SURE FLAME®

Operation and Maintenance Manual

Model No. IX405

Indirect Construction Heater
400,000 Btu/h

⚠ WARNING

Read and follow all installation, and operating instructions before first use of this product

Retain these instructions for future reference

Sure Flame Products
A Divison of Haul-All Equipment
4115 - 18 Avenue North
Lethbridge, Alberta T1H 5G1
www.sureflame.com

P/N 974-1184
Rev 1.3 Sep 24, 2013

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

This heater is designed and approved for use as a construction heater under ANSI Z83.7a-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. Since the products of combustion are released, it is imperative that the flue stack is extended outside of the enclosed area when the heater is positioned indoors.

This 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.

Installation must comply with local codes, or in the absence of local codes, with the *National Fuel Gas Code ANSI Z223.1/NFPA 54* and the *Standard for the Storage and Handling of Liquified Petroleum Gasses ANSI/NFPA 58.*

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.

Table of Contents

SPECIFICATIONS

Model No. IX405

Capacity:	400,000 Btu/h (120 kW)
Gas:	Natural or Propane
Inlet Pressure*:	max 14” WC (3.5kPa)
	min 11” WC (2.75 kPa)
Manifold Pressure:	Natural Gas 5.6”WC (1.4 kPa)
	Propane 2.8”WC (0.7 kPa)
Orifice Size:	9/64” (x7)
Electrical Rating:	120 volts, 12A, 1Ph, 60 Hz
Minimum Temperature:	-30°C (-22°F)
Duct Diameter:	16” or 2 x 12”
Maximum Duct Length:	32’ (9.8 m)
Venting:	Category I
Fuel Consumption:	Natural Gas 400 ft^3/hr
	Propane 159 ft^3/hr
Certification	ANSI Z83.7a-2007

* Minimum inlet pressure is for purpose of input adjustment

Installation

The Sure Flame Model IX405 is an indirect-fired gas heater intended to be used primarily for the temporary heating of buildings under construction, alteration or repair. Since the products of combustion are released, it is imperative that the flue stack is extended outside of the enclosed area when the heater is positioned indoors. The flow of supply air and exhaust gasses must not be obstructed in any manner.

The equipment shall be installed in accordance with the Natural Gas and Propane Installation Code CSA B149.1, and applicable local regulations, which should be carefully followed in all cases. Authorities having jurisdiction should be consulted before installations are made.

The heater shall be used in a horizontal position on a firm, non-combustible surface.

The electrical grounding of the appliance shall be in compliance with the CSA C22.1, Canadian Electrical Code, Part I

Warning: The installation and maintenance of the heater must be accomplished by a qualified service person. The heater should be inspected before each use and at least annually.

Warning: Do not use this heater in a space where gasoline of other liquids with flammable vapours are stored or used.

Clearances

Clearance required for combustibles:

Outlet:	10 ft	(3 m)
Sides:	2 ft	(0.6 m)
Top:	3 ft	(0.9 m)
Flue:	18”	(45 cm)
Floor:	Noncombustible	

Minimum clearance required to LP Gas containers:

Outlet:	20 ft	(6.0 m)
Top & Sides:	10 ft	(3.0 m)

Position heater properly on a horizontal surface before use.

The hose assembly shall be protected from traffic, building materials and contact with hot surfaces both during use and while in storage. For use with or without ductwork. Only ductwork supplied by the manufacturer shall be used with this heater. For either indoor or outdoor use. Adequate ventilation must be provided. This heater is for operation at a temperature rise from 80°C to 140°C (175°F to 285°F).

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

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

Ducting

The IX405 can be ducted on both the inlet and outlet. The inlet duct can be up to 50' of smooth 16" metal duct The outlet duct shall be of a material able to withstand temperatures of up to 450F. Total outlet duct length may be up to 300' of straight, smooth, 16" metal duct Use of flexible ducts, smaller ducts, or bends in the ducts will reduce the allowable length and may result in excessive cycling of the burner.

Venting

This equipment requires CLASS A venting to the exterior. The vent connector should be designed for a negative pressure and be constructed of materials having corrosion resistance and durability to heat at least equivalent to that of No. 24 GSG galvanized steel.

Venting must comply with the Natural Gas and Propane Installation Code CSA B149.1, as well as other local regulations that may apply.

Flue Diameter	8"	6"
Min. vertical height	4'	4'
Max. lateral length*	15'	0'
Max. # of added elbows**	2	0

*Lateral lengths must have a minimum 10% rise.
** A minimum vertical length of 2' is required before the first elbow and after the last elbow.

Consult the manufacturer for additional venting options.

Rated flue gas temperature 480°F (250°C)
Rated vent pressure - Negative
Category I

Gas Connections

Ensure the correct regulator is used to supply the heater with maximum inlet pressure of 14"w.c. Excessive pressure will damage components and void the warranty.

Visually inspect the fuel supply hose assembly. Ensure that it is protected from traffic, building materials, and contact with hot surfaces. Replace if there is evidence of excessive wear or abrasion.

After installation, check for gas leaks by applying a soapy solution at each piping and hose assembly connection.

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, or in the absence of local codes, with the *Standard for the Storage and Handling of Liquedied Petroleum Gases, ANSI/NFPA 58*.

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, or in the absence of local codes, with the *National Fuel Gas Code ANSI Z223.1/ NFPA 54.*

LPG - PROPANE FUEL VAPORIZATION RATE

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

Tank Size Gallons (Pountds)	Maximum intermittent withdrawal rate (BTU/hr) without tank frosting* if lowest outd 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
150 (600)	214,900	187,900	161,800	148,000	134,700	132,400	108,800	10
250 (1000)	288,100	251,800	216,800	198,400	180,600	177,400	145,800	14
500 (2000)	478,800	418,600	360,400	329,700	300,100	294,800	242,300	23
1000 (4000)	852,800	745,600	641,900	587,200	534,500	525,400	431,600	42

* 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 galons USA	91,690,000

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

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.
4) Open gas supply.
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.

Warning: Blower may continue to cycle after heater is turned off due to built up heat in the combustion chamber. Do not stop the heater by unplugging. Heat accumulated in the heater can shorten the life of components.

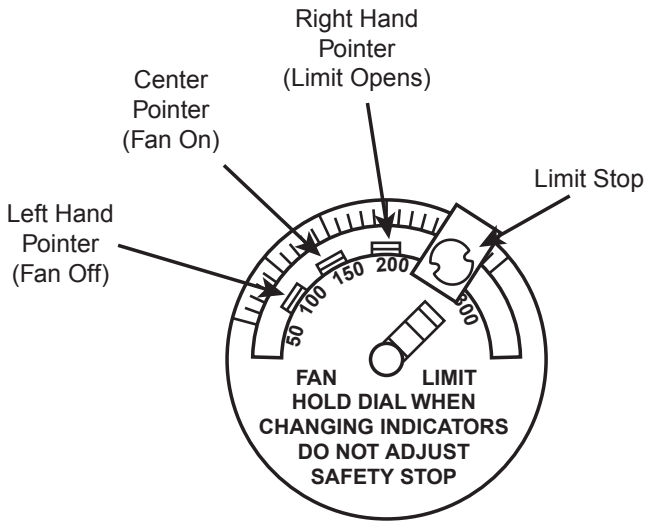
SETTING FAN LIMIT SWITCH

The fan limit switch is factory set and should not normally need to be adjusted. If it is out of adjustment, follow these procedures:

To set pointers, hold dial securely with one hand and move the pointers with the other hand. Do not force the pointers past any stops on the dial even though the dial may be graduated beyond the stops.

Limit
Move the right hand pointer so that its straight edge indicates 250°F.

Fan
Move the “Fan On” pointer so that its straight edge indicates 110°F. This is the temperature at which the blower will start. Move the “Fan Off” pointer so that its straight edge indicates 90°F. This is the temperature at which the blower will stop.



Maintenance

Warning: Disconnect gas and electrical supplies before servicing.

Weekly:

Gas Hose	Check for cracks and damaged connectors
Air flow	Remove any obstructions to air flow

Monthly:

Cords and Connectors	Check for cracks, exposed wires, and dirt in electrical connectors
Physical Integrity	Check for damage to body, louvers, and inlet screens that may obstruct air flow and impact combustion quality
Belt	Replace belt if cracked or worn. Ensure belt tensioner is in place and tensioner roller is running smoothly.

End of Season:

Combustion Chamber	Remove burner assembly Clean inside of combustion chamber with a wire brush. Vacuum all ash and soot from combustion chamber. Inspect combustion chamber for any damage. Do not use a heater that has a hole in the combustion chamber.
Burner	Remove burner from burner assembly Clean flame rod and igniter with solvent or emery cloth. Inspect for cracked ceramic. Ensure they are properly centered in the burner openings. Inspect wires for cracks or evidence of overheating Ensure burner head screws are tight. Ensure openings in orifice plate (located inside the burner pipe) are not blocked. Ensure gasket and door seal are in place and not damaged.
Electrical components	Check all wiring for loose, cracked, or overheated wires and connectors. Replace if necessary. Ensure ground wires are properly connected. Ensure control box seal is in place and not damaged. Wipe dirt from motors. Motors have sealed bearings and do not require lubrication.
Valve Train	Verify that manifold pressure matches the specification label. Adjust regulator pressure if necessary. Inspect strainer and clean if necessary. Using soapy water or gas leak detector, check all gas connections for leaks.
Impellers	Remove any dirt build-up on both burner and blower impellers. Inspect impellers for loose or damaged fins. Run heater and check for vibration. Replace impellers that are damaged or causing vibration.
Body	Ensure all panels and shields are in place and that fasteners are tight. Inspect wheels for wear or excessive play in the bearings.

Heater Troubleshooting

Burner blower does not start, no spark, no flame

Symptom	Possible Problems
No green light when Start Button is pressed. No green light when manual button on Logic Relay is pressed.	No electrical supply. Fuse failure. Transformer failure.
No green light when Start Button is pressed. Green light comes on when manual button on Logic Relay is pressed.	Start switch failure.
Green light comes on when Start Button is pressed, but turns off when button is released.	Logic Relay failure. Stop Switch failure.
Green light is on. No error light on Ignition Control.	Thermostat or Jumper Plug not installed. Thermostat failure. Fan Limit Switch failure.
Green light is on. Single flashes on Ignition Control error light after 30 seconds.	Air Switch failure. Burner Motor failure. Ignition Control failure.
Error light on Ignition Control on steady.	Ignition Control failure.

Burner blower starts, no spark, no flame

Symptom	Possible Problems
Single flashes on Ignition Control error light after 30 seconds.	Air Switch failure. Air Switch set to too high a pressure. Air tubes plugged or insert in wrong air switch position. Burner air inlet obstructed.
Three flashes on Ignition Control error light.	Igniter failure. Igniter shorting to ground. Ignition transformer failure. Loose ignition wire. Ignition Control failure.

Burner blower starts, spark, no flame

Symptom	Possible Problems
No click on Solenoid Valve after 30 second pre-purge. Three flashes on Ignition Control error light.	Output Limit Switch failure. Exhaust Limit Switch failure. Blocked exhaust. Tilt Switch failure. Solenoid Valve failure. Inlet pressure too high. Igniter ceramic cracked. Ignition Control failure.
Gas Valve clicks after 30 second pre-purge. Three flashes on Ignition Control error light.	Manual Valve closed. Gas Hose too long or too small. Burner orifices plugged or dirty. Strainer plugged or dirty. Manifold pressure set too low. Changeover valve set to wrong fuel. Burner air inlet obstructed.

Burner starts, but flame goes out after about 4 seconds

Symptom	Possible Problems
Three flashes on Ignition Control error light.	Loose Flame Rod or ground wire. Flame Rod and Spark Plug wires reversed. Flame Rod wet. Ignition Control failure.

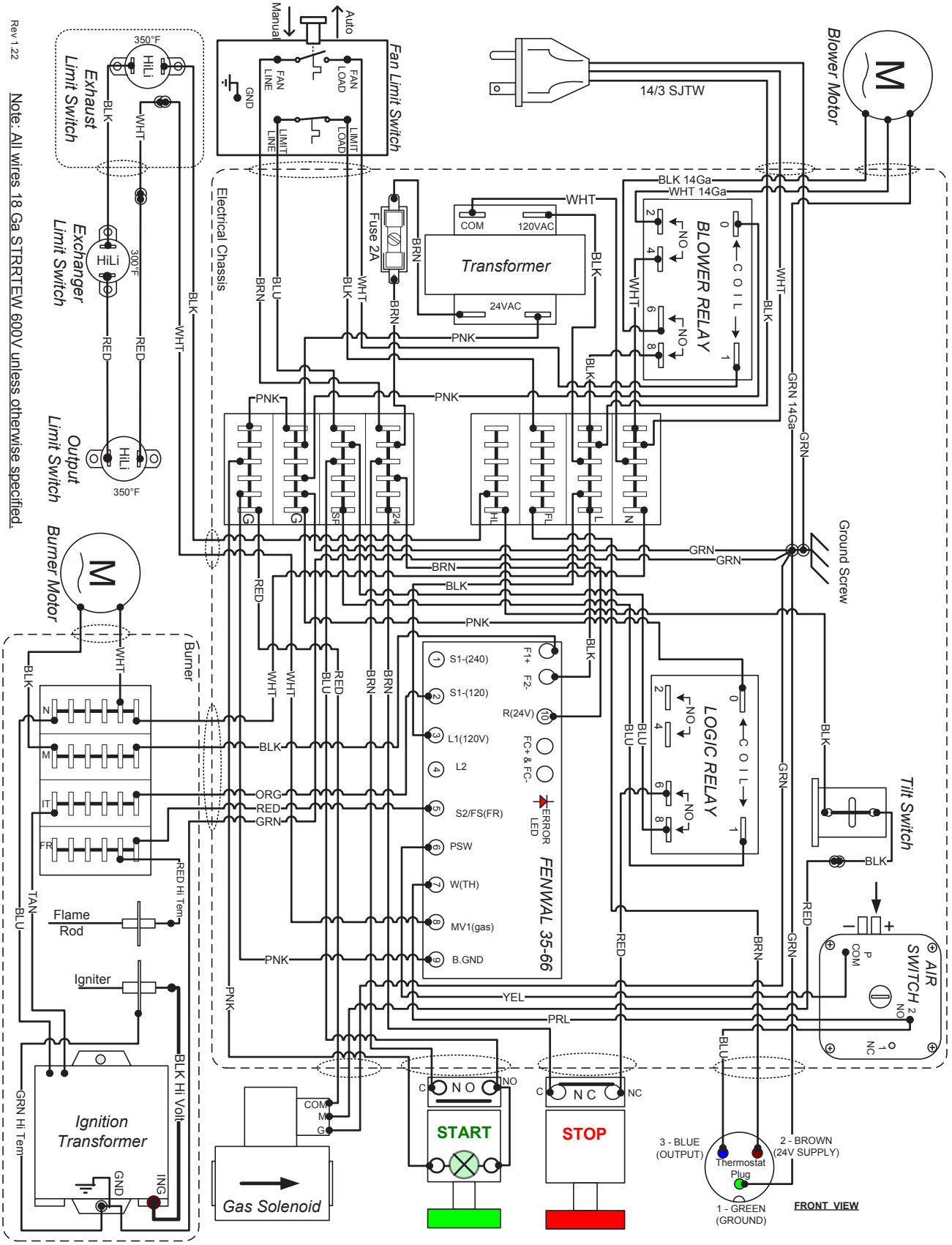
Burner starts, but main blower does not come on

Symptom	Possible Problems
Blower Motor does not start when manual button on Blower Relay is pressed.	Blower Motor failure.
Blower Motor turns on when manual button on Blower Relay is pressed.	Blower Relay failure. Fan Limit Switch failure. Fan Limit Switch settings incorrect.
Blower Motor cannot accelerate to full RPM. (excessive amperage draw). Circuit Breaker trips OFF during Blower Motor acceleration. Heater shuts off when Blower Motor starts. Voltage during Blower Motor start up dropping under 100VAC.	Low Voltage (long extension cord, too small gauge of cord or too many items on circuit). Poor quality power (such as from a generator). Improper voltage. Wrong Hertz. Belt too tight
Blower Motor starts, but little or no air flow.	Belt broken Motor connected in reverse

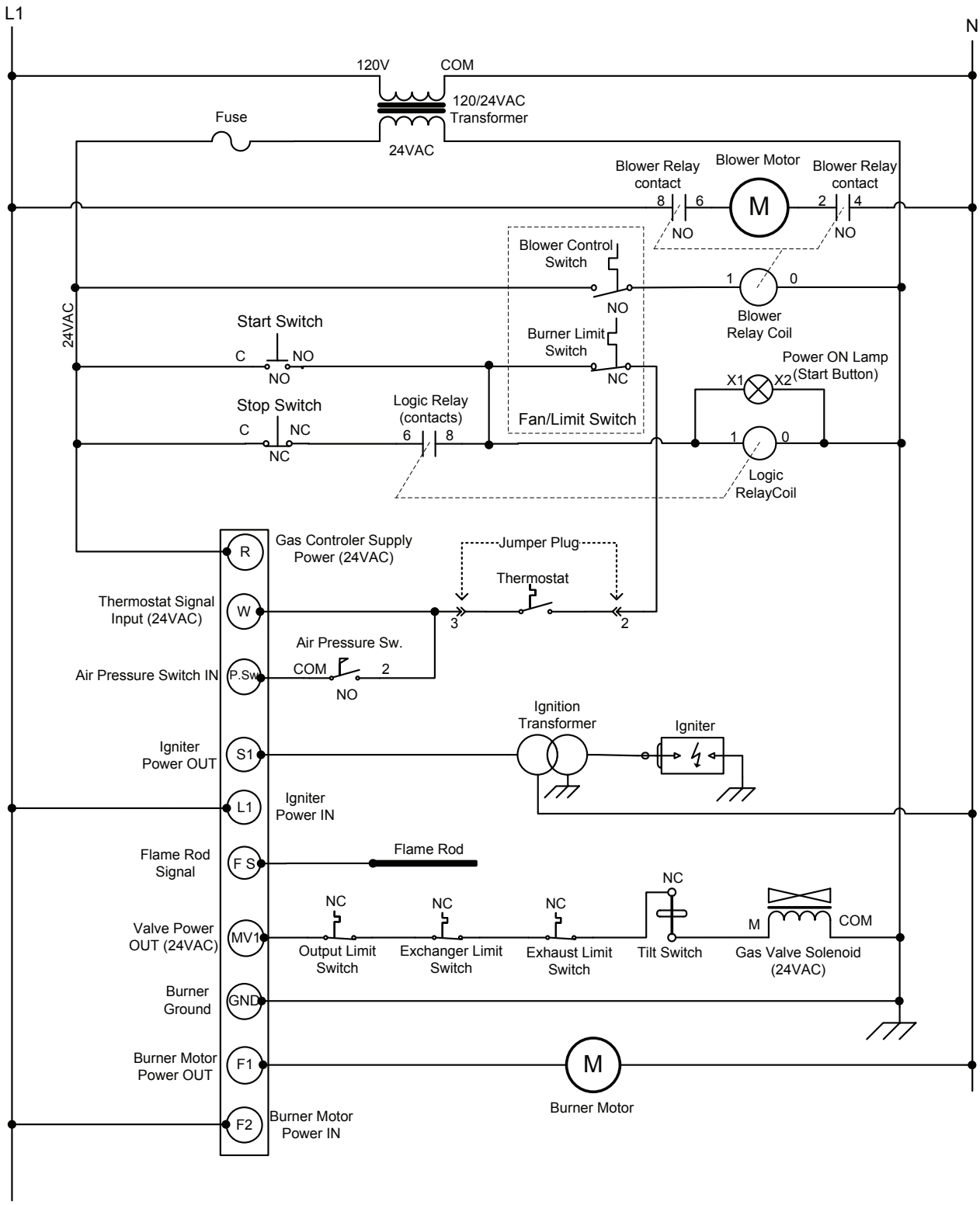
Other problems during operation

Symptom	Possible Problems
Small or poor quality flame. Manifold pressure drops below rated value in function. Heater ignites but may shut off with three flashes on Ignition Control error light.	Propane tank too small to vaporize fast enough, tank freezes. Gas Hose too small, too long, or blocked. Inlet pressure too low. Gas Selector Valve set to wrong fuel. Burner air inlet obstructed.
Heater shuts off unexpectedly with three flashes on Ignition Control error light.	Blocked exhaust. Flame rod failure. Out of fuel. Solenoid Valve failure. Output limit switch failure. Ignition Control failure.
Burner cycles on and off frequently.	Fan Limit Switch settings incorrect. Ducts too long, too small, or obstructed.
Excessive yellow flame. Rumbling noise during flame ignition.	Changeover valve set to wrong fuel. Heater connected to liquid propane supply. Manifold pressure set too high.
Heater does not stop when Stop Button is pressed.	Stop Switch failure. Start Switch failure. Logic Relay failure.
Excessive noise or vibration.	Damaged or unbalanced Burner Impeller. Damaged or unbalanced Blower Impeller.
Blower Motor runs constantly.	Blower Relay failure. Fan Limit Switch set in manual position. Fan Limit Switch settings incorrect (fan off-pointer set to low).
Heater does not turn off when thermostat turned to minimum. No lights on Ignition Control.	Thermostat failure.
Heater does not turn off when thermostat turned to minimum. Two flashes on Ignition Control error light.	Solenoid valve stuck open. Solenoid valve leaking.

IX405 Wiring Diagram

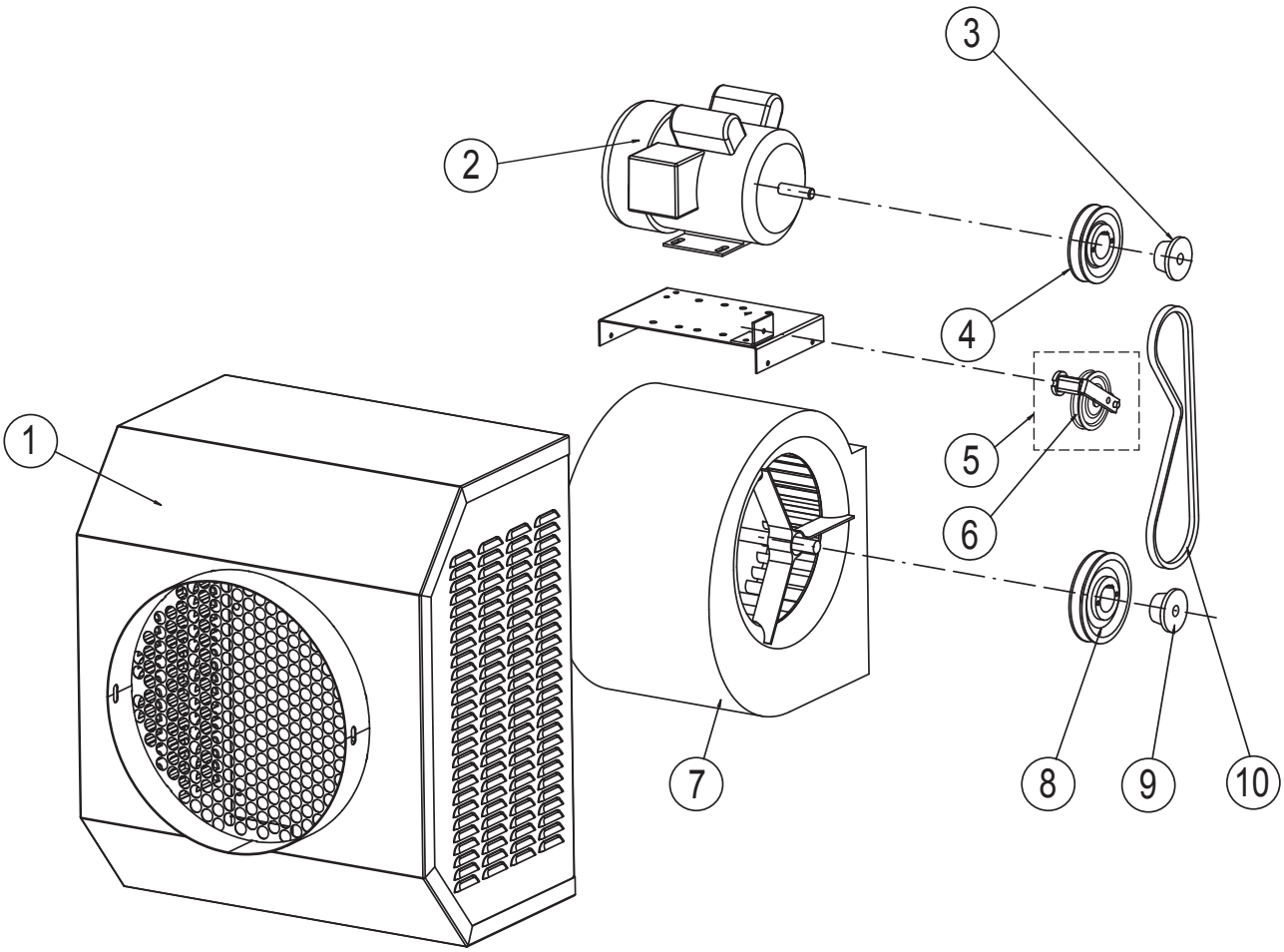


IX405 Ladder Diagram



Parts Breakdown

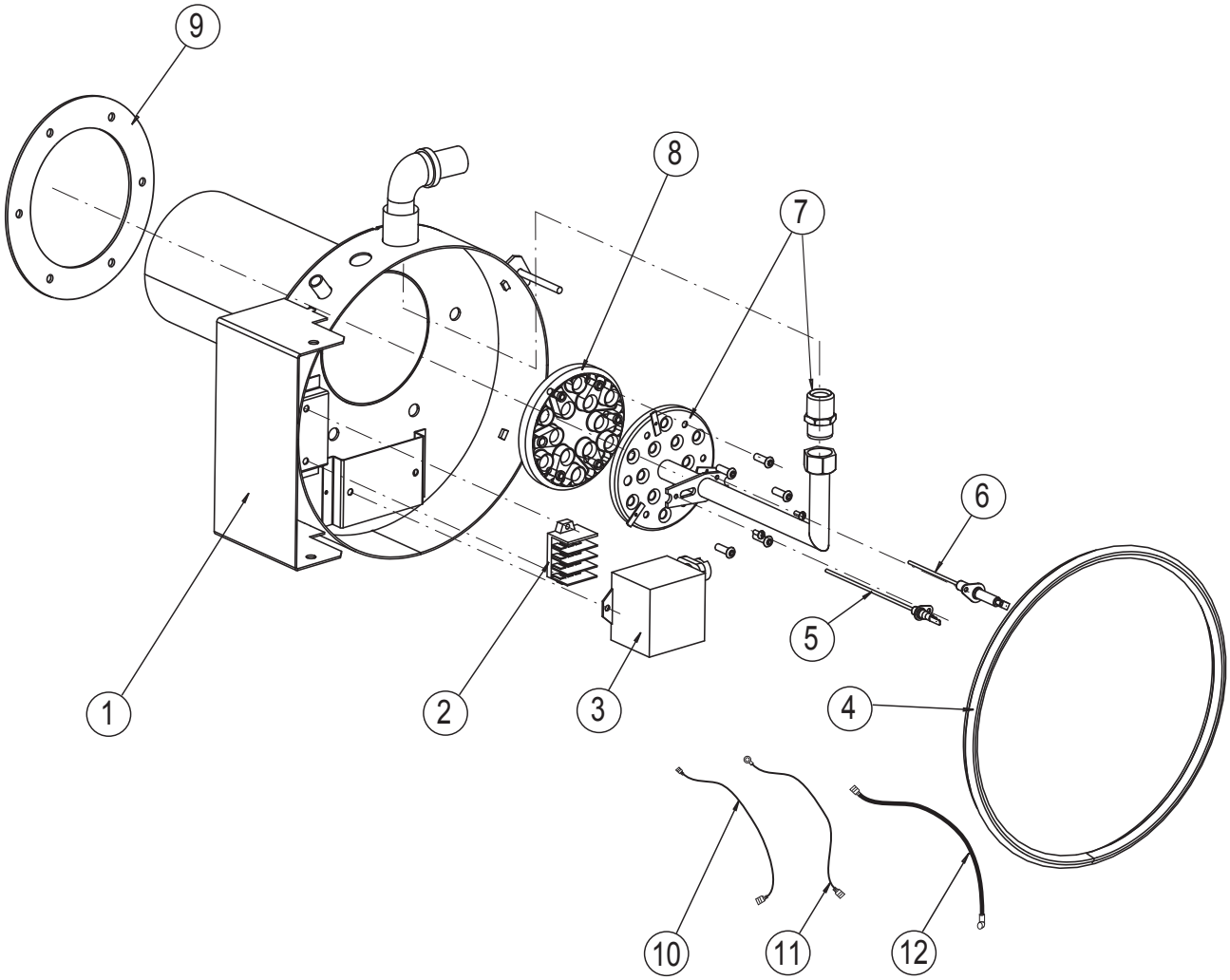
Main Blower



Ref #	Part #	Description	Qty
1	IX-5526	Blower Shroud Weldment	1
2	1460	Motor 1 HP	1
3	6133	Motor Bushing Split Taper	1
4	7747	Motor Sheave	1
5	IX-5782	Belt Tensioner Assembly	1

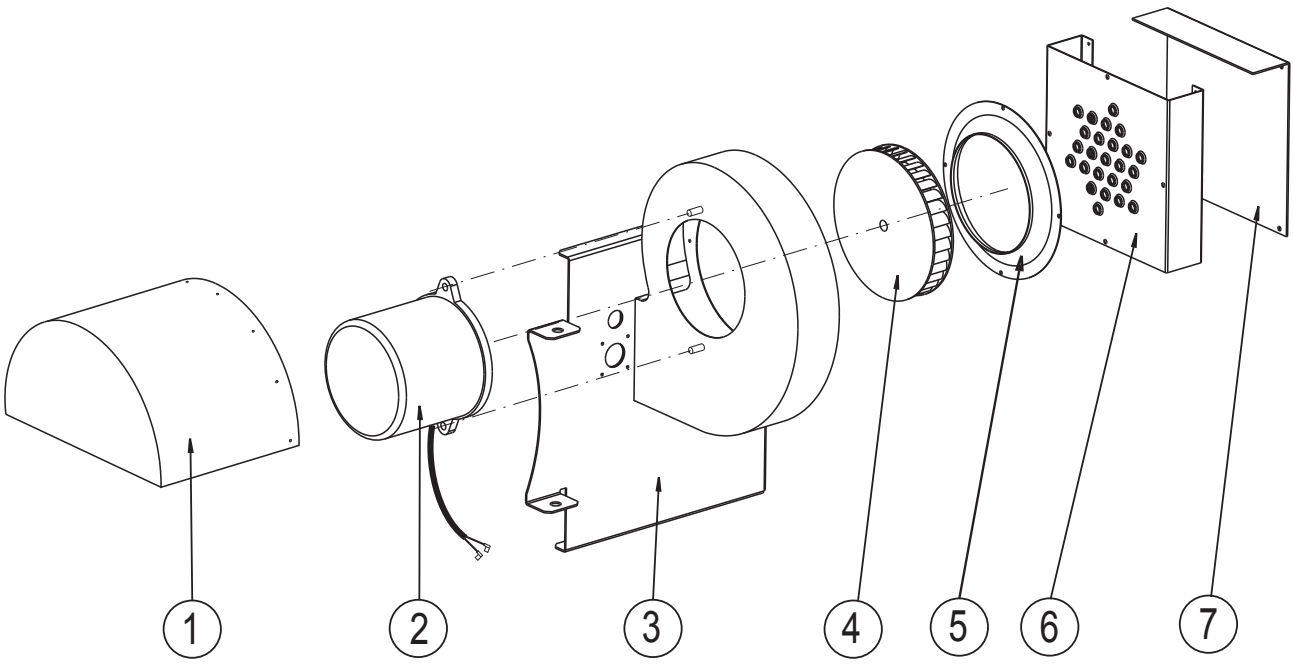
Ref #	Part #	Description	Qty
6	IX-5784	Tensioner Pulley Assembly	1
7	1272	Blower Assembly	1
8	1183	Blower Sheave	1
9	7750	Bushing Split Taper	1
10	1166	Belt	1

Burner



Ref #	Part #	Description	Qty	Ref #	Part #	Description	Qty
1	IX-3533	Burner Housing	1	7	IX-3732	Burner Pipe Assembly	1
2	9823	Terminal Block	1	8	IX-3157	Burner Head	1
3	8676	Ignition Transformer	1	9	IX-3198	Burner Gasket	1
4	7724	Flexible Seal	3.3’	10	WR9RDE-26	Flame Rod Wire	1
5	1305	Flame Rod	1	11	WR9GER-30	Burner Ground Wire	1
6	1306	Igniter	1	12	WRIBEX-22	Ignition Wire	1

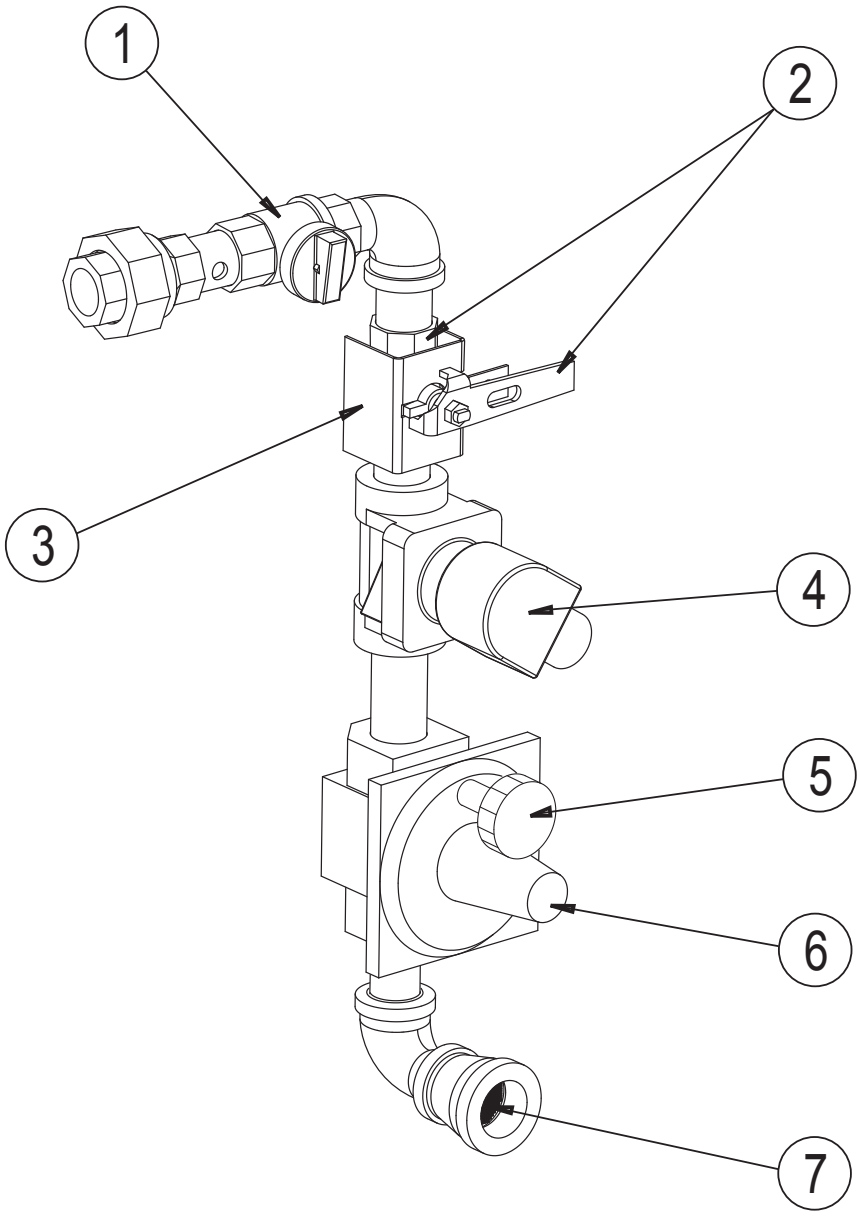
Burner Blower



Ref #	Part #	Description	Qty
1	IX-3539	Burner Motor Cover	1
2	1276	Burner Motor	1
3	IX-3534	Blower Housing	1
4	1274	Impeller	1

Ref #	Part #	Description	Qty
5	1273	Inlet Cone	1
6	IX-3187	Burner Inlet Air Restrictor	1
7	IX-3188	Shroud Side Panel	1

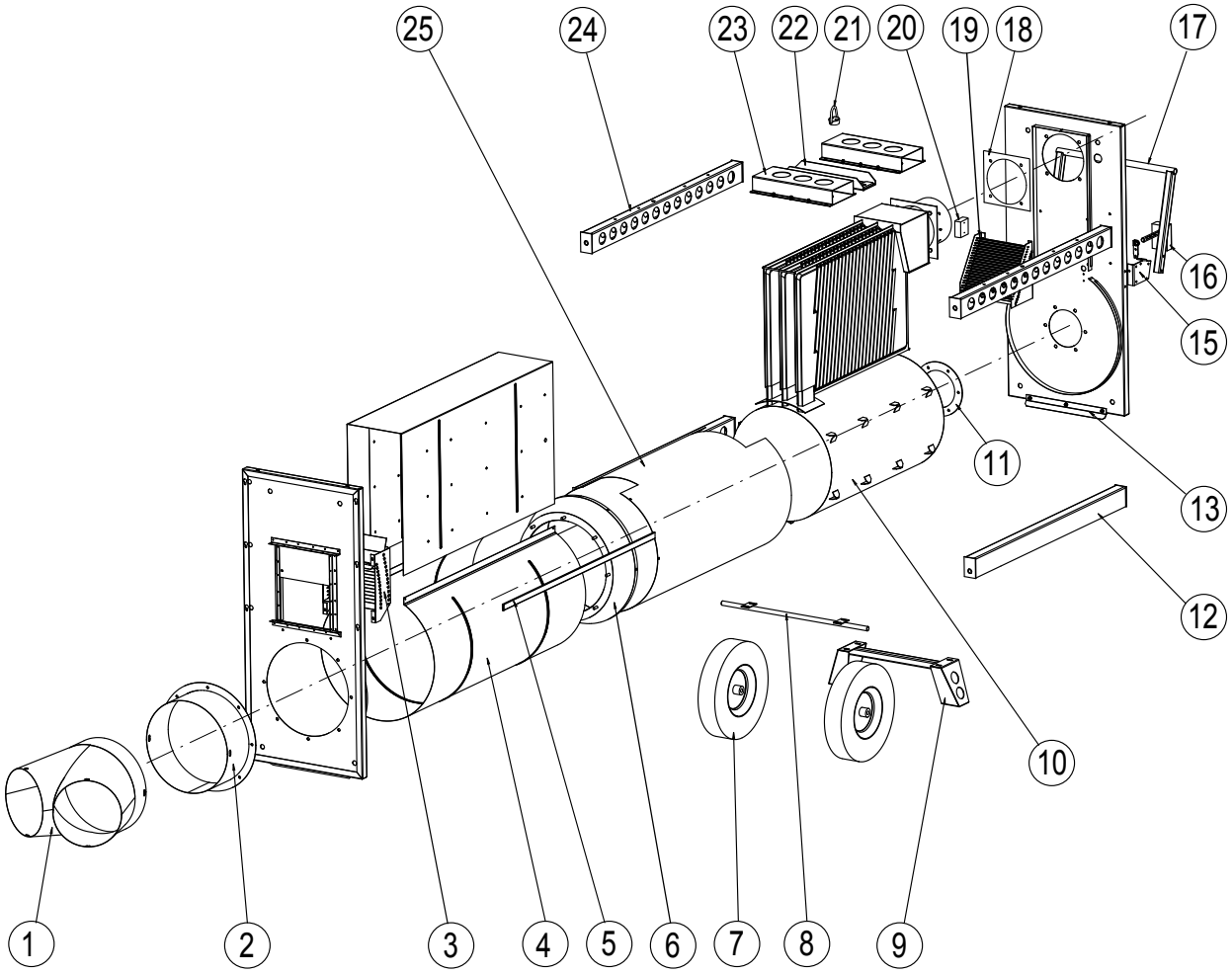
Valve Train



Ref #	Part #	Description	Qty
1	5869	¾" Manual Valve	1
2	IX-3731	Gas Selector Valve	1
3	IX-3193	Locking Bracket	1
4	4514	¾" Solenoid Valve 24V	1

Ref #	Part #	Description	Qty
5	9301	Vent Protector	1
6	2524	¾" Regulator	1
7	IX-3730	Strainer	1

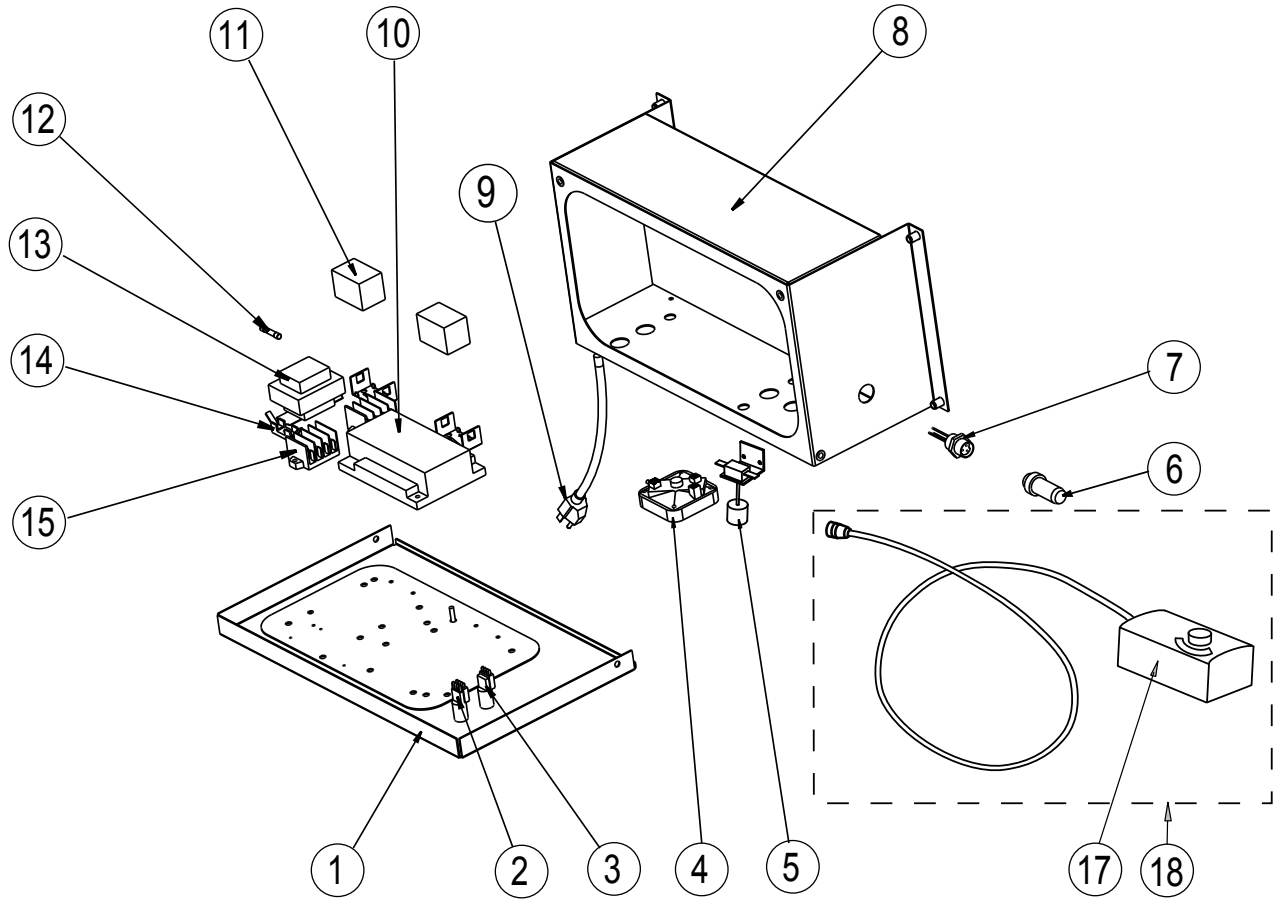
Main Body



Ref #	Part #	Description	Qty
1	IX-5574	Dual Duct Adapter	1
2	IX-5540	16” Duct Adapter	1
3	IX-5532	Blower Air Straightener	1
4	IX-5102	Outer Shell	1
5	1261	S Lock	2
6	IX-4524	Outer Cone	1
7	1269	16” wheel	2
8	IX-5539	Axle	1
9	IX-5538	Leg Assembly	1
10	IX-4523	Combustion Chamber/Exchanger	1
11	IX-3198	Burner Gasket	1
12	IX-5557	Wheel Support	2
13	IX-5183	Stacking Support	2
14	IX-5187R	RH Handle Hinge (not shown)	1

Ref #	Part #	Description	Qty
15	IX-5187L	LH Handle Hinge	1
16	1278	Fan Limit Switch	1
17	IX-5528	Handle	1
18	IX-3201	Exhaust Gasket	1
19	IX-5531	Air Deflector	1
20	IX-5535	Limit Switch Box	1
21	9836	Lifting Ring	1
22	IX-5530	Lifting Ring Base	1
23	IX-5735	Forklift Pocket	2
24	IX-5523	Top Support	2
25	IX-4533	Heat Shield	1
	1199	Output Limit Switch (not shown)	1
	1199	Exhaust Limit Switch (not shown)	1
	4133	Exchanger Limit Switch (not shown)	1

Electrical



Ref #	Part #	Description	Qty
1	IX-5152	Control Box Lid	1
2	IX-5731	Start Pushbutton	1
3	IX-5732	Stop pushbutton	1
4	IX-5734	IX410 Adjusted Air Switch	1
5	4565	Pendulum Switch	1
6	SE-4716	Thermostat Jumper Plug	1
7	WRS-172	Thermostat Receptacle	1
8	9217	Electrical Box	1
9	WRS-165	Power Cord	1

Ref #	Part #	Description	Qty
10	1308	Ignition Controller	1
11	9872	Relay, 24VAC	2
12	9884	Fuse, 2A	1
13	4510	Transformer	1
14	9883	Fuse Holder	1
15	9823	Terminal Block	2
16	7723	Door Seal (not shown)	3.5’
17	2453	Thermostat	1
18	SE-4715	Thermostat Assembly	1

Sure Flame Products - A Divison of Haul-All Equipment
4115 - 18 Avenue North, Lethbridge, Alberta T1H 5G1, Canada
www.sureflame.com