



# SURE FLAME<sup>®</sup>

## SE400 & SE400T CONSTRUCTION HEATERS



November 7, 2012 Rev: 1.2 974-9909  
**SERVICE AND MAINTENANCE MANUAL**  
**PLEASE RETAIN FOR FUTURE REFERENCE**

### SURE FLAME<sup>®</sup> PRODUCTS

A Division of Haul-All Equipment Ltd.  
4115 - 18 Avenue North  
Lethbridge, Alberta T1H 5G1  
[www.sureflame.com](http://www.sureflame.com)

# SE400 CONSTRUCTION HEATER



## GENERAL HAZARD WARNING

Failure to comply with the precautions and instructions provided with this heater, can result in death, serious bodily injury and property loss or damage from hazards of fire, explosion, burn, asphyxiation, carbon monoxide poisoning, and/or electrical shock.

Only persons who can understand and follow the instructions should use or service this heater.

If you need assistance or heater information such as an instruction manual, labels, etc. Contact the manufacturer.



## WARNING

Fire, burn, inhalation, and explosion hazard. Keep solid combustibles, such as building materials, paper or cardboard, a safe distance away from the heater as recommended by the instructions. Never use the heater in spaces which do or may contain volatile or airborne combustibles, or products such as gasoline, solvents, paint thinner, dust particles or unknown chemicals.



## WARNING

**Not for home or recreational vehicle use**

# READ THIS WARNING FIRST !

The heater is designed and approved for use as a construction heater under CSA 2.14a-2007. The primary purpose of construction heaters is to provide temporary heating of buildings under construction, alteration, or repair and to provide temporary emergency heat. Properly used, the heater provides safe economical heating. Products of combustion are vented into the area being heated.

The heater is not designed as an Unvented Gas Fired Room Heater under ANSI-Z21.11.2 and should not be used in the home.

ANSI A119.2(NFPA 501C)-1987 Recreational Vehicle Standard prohibits the installation or storage of LP-Gas containers even temporarily inside any recreational vehicle. The standard also prohibits the use of Unvented Heaters in such vehicles.

**Gas inspection authorities in Canada require that the installation and maintenance of heaters and accessories be accomplished by qualified gas fitters.**

**Installation must comply with local codes, and with the *Natural Gas and Propane Installation Code CSA-B149.1*.**

We cannot anticipate every use which may be made for our heaters. CHECK WITH YOUR LOCAL FIRE SAFETY AUTHORITY IF YOU HAVE QUESTIONS ABOUT LOCAL REGULATIONS.

Other standards govern the use of fuel gases and heat producing products in specific applications. Your local authority can advise you about these.

# SE400/SE400T CONSTRUCTION HEATER

## FOR YOUR SAFETY

**DO NOT USE THIS HEATER IN A SPACE WHERE  
GASOLINE OR OTHER LIQUIDS HAVING  
FLAMMABLE VAPOURS ARE STORED OR USED.**

## CONTENTS

Specifications .....	5
Installation .....	6
Installation Using A Propane Supply Tank.....	7
Installation For Natural Gas Applications.....	7
Operating Instructions .....	8
Preventative Maintenance .....	9
Troubleshooting.....	10
SE400 Connection Wiring Diagram.....	12
SE400 Ladder Wiring Diagram.....	13
SE400T Connection Wiring Diagram.....	14
SE400T Ladder Wiring Diagram.....	15
SE400 Heater Parts.....	16
LPG - Propane Fuel Vaporization Rate .....	18

# SPECIFICATIONS

## Model No. SE400/SE400T Construction Heaters

Gases:	Natural or Propane
Capacity:	400,000 Btu/h (120 kW) maximum
Orifice Size:	11/64" (x6)
Inlet Air Flow:	1150 cfm (545 l/s) at 20°C (68°F)
Outlet Air Flow:	1800 cfm (850 l/s) at 186°C (367°F)
Electrical Rating:	120 volts, 60 Hz., 7.5 amps, single phase
Minimum Temperature:	-30°C (-22°F)
Maximum Duct Length:	32' (9.8 m)
Duct Diameter:	16" or 18"

## Gas Supply:

<u>Inlet Pressure</u>		<u>Manifold Pressure</u>
Max. W.C.	Min.W.C.	Max.W.C.
14" (3500 Pa)	8.0" (2000 Pa)	5.0" (1250 Pa)

(Minimum inlet pressure is for purpose of input adjustment)

# INSTALLATION

The Sure Flame Model SE400 Construction Heater is a direct fired gas heater intended to be used primarily for the temporary heating of buildings under construction, alteration, or repair. Since all the products of combustion are released into the area being heated, it is imperative that adequate ventilation is provided.

- 1 Install the heater in a horizontal position at least 10 feet (3m) from any LP-gas container. Allow the following clearances from any combustible materials:

Front Outlet:	12 feet (3.7 m)	Sides:	2 feet (0.6 m)
Intake:	2 feet (0.6 m)	Top:	5 feet (1.5 m)

Front Outlet must not be directed at any LP-gas container within 20 feet (6 m).

The heater is designed for use with up to 32 feet of 16" or 18" ductwork. Ductwork must be able to handle temperatures of up to 200°C (392°F). Only ductwork supplied by the manufacture shall be use with this heater.

Also make sure that no flammable vapours are present in the space where the heater is being used.

- 2 When connecting the heater to a natural gas or propane supply line ensure that the pressure at the heater inlet is within the specified range. Excessive pressure (over 1/2" psi) will damage the controls and void the warranty.
- 3 Visually inspect the hose assembly and ensure that it is protected from traffic, building materials, and contact with hot surfaces. If it is evident that there is excessive abrasion or wear, or the hose is cut, it must be replaced.
- 4 After installation, check the hose assembly for gas leaks by applying a water and soap solution to each connection.
- 5 Connect the heater to an adequate 120 volt electrical supply as specified on the rating plate. For protection against shock hazard the supply cord must be plugged directly into a properly grounded three-prong receptacle.

Note: Low Voltage (long extension cord or too many items on circuit) will shorten motor life.

## **INSTALLATION USING A PROPANE SUPPLY TANK**

- 1 When installing the heater for use with propane gas, set the gas selector valve to “Propane” and lock in position.
- 2 Arrange the propane supply system to provide for vapour withdrawal from the operating container. Supplying liquid propane to the heater is dangerous and will damage the components. Another regulator must be installed on the heater to reduce the pressure from this regulator to a maximum inlet pressure of 1/2 psi.
- 3 Ensure that for the surrounding temperature the size and capacity of the propane supply container is adequate to provide the rated Btu/h input to the heater.
- 4 Turn off the propane supply valve at the container when the heater is not in use.
- 5 The installation must conform with local codes and with *CSA-B149.1 Natural Gas and Propane Installation Code*.
- 6 When the heater is to be stored indoors the propane container must be disconnected from the heater and the container moved away and stored in accordance with the above national standards.

## **INSTALLATION FOR NATURAL GAS APPLICATIONS**

- 1 When installing the heater for use with natural gas, set the gas selector valve to the “Natural” position.
- 2 A regulator must be installed on the heater to ensure that the pressure to the heater does not exceed 1/2 psi inlet pressure.
- 3 The installation of this heater to a natural gas supply must conform with all applicable local codes and with *CSA-B149.1 Natural Gas and Propane Installation Code*.

# HEATER OPERATING INSTRUCTIONS

1) Set GAS SELECTOR VALVE to gas being used. The conversion shall only be done by the owner or lessor of the equipment.

**NOTE:** When using Propane Gas the SELECTOR VALVE must be locked in position.

2) Ensure valve is in the “ON” position.

3) Connect Power - 120 volt supply. Open gas supply.

4) Set switch to “HEAT” mode.

5) Push “START” button.

6) If equipped with a thermostat, set thermostat to desired temperature.

To stop, push the “STOP” button and turn gas off. Fan will continue operating for 60 second.

The appliance area should be kept clear and free from combustible materials, gasoline, and other flammable vapours and liquids.

Ensure that the flow of supply air and combustion gases is not obstructed.

The installation and operation of the heater shall comply with the code requirements specified by the authorities having jurisdiction.

General criteria for the use of construction heaters may be found in the applicable sections of the Natural Gas and Propane Installation Code CSA-B149.1.

## **THE INSTALLATION AND MAINTENANCE OF THE HEATER MUST BE ACCOMPLISHED BY A QUALIFIED SERVICE PERSON.**

# FAN OPERATING INSTRUCTIONS

1) Set switch to “FAN” mode.

2) Push “START” button.

To stop push the “STOP” button.



# PREVENTIVE MAINTENANCE

Sure Flame construction heaters are built to withstand the rigours of operating on construction sites, in mining applications, and in a multitude of other locations where heaters are used. To maintain the reliable performance required it is necessary to do a certain amount of regular maintenance.

## PERIODIC MAINTENANCE:

### Weekly:

Gas Hose	Check for cracks or damaged connectors
Obstruction of Air flow	Clean & remove debris

### Monthly:

Cords & Connectors	Check for cracks, exposed wires & dirt in electrical connectors. Clean with water and dry out before connecting power.
Physical Integrity	Check for damage to body, louvers and inlet screens that may impact combustion quality.

### End of season:

Manifold Pressure	Check for nominal pressure specified in specification label. Adjust regulator pressure if necessary.
Fan Blade	Remove dirt buildup. Replace damaged or unbalanced blades.
Strainer	Inspect and clean if necessary.
Combustion Chamber & Flame Rod	Remove nose cone and inspect inside for integrity. Remove accumulated carbon deposits with a wire brush. Clean flame rod with solvent or emery cloth. Inspect insulator for cracks. Check flame rod tip for 1/8" gap to ground. Install nose cone.
Gas leaks	Using soapy water or gas leak detector check all gas connections for leaks
Air Tubes	Verify that air tubes are not blocked and that they are securely attached with a 1/8" gap from the combustion chamber wall.
Wiring & Drain holes	Check the electrical box for loose or overheated wires and connectors. Using a dry cloth or compressed air clean bottom drain holes if necessary. Check for integrity of cover seal.

# TROUBLESHOOTING CHART

## Motor does not start

<b>Symptom</b>	<b>Problem</b>
No green power light (after pressing start button)	No electrical supply Fuse or transformer failure (motor starts when manual button on motor relay is pressed) Start switch failure. (After engaging power relay test button green light turns on) Power relay failure Stop switch failure Motor relay failure. Motor won't start (starts after manual button is pressed in motor relay). Motor failure Thermostat failure (starts OK with Jumper Plug) Thermostat and jumper not connected Flame control failure
Green light comes on when start button pressed, but goes off when released	
Green light is on. Motor does not start in either Heat or Fan mode	
Green light is on. Motor does not start in Heat mode, but does start in Fan mode.	
No error lights on flame controller	
Green light is on. Motor does not start in Heat mode, but does start in Fan mode.	
Error light on flame controller is on or flashing	

## Motor starts, but no flame

<b>Symptom</b>	<b>Problem</b>
Blower Motor starts, but burner does not ignite. Flame controller error light flashes 2 times. No gas odor at heater outlet.	Flame control failure
	Flame rod wet
Blower Motor starts, but burner does not ignite. Flame controller error light flashes 3 times. No gas odor at heater outlet.	Manual valve closed
	Limit switch failure. No continuity between terminals
	Air switch failure, air switch set to too high a pressure, or air switch tubes blocked or in wrong position
	Solenoid valve failure
	Second stage regulator set too high, solenoid valve will not open
	Upstream regulators installed backwards
	Flame control failure
	Poor quality power (such as from a generator). Dirty signal or wrong hertz
	Motor running in reverse (incorrect wiring on replacement)
	Igniter failure. Cracked ceramic or Incorrect gap to burner plate (should be 1/8")
Blower Motor starts, but burner does not ignite. Flame controller error light flashes 3 times. Gas odor at heater outlet.	Burner not grounded
	Hose diameter too small and/or hose too long, blocked hose
	Low inlet pressure
	Gas selector valve set to wrong fuel
	Second stage regulator set too low
	Main regulator setting too low

# TROUBLESHOOTING CHART (cont.)

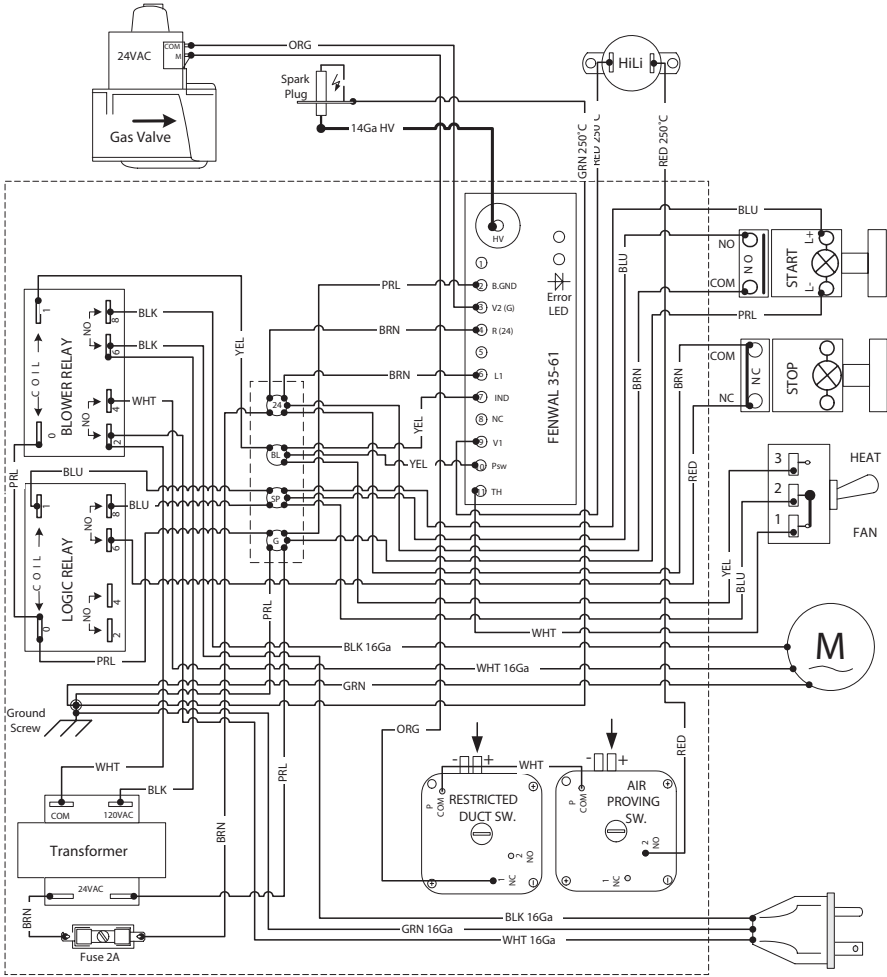
## Heater starts but then fails

<b>Symptom</b>	<b>Problem</b>
Heater starts, but flame goes out about 4 seconds after igniting	Flame rod failure
Heater starts, but fails after running for a period of time	Flame control failure
	Changeover valve set to propane when connected to natural gas Low heat, High CO ; Random shutdown;
	Second stage regulator set too low
	Main regulator setting too low
	Strainer plugged or dirty
	Outlet duct too long or obstructed
	Limit switch failure
Heater sensitive to wind gusts	Air switch set to too high a pressure
Excessive Flame; Heater stops after a few minutes of function (High Limit Switch opens)	Nose cone gap too small
	Changeover valve set to natural gas when connected to propane.
	Connected to liquid propane
	Main regulator setting too high
Blower motor overheats in function (Thermal protection in motor); Random shutdown	Poor quality power (such as from a generator). Dirty signal or wrong hertz

## Other Problems

<b>Symptom</b>	<b>Problem</b>
Motor runs as soon as heater is plugged in.	Motor relay failure
Normal function; Heater stops only if unplugged	Start switch failure
Flame interrupts in function. Frost on propane tank	Stop switch failure
Burner unstable	Propane tank too small to vapourize fast enough, tank freezes
Irregular flame in combustion chamber.	Nose cone gap too big
Excessive carbon deposit in combustion chamber; Burner unstable	Burner orifices plugged or dirty
Gas odor when no call for heat.	Solenoid valve leak
Excessive heater noise. Vibrations	Damaged or unbalanced fan blade
Operates in only heater mode, or only fan mode	Toggle switch failure
Normal function-when inlet obstructed flame shooting out (High Limit Switch opens)	Air switch failure
	Air switch set to too low a pressure

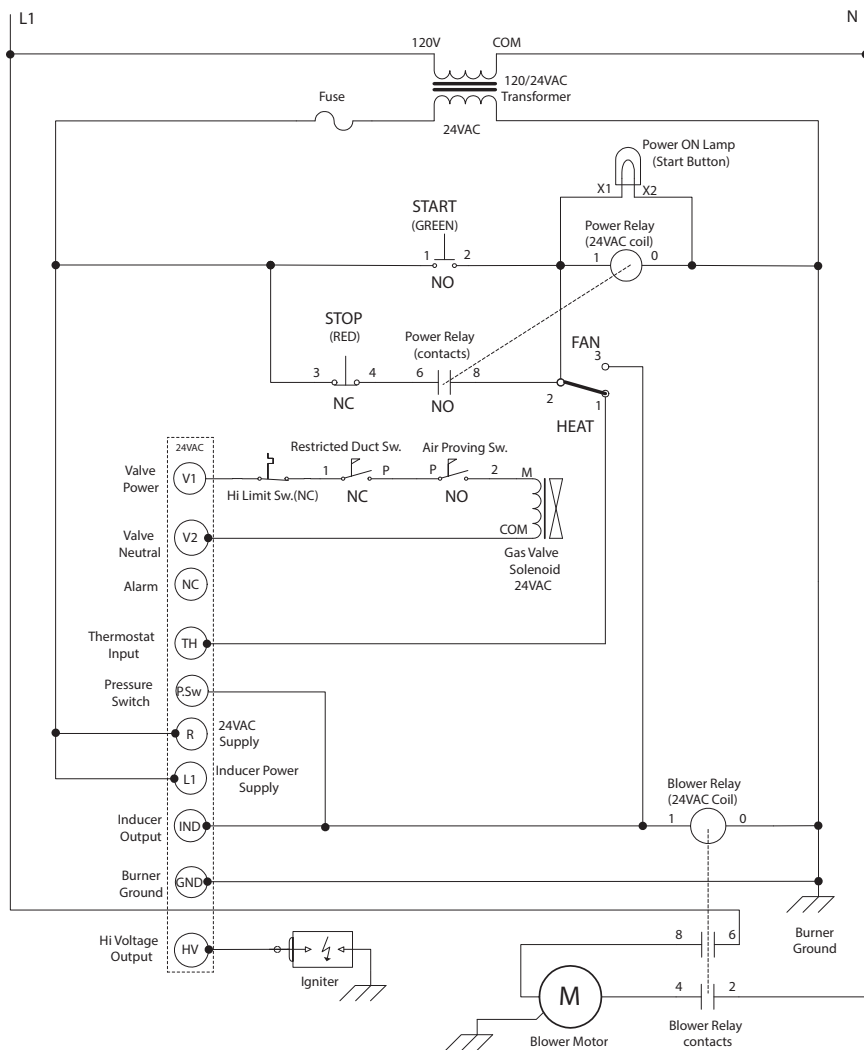
# SE400 Connection Wiring Diagram



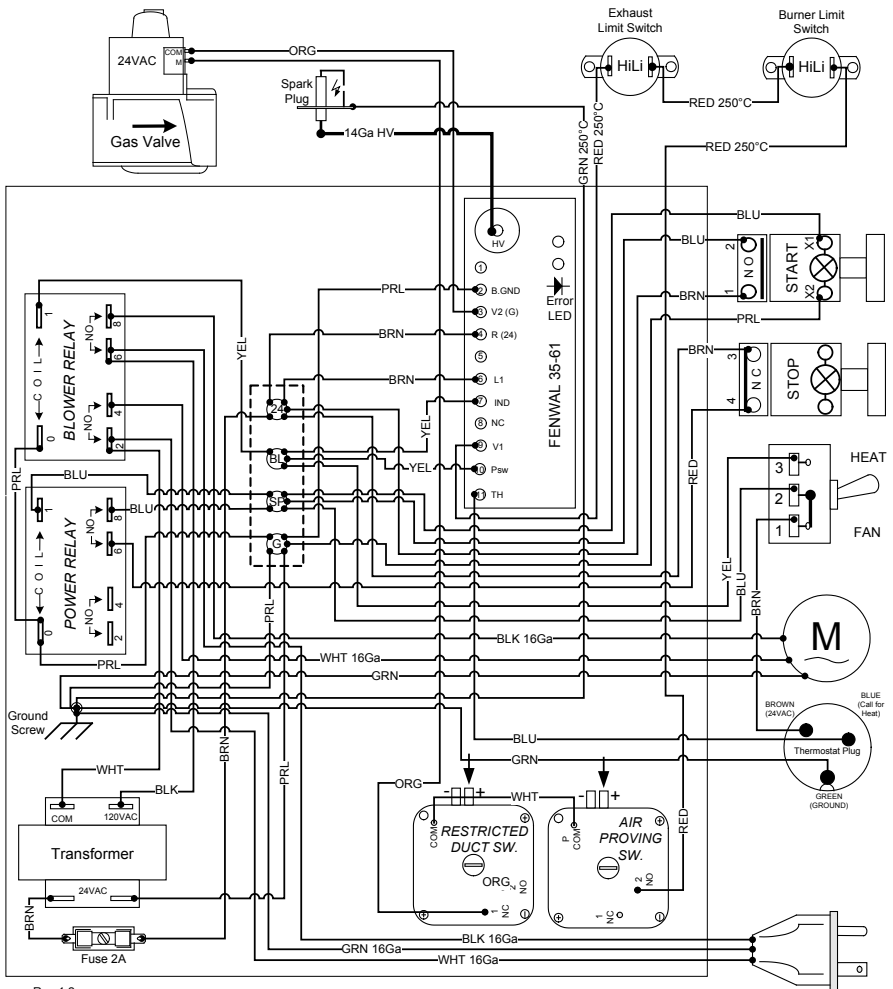
Rev 1 1

Note:: All wires 18 Ga STR TEW 600V unless otherwise specified.

# SE400 Ladder Wiring Diagram

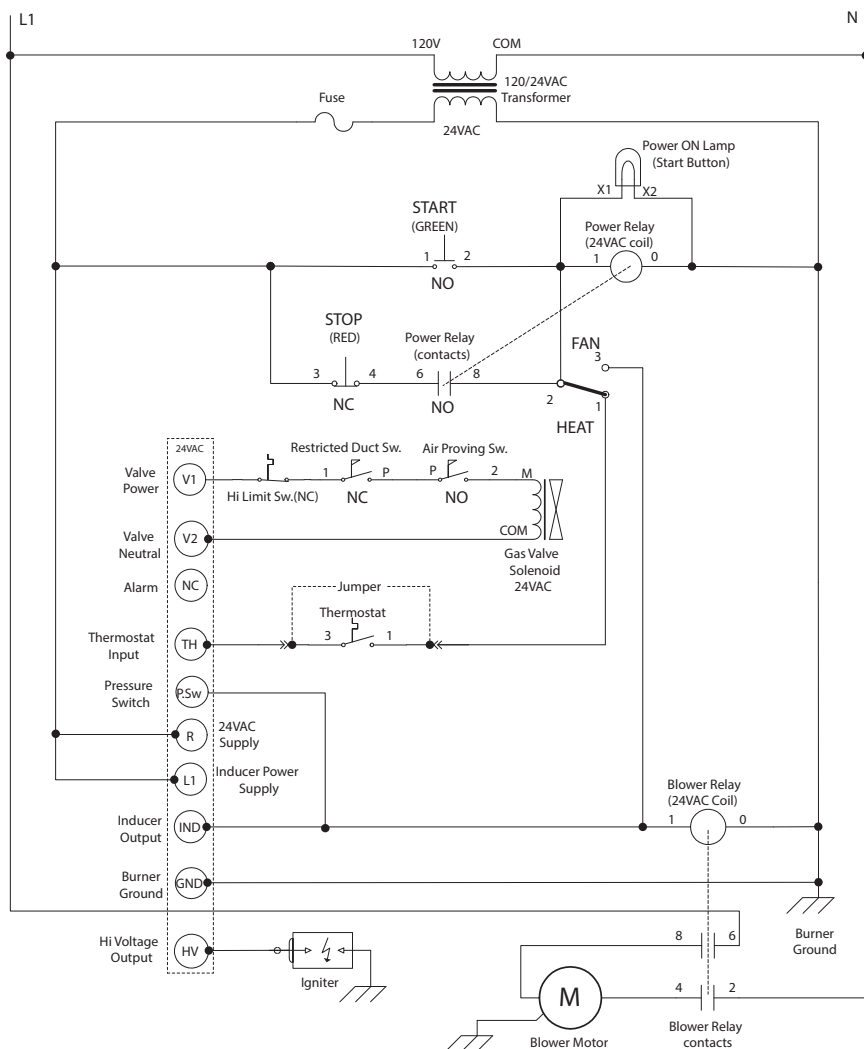


## SE400T Connection Wiring Diagram

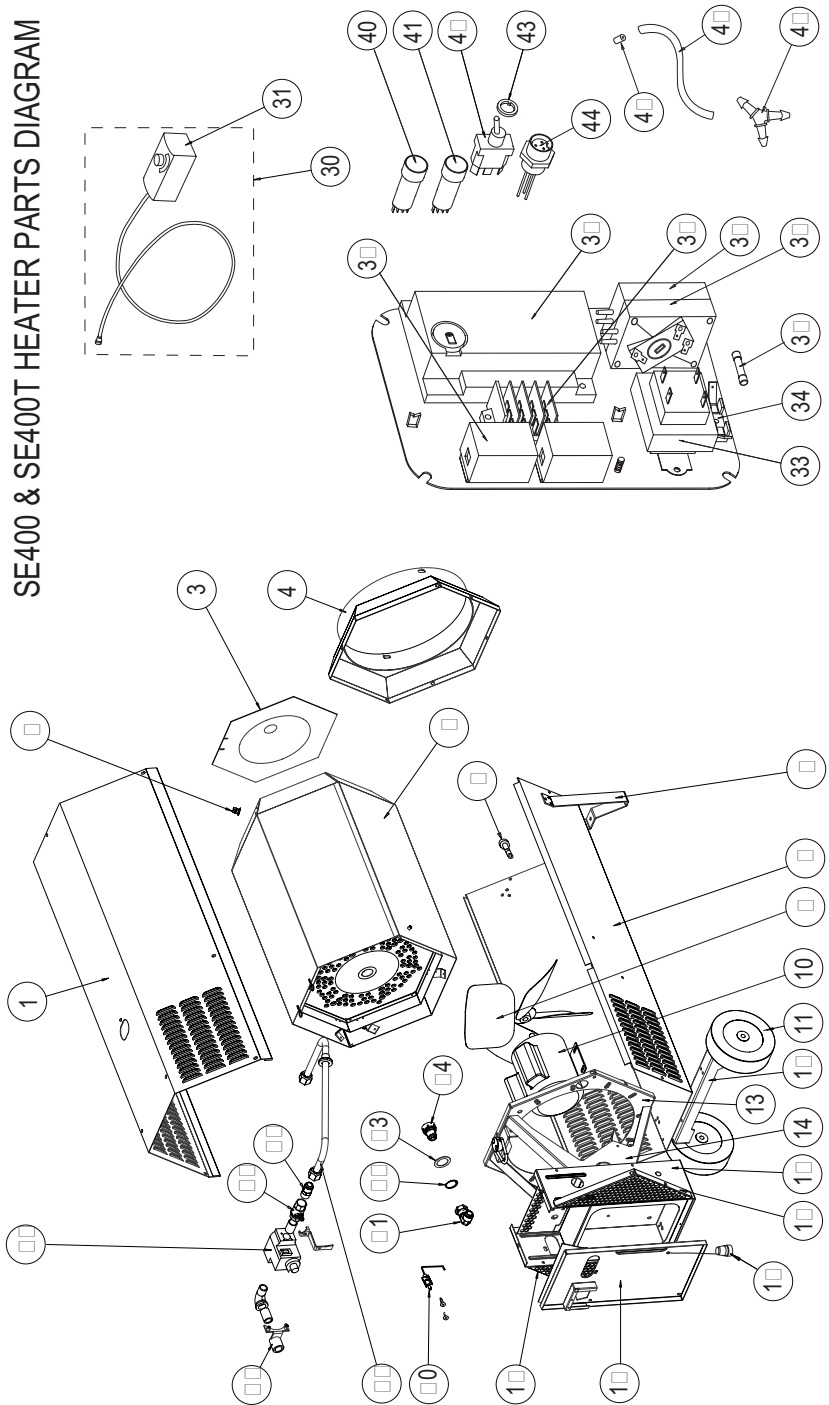


Note:: All wires 18 Ga STR TEW 600V unless otherwise specified.

# SE400T Ladder Wiring Diagram



SE400 & SE400T HEATER PARTS DIAGRAM





<b>Ref Part No.</b>	<b>Description</b>
1 SE-4091	Top Cover
2 9843	Limit Switch
3 SE-4018	Nose Cone
4 SE-4725	Duct Adapter
5 SE-4507	Combustion Chamber
6 SE-4151	Bulkhead Fitting
7 SE-4027	Front Leg
8 SE-4090	Bottom Panel
9 1525	Fan Blade
10 9827	Motor
11 6119	Semi-Pneumatic Wheel
12 SE-4721	Wheel Assembly
13 SE-4726	Blower Plate Assembly
14 SE-4509	Motor Mount
15 SE-4508	Control Box
16 SE-4728	Right Inlet Panel
17 SE-4716	Thermostat Jumper Plug
18 SE-4723	Control Box Lid w/Jumper Plug
19 SE-4727	Left Inlet Panel
20 SE-4730	Electrode Assembly
21 9833	Flare Elbow
22 9832	Bowed Snap Ring
23 SE-4078	Burner Washer
24 9831	Burner Head

<b>Ref Part No.</b>	<b>Description</b>
25 SE-4712	Gas Line Assembly
26 9834	Flare Adapter
27 SE-4718	Gas Selector Valve with Handle
28 SE-4510	Inlet Coupling
29 9830	Gas Valve
30 SE-4715	Thermostat Assembly with Cord
31 2453	Thermostat
32 9872	Relay
33 4510	24V 40VA Transformer
34 9883	Fuse Holder
35 9884	Fuse, 2A/250V, Fast Acting 3AG
36 SE-4732	Restricted Duct Switch
37 SE-4731	Air Proving Switch
38 9823	Terminal Block
39 9828	Flame Control
40 9879	Start Switch
41 9880	Stop Switch
42 9881	Heat / Fan Switch
43 9882	Switch Gasket
44 WRS-163	Thermostat Receptacle
45 SE-4145	Air Tube Damper
46 1707	Air Tube
47 1181	Barb Y Fitting
48 SE-4521	18" duct adapter (not shown)

## LPG - PROPANE FUEL VAPORIZATION RATE

The following chart shows the amount of BTU's that various sizes of tanks will produce on the average at specific temperatures and regular atmospheric conditions.

Tank Size Gallons (Poundts)	Maximum intermittent withdrawal rate (BTU/hr) without tank frosting* if lowest outdoor temperature (average for 24 hours) reaches.							
	+40°F (+4°C)	+30°F (-1°C)	+20°F (-7°C)	+10°F (-12°C)	0°F (-18°C)	-10°F (-23°C)	-20°F (-29°C)	-30°F (-34°C)
150 (600)	214,900	187,900	161,800	148,000	134,700	132,400	108,800	107,100
250 (1000)	288,100	251,800	216,800	198,400	180,600	177,400	145,800	143,500
500 (2000)	478,800	418,600	360,400	329,700	300,100	294,800	242,300	238,600
1000 (4000)	852,800	745,600	641,900	587,200	534,500	525,400	431,600	425,000

\* Frosting on the outside of the tank acts as an insulator, reducing the vaporization rate.

## MAXIMUM BTU CONTENT (PROPANE)

The following table shows the maximum BTU's that a cylinder contains.

Cylinder Size	BTU Content
100 pound	2,159,100
250 gallon USA	22,922,500
500 gallon USA	45,845,000
1000 gallons USA	91,690,000

**CAUTION:** In extremely cold weather it is impossible to completely empty a propane cylinder.

## PRESSURE & FLOW EQUIVALENTS

1 Std. Atmosphere	14.73 lb./sq. in.	1.014 bar
1" Water Column (W.C.)	0.58 oz/sq. in.	2.49 millibar
11" Water Column	0.4 lb/sq. in	27.39 millibar
1 lb./sq. in. (psig)	27.71" W.C.	0.0689 bar
1" Mercury	0.49 psig	33.86 millibar
1 Std. Cubic Ft/Hr	2,500 BTU/Hr	0.2832 cu. m/hr
1 BTU/Hr	0.2931 Watts	