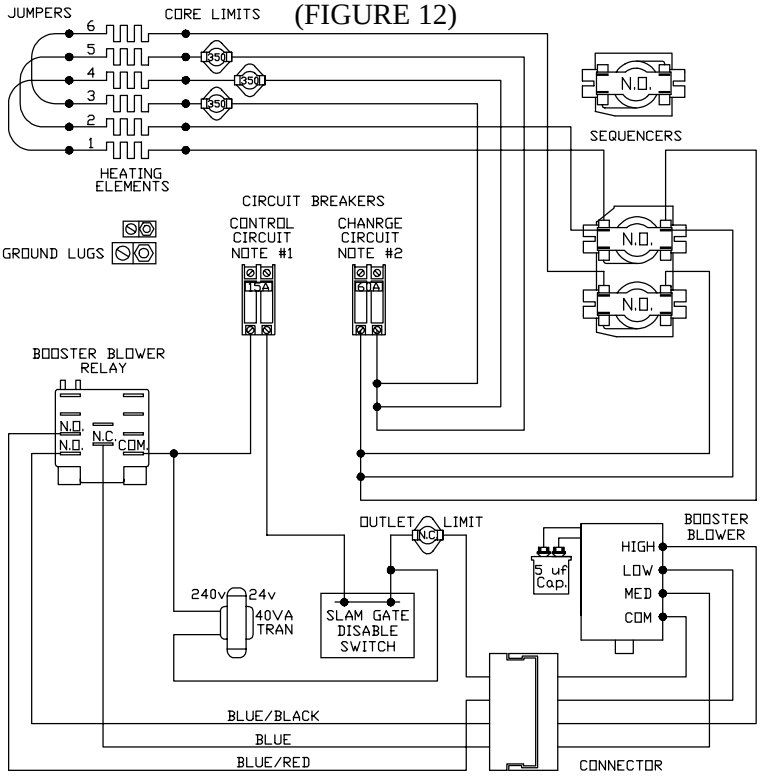
Heat pump interface connections will vary. For proper interface connection, refer to Figures 15, 16, and 17.

HPB FAN SPEED SELECTION
(FIGURE 11)



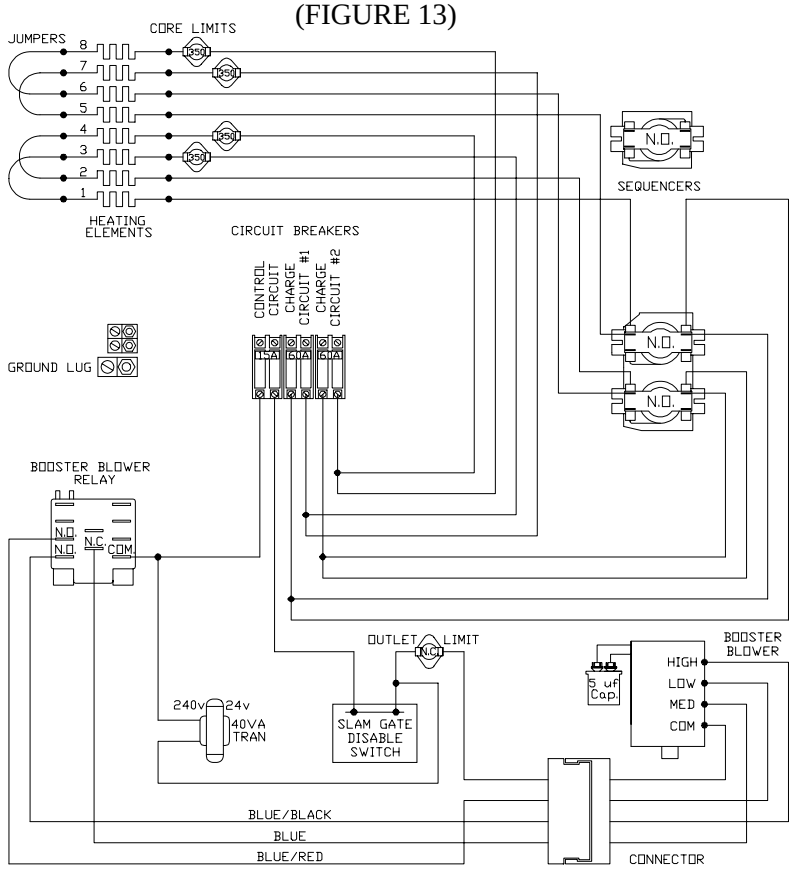
UNIT LINE VOLTAGE WIRING DIAGRAM FOR THE HEAT PUMP BOOSTER MODEL HPB11B

(FIGURE 12)



UNIT LINE VOLTAGE WIRING DIAGRAM FOR THE HEAT PUMP BOOSTER MODEL HPB15B

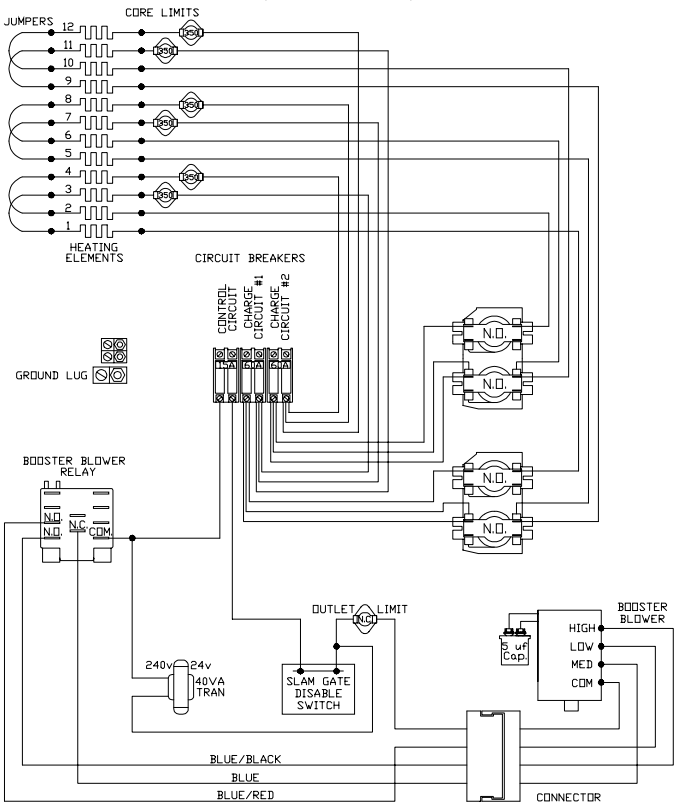
(FIGURE 13)



NOTE: Use copper or aluminum conductors rated for 75C or higher for field connection of this device. Diagrams show high blower run speed. For low and medium speeds, see fan speed selections, Figure 11.

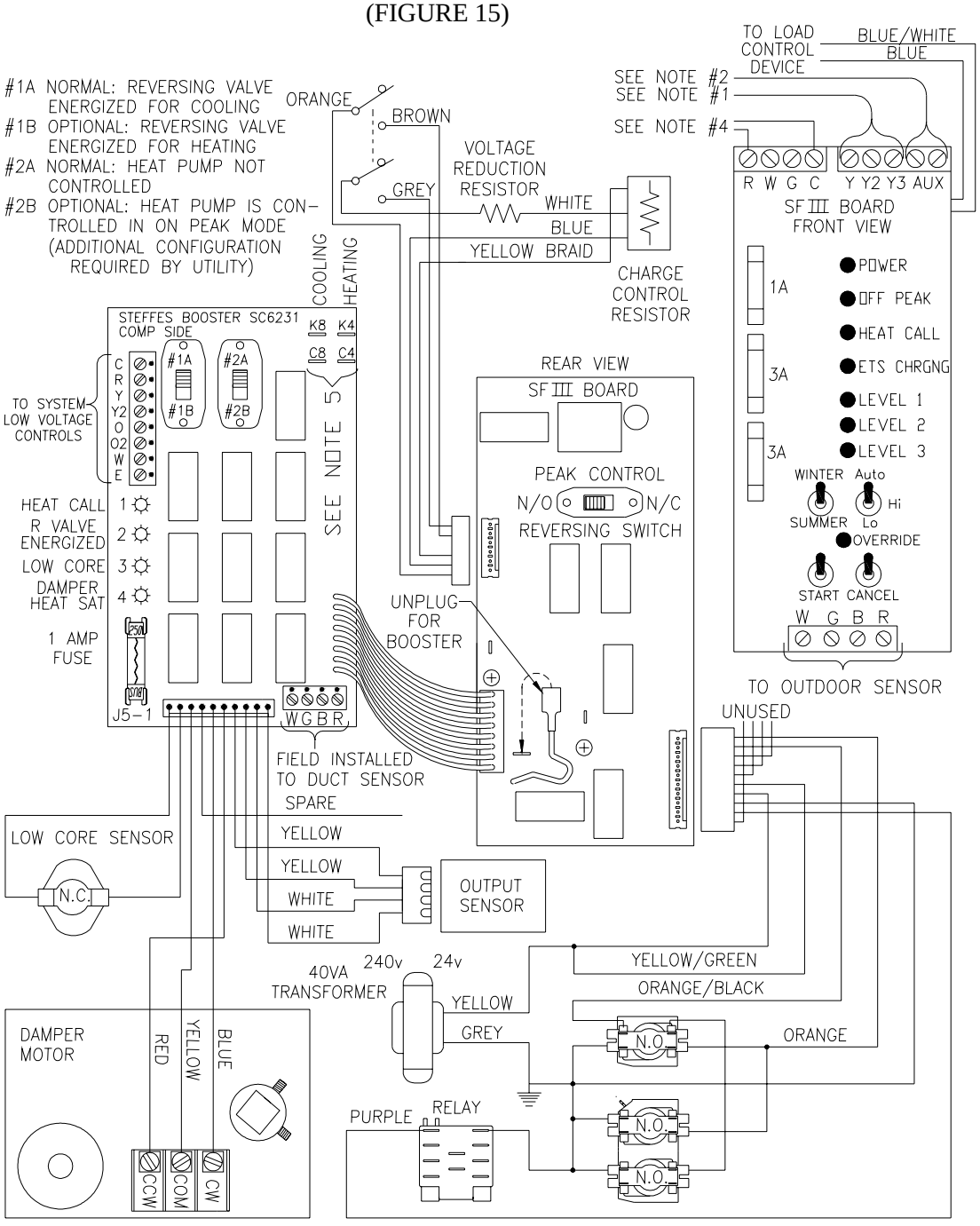
UNIT LINE VOLTAGE WIRING DIAGRAM FOR THE HEAT PUMP BOOSTER MODEL HPB22B

(FIGURE 14)



NOTE: Use copper or aluminum conductors rated for 75C or higher for field connection of this device. Diagrams show high blower run speed. For low and medium speeds, see fan speed selections, Figure 11.

UNIT LOW VOLTAGE WIRING DIAGRAM FOR THE
MODEL HPB11B & HPB15B
(FIGURE 15)

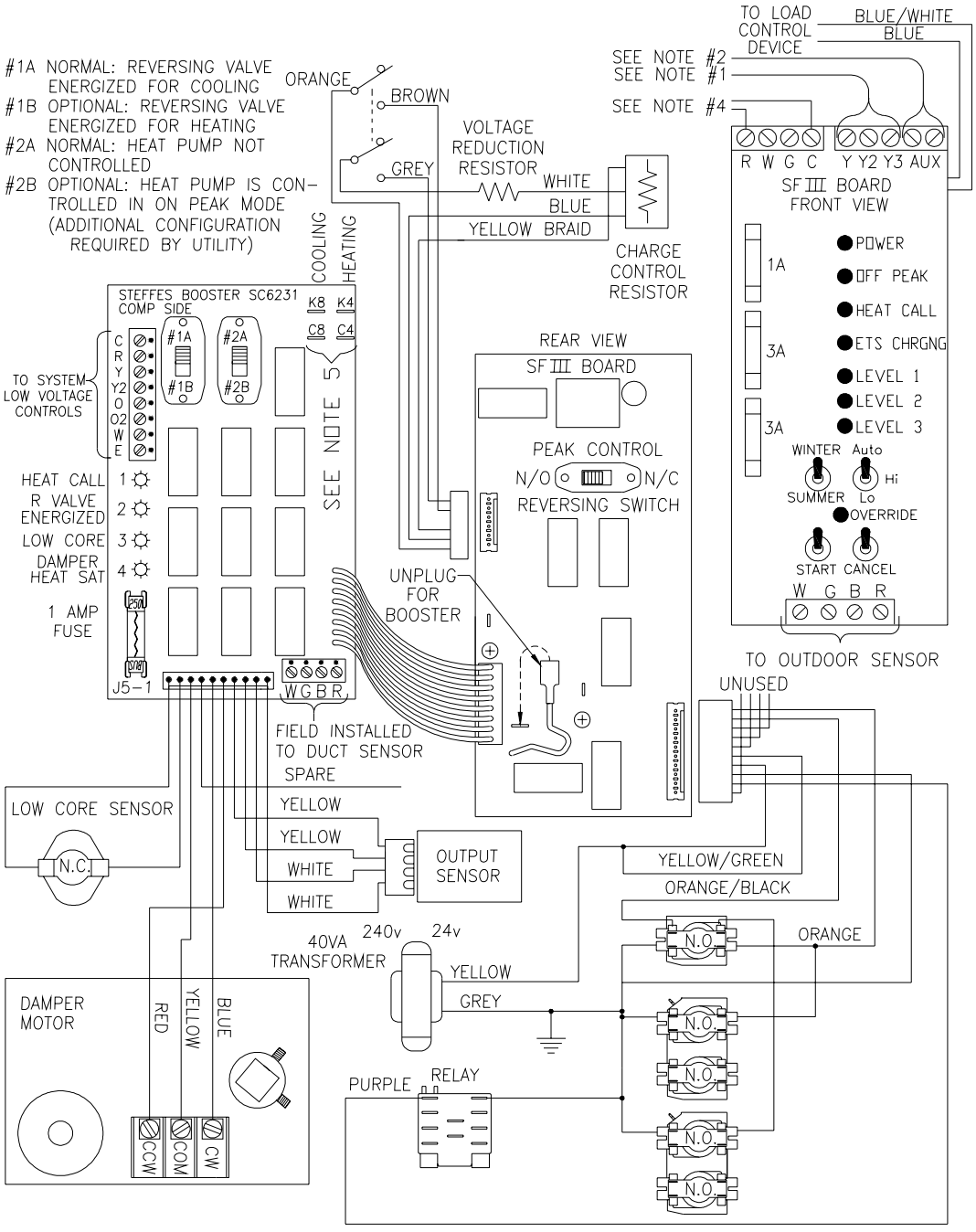


NOTES:

1. Low voltage auxilliary control contacts.
   a. Y to Y2 contacts open when load control device closes.
   b. Y to Y3 contacts closed when load control device closes.
2. Auxilliary contacts close during off-peak heat calls.
3. N.O. used for open on-peak load control device (switch closes to charge).
   N.C. used for closed on-peak control device (switch opens to charge).
4. R & C terminals may be used as a source for 24 volt AC for external device control. (5VA max load.)
5. The Y terminal must be connected to compressor control circuit from the wall thermostat in all installations. When the compressor is to be controlled with load management call in heating or cooling modes, Y2 must be used as the compressor control signal to the outdoor unit. If controlling the compressor in the heating mode, then the K4/C4 jumper must be removed. If controlling the compressor in the cooling mode, then the K8/C8 jumper must be removed. (Only remove these jumpers if using the booster to control the compressor.)

UNIT LOW VOLTAGE WIRING DIAGRAM FOR THE MODEL HPB22B

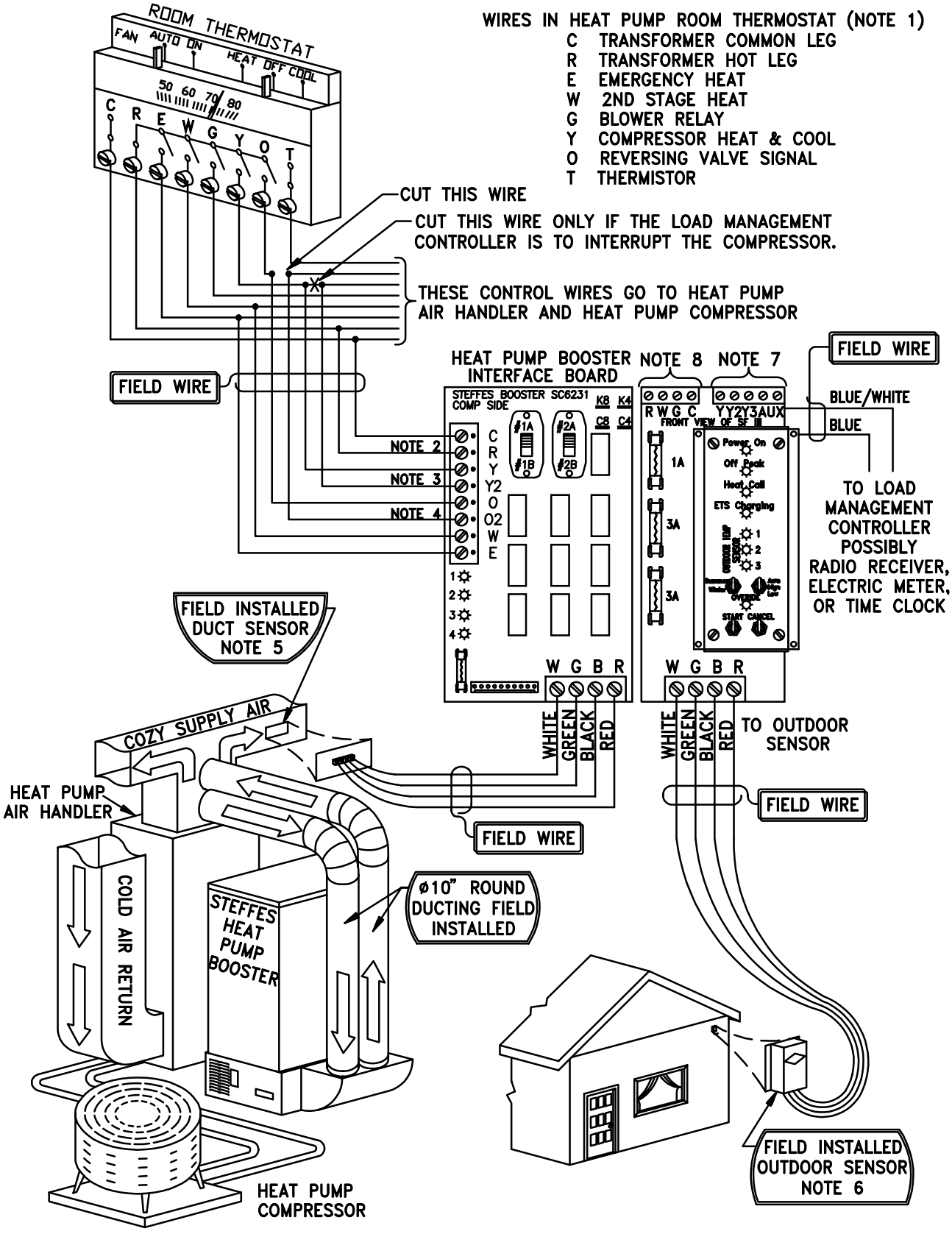
(FIGURE 16)



NOTES:

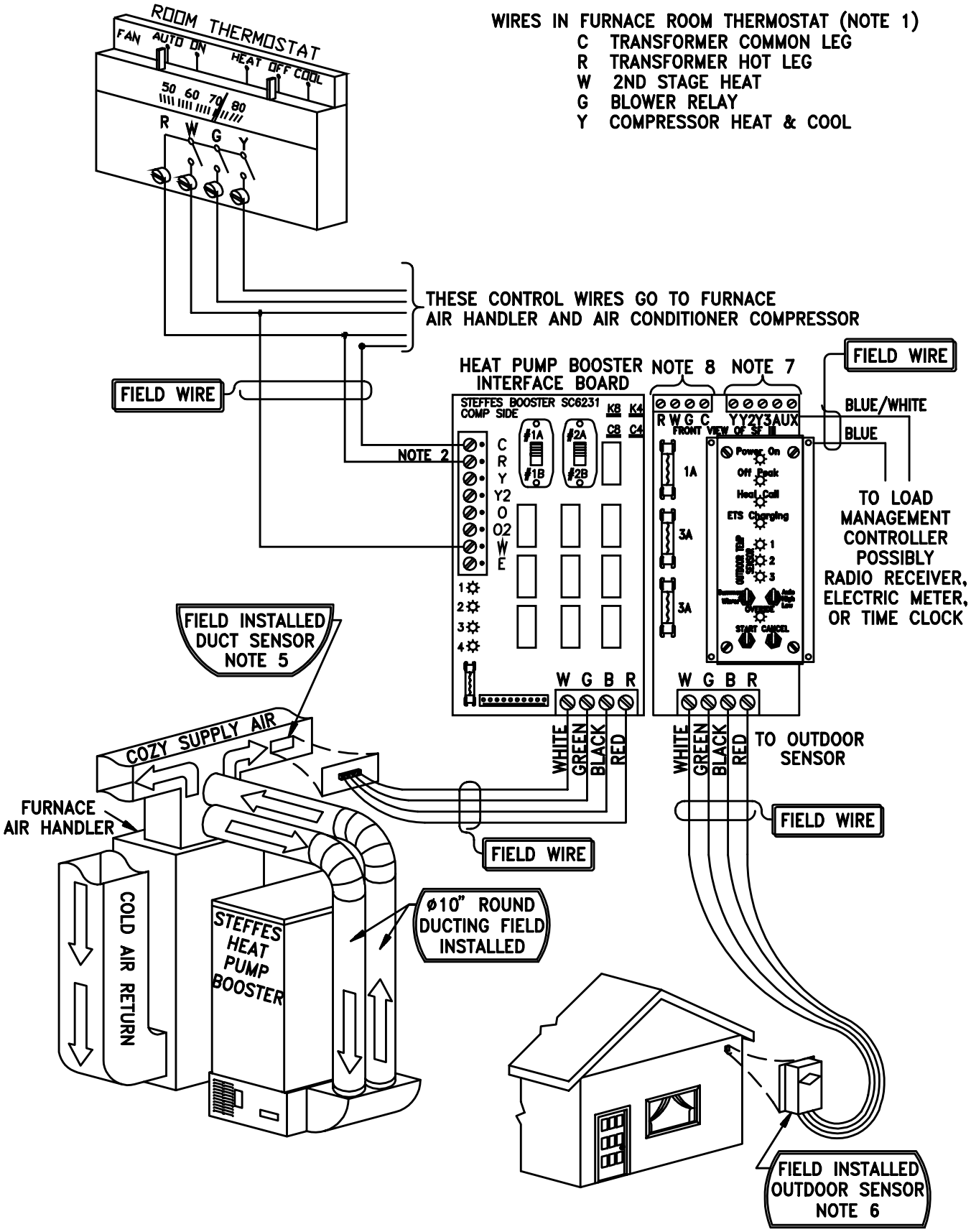
1. Low voltage auxilliary control contacts.
   a. Y to Y2 contacts open when load control device closes.
   b. Y to Y3 contacts closed when load control device closes.
2. Auxilliary contacts close during off-peak heat calls.
3. N.O. used for open on-peak load control device (switch closes to charge).
   N.C. used for closed on-peak control device (switch opens to charge).
4. R & C terminals may be used as a source for 24 volt AC for external device control. (5VA max load.)
5. The Y terminal must be connected to compressor control circuit from the wall thermostat in all installations. When the compressor is to be controlled with load management call in heating or cooling modes, Y2 must be used as the compressor control signal to the outdoor unit. If controlling the compressor in the heating mode, then the K4/C4 jumper must be removed. If controlling the compressor in the cooling mode, then the K8/C8 jumper must be removed. (Only remove these jumpers if using the booster to control the compressor.)

FIELD LOW VOLTAGE CONTROL WIRING
FOR HEAT PUMP APPLICATIONS
(FIGURE 17)



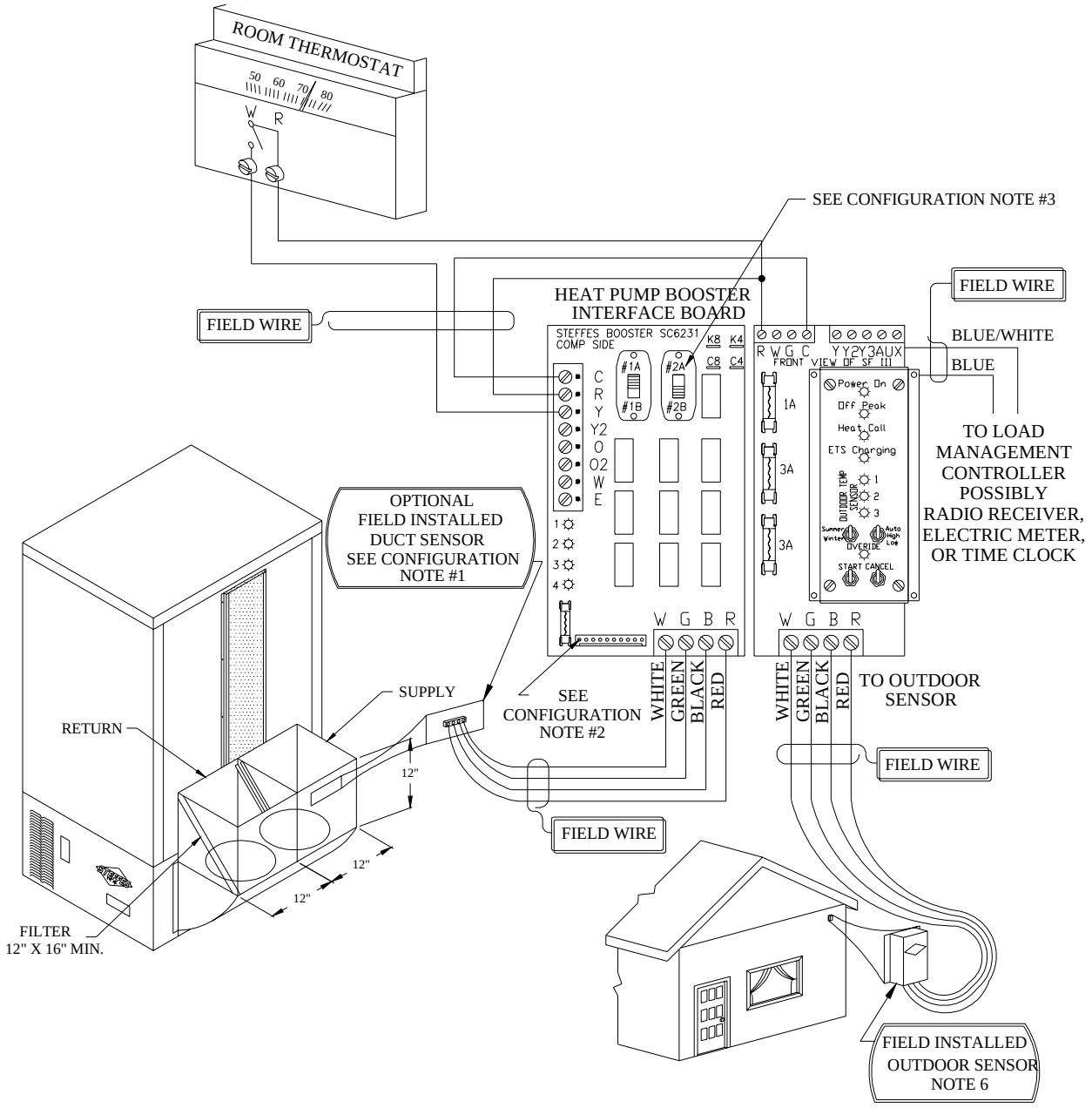
NOTE: See *Installation Notes* in this manual in conjunction with this diagram.

FIELD LOW VOLTAGE CONTROL WIRING
FOR ELECTRIC FURNACE BACK-UP APPLICATIONS
(FIGURE 18)



NOTE: See *Installation Notes* in conjunction with this diagram.

FIELD LOW VOLTAGE CONTROL WIRING FOR
STAND ALONE APPLICATIONS
(Small Central Furnace)
(FIGURE 19)



CONFIGURATION NOTE:

1. If duct sensor is installed, discharge air will be approximately 95 degrees Fahrenheit. If duct sensor is not installed, discharge air temperature will be approximately 150 degrees Fahrenheit.
2. Cut the white/black wires from the 10 pin harness connected at the bottom of the interface board.
3. Place the #2 switch in the #2B position.

NOTE: See *Installation Notes* in conjunction with this diagram.

INSTALLATION NOTES

(See Figures 17, 18, and 19)

NOTE 1:
The letters in the heat pump thermostat may vary, but the function of the wires are normally the same. *(See Terminal Designation on Heat Pump Devices for Various Manufacturers in the Appendix.)*

NOTE 2:
This R MUST be connected to the transformer hot leg in the wall thermostat. Reversing the R&C terminals will cause improper operation.

NOTE 3:
The Y terminal must be connected to compressor control circuit from the wall thermostat in all installations. When compressor is to be controlled with a load management call in heating or cooling modes, Y2 must be used as the compressor control signal to the outdoor unit. If controlling the compressor in heating mode, the K4/C4 jumper must be removed. If controlling the compressor in cooling mode, K8/C8 jumper must be removed. (Only remove these jumpers if using the booster to control the compressor.)

NOTE 4:
The O terminal MUST be hooked up to the thermostat side of the reversing valve signal wire, and 02 MUST be hooked up to the compressor side of the reversing valve signal wire. Failure to do so will result in improper operation of the heat pump and/or booster.

NOTE 5:
The duct sensor is installed a minimum of three (3) feet down stream from the booster inlet and outlet ports. This sensor regulates the heat pump booster output to insure a comfortable cozy air supply.

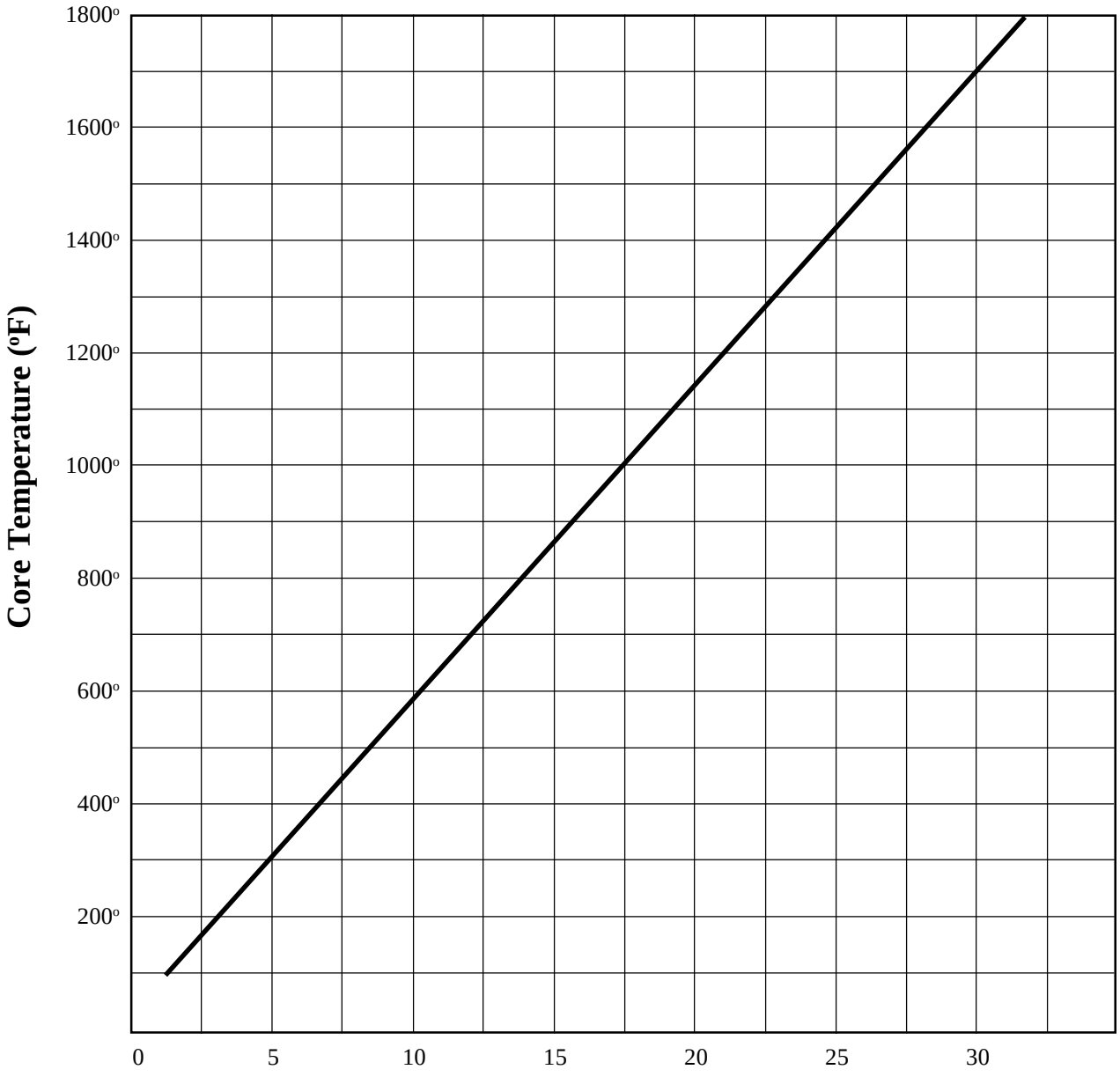
NOTE 6:
The outdoor temperature sensor regulates the amount of heat stored in the booster. The preferred position of this sensor is on the north side of the structure, eight (8) feet above the ground, away from the external heat sources, and out of hot, direct sunlight.

NOTE 7:
These connections can be used to control the water heater or in other appliances. Y is common. Y2 and Y3 are normally open and normally closed and are activated by the load management controller on-peak and off peak. The auxiliary connections are normally open contacts that will close with a room thermostat heat call during off -peak hours.

NOTE 8 :
W&G terminals are NOT USED. 24 VAC can be tapped from the R&C terminal block positions for control of external devices, but this load must not exceed 15VA at 24 VAC.

CAUTION: All circuit board terminals and contacts are for use with Class II circuits only. Do not connect line voltage.

G. CORE TEMPERATURE (ºF)
VS.
MILLIVOLTS (DC)
(FIGURE 20)



Millivolts (DC)
(From Core Temperature Sensor, DWG Ref. No. 15 on Figure 10)

H. THEORY OF OPERATION

(For units after serial/ARL number 00110)

•OUTDOOR TEMPERATURE SENSING

Core charging of the Steffes ETS Heat Pump Booster (HPB) is regulated by a Three-Stage Outdoor Air Temperature Sensor. The mercury bulbs of this sensor are normally calibrated at 45°F, 35°F, and 25°F. These temperatures are set points for charge levels 1, 2, and 3 respectively. *(See Table 1).* Optional temperature set points are available.

The sensors will initiate core charging a drop in outdoor temperature. By design, the on-board charge control system will respond to the coldest temperature signal. As a result, should the charge level 1 sensor fail to respond to the outdoor temperature, the charge level 2 or 3 sensors will initiate core charging. This feature provides control redundancy, reducing the chance of having an uncharged core during cold weather.

•CORE TEMPERATURE REGULATION

Above 45°F (outdoor air), the HPB will not maintain a core charge; but, 1/3 of the core charging elements will be energized only during a home heating call.

During moderate weather (35°F to 45°F) the charge level 1 sensor opens. This signals the HPB charge control circuit board to energize charge level 1 heating elements through the charge control sequencers. In this mode, the charge control circuit board will also apply 24 VAC to both the lower and upper segments of the charge control resistor's center tap. This resistor acts as a setback device by applying heat to the charge control thermostat sensing bulb. When both segments are energized, a 1/3 core charge will be allowed.

During cool weather (25°F to 35°F degrees), charge level 1 and 2 sensors open signaling the HPB charge control circuit board to energize the charge level 1 and 2 elements. 24 VAC will be applied to only the lower segment of charge control resistor allowing a 2/3 core charge.

In cold weather (below 25°F), all sensors open signaling the charge control circuit board to energize all heating elements. In this mode, no voltage is applied to the charge control resistor, and unit will be allowed to charge to its maximum charge level.

•AIR DELIVERY

On a call for heat, the wall thermostat will energize the Y terminal on the HPB's SFIII relay interface board. Depending upon the heat pump control strategy, the O terminal may also be energized which in turn energizes the HPB's internal blower.

A remote mounted duct temperature sensor modulates the HPB's internal damper. This allows the HPB to mix its warm discharge air with the cool output air of the heat pump to ensure comfortable supply temperature.

On a stage 2 heat call, the wall thermostat energizes the Y terminal on the HPB's SFIII relay interface board, and the W terminal will be energized through the HPB's internal controls. The duct sensor is bypassed, and control of the HPB's output temperature shifts to the internal air discharge controller. In this mode, the HPB will provide discharge air at the maximum allowable temperature depending upon the core charge.

Introduction to Steffes ETS.

Dear Valued Customer:

Congratulations On Your New Purchase! The Steffes ETS heaters are of the highest quality storage heat systems available today. We are confident you will be pleased with the warm, comfortable heat from this system as well as the savings you should see in your electric heat bill.

Electric Thermal Storage has been used in the United States for over 20 years. Today, Steffes is known as the leader in this technology. Not only are we setting the industry standards for quality; but, we are also working closely with power companies to ensure comfort, safety, reliability, service, and support needs are being met.

We are committed to ensuring your new heating system will provide you with total satisfaction for many years to come. Your support is appreciated and your comments on the equipment are welcome.

"Thank you for choosing Steffes ETS!"

Sincerely,

Paul Steffes
President and Chief Executive Officer

Owners/Installers, Please Note:

- *This manual provides information for the correct installation procedures and electrical connections for Steffes ETS room units models: HPB11B, HPB15B, and HPB22B.*

- *Assembly of and/or service to these units should be performed only by a qualified electrician in accordance with information contained herein.*

- *This manual must be retained by new owners should ownership change.*

- *Any deviation from these instructions may void the warranty and result in hazardous operating conditions.*

- *The warranty registration card provided as part of the unit documentation set must be completed and returned to Steffes ETS. Failure to do so may adversely affect Warranty Claims which could arise.*

- *Disclaimer: In compiling this manual, Steffes ETS, Inc., 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, whole or in part from the use of this manual or any revisions hereof.*

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STEFFES ETS LIMITED WARRANTY

Steffes Corporation ("Steffes") warrants that the Steffes ETS 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 which prove to be defective under normal use within **five (5) 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.

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.

The equipment described herein is intended for installation in accordance with applicable local, state and national electrical codes and must be installed by a qualified electrician.

This manual should be retained by owner upon completion of the installation and made available to service personnel as required.

STEFFES ETS

"Commitment to Innovation"

P.O. Box 1118
Dickinson, ND 58602-1118

"Manufactured in North America"

ITEM NO. 1200052