



Manufactured in North America

OWNER'S MANUAL

for Room Units



EXT Series



S Series

Models: 212, 312, 412, 512 & 612

Introduction to Steffes ETS, A Division of Steffes Corporation

Dear Valued Customer:

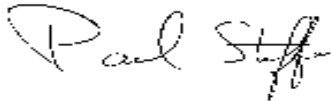
Congratulations On Your New Purchase! The Steffes ETS heaters are of the highest quality storage heat systems available today. We are confident you will be pleased with the warm, comfortable heat from this system as well as the savings you should see in your electric heat bill.

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 heating units (S and EXT Series) models: 212, 312, 412, 512 and 612. The information in this manual can help you take full advantage of your product's many features and ensure many years of safe, reliable operation. Read the enclosed instructions, safety tips, and warranty information before storing this manual in a safe place.
- Assembly of and/or service to these units should be performed only by a qualified electrician in accordance with information contained herein and in accordance with national, state, and local electrical codes.
- 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, a Division of 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, whole or in part from the use of this manual or any revisions hereof.

TABLE OF CONTENTS

1. GENERAL INFORMATION	1
2. OPERATION	1 - 3
A. SAFETY TIPS	1
B. CONTROL STRATEGY	2 - 3
-Core Charging Schedule (Table 1)	1
-S Series	
Space Heating	2
Core Charging	2
-EXT Series	
Space Heating (Figure 1)	2
Core Charging (Figure 1)	3
Overrides (Figure 2)	3
Indicator Lights (Figure 2)	3
C. CONTROL DEVICES/SAFETY LIMIT DEVICES (Table 2)	4
D. MAINTENANCE/CLEANING	4
-Service Light	4
3. INSTALLATION	5 - 8
A. PLACEMENT	5
B. CLEARANCE REQUIREMENTS	5
C. SET-UP PROCEDURE	5 - 8
-Room Unit and Site Preparation	5
Wall Attachment (Figure 3)	5
-Electrical Connections	6
120V Cord Connect (Figure 4)	6
-Brick Loading	7
Brick Stacking (Figure 5)	7
Grill Attachment (Figure 6)	8
-Room Thermostat Installation	8
4. APPENDIX	9 - 24
A. UNIT SPECIFICATIONS (Table 3)	9
B. WIRING	10 - 16
-Field Connection Wiring (Table 4)	10
-Unit Identification Label (Figure 7)	10
-Unit Wiring (Table 5)	10
-Typical System Wiring Diagrams	11 - 12
Automatic Charge Control - S Series (Figure 8)	11
Manual Charge Control - S Series (Figure 9)	11
Automatic or Manual Charge Control - EXT Series Shown with Two-Mode Circuit Board (Figure 10)	11
Automatic or Manual Charge Control - EXT Series Shown with Multi-Mode Circuit Board (Figure 11)	12
-Unit Wiring Diagrams	12 - 15
212S - 312S (Figure 12)	12
412S (Figure 13)	12
512S - 612S (Figure 14)	13
212EXT - 312 EXT Shown with Two-Mode Circuit Board (Figure 15)	13
212EXT - 312EXT Shown with Multi-Mode Circuit Board (Figure 16)	14
212EXT - 312EXT Shown with Multi-Mode Circuit Board and 120 Volt Cord Connect(Figure 17)	14
412 EXT Shown with Two-Mode Circuit Board (Figure 18)	15
512EXT - 612EXT Shown with Two-Mode Circuit Board (Figure 19)	15
-Circuit Board Face Plates - EXT Series	16
Two-Mode (Figure 20)	16
Multi-Mode (Figure 21)	16
Variable Charge (Figure 22)	16
-Charge Control Board Configuration - EXT Series	16
Multi-Mode Circuit Board Configurator (Figure 23)	16
Two-Mode Board Configurator (Figure 24)	16
Jumper Configurations	16
C. EXPLODED VIEW DIAGRAM - EXT Series (Figure 25)	17
D. EXPLODED VIEW DIAGRAM - S Series (Figure 26)	18
E. ROOM UNIT PARTS LIST - S and EXT Series (Table 6)	19 - 20
F. ROOM UNIT TROUBLESHOOTING GUIDES - S SERIES ONLY	21 - 24

1. GENERAL INFORMATION

Steffes ETS room heating units utilize off-peak electricity available during those times of the day or night when the power company can supply you with electricity more economically. By using this off-peak electricity for heating, the power company may offer you a special incentive such as a reduced electric rate, an off-peak heating rate, a time-of-use (TOU) rate, or monthly credits on your heating bill.

When off-peak hours are available, the room heating unit converts electricity to heat which is then stored in its ceramic brick core. The ceramic brick core of the room heating unit can store heat at varying levels depending upon outdoor temperature, owner preference, utility peak conditions, and the requirements of the space being heated. This stored heat becomes available for space heating needs as determined by the heater's room temperature thermostat.

Heating is accomplished radiantly and by thermostatically controlled fans. A small amount of radiant heat is given off by the heating unit's cabinet. When the room thermostat senses a need for heat, the heating unit's fan(s) are energized; and, heat is extracted from the ceramic brick core to maintain a constant, comfortable, room temperature.

2. OPERATION

A. SAFETY TIPS

1. Do not allow objects to fall between the room heating unit and the wall.
2. Do not place anything on top of the room heating unit. Protection from damage due to objects being placed on the top of the unit may be reduced by installing a Steffes heat shield cover.
3. Do not stick any objects through the air discharge grill.
4. As is true with all heating appliances, materials that may produce explosive or flammable gases must not be used or stored near the room heating unit!
5. Repeated illumination of the service light indicates a need for immediate service by a qualified technician. Refer to Table 2 and the Maintenance and Cleaning section of this manual for more information on this safety device.
6. Do not energize unit while disassembled or without ceramic heat storage bricks in place.
7. Be sure there is always enough distance from the heater to any object such as the wall, shelves, curtains, furniture, bed covers, or etc. The minimum distances any object can be placed by the heater are specified in the Clearance Requirements section of this manual.

CAUTION: This unit may be connected to more than one branch circuit.
Disconnect all branch circuits before servicing.

B. CONTROL STRATEGY

CORE CHARGING SCHEDULE
TABLE 1

CHARGE LEVEL		CORE TEMPERATURE ° F (Nominal)
S SERIES KNOB SETTING	EXT SERIES SWITCH SETTING	
1	Low	500
2	Med	900
3	High	1350

S SERIES

•Space Heating

Heating is accomplished both radiantly and by thermostatically controlled fans. Radiant heat is the heat given off from the warm room unit cabinet. If the radiant heat is not sufficient to satisfy the room's heat requirements, the wall mounted room thermostat will automatically cycle the unit fan(s), circulating air through the brick core and back into the room to maintain a constant temperature. The wiring configuration of fan(s) and elements allow fan cycling regardless of peak conditions.

•Core Charging

With manual operation, the homeowner regulates the amount of heat to be stored in the brick core. The adjustable charge control knob has four marked positions: OFF, 1, 2 and 3.

OFF position is used when no heat storage is required. Position 1 is normally used during late fall and early spring. Positions 2 and 3 will be used during most of the winter heating season depending upon temperature extremes and owner preference. The knob may be set at any point between marked positions and still allow the unit to charge.

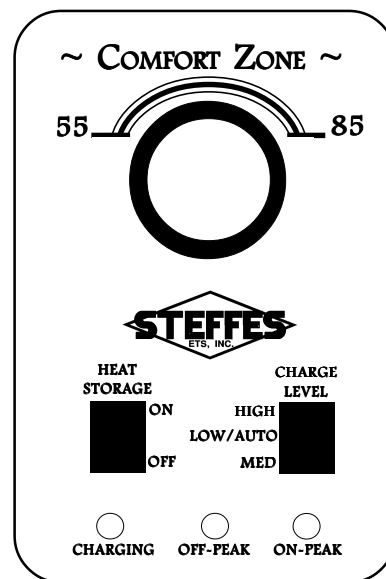
With the addition of the automatic charge control option, core temperature is automatically regulated in relation to outdoor air temperature. For automatic charge regulation, the charge control knob should be set on position 3 to allow the unit to charge to the level deemed necessary by the automatic charge controller's outdoor air sensor. If no charge is required, the charge control knob should be set to OFF position. If automatic charge control is desired, order Steffes automatic charge controller, item #1301000 if utility switch closes to charge. Order item #1301001 if utility switch opens to charge. Consult with your electric utility as to which method they use. Either controller can control up to twenty-five (25) units.

EXT SERIES

•Space Heating

Heating is accomplished both radiantly and by thermostatically controlled fans. Radiant heat is the heat given off by the warm room unit cabinet. If the radiant heat is not sufficient to satisfy the rooms heat requirements, the on-board room temperature thermostat located on the front panel of the unit will automatically cycle the unit's fan(s), circulating air through the ceramic brick core and back into the room to maintain a constant temperature. In installations where the heater is not the sole source of heat for the home, the unit's fan(s) may be locked out during some modes of operation. This lock-out allows the unit to fully utilize it's storage capacity, reduce installation costs, and obtain the highest efficiency possible.

EXT FACE PLATE
FIGURE 1



•Core Charging

The EXT series can be configured in many ways. Due to the wide variety of setup methods and options, it may be necessary to consult with your sales representative for the operation instructions of your heating system.

Several control devices can be used for core charging. Different combinations of these devices will provide for optimal unit function based upon utility needs, home characteristics, and installation requirements.

Rocker switches, if unit is equipped, are located on the front control panel and will vary the level of charge that is stored in the unit's brick core. The HEAT STORAGE rocker switch can be set in the OFF position to minimize the amount of heat stored or in the ON position to activate the CHARGE LEVEL rocker switch. The CHARGE LEVEL switch can be placed in the LOW/AUTO position for applications using automatic charge control. With the addition of this option, core temperature is automatically regulated in relation to outdoor air temperature. Override of the automatic charge controller can occur by setting the CHARGE LEVEL rocker switch to MEDIUM or HIGH.

Automatic charge control may also be configured without rocker switches. In these installations, core temperature level is solely controlled by an outdoor air temperature sensor, by the utility, or self regulated by the amount of heat being required to satisfy the room's requirements.

For applications without automatic charge control, LOW/AUTO position is normally used during the early spring and late fall. Setting the CHARGE LEVEL switch to positions MEDIUM or HIGH will increase charge levels for colder weather conditions.

•Overrides

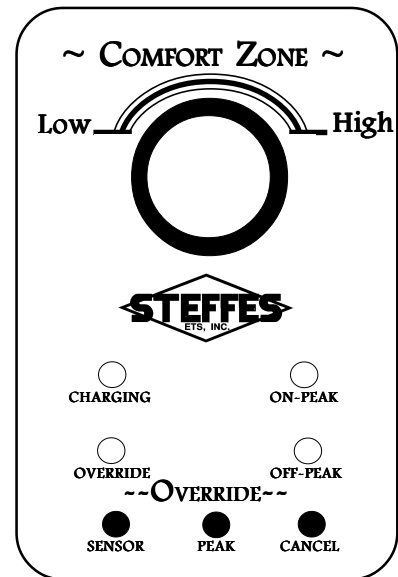
Some units are equipped with override systems. These override buttons, if the unit is equipped, are located on the front control panel. The PEAK OVERRIDE button is for emergency heat only (utility permitting) and will provide heating element operation during peak times when pushed. The SENSOR OVERRIDE button will override the outdoor air temperature sensor when pushed to increase the charge level in anticipation of colder weather conditions within the next twenty-four hour period. Both overrides are self-cancelling or can be cancelled by the CANCEL OVERRIDE button.

An optional peak override wind-up timer is also available for peak overrides. This timer is mounted on the side of the unit. The user selects the override time which can vary from zero to six hours.

•Indicator Lights

Indicator lights signal the unit's operating mode to the user. The green OFF-PEAK light illuminates during off-peak periods. The yellow CHARGING light illuminates whenever the elements are charging usually during off-peak periods or during on-peak if the PEAK OVERRIDE button is pushed. The red ON-PEAK light illuminates during on-peak periods to indicate element control. If the unit is equipped with an override system, it will also have an orange OVERRIDE light. This light illuminates whenever the PEAK OVERRIDE button or SENSOR OVERRIDE button have been pushed.

**EXT FACE PLATE
WITH OVERRIDES
FIGURE 2**



C. CONTROL DEVICES/SAFETY LIMIT DEVICES

Table 2

CATEGORY	DEVICE NAME	ACTION
Control Devices:	Charge Control Thermostat/Switches	Cycles charging elements to maintain a proper core charge level.
	Room Temperature Thermostat	Cycles unit fan(s) to maintain space temperature.
	Bimetallic Coil and Damper Assembly	Modulates damper to maintain a preset discharge temperature.
	Charge Control Sequencer/Relay	Stages elements "ON" to reduce load on charge control thermostat. (Used only on models 412, 512 & 612)
	Charge Indicator Light (If unit is equipped.)	Indicates heating elements are being energized.
	Time Clock -- Seven day programmable with Battery Back-Up (Optional in EXT series only.)	Monitors time and signals heating elements to charge during off-peak hours. Typically used in Time-of-Use (TOU) utility rate strategies.
	Peak Override Wind-up Timer (Optional in EXT series only.)	Overrides peak signal to allow charging of heating elements during a control period. (Emergency heat for a preset time initiated by user only.)
	Power Line Carrier	Provides wireless control signals for utility on-peak and off-peak periods.
	Utility Mode Timer (Optional in EXT series only.)	Initiates a time-based on-peak period upon the completion of a utility controlled charging period.
	Peak Control Sequencer (Optional in EXT series only.)	Monitors voltage of charging circuits to signal peak conditions when line voltage interruption is used for peak control.
	Low Voltage Control Module (Optional in S series only.)	Provides low voltage control of element charging and fan operation.
Safety Devices:	Core Charging High Limit Switch(es)	De-energizes heating elements if maximum core temperature is exceeded. (Automatically resets when core temperature decreases.)
	Discharge Fan High Limit Switch(es)	Monitors discharge air temperature and de-energizes fan(s) if maximum temperature is exceeded. (Automatically resets when discharge air temperature decreases.)
	Service Light	Indicates the core charging high limit switch has interrupted power to the heating elements.
	Tip Over Switch (Units equipped with security base only)	Disables heating elements and fan(s) if unit is not in the upright position.

D. MAINTENANCE/CLEANING

As with most heating systems, air borne particles in the room may be drawn into the heating system and oxidized. As these air borne particles are expelled back into the room, they may accumulate on the heater 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 such things as aerosols, dust, candles, incense, pet hair, high humidity, smoke or cooking can contribute to poor indoor air quality and accelerate this process.

To minimize the black residue build up, clean the outer surface of the heater on an annual basis or as needed. Wash the cabinet only when cool with any liquid cleaner. Do not use scouring powders or furniture polish. Steffes ETS recommends using "Soft Scrub with Bleach" brand cleanser or equal. Regularly vacuum around all sides of the heater.

•Service Light

A red service light located in the bottom right corner of the grill (See Figure 6) will illuminate whenever the core charging high limit is tripped. The illumination of the light may indicate violated clearances or possibly an operational difficulty within the heater. The unit will function with the service light illuminated; however, long-term operation may reduce the life expectancy of internal components. If the light illuminates repeatedly, notify a service technician.

3. INSTALLATION

A. PLACEMENT

Room units can normally be placed on standard flooring systems with any type of covering, i.e., wood, carpet, linoleum; but, heater weight must be considered. If in doubt, consult a building contractor or an architect. (See Table 3 for weight and physical dimensions of unit being installed.)

Room units are equipped with adjustable leveling legs or a security base. When installing a room unit with adjustable leveling legs on carpet, adjust the legs so that carpet compression does not cause upward bowing of unit's floor panel. Leg extension should not, however, exceed 3/4 inch overall. On extremely thick padded carpet, it may be necessary to place the unit on a one inch nominal board, 8 3/4 inches wide and of appropriate length for the heating unit being installed. Failure to follow these guidelines could result in damage to the flooring.

B. CLEARANCE REQUIREMENTS

Allow 1 5/8 inches clearance from the sides and back of the heater, and a minimum of four inches from the top of the heater. The factory supplied wall mounting bracket, located on the heater's shipping pallet, will provide the correct wall to back of heater clearance. If the heater is a 120V plug-in model with a security base, the base will provide the proper wall to back of the heater clearance. If enclosing the S Series unit in a wooden cabinet or recessing unit into a wall, allow two inches clearance on sides and four inches on top. Do not enclose or otherwise obstruct access to the heaters's front panel and grill. It is not recommended to recess or enclose an EXT Series unit as it may cause some inaccuracy in room thermostat operation. All objects must be kept a minimum of four inches from all unit surfaces and 15 inches from the grill.

(NOTE: For ease of servicing the EXT series unit, a clearance of 12" on the right side of unit is recommended.)

C. SET-UP PROCEDURE

GENERAL NOTE:

- A. For cross reference to number coded components, see Figure 7 (S series) or Figure 8 (EXT series).

•Room Unit and Site Preparation

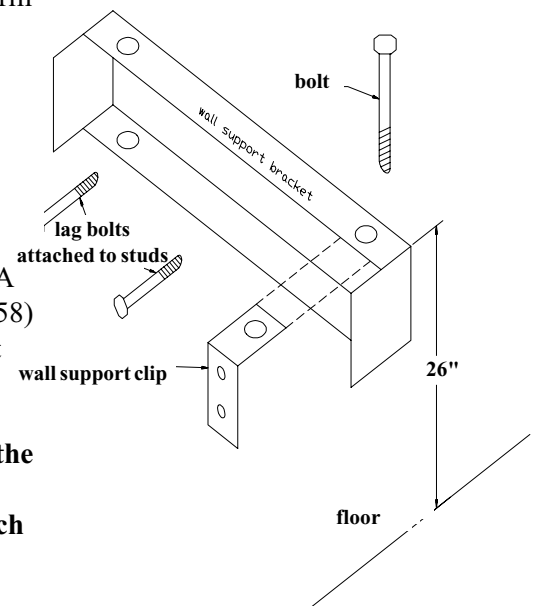
1. Remove control knob (44), if unit is equipped, grill (46) and grill support bracket (22) from unit.

(NOTE: If unit being installed is equipped with a security base, skip to Step 4.)

2. Establish unit location and attach wall support bracket (1) to wall using the lag bolts provided. (See Figure 3). The wall support bracket is shipped on the pallet under the room unit. A plastic bag containing the wall support bracket hardware kit (58) is provided inside the lower fan cavity. The top of the bracket should be 26" from the floor.

(NOTE: The lag bolts must attach to wood wall studs. If the wall is not a standard wood studded structure, alternate fasteners must be used to securely attach the wall bracket.)

**WALL ATTACHMENT
FIGURE 3**



- Attach 1 3/4" x 1 5/8" wall support clips (31) to upper back side of unit using #8 x 1/2" sheet metal screws provided in hardware kit. Use the carriage bolts to secure the room heating unit to the wall support bracket.
- Install field connection junction box. (If installing a 120 volt plug-in unit, skip to Electrical Connections section.)

- (NOTES: 1. **Where possible, flush mount using a Sylvania #2002-R-C or equal. If unavoidable, surface mount using a Steel City #72151 - 1/2 + 3/4 or equal. Mount at floor level. Line voltage field wire must be rated for 75° C minimum.**
2. **Different wiring methods and unit sizes necessitate larger junction boxes than specified above. Check State and National Electrical Codes for proper junction boxes.)**

•Electrical Connections

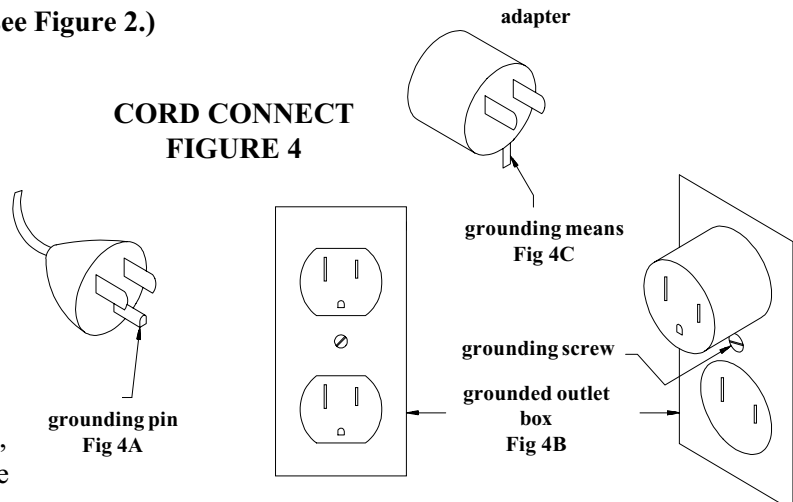
- For wiring connections, refer to Figure 10, 11, 12, or 13.

(NOTE: If installing an EXT series unit, skip to Step 3.)

- All S series units are equipped for automatic charge control. If these units are to be controlled manually, insulate the orange umbilical cord wires at the junction box.
- Check the unit identification label for correct voltages and wattages.

(NOTE: For 120 volt plug-in units, see Figure 2.)

This heater is for use on 120 volts. The cord has a plug as shown at Figure 4A. An adapter as shown in Figure 4C is available for connecting three blade grounding type plugs to two slot receptacles. The green grounding lug extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box. The adapter should not be used if a three slot grounded receptacle is available.



- Upon completing electrical connections, move room unit into position and secure wall support clips (31) to wall support bracket (1) with 1/4" x 2" bolts provided. Omit this step if installing a unit equipped with a security base.
- If unit is equipped with leveling legs (17) adjust prior to brick loading. If installing a unit equipped with a security base (72), this base must be secured to unit prior to loading the brick or putting the unit into operation. Remove the 5/16" X 1 1/2" bolts from the bottom of the unit. Attach base by inserting these bolts through the base and screwing back into the same threaded openings they were removed from.

(NOTE: For safety and ease of servicing, label all charging and control circuits in the distribution panel with the orange panel label provided in the wall support bracket hardware kit (58) .)

•Brick Loading

GENERAL NOTES:

- A. Room Units and ceramic heat storage bricks (13) are packed separately. The bricks are shipped in boxes of four (white box) and boxes of five (brown box). One box of each is required per element bay or nine bricks total. Refer to Table 3 for the total number of bricks required in model being installed.
- B. All bricks for the Steffes ETS room units are identical. One side of the brick is indented to accommodate the factory installed heating elements. Bricks are inserted in rows four deep and two high. Bricks are “loaded” by maneuvering them around the elements taking care to bend elements as little as possible.

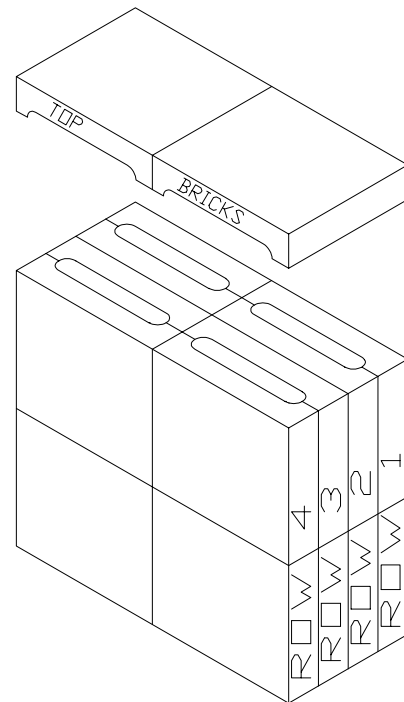
CAUTION: Use NIOSH/MSHA approved respirator, gloves, and long sleeved garments when handling insulation materials in accordance with generally accepted safety practices.

1. Remove hex head sheet metal screws at lower edge of front panel (4); pull panel outward and down to detach.
2. Lift 1/2" white blanket-type insulation (5) up and drape over top of unit.
3. Remove front aluminized steel (8).

(NOTE: To catch brick debris and to protect the flooring, we recommend laying the unit shipping box in front of the unit before loading the brick.)

4. Begin brick loading with Row 1 starting with the right side and working toward left. Follow with the upper layer of the back row in the same manner. Make sure that all bricks are flush with the back aluminized steel (9) and the brick indentation is facing the front of the unit (See Figure 5).
5. Next, load Rows 2 and 3 using the same method reversing brick indentation as required to accommodate heating elements (54). Again, make certain all bricks fit flush against the previous rows of brick.

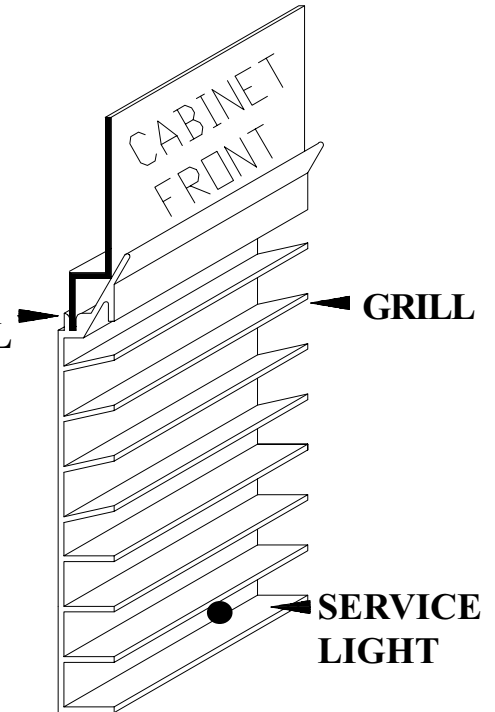
**BRICK STACKING
FIGURE 5**



6. After loading Row 3, insert a row of bricks on top with the indentation facing down. Continue with Row 4 starting with a lower brick followed by the upper brick.
7. Return the front aluminized steel (8) to position.
8. Carefully replace 1/2" blanket insulation (5) making sure all edges fit snugly.
9. Install front panel (4) using hex head sheet metal screws at lower edge.
10. Vacuum lower portion of the unit.
11. Make sure fan impellers (53) turn freely.
12. Manually open air mixing damper by depressing bimetallic coil (39) to check for freedom of operation and absence of debris.
13. Reassemble the unit (See Figure 6).
14. Complete Owner Registration Card and return to Steffes ETS, Inc.

**GRILL ATTACHMENT
FIGURE 6**

**GRILL MUST
ATTACH
TO FRONT PANEL
AS SHOWN**



(NOTE: Serial number information can be found in several places:

1. **Unit shipping box**
2. **Label on lower right side panel of unit**
3. **Blue and Silver listing label on bottom panel inside the fan compartment.**
4. **The Owner Registration Card provided with the manual has been labeled with unit serial number information at the factory.)**

•ROOM THERMOSTAT INSTALLATION

EXT units come standard with an on-board low voltage room temperature thermostat mounted on the front panel.

For units not equipped with on-board thermostat (S or EXT series), mount room thermostat on an interior wall near the room entrance at a height of five feet from floor level. Choose location to ensure thermostat will be unaffected by drafts, sunlight, or other sources of heat or cold.

Line or low voltage thermostats are available. If line voltage is desired, order Steffes thermostat #1300000. If low voltage is desired, order Steffes low voltage thermostat item #1300002 which provides low voltage control of fan operation; however, low voltage contact is required for element control. Steffes thermostat, item #1300007 has a built in clock which provides low voltage control of element charging and fan operation with no other element control device required. On S series units, both low voltage thermostats must be used in conjunction with the Steffes low voltage control module, item #1300004.

4. APPENDIX

A. UNIT SPECIFICATIONS - TABLE 3

MODEL	212		312		412		512		612	
	S	EXT	S	EXT	S	EXT	S	EXT	S	EXT
Length - inches	22	28	30	36	38	44	46	52	54	60
Height - inches	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5
Depth - inches (w/out wall bracket)	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75	9.75
Number of Bricks	18	18	27	27	36	36	45	45	54	54
Weight of Bricks-lbs	182	182	273	273	364	364	455	455	546	546
Installed Weight-lbs	255	262	365	372	480	487	592	599	706	713
*Element Voltage-Std (277V & 208V opt. all series 120 V opt. EXT series, 1.32 kW maximum)	240	240	240	240	240	240	240	240	240	240
*Fan Voltage - Std. (Standard output - 115, 208 & 277 opt.) (High output - 115 opt.)	230	230	230	230	230	230	230	230	230	230
*Chg Ctrl Resistor Wattage Voltage (Consult factory for optional voltages.)	12.8 240	N/A N/A	12.8 240	N/A N/A	12.8 240	N/A N/A	12.8 240	N/A N/A	12.8 240	N/A N/A
Number of Fans	1	1	1	1	2	2	2	2	2	2
Fan Wattage - each Standard Output High Output	12 N/A	12 80	28 N/A	28 80	15 N/A	15 80	15 N/A	15 N/A	28 N/A	28 N/A
On-Peak Capacity kWh BTU	13.5 46,062	13.5 46,062	20.25 69,093	20.25 69,093	27 92,124	27 92,124	33.75 115,155	33.75 115,155	40 136,480	40 136,480
Max. Daily Output 8 hour charge kWh BTU	19 64,828	** 81,888	29 98,948	** 122,832	38 129,656	** 163,770	48 163,776	** 204,720	58 197,896	** 245,664
Max. Daily Output 12 hour charge kWh BTU	29 98,948	** 122,832	43 146,716	** 184,248	58 197,896	** 245,664	72 245,664	** 307,080	86 293,432	** 368,496

**See Unit Identification label on lower right side panel of unit for proper voltages.*

***With 1500 watt elements and high output fans.*

B. WIRING

FIELD CONNECTION WIRING TABLE 4


WIRE SIZE	MAXIMUM kW		
	240VAC	277VAC	208VAC
#14 AWG	2.8	3.3	2.4
#12 AWG	3.8	4.4	3.3
#10 AWG	5.7	6.6	4.9
#8 AWG	7.6	8.8	6.6
#6 AWG	11.5	13.2	9.9

Use copper wire rated at 75°C minimum, only.

NOTES:

1. 512 and 612, S and EXT series units, are equipped with a two circuit element feed option. If dual feed is used, see unit identification label located on right side panel for proper sizing of each circuit. Charge Circuit #1 + Charge Circuit #2 = Total Wattage.
2. The field connection wire size guide reflects only the code interpretation of Steffes ETS. It is the responsibility of the installer to follow all applicable codes and regulations for the installation.

UNIT IDENTIFICATION LABEL FIGURE 7

Steffes ETS, Dickinson, ND				Electric Air Heater		
Manufactured in U.S.A.		VAC	Watts			
Model		Charge Crct #1				
S/N		Charge Crct #2				
Options		Fan/Cntrl Crct				
U.S. Patent #5.042.081		Temp Cntrl Crct				

UNIT WIRING TABLE 5

WIRE COLOR	CONNECTION TERMINALS	CIRCUIT DESCRIPTION
Black	L1 and L2 terminals on main terminal block.	Right heating element circuit. (Charge circuit #1)
Red	L1 and L2 terminals on auxilliary terminal block. (512 and 612 units only)	Left heating element circuit. (Charge circuit #2)
Blue	F1 and F2 terminals on main terminal block with S series only. F1 and F3 terminals on main terminal block with EXT series only.	Fan and control circuit.
Orange	A1 and A3 terminals on main terminal block with S series only.	Automatic charge control circuit.

See Unit Identification Label on lower right side of unit for proper fan and element voltages.

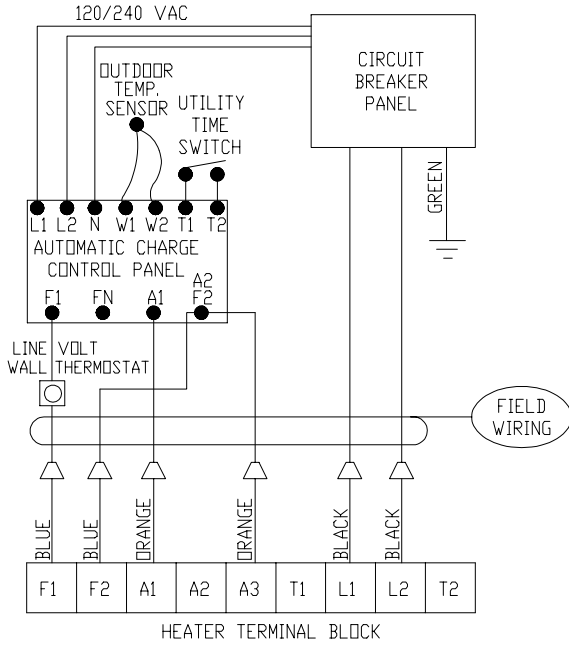
TYPICAL SYSTEM WIRING DIAGRAMS

Connections shown are for 230 VAC fans.

See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.
(Refer to the Face Plate Diagrams to determine which circuit board your heater incorporates.)

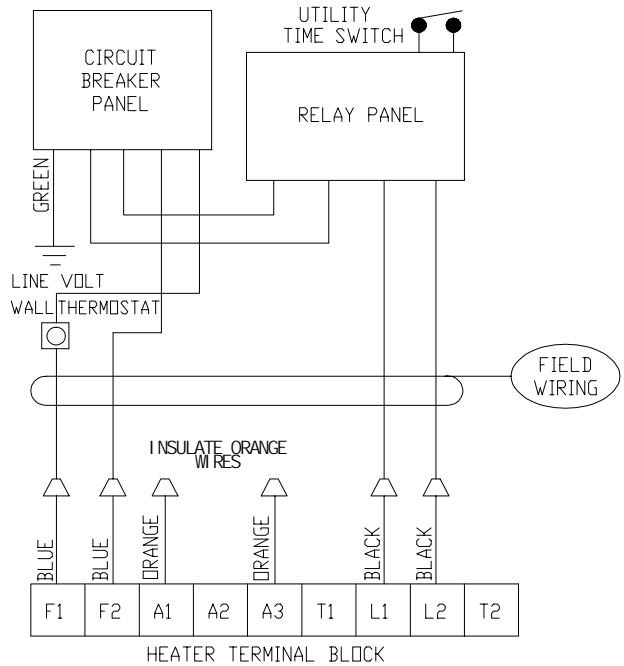
S Series - Automatic Charge Control

FIGURE 8



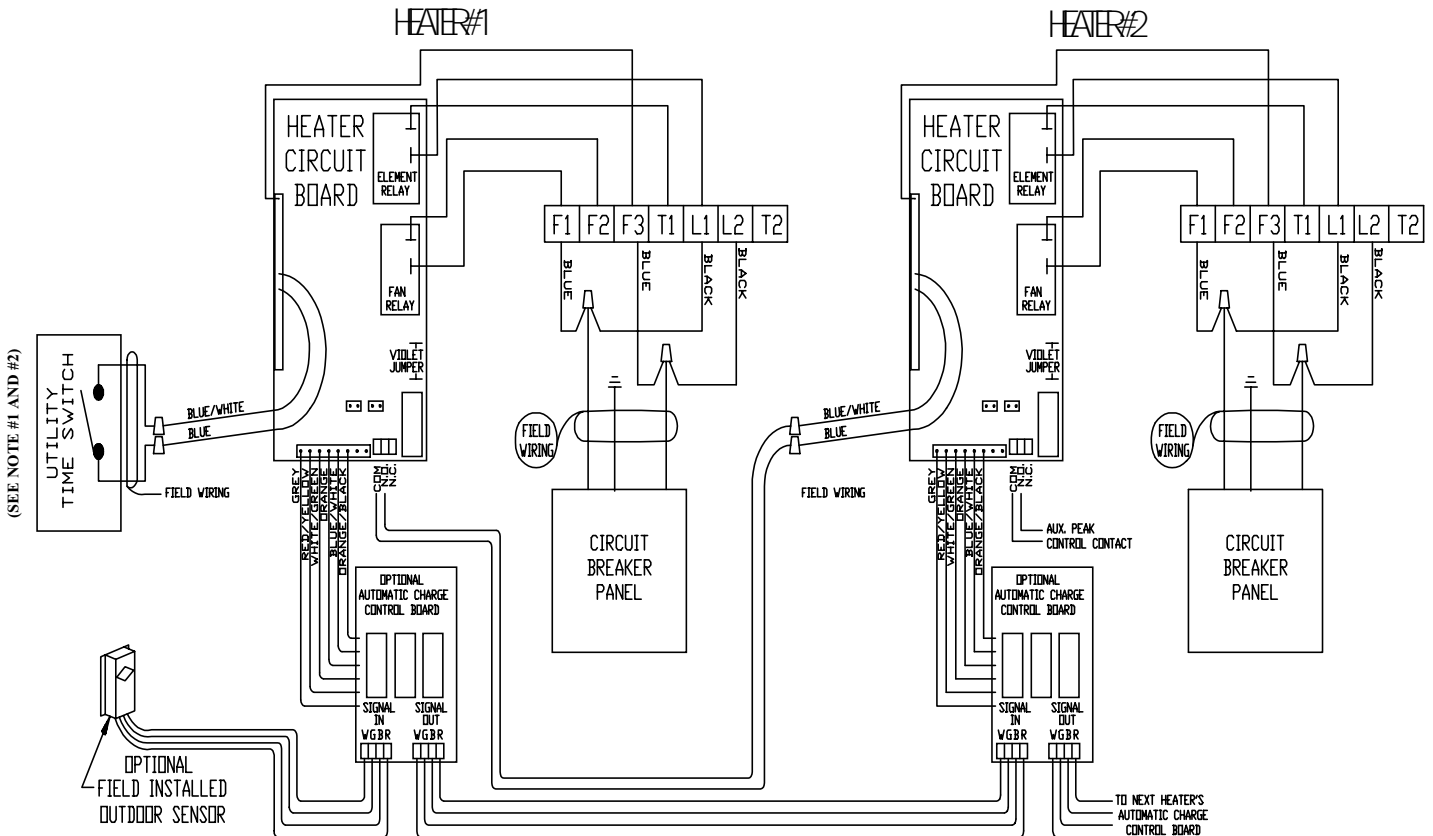
S Series - Manual Charge Control

FIGURE 9



EXT Series - Automatic or Manual Charge Control
(shown with two-mode circuit board)

FIGURE 10



TYPICAL SYSTEM WIRING DIAGRAMS CONTINUED...

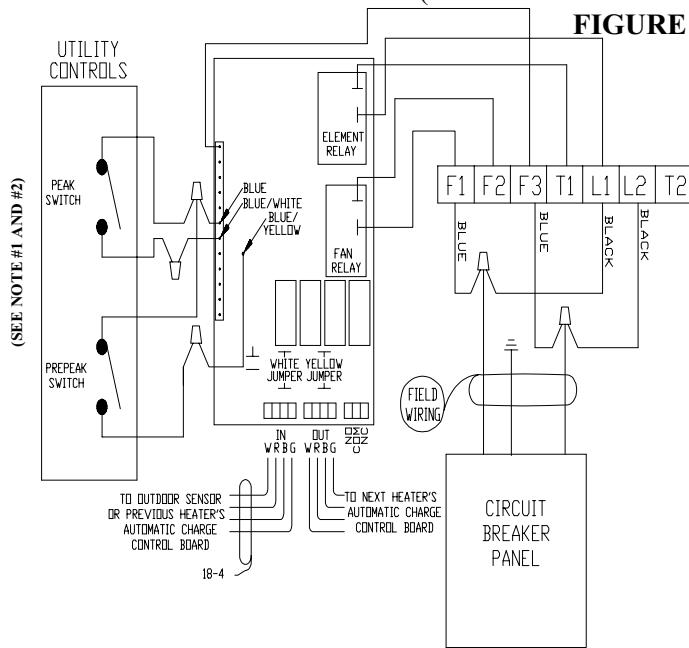
Connections shown are for 230 VAC fans.

See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.

(Refer to the Face Plate Diagrams to determine which circuit board your heater incorporates.)

EXT Series - Automatic or Manual Charge Control (shown with multi-mode circuit board)

FIGURE 11



NOTES FOR FIGURES 10 & 11:

#1: Never apply any external voltage to the Blue and Blue/White Low Voltage Conductors.

#2: Peak Control Sequencer cannot be used if utility time switch is connected to Blue and Blue/White wires.

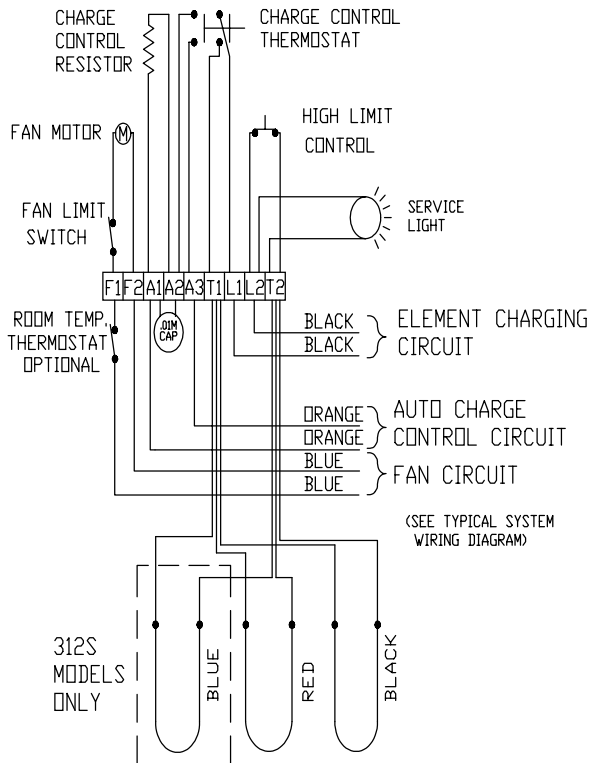
UNIT WIRING DIAGRAMS - S SERIES

Connections shown are for 230 VAC fans.

See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.

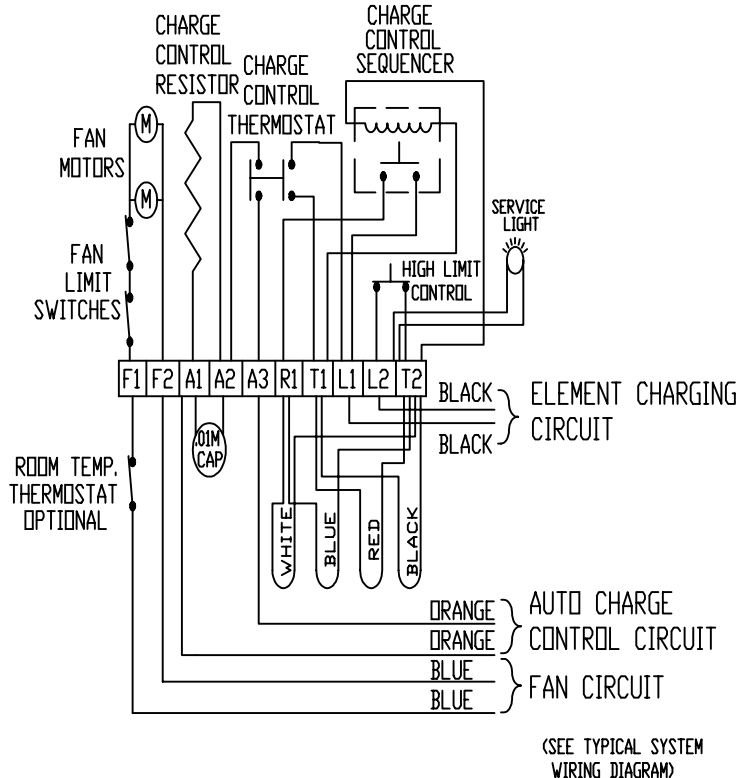
Models: 212S - 312S

FIGURE 12



Model: 412S

FIGURE 13



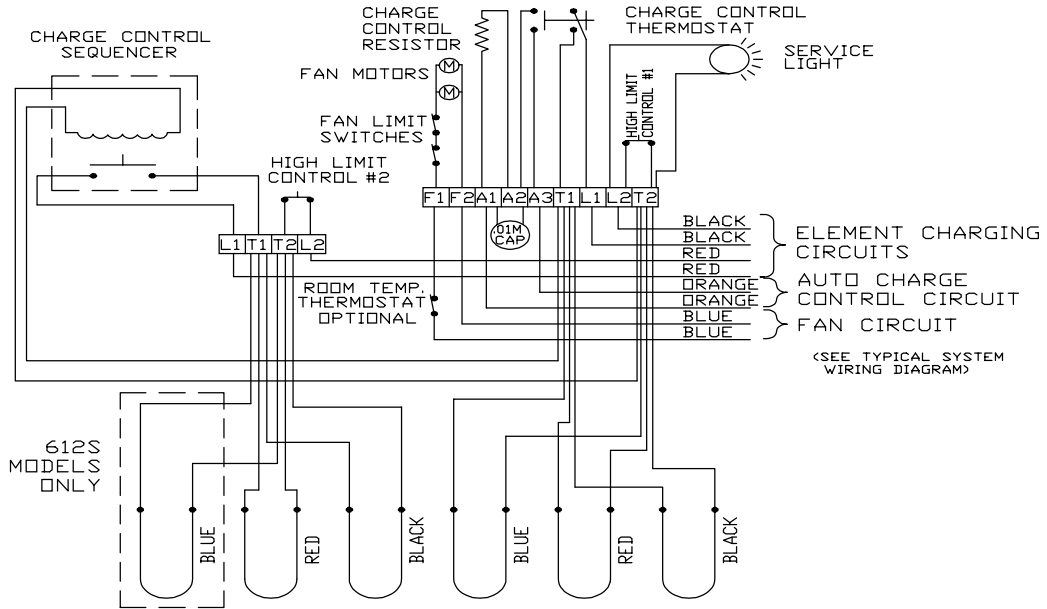
UNIT WIRING DIAGRAMS - S SERIES CONTINUED...

Connections shown are for 230 VAC fans - See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.

(Refer to the Face Plate Diagrams to determine which circuit board your heater incorporates.)

Models: 512S - 612S

FIGURE 14



UNIT WIRING DIAGRAMS - EXT SERIES

Connections shown are for 230 VAC fans.

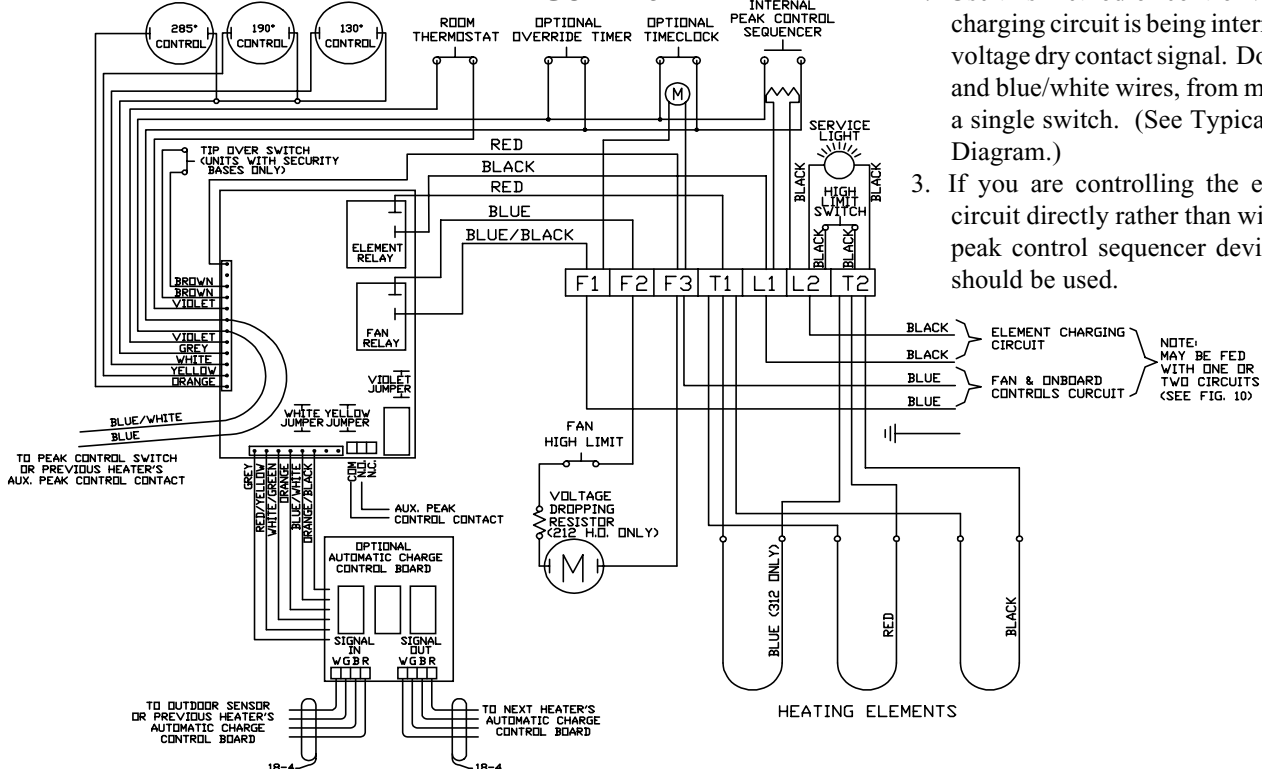
See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.

(Refer to the Face Plate Diagrams to determine which circuit board your heater incorporates.)

Models: 212EXT - 312EXT

(shown with two-mode circuit board)

FIGURE 15



NOTES FOR FIGURE 15:

1. See Typical System Wiring Diagram.
2. Use this method of control when the element charging circuit is being interrupted with a low voltage dry contact signal. Do not parallel blue and blue/white wires, from multiple heaters to a single switch. (See Typical System Wiring Diagram.)
3. If you are controlling the element charging circuit directly rather than with low voltage, a peak control sequencer device (see Table 2) should be used.

UNIT WIRING DIAGRAMS - EXT SERIES CONTINUED . . .

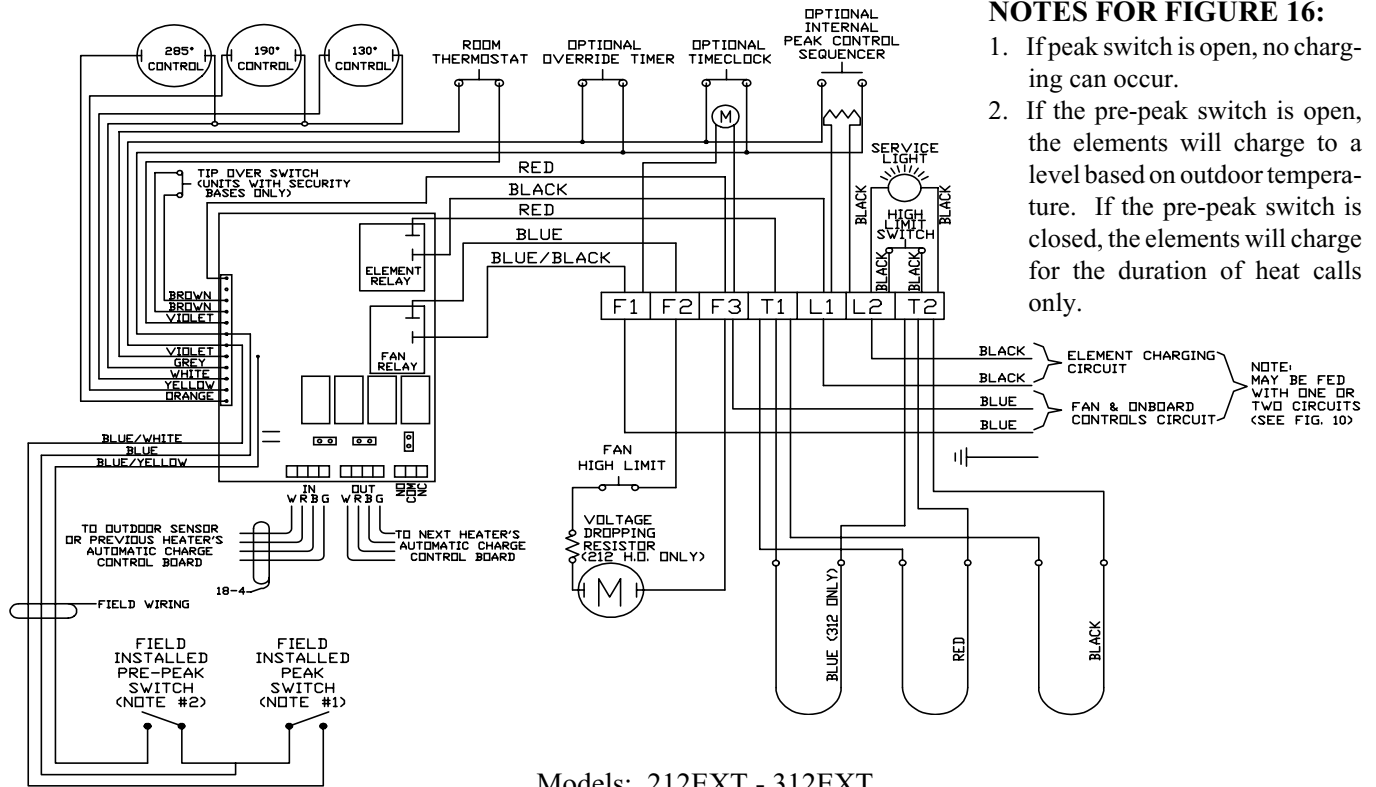
Connections shown are for 230 VAC fans.

See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.

(Refer to the Face Plate Diagrams to determine which circuit board your heater incorporates.)

Models: 212EXT - 312EXT
(shown with multi-mode circuit board)

FIGURE 16

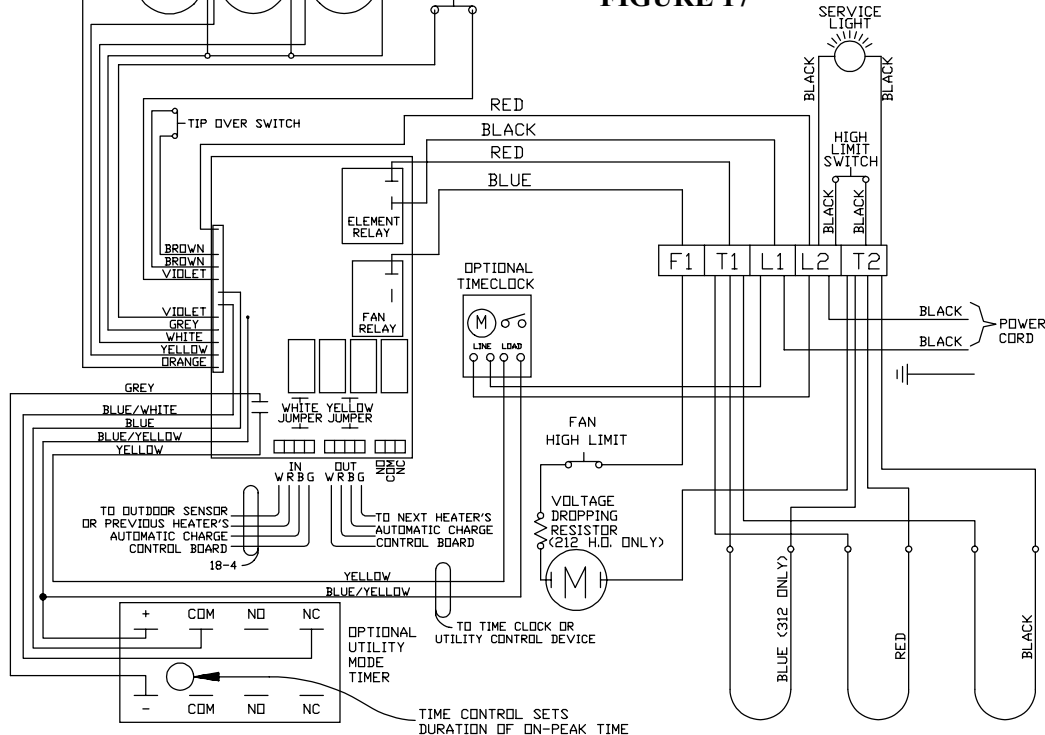


NOTES FOR FIGURE 16:

1. If peak switch is open, no charging can occur.
2. If the pre-peak switch is open, the elements will charge to a level based on outdoor temperature. If the pre-peak switch is closed, the elements will charge for the duration of heat calls only.

Models: 212EXT - 312EXT
(shown with multi-mode circuit board
and 120 Volt cord connected)

FIGURE 17



UNIT WIRING DIAGRAMS - EXT SERIES CONTINUED...

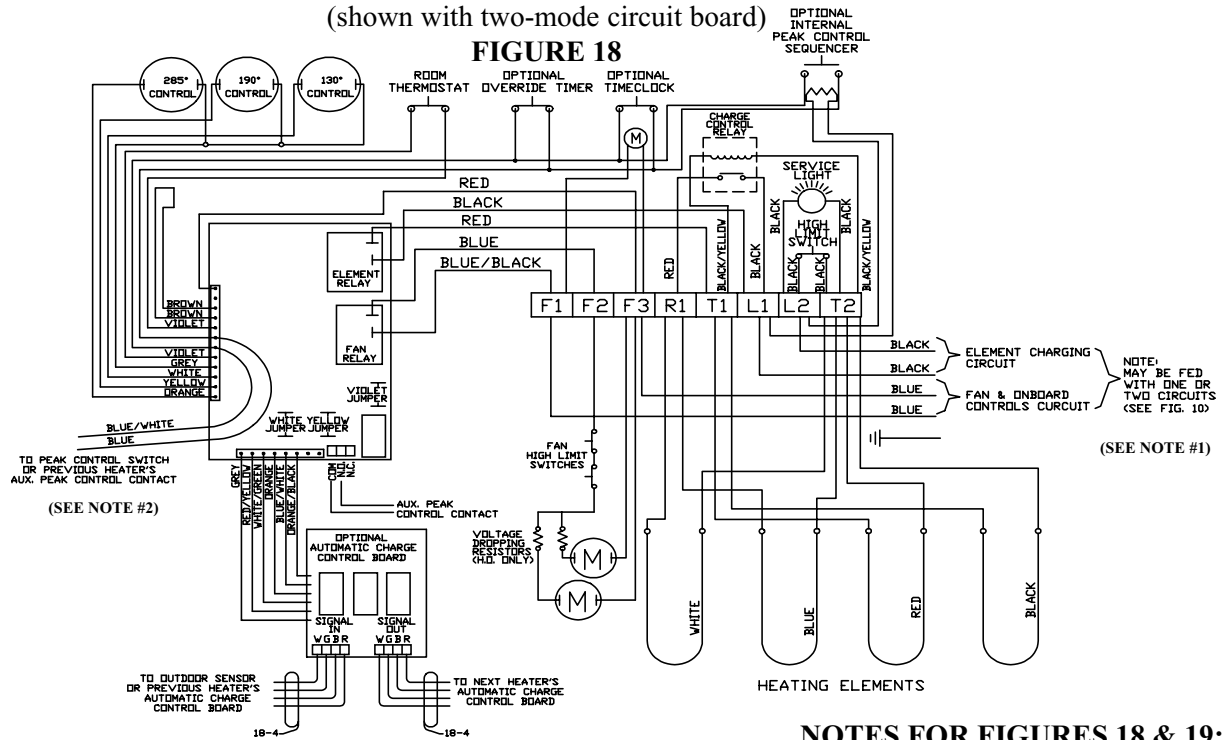
Connections shown are for 230 VAC fans.

See Unit Identification Label on lower right side panel of unit for proper fan and element voltages.
(Refer to the Face Plate Diagrams to determine which circuit board your heater incorporates.)

Model: 412EXT

(shown with two-mode circuit board)

FIGURE 18

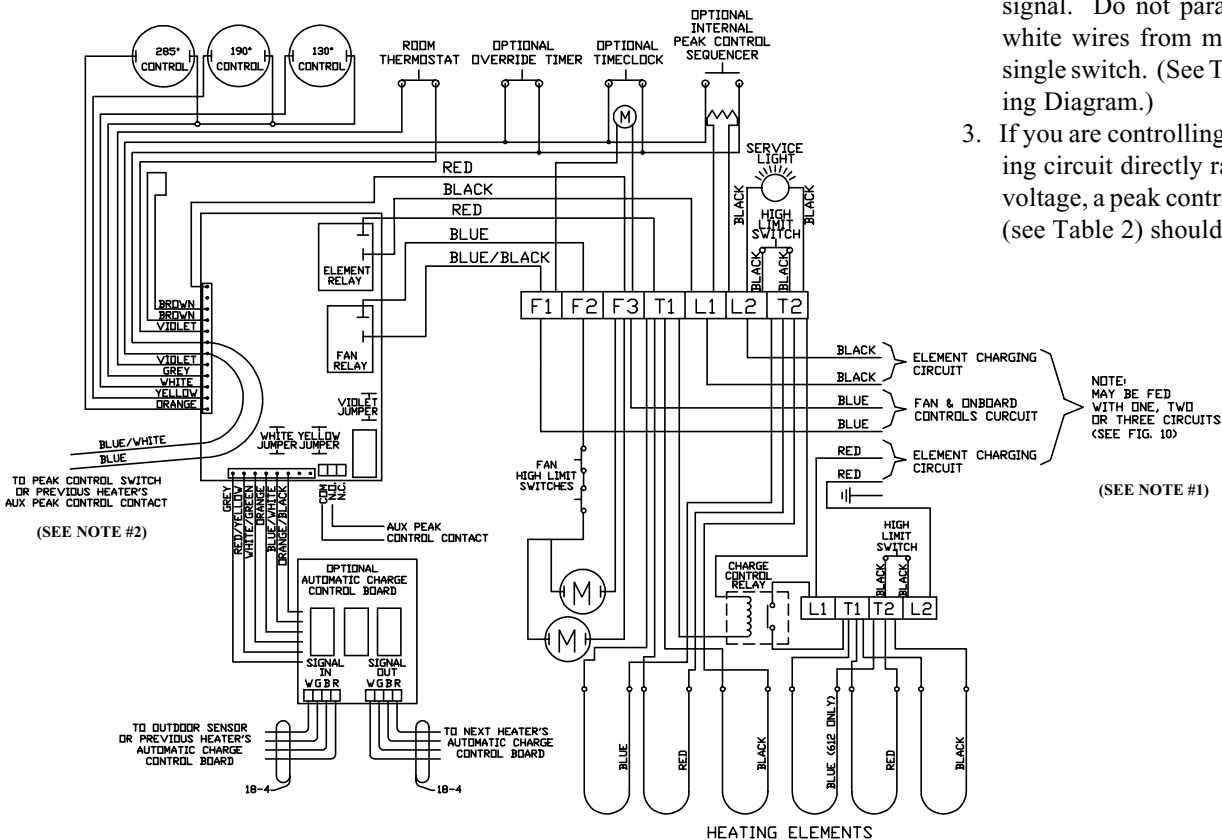


NOTES FOR FIGURES 18 & 19:

1. See Typical System Wiring Diagram.
2. Use this method of control when the element charging circuit is being interrupted with a low voltage dry contact signal. Do not parallel blue and blue/white wires from multiple heaters to a single switch. (See Typical System Wiring Diagram.)
3. If you are controlling the element charging circuit directly rather than with low voltage, a peak control sequencer device (see Table 2) should be used.

Models: 512EXT - 612EXT
(shown with two-mode circuit board)

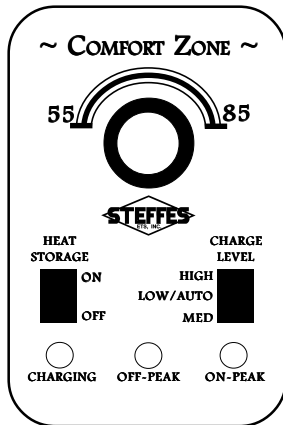
FIGURE 19



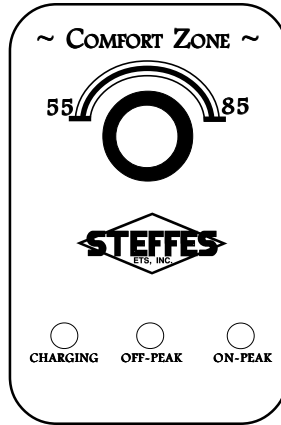
CIRCUIT BOARD FACE PLATES - EXT SERIES

(NOTE: When reading the Typical System Wiring Diagrams and Unit Wiring Diagrams, use these schematics to determine which circuit board your heater incorporates.)

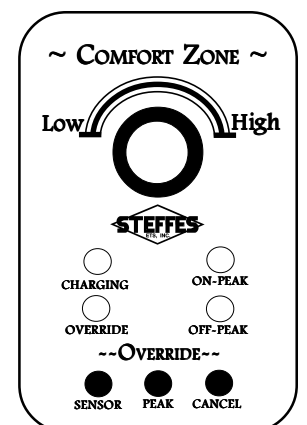
**TWO-MODE
FIGURE 20**



**MULTI-MODE
FIGURE 21**

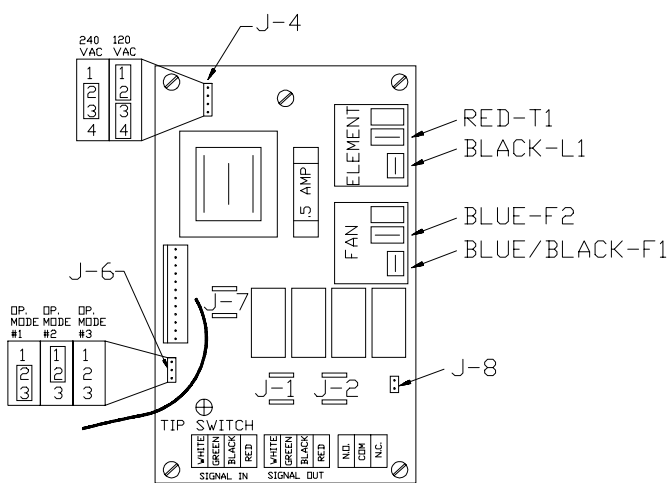


**VARIABLE CHARGE
FIGURE 22**

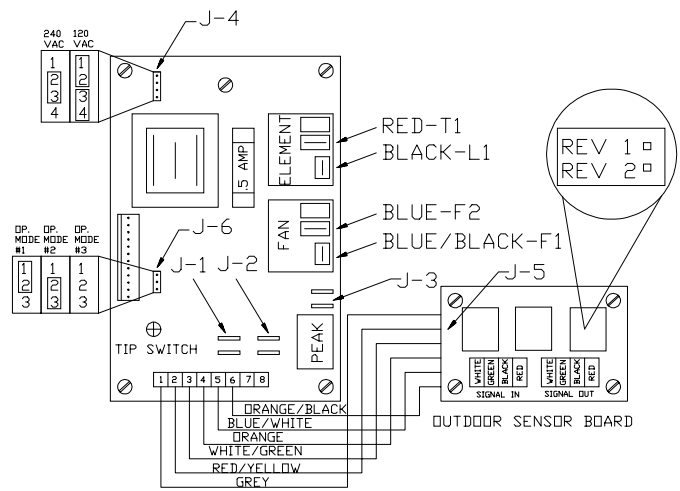


CHARGE CONTROL CIRCUIT BOARD CONFIGURATORS - EXT SERIES

**Multi-Mode Circuit Board Configurator
FIGURE 23**



**Two-Mode Circuit Board Configurator
FIGURE 24**



Jumper Configurations

Jumper

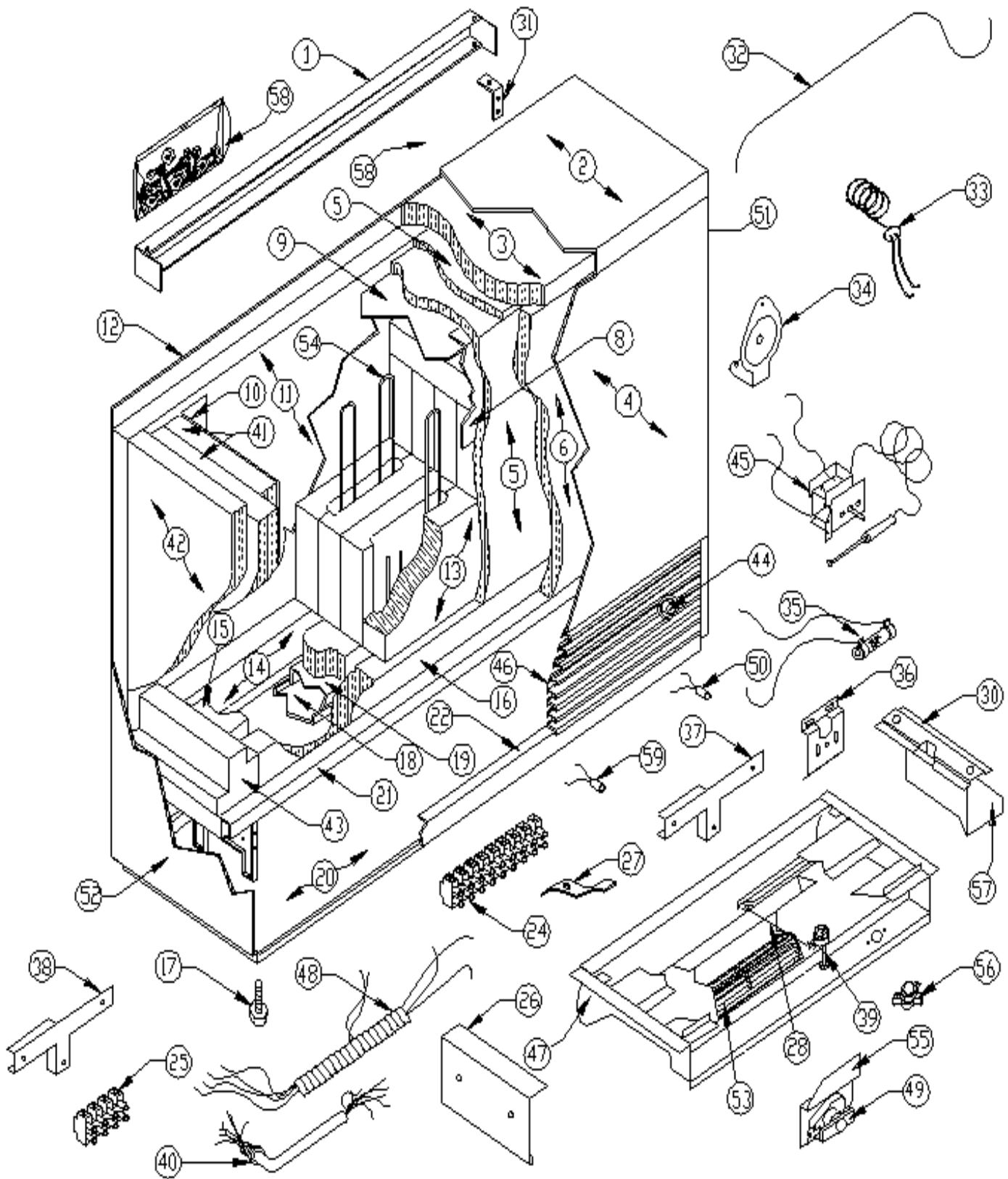
Connections

- J-1** Connected with a jumper in all modes except when using automatic charge control with two-mode circuit boards.
- J-2** Always connected with jumper.
- J-3** Connected with violet jumper except when fans are to be disabled during the charge period.
- J-4** Input voltage selector: When fan circuit input voltage is 208-240 VAC, J4-2 to J4-3 are connected. When fan circuit input voltage is 120 VAC, J4-1 to J4-2 and J4-3 to J4-4 are connected.
- J-5** Factory wired with plug-in header connector.
- J-6** Fan run time based charging jumper: In OP. MODE #1, off-peak heat call can bring core to a 1/3 charge level when no other charging method is being used. OP. MODE #2 will allow off-peak heat calls to bring core to full charge. OP. MODE #3 will not allow core charging based on fan run time (positive off).
- J-7** 24 VDC output from circuit board used for auxiliary control devices or to run peak and pre-peak signals on DC power rather than AC power.
- J-8** When connected, enables fans during pre-peak charging mode.

C. EXPLODED VIEW DIAGRAM - S SERIES

FIGURE 25

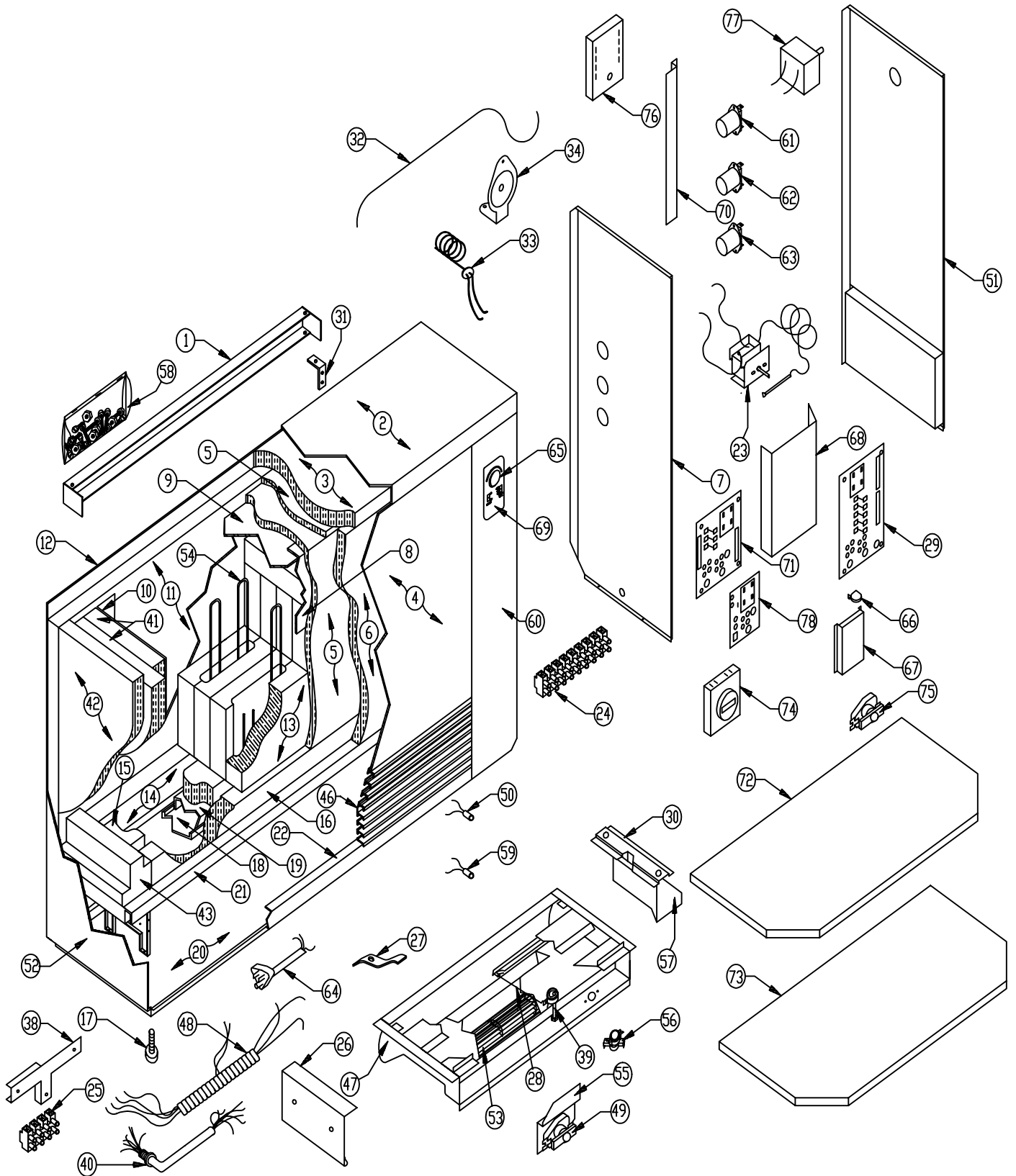
(Note: Refer to the Room Unit Parts List for part descriptions and order item numbers.)



D. EXPLODED VIEW DIAGRAM - EXT SERIES

FIGURE 26

(Note: Refer to the Room Unit Parts List for part descriptions and order item numbers.)



E. ROOM UNIT PARTS LIST - S AND EXT SERIES - TABLE 6
*(Note: When ordering replacement parts, please include unit model number and serial number.
Refer to Exploded View Diagrams for Drawing Reference Number.)*

DWG. REF. NO.	DESCRIPTION	212S ITEM#	212EXT ITEM#	312S ITEM#	312EXT ITEM#	412S ITEM#	412EXT ITEM#	512S ITEM#	512EXT ITEM#	612S ITEM#	612EXT ITEM#
1	Wall Support Bracket	1141010	1142000	1141012	1142001	1141014	1142002	1141016	1142003	1141018	1142004
2	Painted Panel, Top	1141142	1142010	1141143	1142011	1141144	1142012	1141145	1142013	1141146	1142014
3	1" Blanket Insulation, Top	1050010	1050010	1050011	1050011	1050012	1050012	1050013	1050013	1050014	1050014
4	Painted Panel, Front	1141147	1141147	1141148	1141148	1141149	1141149	1141150	1141150	1141151	1141151
5	1/2" Insulation Blanket, Front & Top	1050020	1050020	1050021	1050021	1050022	1050022	1050023	1050023	1050024	1050024
6	Insulation Panel, Front	1053000	1053000	1053002	1053002	1053004	1053004	1053006	1053006	1053008	1053008
7	Mid Side Panel	N/A	1142045	N/A	1142045	N/A	1142045	N/A	1142045	N/A	1142045
8	Aluminized Steel, Front	1140002	1140002	1140004	1140004	1140006	1140006	1140008	1140008	1140010	1140010
9	Aluminized Steel, Back & Top	1140012	1140012	1140014	1140014	1140016	1140016	1140018	1140018	1140020	1140020
10	Aluminized Steel Side	1142050	1142050	1142050	1142050	1142050	1142050	1142050	1142050	1142050	1142050
11	Insulation Panel, Back	1053000	1053000	1053002	1053002	1053004	1053004	1053006	1053006	1053008	1053008
12	Painted Panel, Back	1141135	1142020	1141136	1142021	1141137	1142022	1141138	1142023	1141139	1142024
13	Heat Storage Brick	1093007	1093007	1093007	1093007	1093007	1093007	1093007	1093007	1093007	1093007
14	Brick Support Insulation, Back	1052000	1052000	1052001	1052001	1052002	1052002	1052003	1052003	1052004	1052004
15	Brick Support Insulation, Center	1052011	1052011	1052012	1052012	1052013	1052013	1052014	1052014	1052015	1052015
16	Brick Support Insulation, Front	1052016	1052016	1052017	1052017	1052018	1052018	1052019	1052019	1052020	1052020
17	Leveling Leg	1159003	1159003	1159003	1159003	1159003	1159003	1159003	1159003	1159003	1159003
18	Element Tray Cover, Right (Std Output)	1141092	1142092	1141096	1141096	1141094	1141094	1141094	1141094	1141096	1141096
19	Element Tray Cover, Left	N/A	N/A	N/A	N/A	1141094	1141094	1141098	1141098	1141096	1141096
20	Element Tray (Std Output)	1141116	1141116	1141118	1141118	1141120	1141120	1141122	1141122	1141124	1141124
21	Painted Panel, Bottom	1141032	1142030	1141034	1142031	1141036	1142032	1141038	1142033	1141040	1142034
22	Brick Support Assembly (Std Output)	1141106	1141106	1141108	1141108	1141110	1141110	1141112	1141112	1141114	1141114
23	Grill Support Bracket	1141001	1142070	1141003	1142071	1141005	1142072	1141007	1142073	1141009	1142074
24	Room Thermostat Kit	N/A	1190114	N/A	1190114	N/A	1190114	N/A	1190114	N/A	1190114
25	Terminal Block Kit (Main)	1040063	1040240	1040063	1040240	1040064	1040240	1040063	1040240	1040063	1040240
26	Terminal Block Kit (Aux)	N/A	N/A	N/A	N/A	N/A	N/A	1040062	1040062	1040062	1040062
27	Fan Support Bracket	1140220	1140220	1140220	1140220	1140220	1140220	1140220	1140220	1140220	1140220
28	Element Retainer	1141104	1141104	1141104	1141104	1141104	1141104	1141104	1141104	1141104	1141104
29	Bimetallic Linkage	1140001	1140001	1140001	1140001	1140001	1140001	1140001	1140001	1140001	1140001
30	Charge Control Circuit Board	N/A	*	N/A	*	N/A	*	N/A	*	N/A	*
31	Center Fan Track Assembly	N/A	N/A	N/A	N/A	N/A	N/A	1140242	1040242	N/A	N/A
32	Wall Support Clip	1141020	1141020	1141020	1141020	1141020	1141020	1141020	1141020	1141020	1141020
33	High Limit Guide Tube, Right	1105005	1105005	1105006	1105006	1105007	1105007	1105008	1105008	1105011	1105011
34	High Limit Guide Tube, Left	N/A	N/A	N/A	N/A	N/A	N/A	1105009	1105009	1105010	1105010
35	Core Charging High Limit	1012000	1012000	1012000	1012000	1040056	1040056	1012000	1012000	1012000	1012000
36	Core Charging High Limit Mtg. Brkt.	1140190	1140190	1140190	1140190	1140190	1140190	1140190	1140190	1140190	1140190
37	Chg Ctrl Resistor, 4500 Ohm (240 VAC)	1040252	N/A	1040252	N/A	1040252	N/A	1040252	N/A	1040252	N/A
38	Charge Control Mounting Bracket	1142100	N/A	1142100	N/A	1142100	N/A	1142100	N/A	1142100	N/A
39	T-Block Mounting Bracket (Main)	1141084	N/A	1141084	N/A	1141084	N/A	1141084	N/A	1141084	N/A

F. ROOM UNIT TROUBLESHOOTING GUIDES

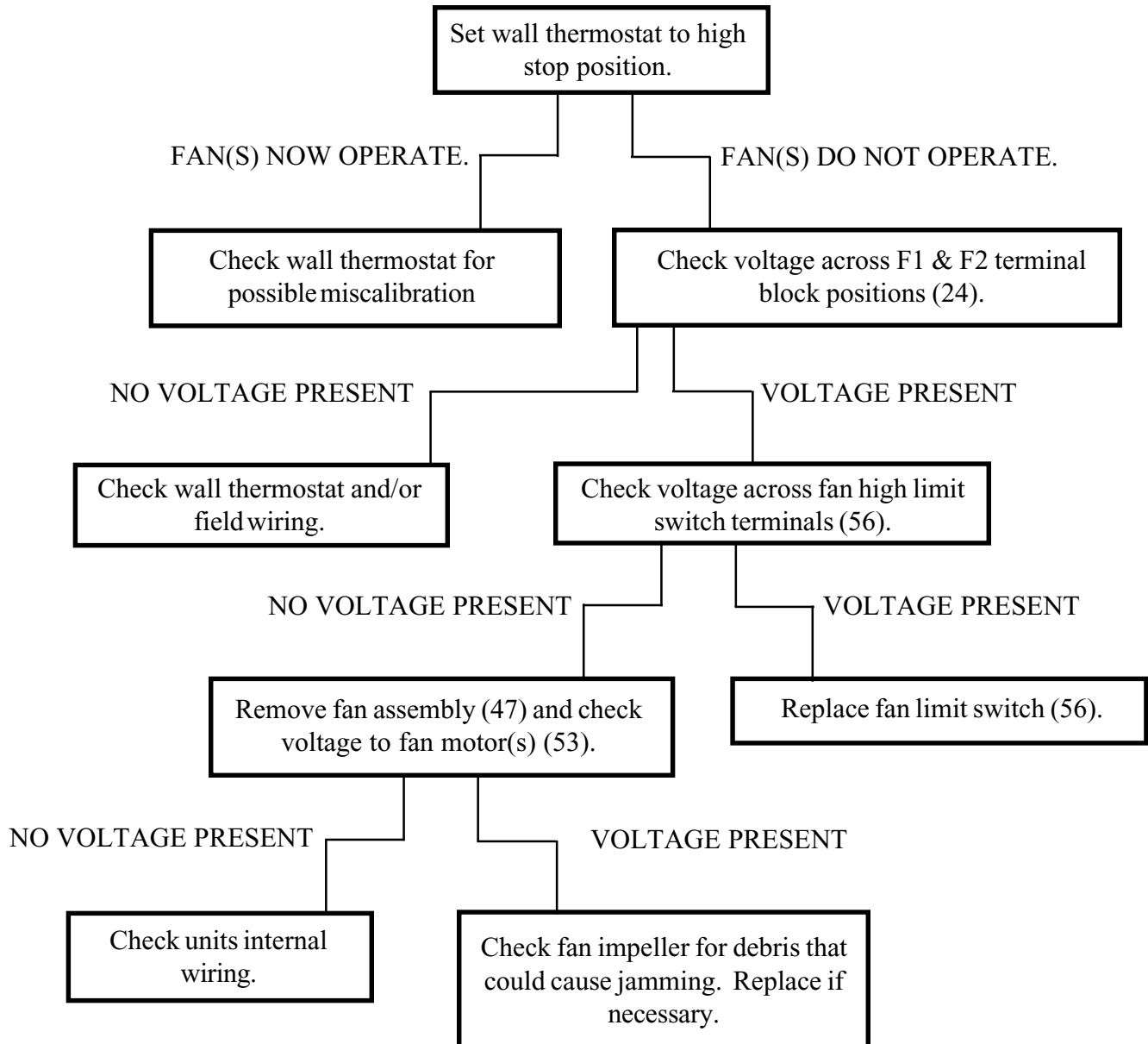
Model: S Series Only

Function: Air Delivery

Problem: Fan(s) do not operate.

Before starting any procedures listed below, check room thermostat and circuit breaker settings.

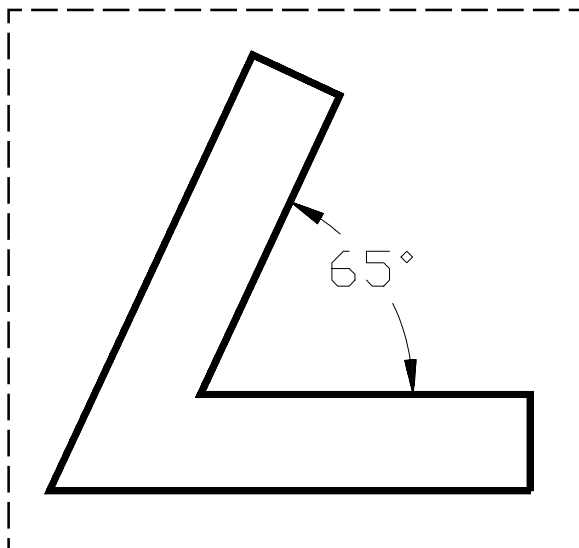
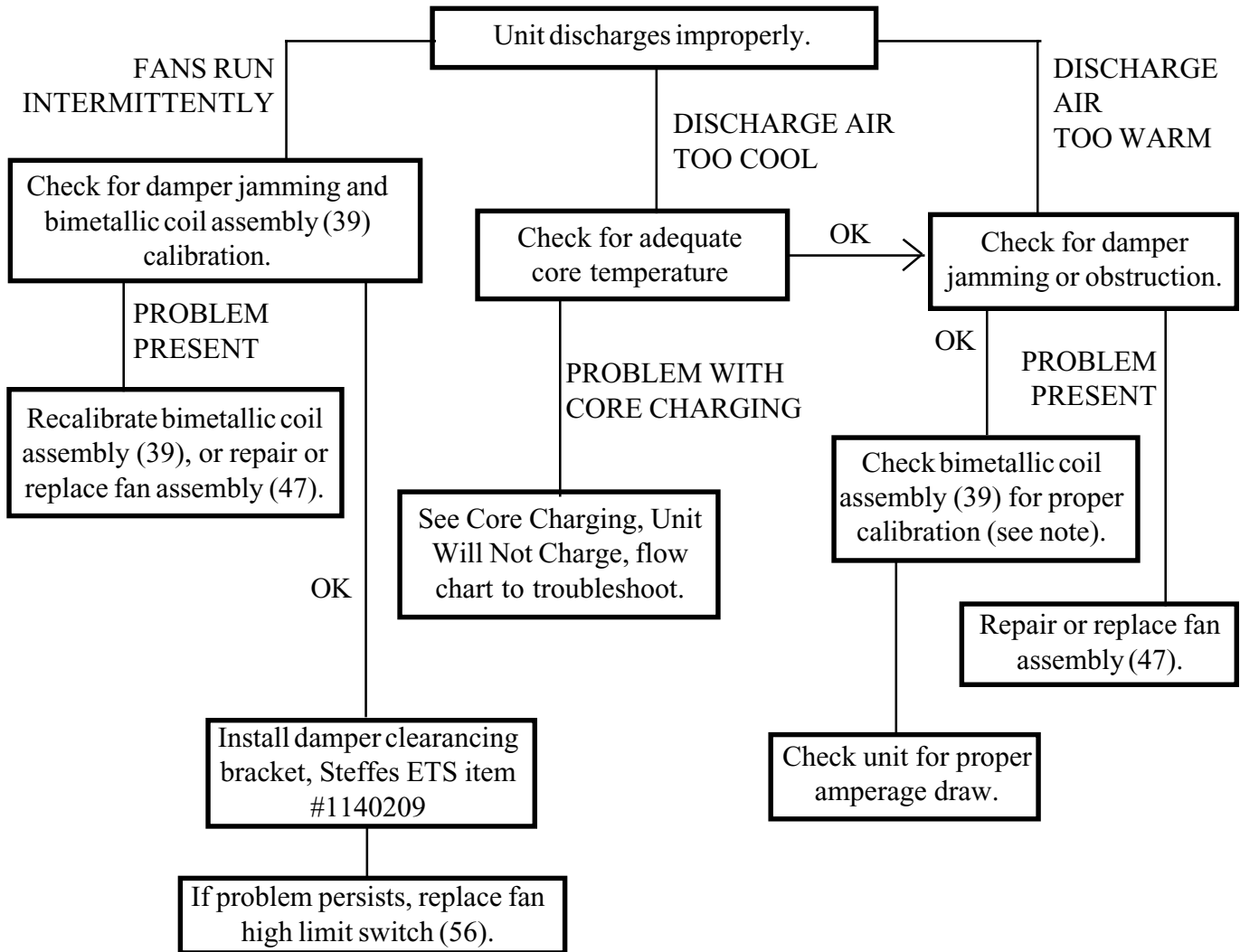
Note: For cross reference to number coded components, see figure 7.



Model: S Series Only
Function: Air Delivery
Problem: Improper Air Discharge.

Before starting any procedures listed below, check room thermostat and circuit breaker settings.

Note: For cross reference to number coded components, see figure 7.

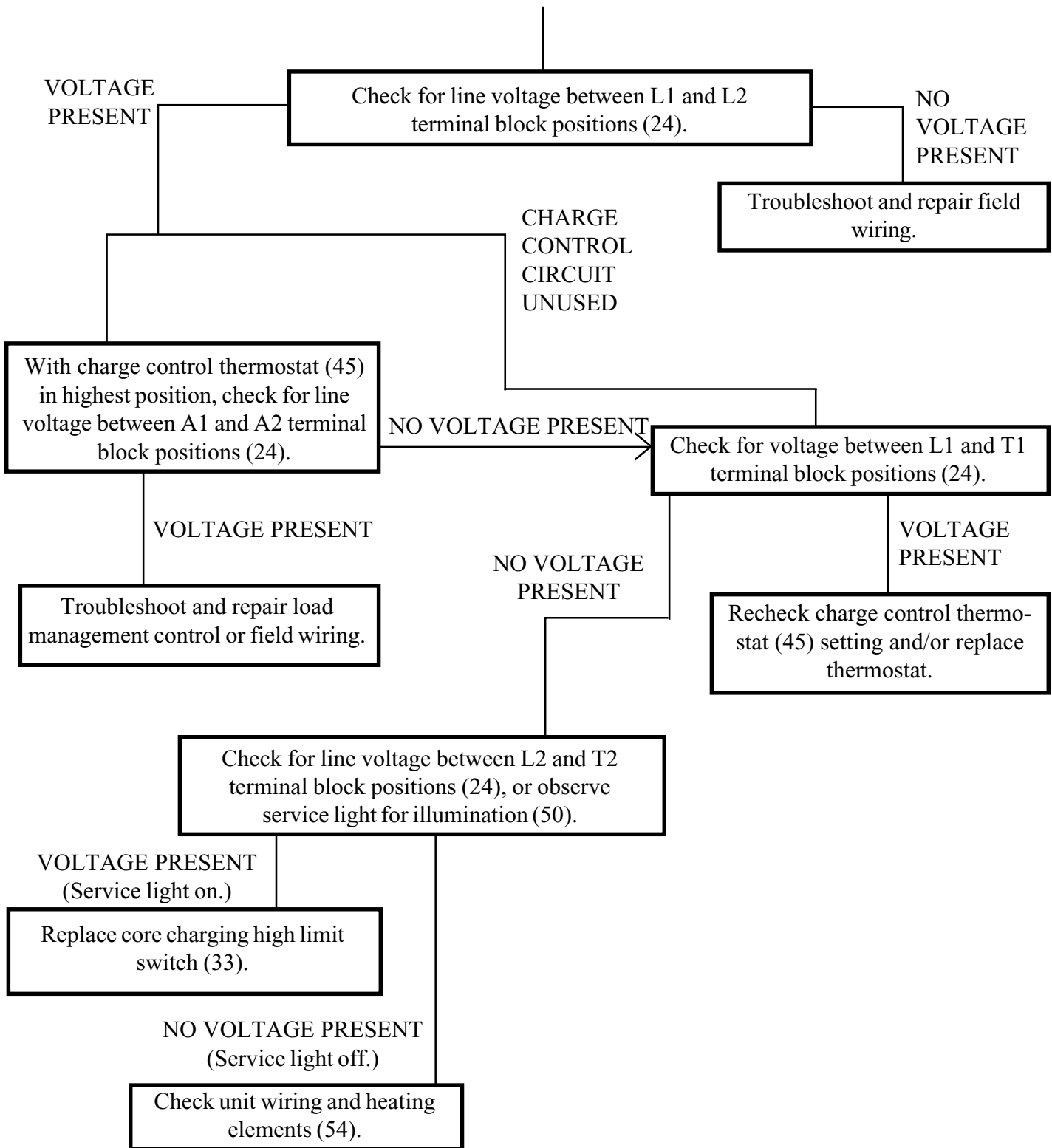


NOTE: To test the bimetallic coil assembly, it must be completely cold. Either allow room unit to cool completely or remove fan assembly and cool to room temperature. Once the coil is cold, disconnect the damper linkage and let the bimetallic coil go to its relaxed position. The bimetallic coil on units equipped with air deflectors should be calibrated at a 90° angle from the front of the fan assembly. The bimetallic coil of units not equipped with an air deflector are calibrated at a 65° angle from the front of the fan assembly. Use the cutout gauge on the left for checking this calibration. (To determine whether the unit is equipped with an air deflector, these deflectors would be located in fan assembly behind bimetallic coil.)

Model: S Series Only
Function: Core Charging
Problem: Unit will not charge.

Before starting any procedures listed below, check room thermostat and circuit breaker settings.

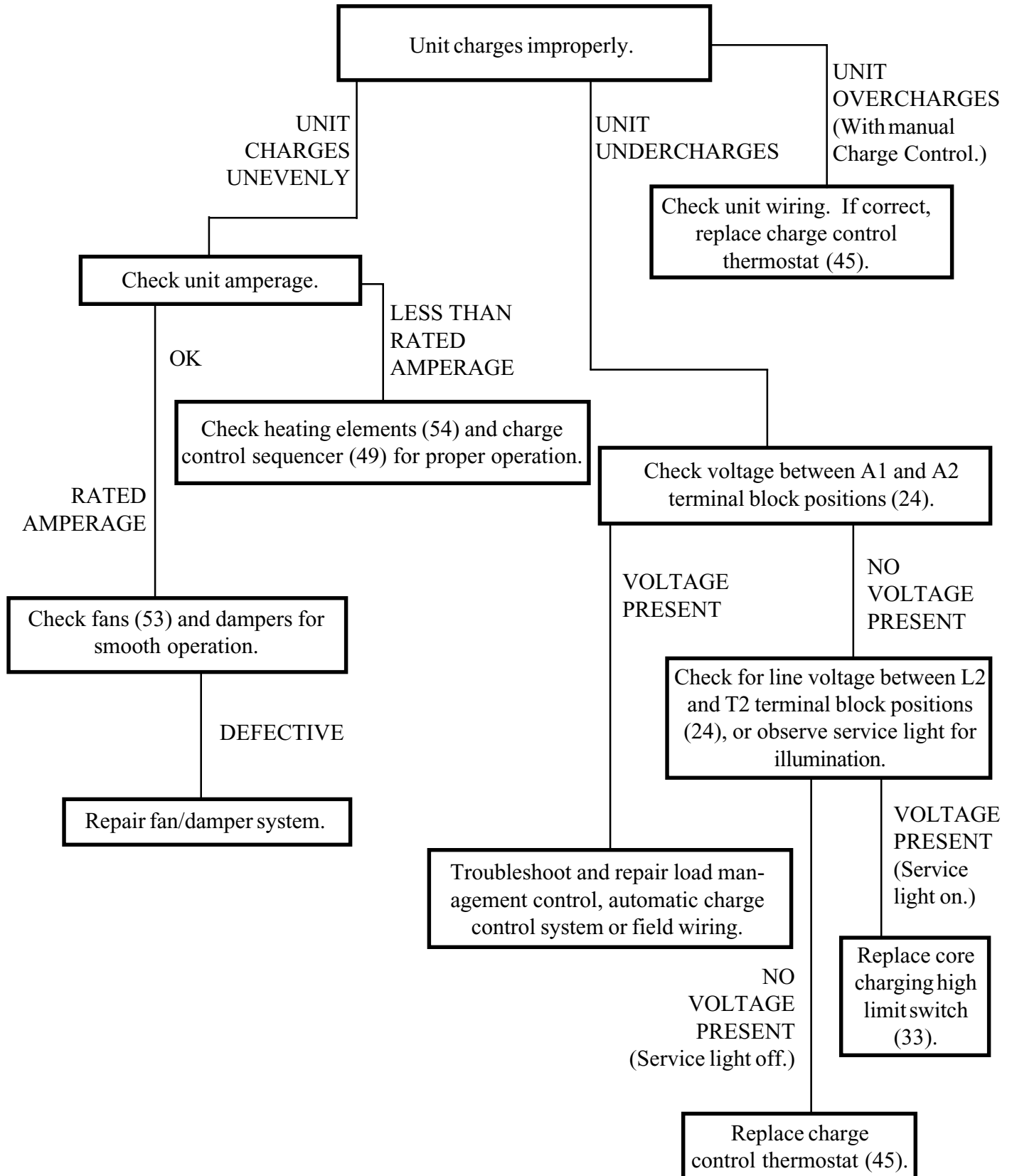
Note: For cross reference to number coded components, see figure 7.



Model: S Series Only
Function: Core Charging
Problem: Improper Charging

Before starting any procedures listed below, check room thermostat and circuit breaker settings.

Note: For cross reference to number coded components, see figure 7.



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.



3050 Highway 22 North
Dickinson, ND 58601-9413

"Commitment to Innovation"

ITEM NO. 1200050