DES3 Series
Insert Manual

For complete installation instructions, see the Tube Heater General Manual that accompanies this Series Insert Manual.

The DES3 Series Infrared Tube Heater is a positive pressure, single-stage radiant heater system. This insert manual is a supplement to the Tube Heater General Manual and provides specific information related to the DES3 Series model. All persons involved with the installation, operation and maintenance of the heater system must read and understand the information in this insert manual and the accompanying Tube Heater General Manual.

⚠ WARNING



Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operation and maintenance instructions thoroughly before installing or servicing this equipment.

This heater must be installed and serviced by trained gas installation and service personnel only. Failure to comply could result in personal injury, asphyxiation, death, fire or property damage.



In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Signs must either be posted adjacent to the heater thermostats or in the absence of such thermostats, in a conspicuous location.



Not for residential use! Do not use this heater in the home, sleeping quarters, attached garages, etc. **Installation of a commercial tube heater system in residential indoor spaces may result in property damage, serious injury, asphyxiation or death.**

For Your Safety

If you smell gas:

- Do not try to light any appliance.
- Do not touch any electrical switch.
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone.
- Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Keep these instructions for future reference.

LIODES3-Rev. 18111
Print: 1M-9/12(CDS)
Replaces: LIODES3-1M-8/10(CDS)

Contents

1.0 Safety 3
Safety Labels and Locations 3
Clearances to Combustibles 4
2.0 Installation 6
Gas Requirements 6
Electrical Requirements. 6
Wiring 7
Specifications 10
Tube Installation Sequence 11
3.0 Operation 12
Sequence of Operation 12
Thermostat 12
4.0 Troubleshooting Guide 14
5.0 Parts 18
Burner Assembly Components 18
Tube and Reflector Components 19
Kit Contents Check List 20
Approvals. 20
Limited Warranty 20

NOTE: See **page 10** for a list of available models and specifications.

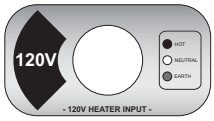
1.0 Safety



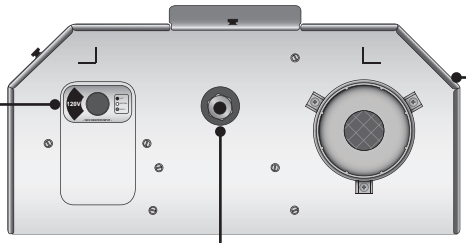
Read and understand all safety information and warnings in this insert manual and the Tube Heater General Manual before installation, operation and maintenance of the radiant tube heater system.

Safety Labels and Their Locations

Product safety signs or labels should be replaced by the product user when they no longer are legible. Contact either your local distributor or the product manufacturer for obtaining replacement signs or labels.



F/N: LLV3EP1

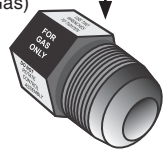


Back Panel

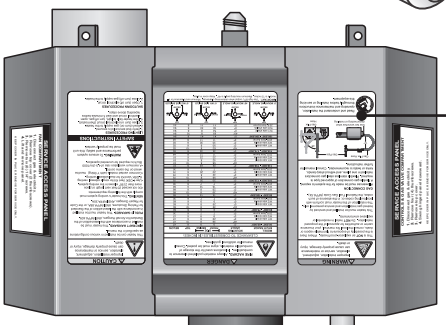


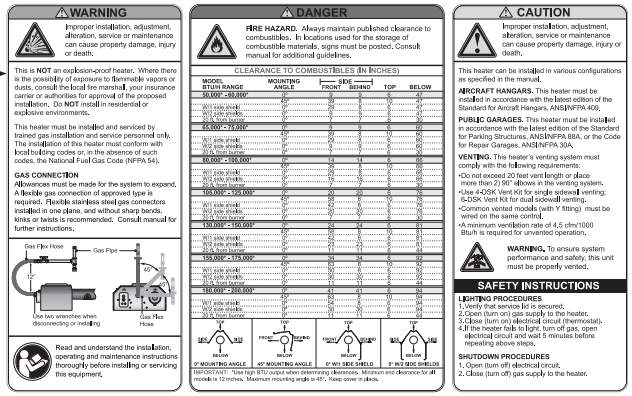
F/N: LLAC
Air Metering Orifice

F/N: LLTB018 (Natural Gas)
F/N: LLTB019 (LP Gas)



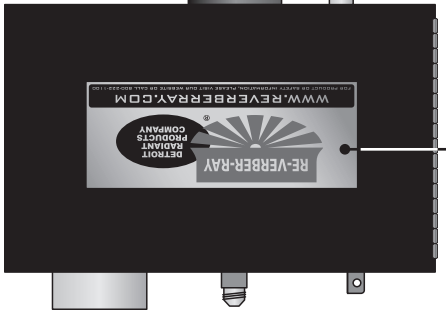
Top Panel

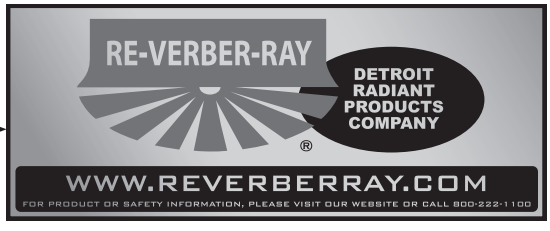




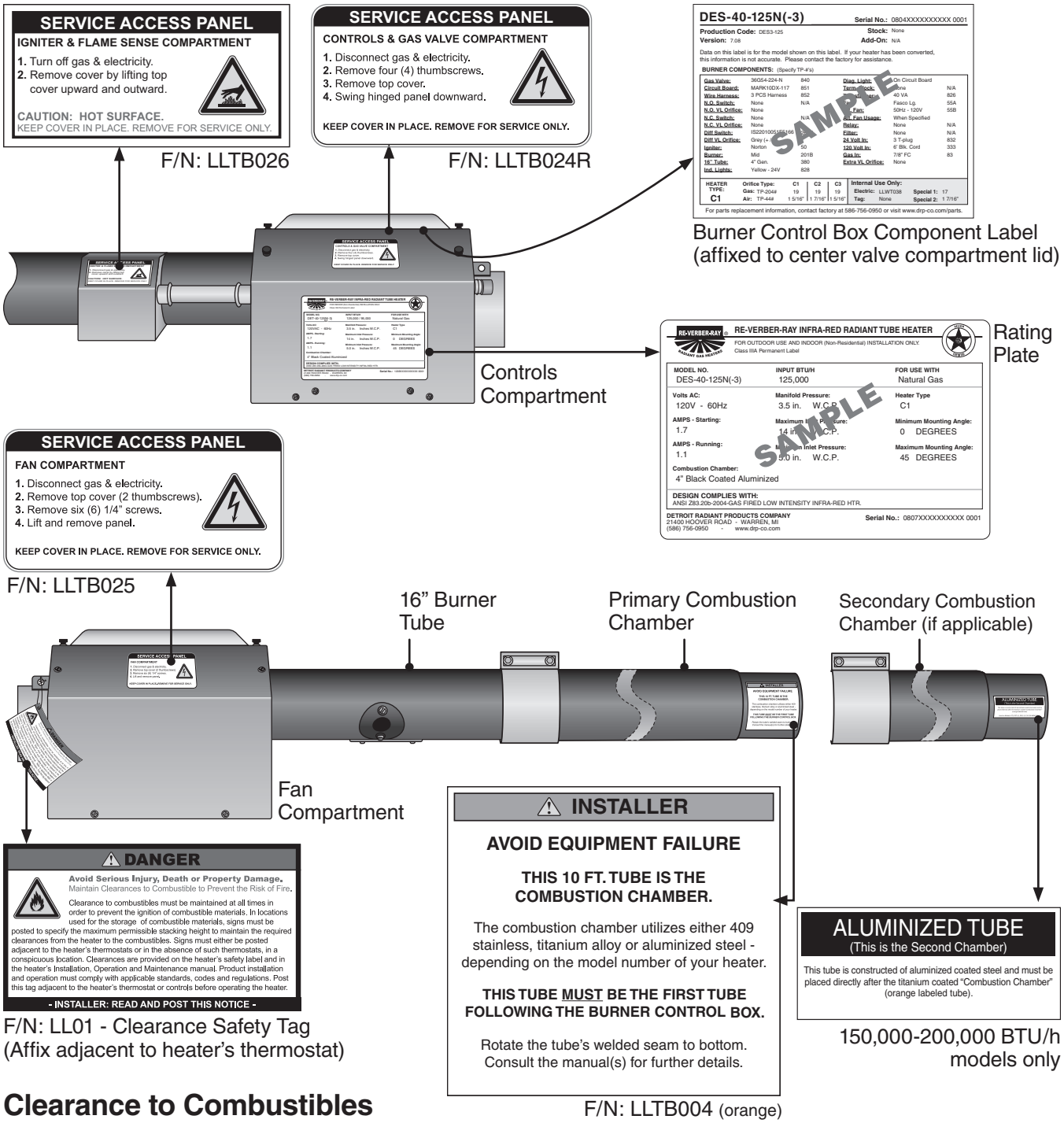
F/N: LLTCL001L, C, R
Clearance to Combustibles Labels

Bottom Panel





F/N: LLLOGO1 Logo Label



Clearance to Combustibles

⚠ WARNING



Placement of explosive objects, flammable objects, liquids and vapors close to the heater may result in explosion, fire, property damage, serious injury or death. Do not store, or use, explosive objects, liquids and vapor in the vicinity the heater.

Clearance to Combustibles is defined as the minimum distance that must exist between the tube surface, or reflector, and any combustible items (see Figure 1.1). It also pertains to the distance that must be maintained from moving objects around the tube heater. When installing the tube heater system, clearances to combustibles for the model tube heater and configuration must be maintained. Refer to Chart 1.1 to determine the required distances for your model.

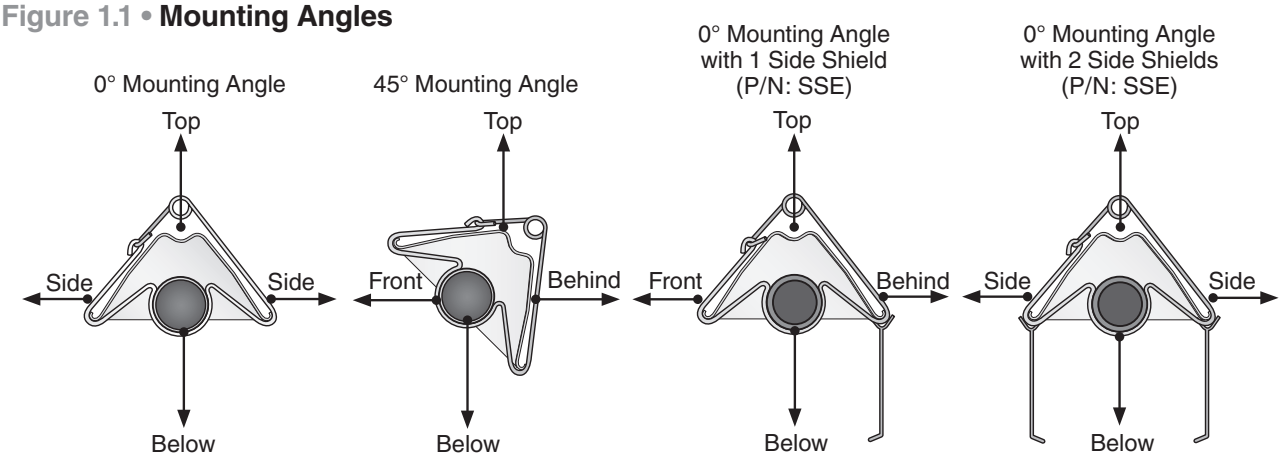
Chart 1.1 • Clearance to Combustibles in Inches (see Figure 1.1 for Mounting Angles)

Model Number	Mounting Angle *	Sides		Top	Below
		Front	Behind		
DES3 (20, 30, 40) - (50, 60) [N, P]	0°	9	9	6	47
	45°	39	8	10	47
with 1 side shield	0°	29	8	6	47
with 2 side shields	0°	9	9	6	47
20 ft. from burner	0°	7	7	6	30
DES3 (20, 30, 40) - 75 [N, P]	0°	9	9	6	60
	45°	39	8	10	60
with 1 side shield	0°	29	8	6	60
with 2 side shields	0°	9	9	6	60
20 ft. from burner	0°	7	7	6	30
DES3 (30, 40, 50) - 100 [N, P]	0°	14	14	6	66
	45°	39	8	10	66
with 1 side shield	0°	29	8	6	66
with 2 side shields	0°	16	16	6	66
20 ft. from burner	0°	7	7	6	30
DES3 (40, 50, 60) - 125 [N, P]	0°	20	20	6	76
	45°	58	8	10	76
with 1 side shield	0°	42	8	6	76
with 2 side shields	0°	20	20	6	76
20 ft. from burner	0°	7	7	6	30
DES3 (40, 50, 60) - 150 [N, P]	0°	24	24	6	81
	45°	58	8	10	81
with 1 side shield	0°	42	8	6	81
with 2 side shields	0°	23	23	6	81
20 ft. from burner	0°	11	11	6	44
DES3 (50, 60) - 175 [N, P]	0°	34	34	6	92
	45°	63	8	10	92
with 1 side shield	0°	50	8	6	92
with 2 side shields	0°	30	30	6	92
20 ft. from burner	0°	11	11	6	44
DES3 (50, 60) - 200 [N, P]	0°	41	41	6	94
	45°	63	8	10	94
with 1 side shield	0°	54	8	6	94
with 2 side shields	0°	30	30	6	94
20 ft. from burner	0°	11	11	6	44

*****Heaters mounted on an angle between 0° to 45° must maintain clearances posted for 0° or 45°; whichever is greater.

The stated clearance to combustibles represents a surface temperature of 90ºF (32ºC) above room temperature. Building materials with a low heat tolerance (such as plastics, vinyl siding, canvas, tri-ply, etc.) may be subject to degradation at lower temperatures. It is the installer's responsibility to assure that adjacent materials are protected from degradation.

Figure 1.1 • Mounting Angles



2.0 Installation

⚠ WARNING



Improper installation, adjustment, alteration, service or maintenance can cause property damage, serious injury or death. Read and understand, the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment. Only trained, qualified gas installation and service personnel may install or service this equipment.

Not for residential use! Do not use this heater in the home, sleeping quarters, attached garages, etc. **Installation of a commercial tube heater system in residential indoor spaces may result in property damage, serious injury or death.**

Instructions for the following are detailed in the Tube Heater General Manual:

- Design considerations
- Hanger suspension and placement
- Tube layout and assembly
- Burner control box suspension
- Reflectors (and accessories)
- Venting and combustion air intake
- Gas requirements
- Baffle assembly

NOTE: Electronic versions of all manuals are available at www.detroitradiant.com

Gas Requirements

Type of Gas	Required Manifold Pressure	Minimum Inlet Pressure	Maximum Inlet Pressure
Natural	3.5 inches W.C.	5.0 inches W.C.	14.0 inches W.C.
Liquefied Petroleum	10.0 inches W.C.	11.0 inches W.C.	14.0 inches W.C.



IMPORTANT: Consult the Tube Heater General Manual for gas connection requirements.

Electrical Requirements

- 120VAC-60 Hz, single-phase, 3-wire.
- 120VAC thermostat connection; 24VAC with optional relay transformer.
- Starting current 1.7 amps
- Running current 1.1 amps

Wiring

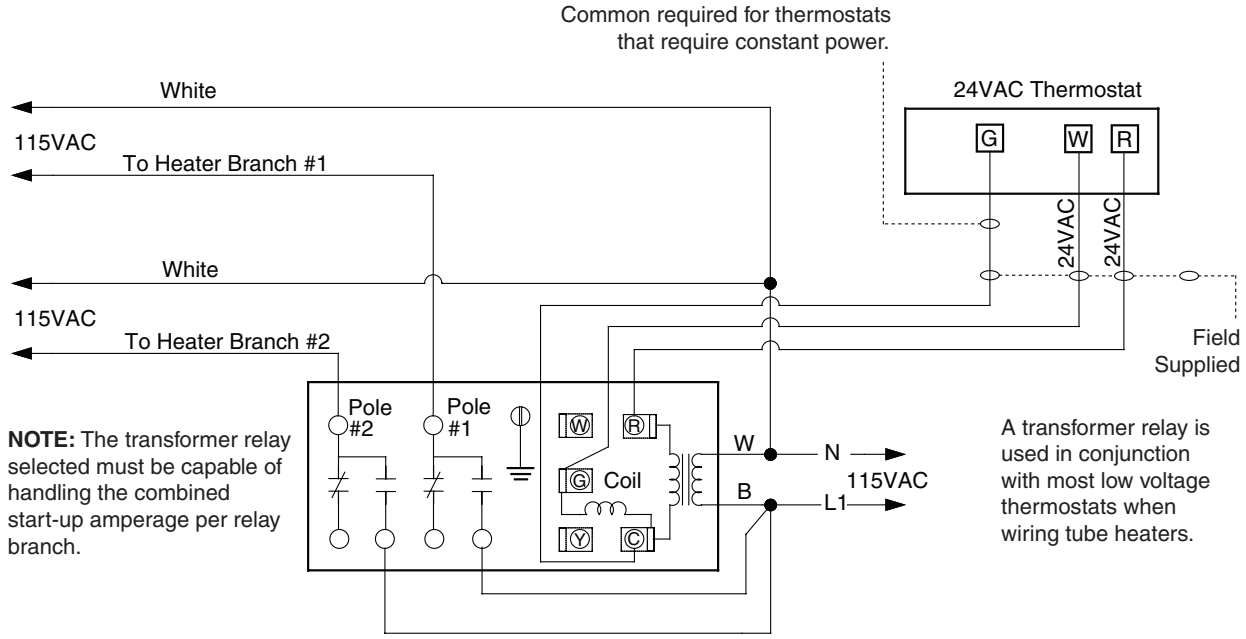
⚠ WARNING

Electric Shock

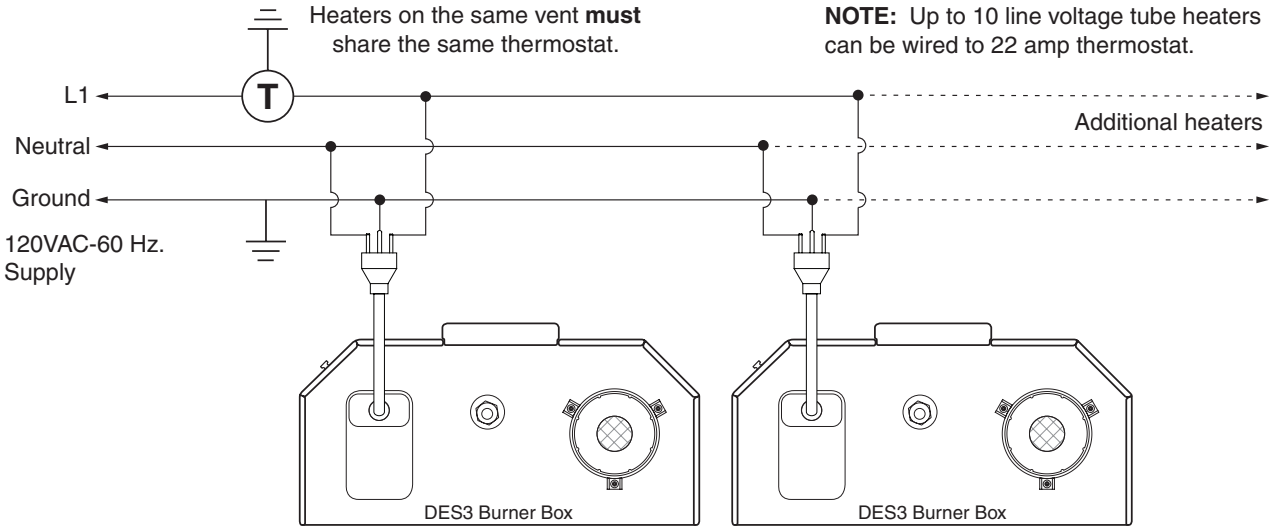
Field wiring to the tube heater must be connected and grounded in accordance with national, state, provincial, local codes and to the guidelines in the Tube Heater General Manual and Series Insert Manual. In the United States refer to the most current revisions to the ANSI/NFPA 70 Standard, and in Canada refer to the most current revisions to the CSA C22.1 Part I Standard.

Figure 2.1 • Field Wiring Diagrams

A. 24VAC Thermostat Control (requires optional combination relay transformer P/N: R8285B).



B. 120VAC Thermostat Connection(s).

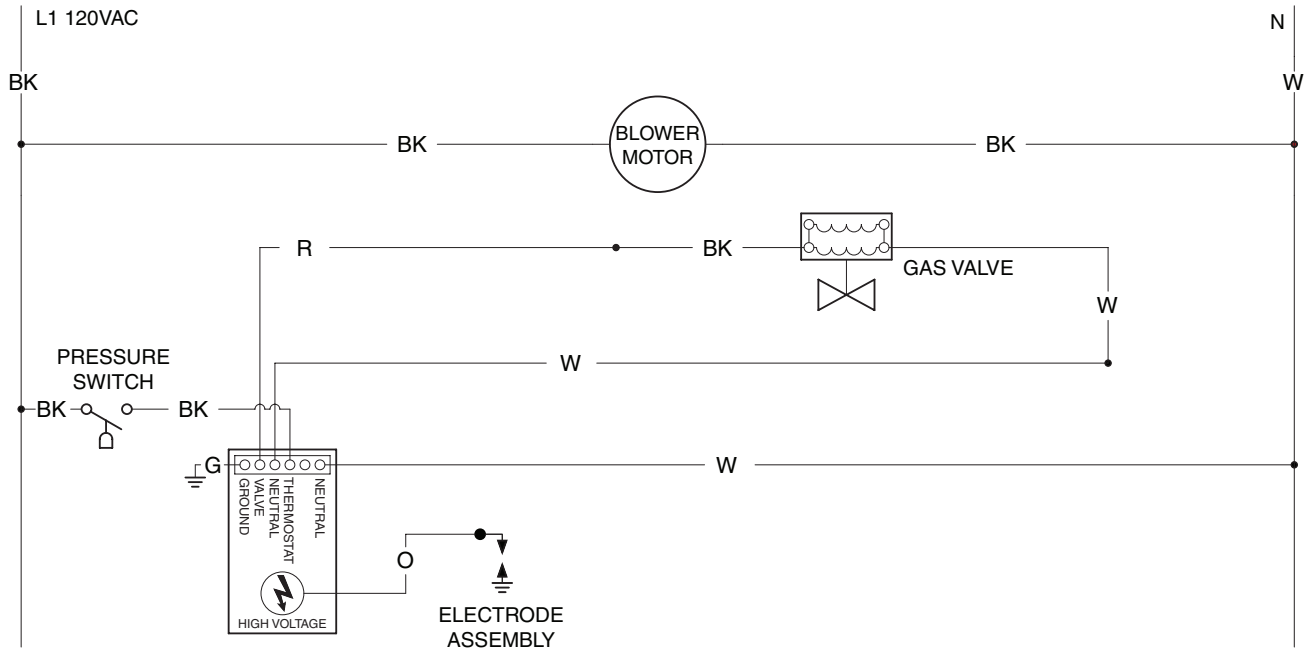


Before field wiring this appliance - Check existing wiring; replace if necessary.

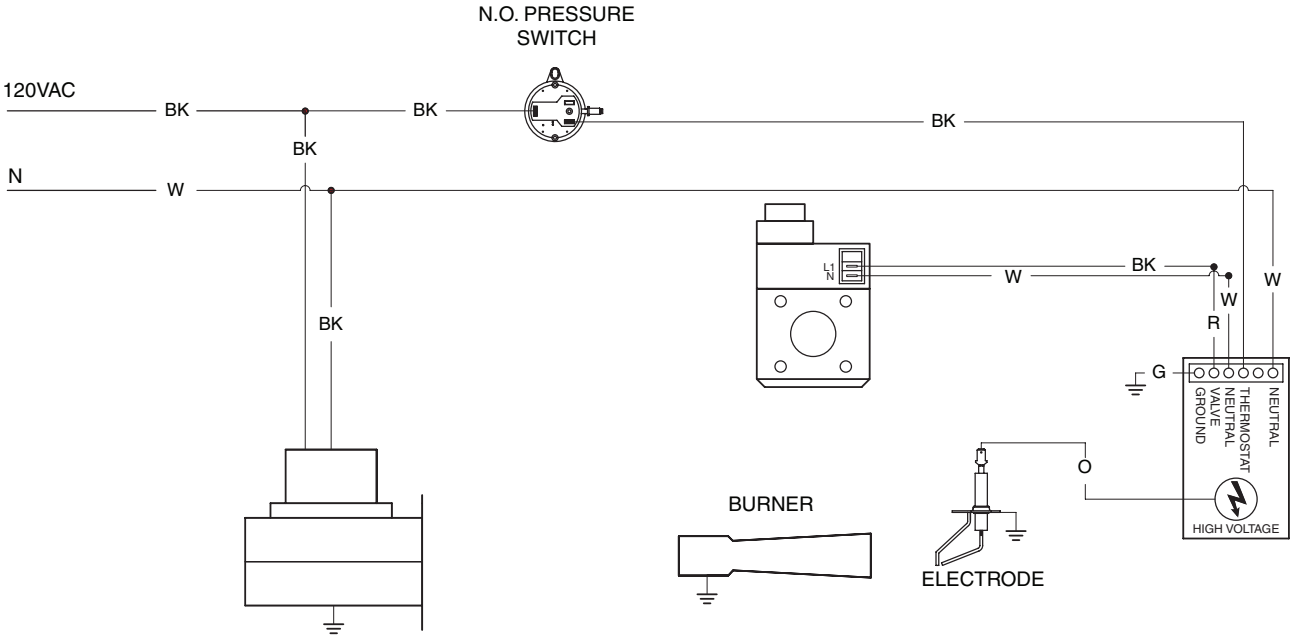
NOTE: If any of the original wire supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105°C**.**

Figure 2.2 • Internal Wiring Diagrams

A. DES3 Ladder Diagram



B. DES3 Block Diagram



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There are no alternative wiring diagrams for the DES3 Series

Specifications

Chart 2.1 • Specifications

Model Number	Gas Type (Select One)	BTU/h	Straight Length	U-Tube Length	Standard Weight (lbs.)	Recommended Mounting Height^	Combustion Chamber(s) (Black Coated)	Radiant Emitter Tube(s) (Uncoated)	Radiant Surface Area (sq. ft.)	36" Baffle Quantity
DES3-20-50	N or LP	50,000	21'-9"	13'-1"	120	9' to 14'	Alum	HRT	20.2	5
DES3-20-60	N or LP	60,000	21'-9"	13'-1"	120	10' to 15'	Alum	HRT	20.2	5
DES3-20-75	N or LP	75,000	21'-9"	13'-1"	120	11' to 18'	Alum	HRT	20.2	5
DES3-30-50	N or LP	50,000	31'-5"	**17'-9"	160	10' to 15'	Alum	HRT	30.4	5
DES3-30-60	N or LP	60,000	31'-5"	**17'-9"	160	11' to 18'	Alum	HRT	30.4	5
DES3-30-75	N or LP	75,000	31'-5"	**17'-9"	160	12' to 20'	Alum	HRT	30.4	5
DES3-30-100	N or LP	100,000	31'-5"	**17'-9"	160	13' to 23'	Alum	HRT	30.4	5
DES3-40-50	N or LP	50,000	41'-1"	22'-9"	190	11' to 18'	Alum	HRT	40.5	5
DES3-40-60	N or LP	60,000	41'-1"	22'-9"	190	11' to 18'	Alum	HRT	40.5	5
DES3-40-75	N or LP	75,000	41'-1"	22'-9"	190	12' to 20'	Alum	HRT	40.5	4
DES3-40-100	N or LP	100,000	41'-1"	22'-9"	190	13' to 23'	Alum	HRT	40.5	4
DES3-40-125	N or LP	125,000	41"-1"	22'-9"	190	14' to 25'	Alum	HRT	40.5	5
DES3-40-150	N or LP	150,000	41"-1"	22'-9"	190	15' to 27'	Titan/Alum	HRT	40.5	5
DES3-50-100	N or LP	100,000	50'-9"	**27'-5"	235	15' to 27'	Alum	HRT	50.6	2
DES3-50-125	N or LP	125,000	50'-9"	**27'-5"	235	15' to 27'	Alum	HRT	50.6	3
DES3-50-150	N or LP	150,000	50'-9"	**27'-5"	235	16' to 30'	Titan/Alum	HRT	50.6	3
DES3-50-175	N or LP	* 175,000	50'-9"	**27'-5"	235	17' to 35'	Titan/Alum	HRT	50.6	3
DES3-50-200	N or LP	* 200,000	50'-9"	**27'-5"	235	18' to 40'	Titan/Alum	HRT	50.6	2
DES3-60-125	N or LP	125,000	60'-5"	32'-5"	265	16' to 30'	Alum	HRT	60.7	2
DES3-60-150	N or LP	150,000	60'-5"	32'-5"	265	17' to 35'	Titan/Alum	HRT	60.7	2
DES3-60-175	N or LP	* 175,000	60'-5"	32'-5"	265	17' to 35'	Titan/Alum	HRT	60.7	2
DES3-60-200	N or LP	* 200,000	60'-5"	32'-5"	265	18' to 40'	Titan/Alum	HRT	60.7	2

* Model requires stainless steel tube clamp (P/N: TP-220) to be located at the seam between the primary combustion chamber and the secondary combustion tube downstream of the burner control box.

** Model requires 5EA-SUB accessory package when installing in a 'U' configuration (P/N: TF1B).

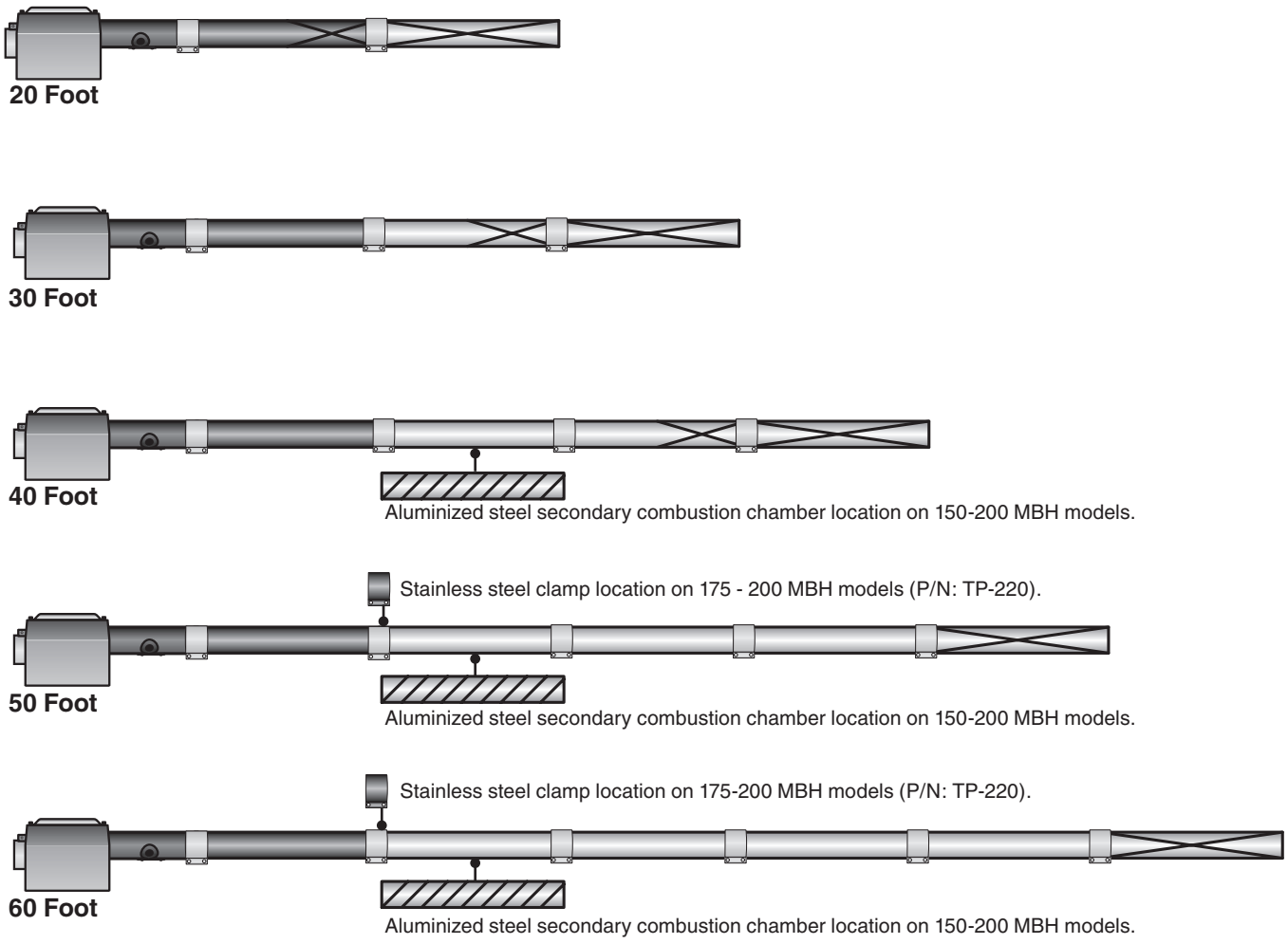
^ Factory recommended mounting heights are listed as a guideline.

IMPORTANT: Reference box label to determine the quantity of required baffle sections for each model heater.

HRT = Uncoated hot-rolled steel.
Alum= Black coated aluminized treated steel.
Titan = Black coated titanium stabilized aluminized steel.

Figure 2.3 • Tube Installation Sequence

Important! The combustion chamber & radiant tube sections must be installed in the following order.



Key

- Burner Control Box with 16” Burner Tube
- Primary Combustion Chamber Tube
- Secondary Aluminized Steel Combustion Chamber (150-200 MBH models only)
- Hot-rolled Steel Radiant Emitter Tube
- Standard Tube Clamp
- Stainless Steel Tube Clamp (P/N: TP-220)
  175-200 MBH models only - Located between 1st and 2nd 10 ft. tube sections.
- Baffle Location

NOTE: Refer to the Tube Heater General Manual, Chart 3.6 (page 23) for secured reflector joints.

3.0 Operation

⚠ WARNING



This heater must be installed and serviced by trained gas installation and service personnel only.

Do not bypass any safety features or the heater's built in safety mechanisms will be compromised.

NOTE: Reference the Tube Heater General Manual (LIOGT3) for installation requirements.

Sequence of Operation

Starting Circuit: Upon a call for heat, the fan is energized. Once operational static pressure is achieved, the differential switch will close initiating the ignition sequence. After a 7-second pre-purge, the spark electrode is energized and the gas valve opens. The trial for ignition is 15 seconds. If flame is not sensed, the heater will attempt two (2) additional ignition sequences before proceeding into hard lockout.

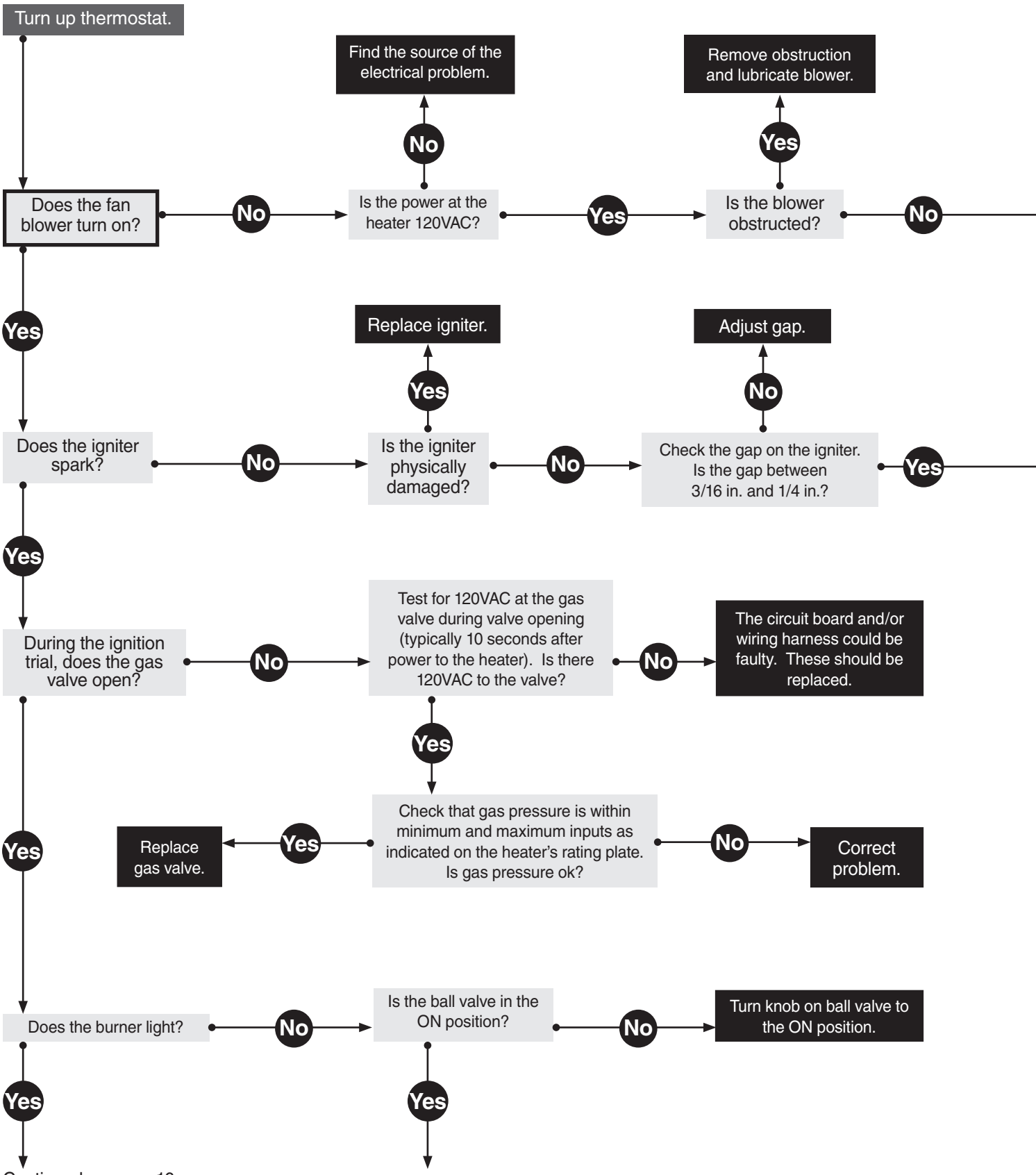
Running Circuit: After ignition, the control senses and monitors burner flame through the electrode. If sense of flame is lost, the control immediately disrupts power to the gas valve and then re-cycles the unit (identical to the starting sequence). If flame sense is not established within 15 seconds, the heater will attempt two (2) additional ignition sequences before proceeding to hard lockout. The control can be reset by briefly interrupting the power source.

Thermostat

NOTE: Different thermostats operate according to their particular features. Refer to thermostat specifications for details.

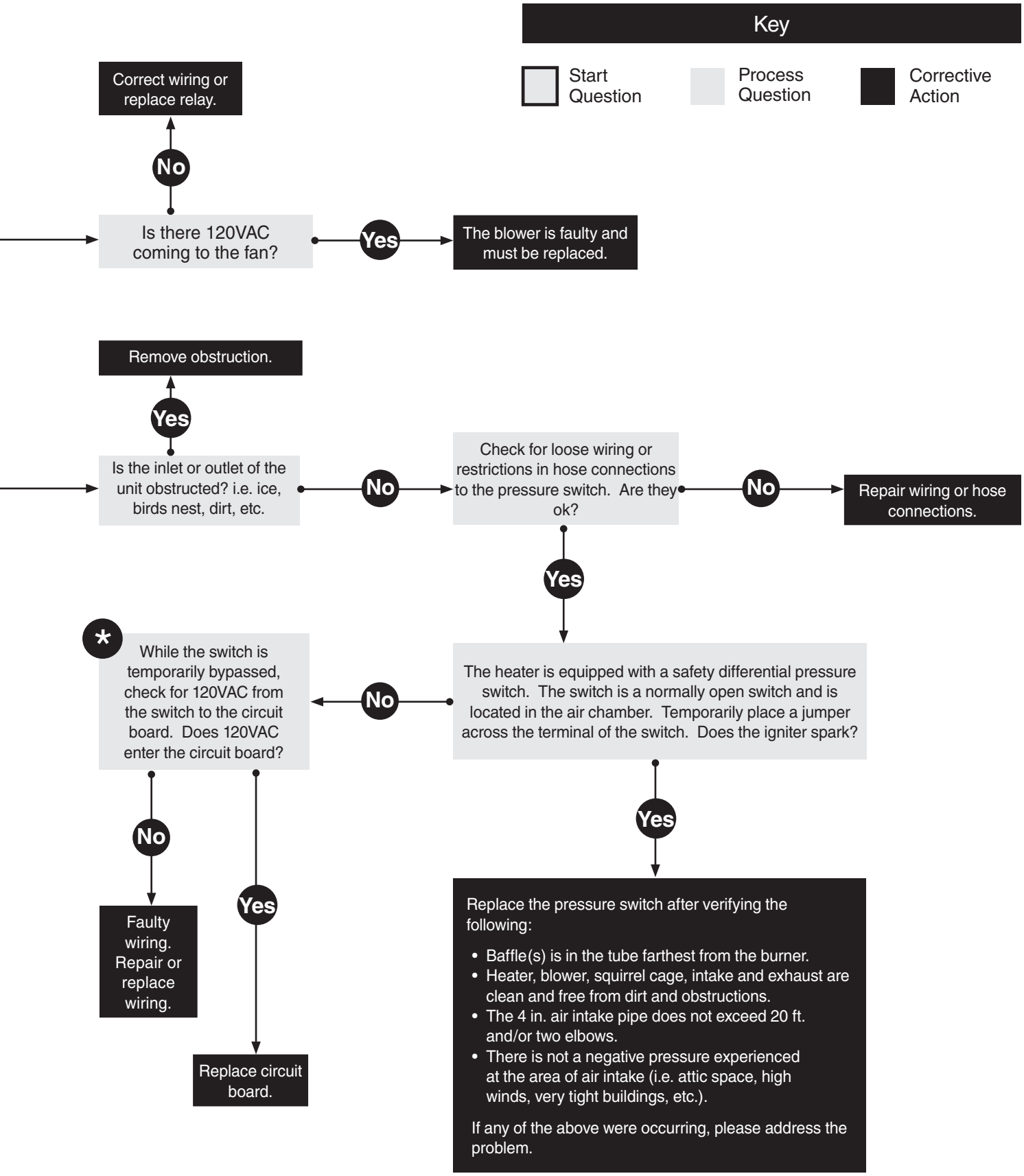
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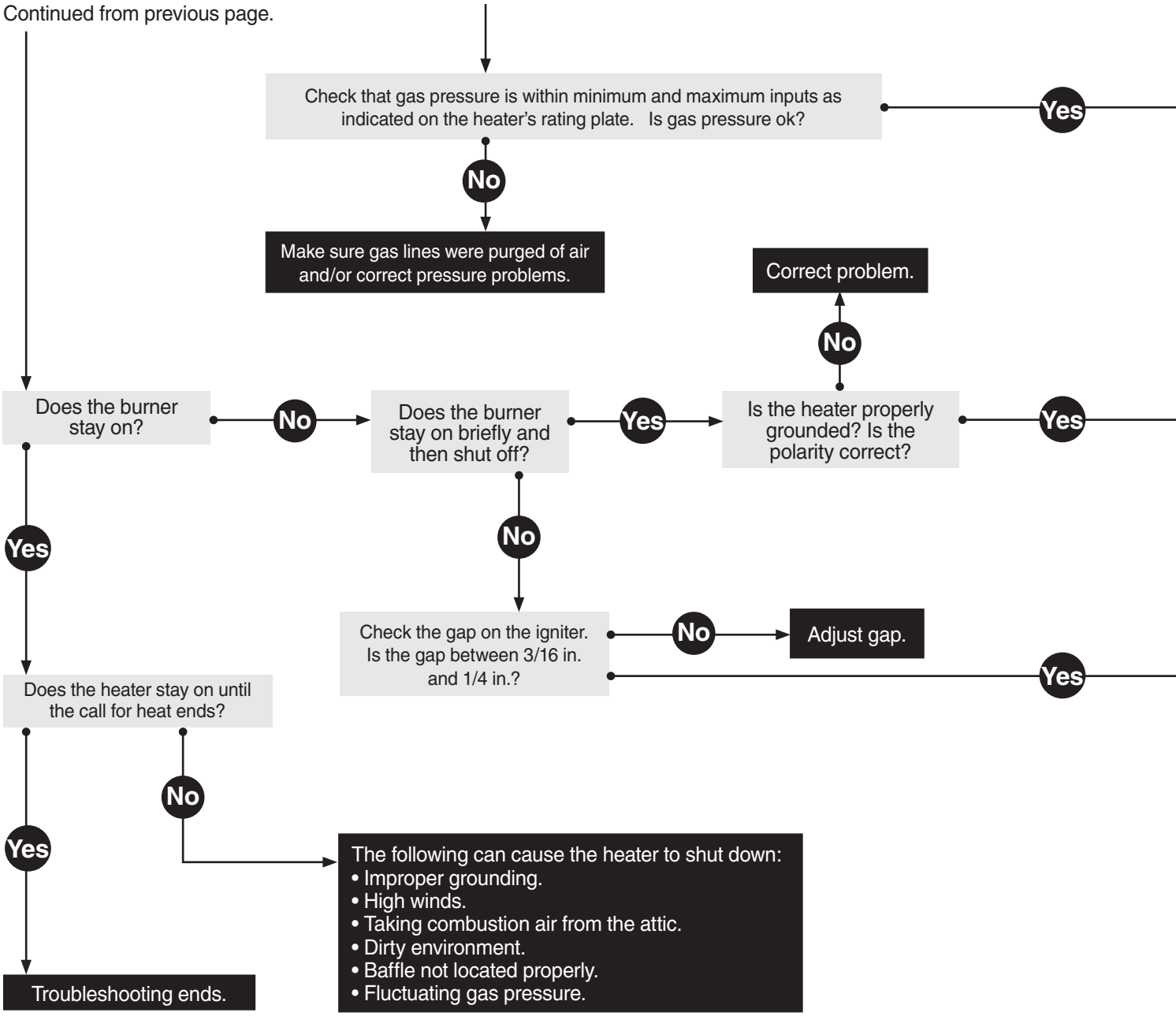
4.0 Troubleshooting Guide

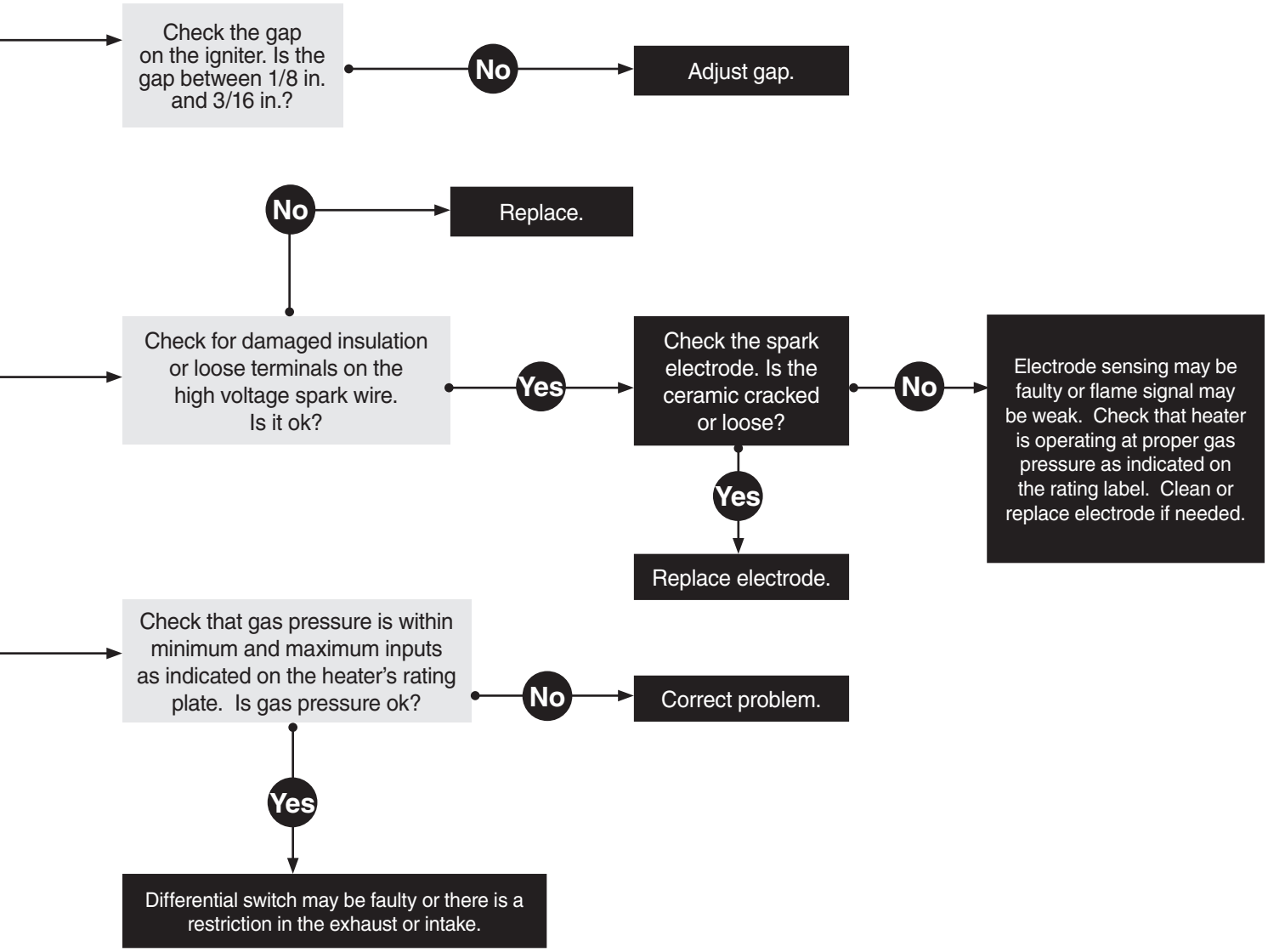


Continued on page 16.

*** NOTICE** **Bypassing any switch is intended for testing purposes only. Do not leave switch bypassed during normal operation or the heater's built-in safety mechanisms will be compromised.**

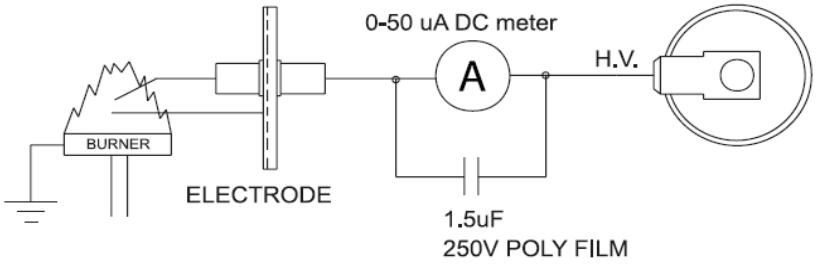



Continued from previous page.
Check that gas pressure is within minimum and maximum inputs as indicated on the heater's rating plate. Is gas pressure ok?
Yes
No
Make sure gas lines were purged of air and/or correct pressure problems.
Correct problem.
No
Does the burner stay on?
No
Does the burner stay on briefly and then shut off?
Yes
Is the heater properly grounded? Is the polarity correct?
Yes
Yes
No
Check the gap on the igniter. Is the gap between 3/16 in. and 1/4 in.?
No
Adjust gap.
Yes
Does the heater stay on until the call for heat ends?
No
Yes
The following can cause the heater to shut down:
• Improper grounding.
• High winds.
• Taking combustion air from the attic.
• Dirty environment.
• Baffle not located properly.
• Fluctuating gas pressure.
Yes
Troubleshooting ends.



Flame Current Check: Single Spark & Sense

To measure flame current, disconnect input voltage, then insert a 0-50 µA DC meter and capacitor in series with the spark electrode as shown below. Reconnect input voltage and initiate call for heat. After sparking is complete and flame is established, meter should read 1.0 µA or higher while flame is established. If meter reads below "0" on the scale, meter leads are reversed. Disconnect power and reconnect meter lead for proper polarity.



5.0 Parts

Figure 5.1 • Burner Assembly Components

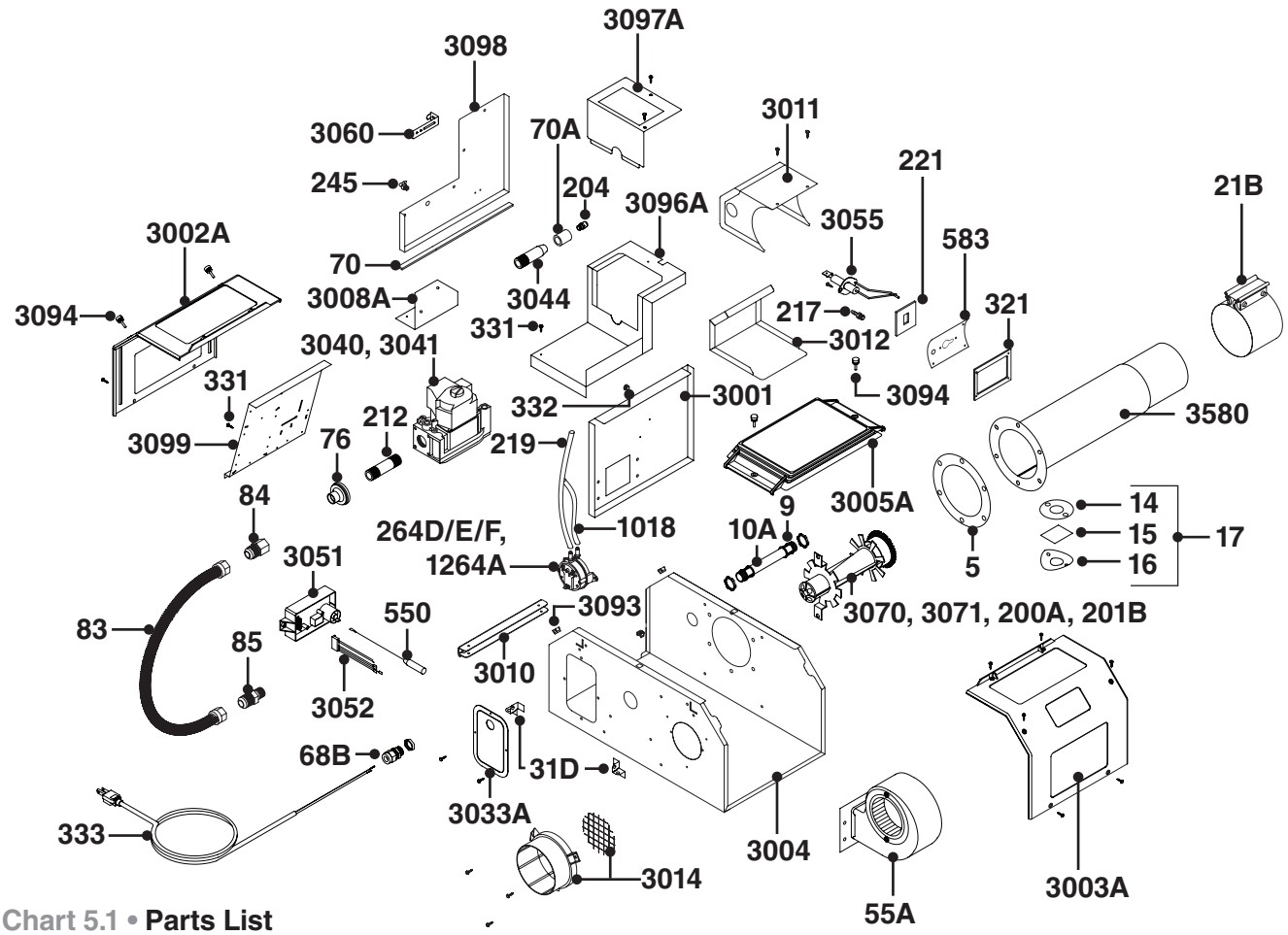
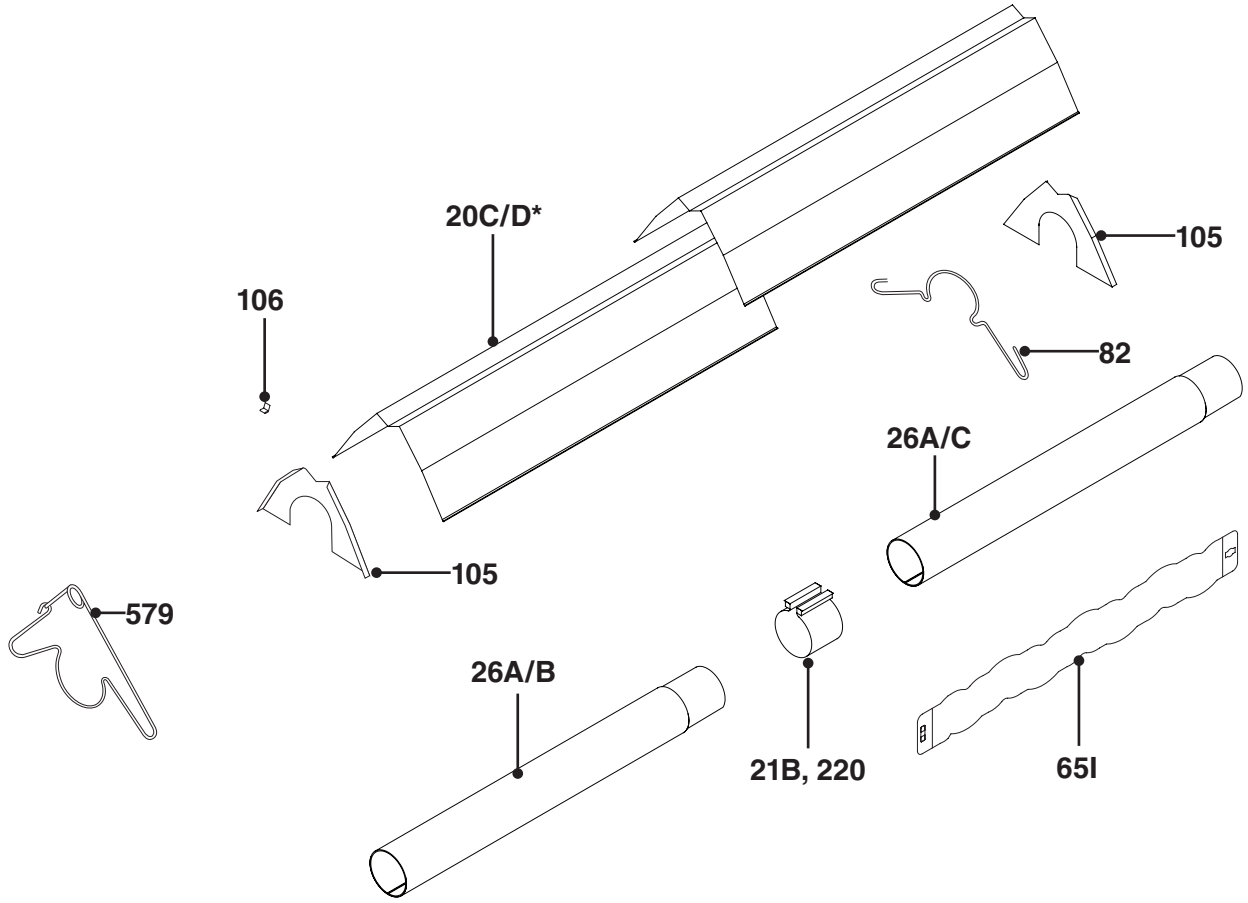


Chart 5.1 • Parts List

Part #	Description	Part #	Description
TP-5	Flange Gasket	TP-76	Rubber Grommet
TP-9	Conduit Coupling	TP-82	Reflector Center Support
TP-10A	Conduit	TP-83	Stainless Steel Flexible Gas Connector
TP-14	Sight Glass Gasket	TP-84	1/2 in. Female/Male Flare Fitting
TP-15	Sight Glass	TP-85	1/2 in. Male / Male Flare Fitting
TP-16	Sight Glass Washer	TP-105	Reflector End Cap
TP-17	Sight Glass Kit	TP-106	Reflector End Cap Clips (8 pcs.)
TP-20C	10 ft. Aluminum Reflector	TP-200A	V.3 Low SS Burner (Color Code - BLUE)
TP-20D*	10 ft. Stainless Steel Reflector*	TP-201B	V.3 Mid Burner (Color Code - TAN)
TP-21B	4 in. O.D. Tube Clamp	TP-204	Gas Orifice - consult factory
TP-26A	10 ft. Aluminized Combustion Tube	TP-212	1/2 in. x 3 in. Pipe Nipple
TP-26B	10 ft. Titanium Primary Combustion Tube	TP-217	Brass Pressure Switch Barb Fitting
TP-26C	10 ft. Uncoated Hot Rolled Radiant Tube	TP-219	Differential Vinyl Sensing Tube
TP-31D	Mounting Bracket (Qty. 2)	TP-220	4 in. O.D. Stainless Steel Tube Clamp
TP-55A	Fan Blower	TP-221	Spark Igniter Mounting Bracket Gasket
TP-65I	36 in. Interlocking Turbulator Baffle Section	TP-245	3/16” X 1/8” Plastic Gas Valve 90° Vent
TP-68B	Large Strain Relief Bushing	TP-264D	Differential Pressure Switch, 60 to 75 MBH
TP-70	1/2 in. Control Box Gasket (10.3 inches)	TP-264E	Differential Pressure Switch, 50 MBH
TP-70A	1 in. Control Box Gasket (6 inches)	TP-264F	Differential Pressure Switch, 150 to 200 MBH

* Optional upgrade or add-on item.

Figure 5.2 • Tube & Reflector Components

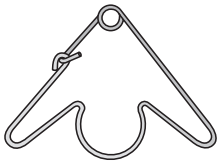
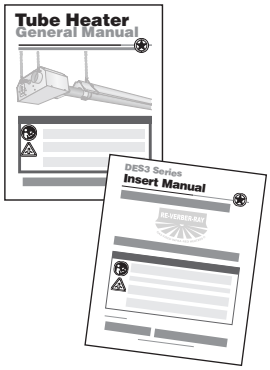
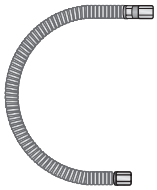
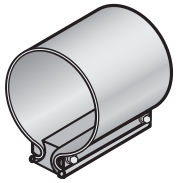
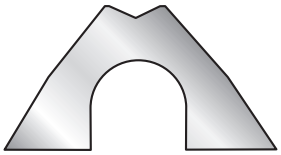


Part #	Description	Part #	Description
TP-321	Ignition Plate Gasket	TP-3041	VR4205-1357 Gas Valve - LP Gas Assembly
TP-331	Green Self-Tap Ground Screw (Qty. 2)	TP-3033A	Power Entry Plate “A”
TP-332	Divider Grommet	TP-3044	Gas Manifold
TP-333	6 ft. Black 120VAC Power Cord	TP-3051	35-72 DSI Circuit Board
TP-579	4 in. Wire Hanger	TP-3052	Wiring Harness
TP-583	Spark Igniter Plate	TP-3055	Spark Igniter Electrode
TP-1018	APS 1/4 in. Silicone Sensing Tube	TP-3060	Pressure Switch Mounting Bracket
TP-1264A	Differential Pressure Switch, 100 to 125 MBH	TP-3070	Low BTU SS Burner (Color Code - RED)
TP-3001	Divider Panel	TP-3071	High BTU Burner (Color Code - PURPLE)
TP-3002A	Left End Panel	TP-3093	#8-32 Cage Nut (Qty. 4)
TP-3003A	Right End Panel	TP-3094	#8-32 x 1/2 in. Black Nylon Shoulder Screw (Qty. 4)
TP-3004	Main Control Box Panel	TP-3096A	Valve Compartment Bottom Panel
TP-3005A	Control Box Chamber Lid	TP-3097A	Valve Compartment Top Panel
TP-3008A	Gas Valve Mounting Bracket	TP-3098	Valve Compartment Side Panel
TP-3010	Service Panel Hinge	TP-3099	Controls Mounting Panel
TP-3011	Spark Igniter Box	TP-3580	16 in. DSI Burner Tube Flange with Fittings
TP-3012	Spark Igniter Box Cover		
TP-3014	V.3 Plastic Air Orifice w/Screen-Contact Factory		
TP-3040	VR4205-1324 Natural Gas Valve Assembly		

* Optional upgrade or add-on item.

Kit Contents Check List

Chart 5.2 • **Kit Contents for DES3 Series -** Reference the length column for your model.

DES3 Series Kit Contents			
TP-579 4" Hanger 	**TP-82** 4 in. Reflector Center Support (RCS) 	**TP-106** Reflector End Cap Clips 	General Manual and DES3 Series Insert **F/N: LIOGT3 & LIODES3** 
TP-83 24 in. Stainless Steel Flex. Gas Connector 	**TP-21B** 4" Tube Clamp 	**TP-105** Reflector End Cap 	

Part No.	Description	20 ft.	30 ft.	40 ft.	50 ft.	60 ft.
TP-19B	4 in. Hanger	3	4	5	6	7
TP-21B	4 in. Tube Clamps	2	3	4	5*	6*
TP-82	4 in. Reflector Center Support	1	1	1	1	1
TP-83	24 in. S.S. Flexible Gas Connector	1	1	1	1	1
TP-105	Reflector End Caps	2	2	2	2	2
TP-106	Reflector End Cap Clips	8	8	8	8	8
LIOGT3	Tube Heater General Manual	1	1	1	1	1
LIODES3	DES3 Series Insert Manual	1	1	1	1	1

Filled By: _____

*One 4" stainless steel tube clamp (P/N: TP-220) is provided for each 175,000 - 200,000 BTU model. Place as shown on page 11.

Approvals

- CSA
- Commercial approval.
- Industrial approval.

Limited Warranty

- 1 year - Burner box components.
- 2 years - Combustion and radiant tubes.
- 3 years - Stainless steel burner.
- See page 36 of the Tube Heater General Manual for Terms and Conditions.

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21400 Hoover Road • Warren, MI 48089
Phone: 586-756-0950 • Fax: 586-756-2626
www.detroitradiant.com • sales@drp-co.com

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