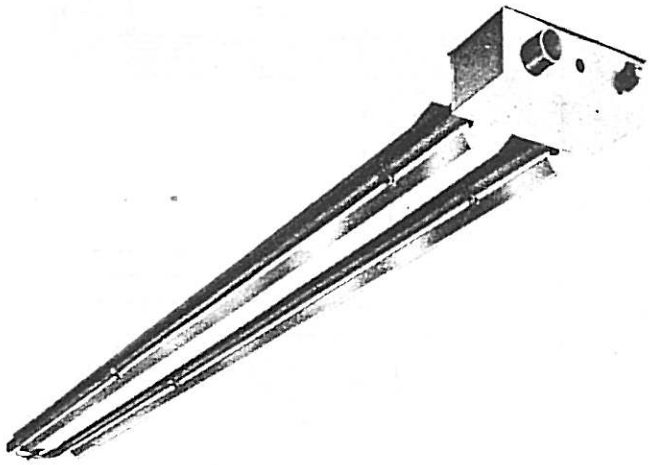
RE-VERBER-RAY

DETROIT RADIANT PRODUCTS COMPANY



VENTED RADIANT TUBE HEATER OPERATION, INSTALLATION MAINTENANCE AND PARTS MANUAL

Read carefully before attempting to install, operate or service the heaters. Retain for future reference.

FORM # T10M - 103

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DESCRIPTION

The Tube Heater works like this: An automatic burner is placed in one end of a 4" dimeter aluminized steel "U" tube either 20 feet or 40 feet in length. A fan assures that after ignition hot gases and air are forced through the tube saturating it to its hottest.

As the tube gets hot, it radiates heat. It is this simple technology which makes the "Re-Verber-Ray" Radiant Tube Heater the most cost-effective and flexible form of industrial heating.

Infra-red radiant energy behaves similarly to light, and like light, it can be reflected to concentrate heat where it is needed -- on the shop floor.

APPROVAL STANDARDS AND INSTALLATION CODES

Re-Verber-Ray Radiant Tube Heaters are designed to comply with American National Standards.

Installation must be in accordance with local code as well as the National Electrical Code (NEC) NFPA 70-1971 and the Occupational Safety and Health Act (OSHA).

In public garages the heaters must be installed in accordance with NFPA 88-1968 standards for garages and shall not be installed less that 8 feet from the floor.

In aircraft hangars, the heaters must be installed in accordance with NFPA No. 409-1971 standards for aircraft hangars. The heaters must be installed at least ten (10) feet above the upper surface of wings or engine enclosures of the highest aircraft which may be stored in the hangar. In areas adjoining the aircraft storage area, the heaters must not be installed less that eight (8) feet above the floor. also the heaters must be located to prevent damage from sections of the aircraft, cranes, scaffolds, or other movable objects.

The units must be electrically grounded in accordance with the National Electrical Code ANSI C1-1978 when an external electrical source is utilized.

Installation must conform with requirements stated in the American National Standards, National Fuel Gas Code ANS Z223.1 (NFPA No. 54-1974).

PIPING AND GAS SUPPLY

1. The gas supply line must be sufficient in size to provide the required capacity and inlet pressure of 6.0" W.C. to the heater(s) for natural gas. Pressure must be measured while all heaters are operating. Do not exceed 14" W.C. pressure for natural or propane Gas
2. Provide a 1/8" NPT plugged tapping accessible for test gauge connection immediately upstream of gas connection to heater.
3. An approved flexible gas connector and shut-off cock should be installed between gas supply line and heater to allow for heater expansion.
4. A drip leg and a ground joint union should be provided in the gas supply line.
5. Use only a pipe joint compound that is approved resistant to L.P. Gas.
6. In checking for gas leaks use a soap and water solution. Do not use an open flame.
7. Gas supply line must be free of debris, dirt and other foreign matter.
8. Purge gas line of air before light - off.

ELECTRICAL

1. Heaters operate on 120 volts 60 Hz. Ignition current requires 4.8 amps. Running current requires .9 amps.
2. Heater must be grounded in accordance with the National Electrical Code ANSI C1-1971 when an external source is utilized.
3. It is recommended that the thermostat be installed on the hot side of a fused supply line and have a sufficient ampere rating for the heater(s) it will control.
4. Wiring must not be run above or below the heater nor exposed to the radiant output.
5. Observe electrical polarity.

ORIFICES AND PRESSURE

The chart below lists the respective orifice drill size in relation to the rated capacity of the burner.

Natural Gas Orifice Size	BTU/HR	Propane Gas Orifice Size
#11 DMS	100,000	-------
#19 DMS	75,000	#39 DMS
#26 DMS	60,000	#43 DMS
#29 DMS	50,000	#45 DMS
#31 DMS	40,000	#49 DMS

USE ONLY FACTORY SUPPLIED ORIFICES

All units at the various rated capacities rely on 6.0" W.C. minimum inlet and pressure and 3.8" W.C. manifold pressure for natural gas.

When reading manifold pressure be sure that all units on the same line in are in operation.

LIGHTING INSTRUCTIONS

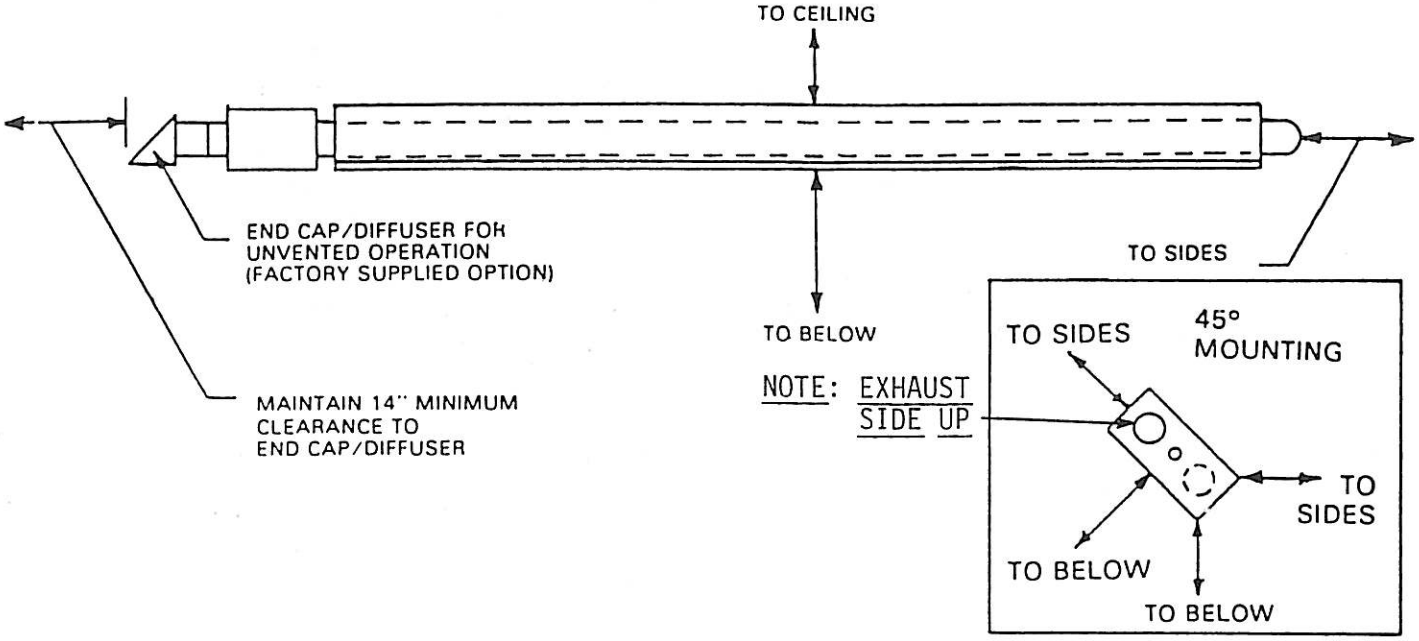
1. Purge main gas supply line.
2. Rotate heater's manual gas valve knob to "ON" position.
3. Close electrical circuit.
4. If heater fails to light, turn off gas and wait 5 minutes before repeating above.

TO SHUT DOWN

1. Rotate heater's manual gas valve to "OFF" position.
2. Open electrical circuit.

SPECIFICATIONS AND TECHNICAL DATA

CLEARANCES TO COMBUSTIBLE MATERIALS AND VEHICLES PARKED BELOW



Model / Tube Length / BTU/H x 1000 / Gas	RADIANT SURFACE AREA (SQ. FT.)	TYPICAL MOUNTING HEIGHT (FT.)	CLEARANCES TO COMBUSTIBLES (INCHES) TOP	BELOW	SIDES	LENGTH (INCHES)	WIDTH (INCHES)	HEIGHT (INCHES)	NET WT. (Lbs.)	SHIP WT. (Lbs.)
DTH 20 - 40 N or P	23.3	9-14	9	36	10	139	26	8	90	105
DTH 20 - 50 N or P	23.3	10-15	9	42	10	139	26	8	90	105
DTH 20 - 60 N or P	23.3	11-16	9	54	10	139	26	8	90	105
DTH 20 - 75 N or P	23.3	13-17	9	60	10	139	26	8	90	105
DTH 40 - 40 N or P	43.5	8-12	9	24	10	255	26	8	160	180
DTH 40 - 50 N or P	43.5	9-13	9	36	10	255	26	8	160	180
DTH 40 - 60 N or P	43.5	10-14	9	40	10	255	26	8	160	180
DTH 40 - 75 N or P	43.5	11-15	9	54	10	255	26	8	160	180
DTH 40 - 100 N	43.5	13-17	12	72	24	255	26	8	160	180

N = NATURAL GAS — P = PROPANE GAS

Combustion Air and Venting

Consult local codes or governing agency Optional: Outside air for combustion may be provided - 4" inlet required - Venting accomplished through 4" flue.

Mounting

Units equipped with eye bolts for turnbuckle leveling and chain hanging.

Electrical

120 volt 60 hz
Starting current 4.8 amps.
Running current 0.9 amp.

Gas Supply

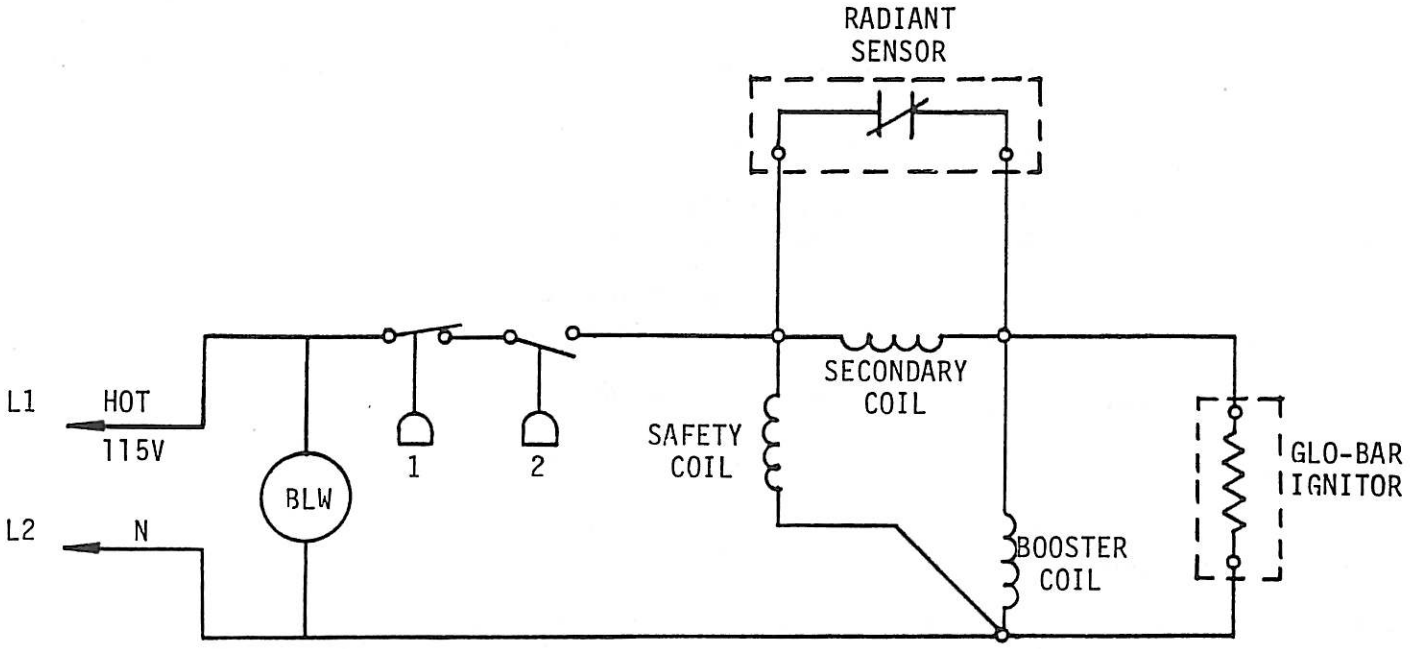
	Natural	Propane
Manifold pressure	3.8" W.C.	11.0" W.C.
Min. inlet pressure	6.0" W.C.	12.0" W.C.
Max. Inlet pressure	14.0" W.C.	14.0" W.C.

Gas connection ½" F.P.T.

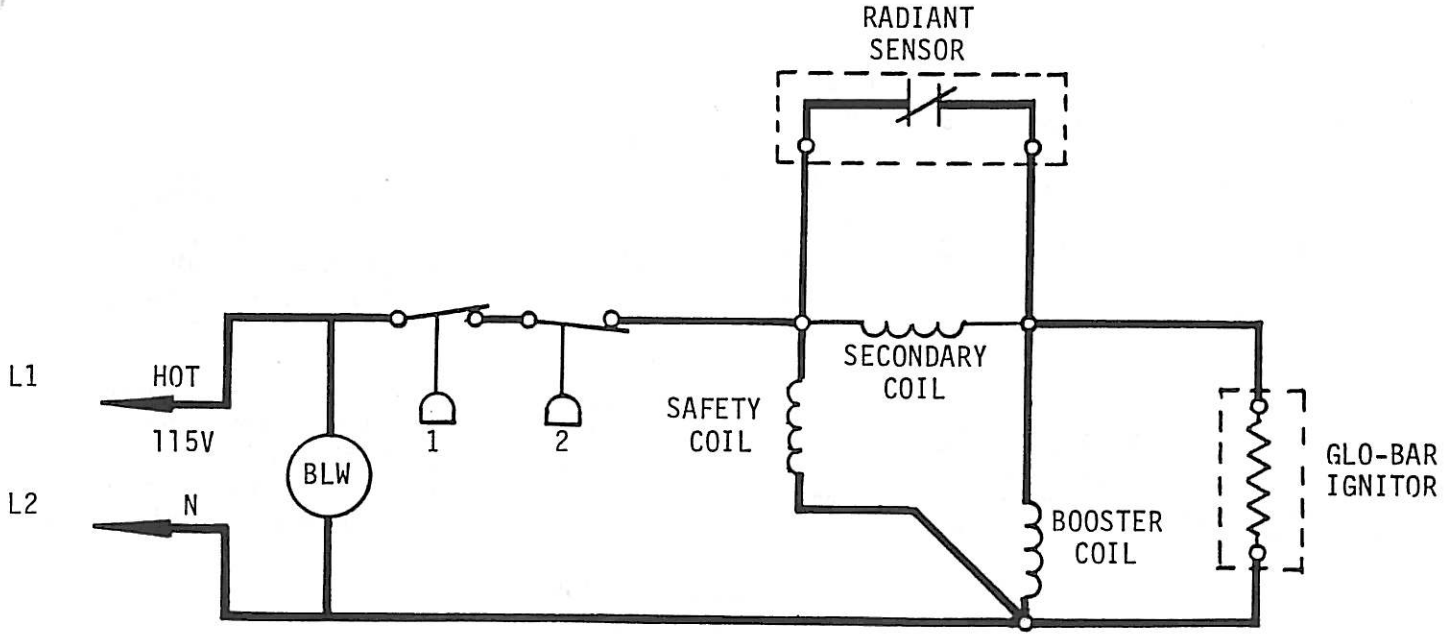
UNVENTED OPERATION

The DTH model unis are approved for unvented operation when equipped with a factory supplied end cap/diffuser. This allows the products of combustion from the units to discharge into the space being heated. Ventilation of the space is required to sufficiently dilute these products of combustion. For proper ventilation, it is recommended that a positive air displacement of at least 4 CFM per 1000 BTUH of gas input be provided. This air displacement may be accomplished by either gravity or mechanical means. Provisions must made to provide sufficient fresh air intake area and exhaust air outlet area to accomplish the displacement. When a mechanical exhaust system is provided, it should be interlocked with the electrical supply line to the heaters to enable both to function simultaneously.

WIRING DIAGRAM AND SEQUENCE OF OPERATION



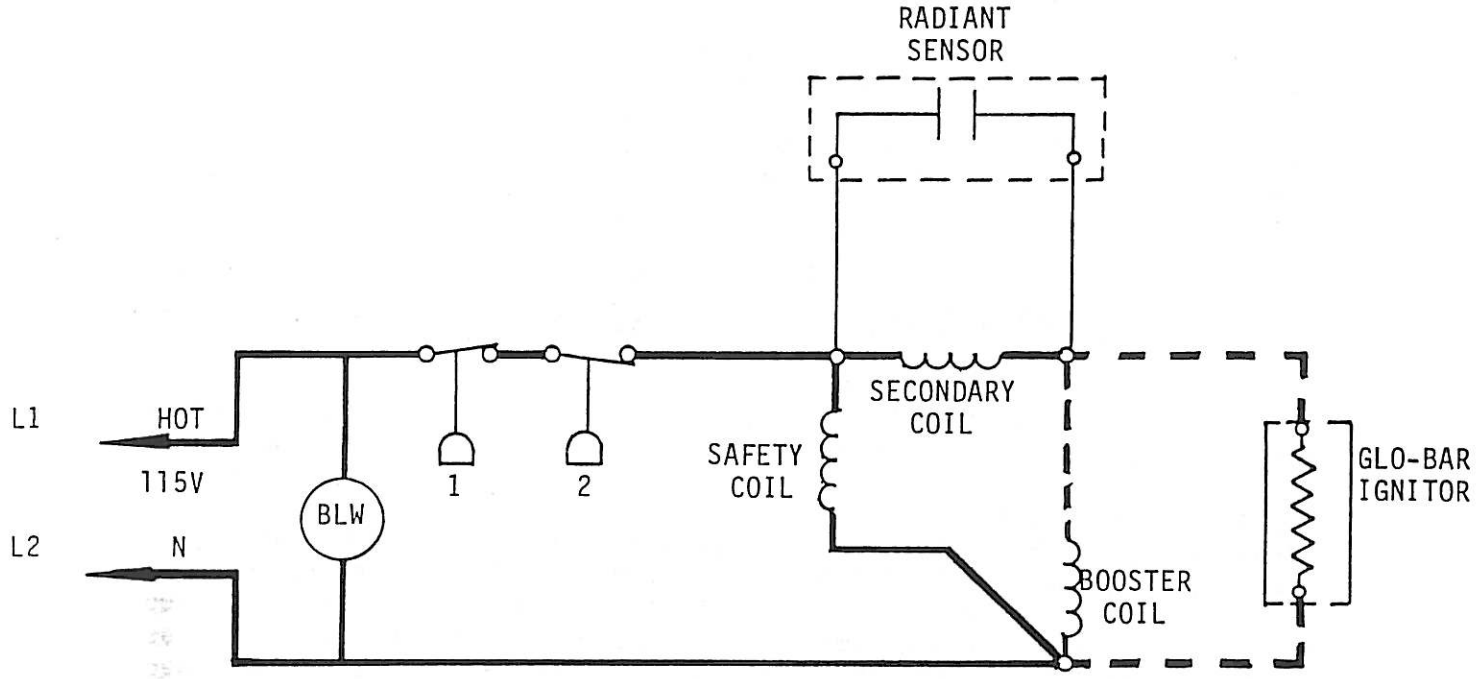
(A) BURNER CIRCUIT



(B) STARTING CIRCUIT

When voltage is applied to L1 and L2 a circuit is completed from L1 to the Blower Motor to L2. Air pressure generated by the Blower will cause the normally open Pressure Switch 2 to close by this action. Another circuit is completed from

L1 to the Radiant Sensor and Glo-Bar back to L2. Simultaneously, the Safety and Booster Coils of the first of two Redundant Valves is energized through the contacts of the Radiant Sensor. This causes the valve to open and the Glo-Bar to heat up. No gas flows, however, until the second Redundant Valve is energized and opened.



(C) RUNNING CIRCUIT

When the Glo-Bar reaches ignition temperature, the Radiant Sensor is heated and opens (max. 60 seconds).

The second Redundant Valve, now in series with the Glo-Bar, is energized and opened. Gas flow results at the burner and is ignited by the Glo-Bar.

The Secondary Coil remaining in series with the Glo-Bar causes the Glo-Bar to cool down, however, the Radiant Sensor is held open by radiant heat emitted from the gas flame. The Booster coil of the first Valve becomes placed in series with the Secondary Coil and very low current results in the coil. The Safety Coil only is sufficient to hold the first Valve open. If a momentary power failure occurs, the First Valve will shut down gas supply to the burner and when power is restored, the Safety Coil alone is not sufficient to pull Valve open. Therefore, the Radiant Sensor cools down and the contacts close and recycle occurs (max. 60 seconds).

COMBUSTION AIR

1. Combustion air intake is a factory pre-set opening.

2. If indoor combustion air is to be supplied from a tightly closed room, one square inch of free area opening should be provided for each 5,000 BTUH of heater input.

3. If the building has a negative pressure or if contaminants in the air will upset burner combustion then outside combustion air should be directly supplied to the heater. Outside combustion air may be provided by an accessory 4" air duct and directly attached over the air inlet opening. (See illustration page 16.)

4. Outside air will assist in conserving gas because heated indoor air will not be wasted in the combustion process.

FLUE VENTING

1. Check all codes prior to installing any flue stacks. Local codes may vary.

2. Heater exhaust end will receive a 4 diameter flared or swedged stack.

3. Stacks may consist of a 10' section of radiant tubing if desired. Total stack length from the heater to the exit should not exceed 25' to 35' on the DTH-20 models and 10' to 15' on the DTH-40, depending upon input. The portion of the stack that passes through combustible material of the building wall or roof must be dual insulated flue pipe. (See Ilstr. pg. 17)

4. Stacks may exit the building either horizontally or vertically. For horizontal venting the stack should exit the building 2 feet above the eave of the roof or far enough away from the building sidewall to prevent any static pressure build-up that could cause the heater to go into nuisance shut-down. Care should be exercised to assure that vent opening is beyond any combustible overhang.

5. If condensation within the stack becomes a problem, the stack length should be shortened or insulated.

6. A common flue may be used for double venting of units. Assure that the open area of the double flue vent equals the sum of the open area for individual flue vents. (See illustration page 18.)

7. Do not use more than 2 90°elbows for model DTH-20 nor more than 2 90°elbows for model DTH-40.

REFLECTOR ASSEMBLY

1. Assemble bolt with washers and clamps to the reflector. (As shown in exploded heater view page 10.)

2. Attach reflector with clamp attachment to heater.

MOUNTING THE HEATER

1. Heater comes equipped with the necessary eye bolt and tube clamp for heater hanging. The DTH-20 has three, and the DTH-40 has four. (See exploded heater view page 10.)

2. Number 3 Double Loop chain is recommended for heater hanging. Turn buckles in combination with chains are recommended to assure heater leveling. If rods or other rigid means are used, provide sufficient lengths or swing joints to allow for heater expansion.

3. Mount heaters in conformity with the Standards Approvals referenced on page 1 of this manual.

4. Heater must be independently supported and not rely on the gas or electrical line for any of its support.

OPERATION

A. Burner Assembly:

1. Upon the thermostat calling for heat, the burner blower will operate and pressurize the control box and burner chamber. Pressure switch is satisfied, and the glo-bar will energize. This purge cycle will take approximately 35 seconds.

2. Upon the radiant sensor sensing, glo-bar de-energizes (residual glo-bar energy will ignite burner gas). The radiant sensor will then sense main burner ignition and continue to operate.

3. When the thermostat is satisfied, the motor de-energizes, valve closes and system waits next cycle of operation.

B. Blower Fan:

1. Blower fan mounted in the control box is rated to supply sufficient combustion air as applied to the heater.

2. Blower fan is U.L. listed and includes a thermal protector overload. Periodic lubrication is required.

C. Pressure Switches:

1. Mounted adjacent to the blower are two pressure switches.

2. The combustion chamber pressure switch is factory pre-set to assure that a minimum of 2/3 normal rate of combustion air is passed into the combustion chamber. Any air flow restriction less than 2/3 normal rate will cause the pressure switch to shut down the entire system.

3. The exhaust pressure switch is factory pre-set to assure that a minimum of 1/2 normal rate of exhaust air is being passed. Any air flow restriction less than 1/2 normal rate will cause the pressure switch to shut down the entire system.

GAS CONTROLS

A. Gas Valves:

Gas valve number 25K39A includes a safety and secondary valve with pressure regulator removed.

The safety valve is activated by means of a double coil (split coil - safety and booster). Both coils are utilized to open the safety valve.

The secondary has a single coil. Should the safety coil or the booster coil require replacement, they must be replaced as a unit. The internal regulator is blocked open and external combination regulator is used to control shut off and regulate manifold pressure.

B. Glo-Bar Ignitor:

The Glo-Bar Ignitor consists of a recrystallized silicon carbide material which becomes white hot during the ignition cycle of the system. Main burner gas ignites after the gas valve opens and the ignitor has reached ignition temperature.

The ignitor has been design tested to withstand 100,000 cycles of operation. However, it is fragile and must be handled carefully to avoid breakage.

The ignitor is attached to the side of the venturi by means of a mounting screw and is electrically connected with spade terminals.

Service to the Glo-Bar is limited to replacing it if determined to be defective.

C. Radiant Sensor:

The radiant sensor is mounted outside the radiant tube and near the pressurized control box. It is enclosed by a pressurized cover box.

The radiant sensor is a heat sensitive bi-metal switch with a single throw contact that is normally in the closed position.

It is calibrated to open when the Glo-Bar has attained ignition temperature. After the burner has ignited, burner heat causes the radiant sensor to remain open. When the burner flame terminates the radiant sensor contact recloses approximately thirtyfive seconds later.

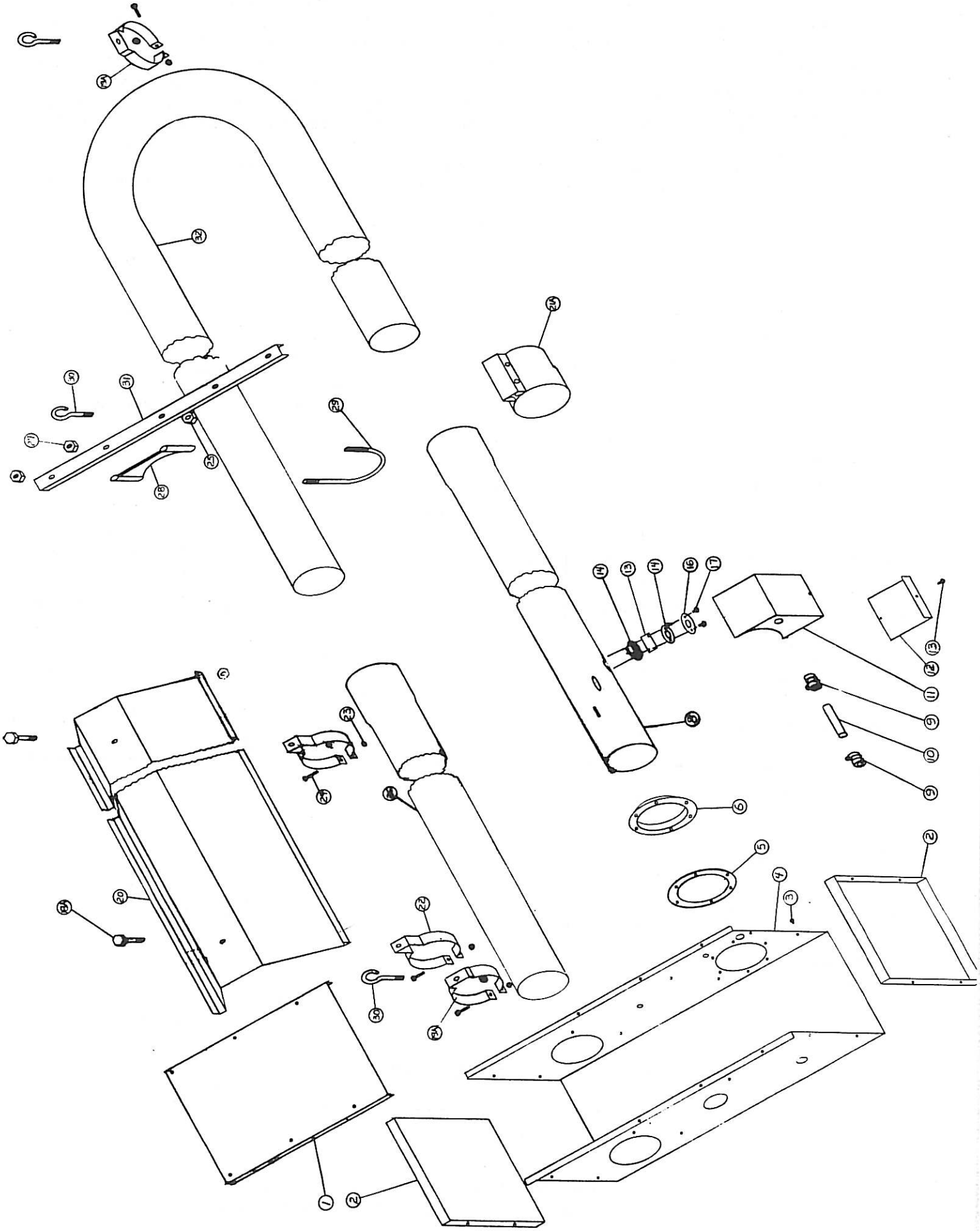
The radiant sensor is dependent on pressurized control box air conducted through the electrical conduit connection to prevent it from overheating. This air passage should be kept open and the conduit connection kept in place.

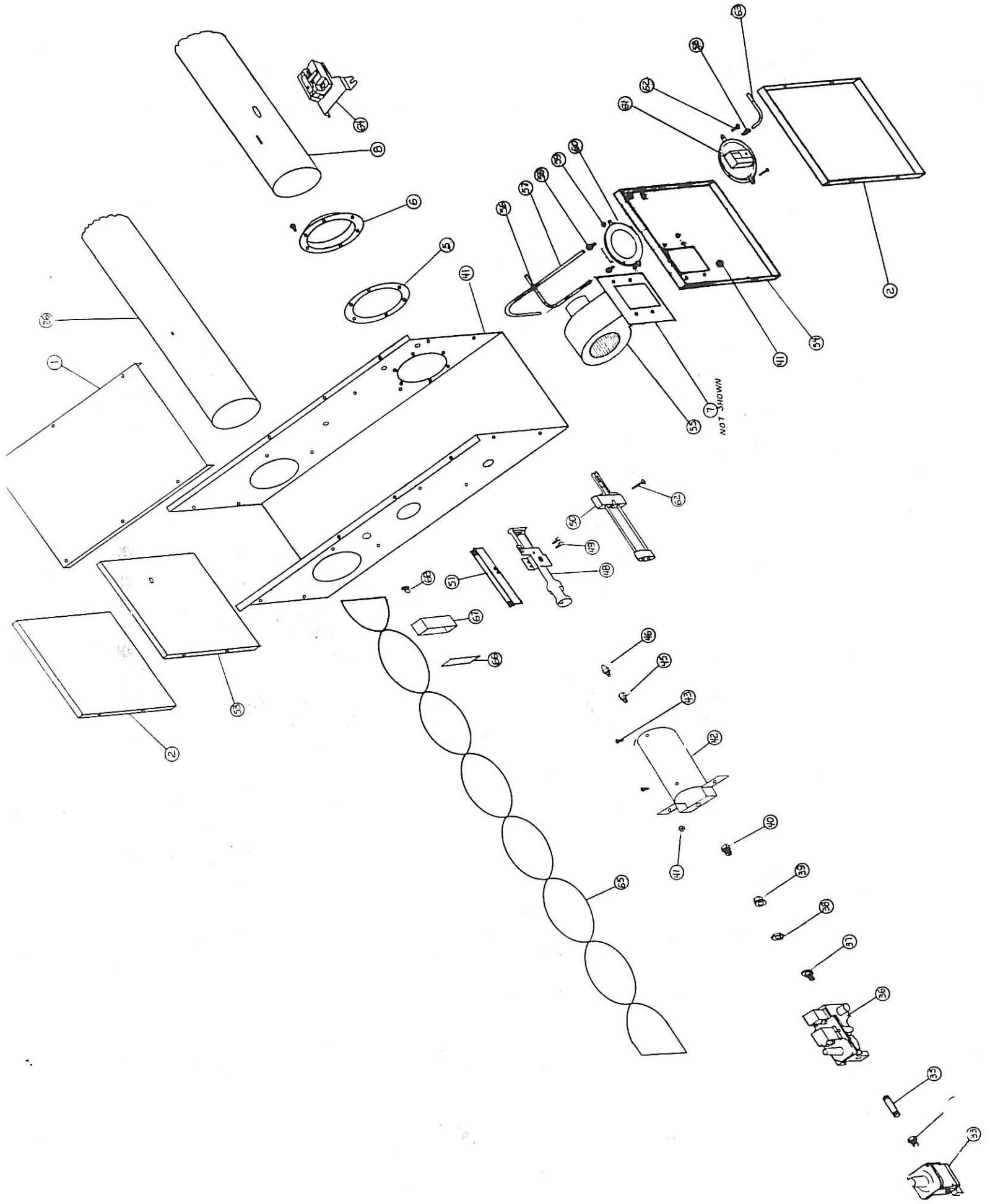
Mounting of the radiant sensor to the radiant tube is critical. Any misalignment between the radiant sensor and the radiant tube "window" will cause the system to go into nuisance shutdown.

TROUBLE SHOOTING SERVICE AND MAINTENANCE CHECK LIST

SYMPTOM	POSSIBLE CAUSES	SERVICE
1. Thermostat closed but nothing happens	1. Blown fuse	1. Replace
	2. Defective thermostat	2. Replace
	3. Loose or disconnected wire	3. Repair as required
	4. Defective Fan	4. Lubricate, repair or replace
	5. Box cover or gasket not in place	5. Put in place
2. Thermostat closed. Fan operates. No Glo-Bar energization	1. Loose or disconnected wire	1. Repair as required
	2. Plugged or restricted exhaust vent	2. Remove foreign matter
	3. Plugged pressure switch lines	3. Clean as required

SYMPTOM	POSSIBLE CAUSES	SERVICE
	5. Defective pressure Switches	5. Replace only. Do not adjust
	6. Defective Glo-Bar	6. Replace
	7. Normally closed contacts in radiant sensor stay open	7. Replace radiant sensor
3. Thermostat closed, Fan and Glo-Bar operate. After 45 seconds Glo-Bar shuts off. No ignition.	1. Closed gas supply	1. Open all gas connections
	2. Dirty or restricted orifice	2. Remove and clean with a soft object
	3. Defective valve, valve coil, disconnected valve wire	3. Replace or repair
4. Thermostat closed, Fan and Glo-Bar operate. After 1 minute, Glo-Bar stays on. No ignition	1. Dirty or sooted radiant sensor window	1. Clean as necessary
	2. Misaligned radiant sensor window, fails to "see" glo-bar operation.	2. Adjust radiant sensor to radiant tube using prepunched mounting holes
	3. Normally closed contacts in radiant sensor stay closed.	3. Replace radiant sensor
5. Thermostat closed. Fan and glo-bar operate. Ignition occurs. Burner cycles off after minimum of 1 minute	1. Dirty or sooted radiant sensor window	1. Clean as necessary
	2. Misaligned radiant sensor fails to "see" main burn operation	2. Adjust radiant sensor to radiant tube using prepunched mounting holes
	3. Low gas pressure	3. Provide required gas pressure
	4. Dirty or restricted orifice	4. Remove and clean with a soft object
6. Loss of heater efficiency	1. Low gas pressure	1. Provide required gas pressure
	2. Dirty or restricted orifice	2. Remove and clean with a soft object. Replace
	3. Foreign matter inside burner assembly	3. Clean as necessary
	4. Unit cycles on and off	4. Check cause #5
	5. Reflector is sooted and lost its reflective ability	5. Clean with aluminum cleaner and soft wiping cloth
	6. Reflector not in place	6. Put in place.
7. Visual inspection of burner operation not possible	1. Dirty or sooted sight glass	1. Remove, clean and replace
8. Radiant tubes leaking burnt gasses	1. Loose tube connections	1. Assure that tube end is fully inserted into flared end and properly clamped
	2. Holes or cracks in radiant tubes.	2. Replace.

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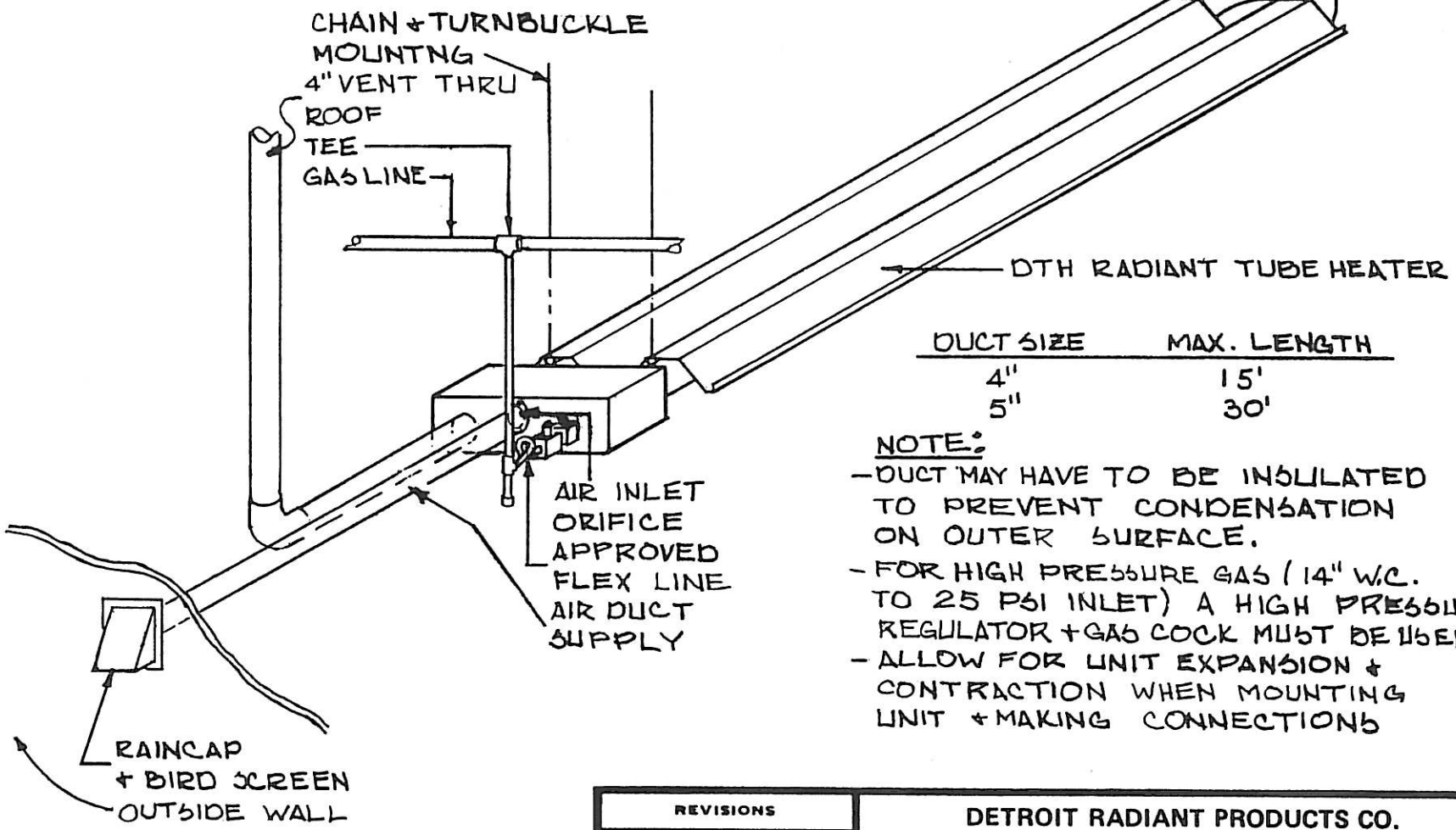
PARTS LIST

	DESCRIPTION	QUANTITY REQUIRED FOR DTH-20		DTH-40
1.	Control Box Cover	1	----	1
2.	Outside Control Box End	2	----	2
3.	#8 Sheet Metal Screw 1/4	16	----	16
4.	Control Box	1	----	1
5.	Gasket	1	----	1
6.	Tube Flange	1	----	1
7.	1/4 - 20 x 1/2 Machine Screw	8	----	8
8.	10' Burner Tube Straight	0	----	1
9.	Conduit Coupling	2	----	2
10.	Aluminum Tube 4" x 1/2"	1	----	1
11.	Radiant Sensor Box	1	----	1
12.	Radiant Sensor Lid	1	----	1
13.	#8 x 1/2 Self Drilling Screw	3	----	3
14.	Sight Glass Gasket	2	----	2
15.	Sight Glass	1	----	1
16.	Sight Glass Washer	1	----	1
17.	1/4 - 20 x 1/2 Thread Cutting Screw	2	----	2
18A.	Machine Screw 5/16 - 18 x 1/2	4	----	8
19A.	Hanging Clamp	3	----	3
20.	Reflector	2	----	4
21A.	Tube Clamp	0	----	2
22.	Reflector Clamp	4	----	8
23.	1/4 - 20 Nut	7	----	11
24.	1/4 - 20 x 1 1/4 Machine Screw	7	----	11
25.	Nut 5/16	6	----	8
26.	10' Exhaust Tube Straight	0	----	1
27.	"U" Bolt Nut	0	----	4
28.	"U" Bolt Saddle	0	----	2
29.	"U" Bolt	0	----	2
30.	Eye Bolt	3	----	4
31.	Tube Support Bracket	0	----	1
32.	10' "U" Tube	1	----	1
33.	VR 16 Natural Gas or R400 Propane Regulator	1	----	1
34.	3/8 x 1/2 Bushing	1	----	1
35.	Pipe Nipple 2 1/2 x 3/8	1	----	1
36.	3/8 Gas Valve	1	----	1
37.	3/8 Union Fitting	1	----	1
38.	Union Nut	1	----	1
39.	1/2 Union Fitting	1	----	1
40.	1/2 x 1/4 Bushing	1	----	1
41.	1/4 x 20 Nut	10	----	10
42.	Burner Casing	1	----	1
43.	#8 x 1/4 Sheet Metal Screw	3	----	3
44.	Inlet Air Orifice W/Screen	1	----	1
45.	1/4 x 1/8 Bushing	1	----	1
46.	Orifice	1	----	1

	DESCRIPTION	QUANTITY REQUIRED FOR DTH-20		DTH-40
48.	Main Burner	1	----	1
49.	#8 x 1/4 Sheet Metal Screw	2	----	2
50.	Glo-Bar Ignitor	1	----	1
51.	Main Burner Bracket	1	----	1
52.	#8 x 1 Machine Screw	1	----	1
53.	Exhaust Box Divider	1	----	1
54.	Burner Box Divider	1	----	1
55.	Fan Blower	1	----	1
56.	1/4 Atmospheric Pressure Tube	1	----	1
57.	1/4 Exhaust Pressure Tube	1	----	1
58.	Male Compression Fitting	3	----	3
59.	#8 Nut	2	----	2
60.	Exhaust Pressure Switch	1	----	1
61.	Burner Pressure Switch	1	----	1
62.	#8 x 1/2 Machine Screw	2	----	2
63.	1/4 Burner Pressure Tube	1	----	1
64.	Radiant Sensor	1	----	1
65.	Heat Diffuser	2	----	4
66.	2 x 4 Outlet Box	1	----	1
67.	2 x 4 Outlet Box Cover	1	----	1
68.	Conduit Nipple	1	----	1



DUCT SIZE	MAX. LENGTH
4"	15'
5"	30'

NOTE:

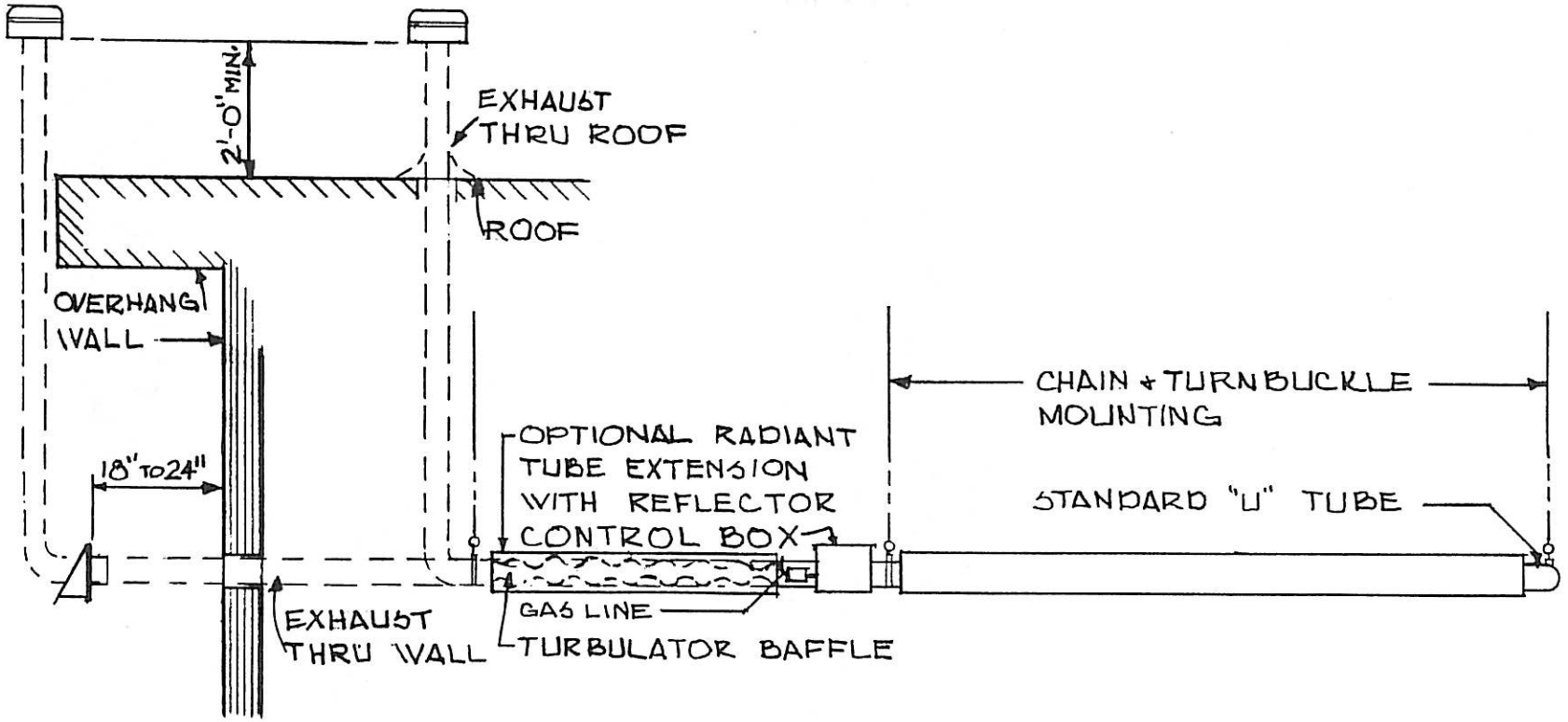
- DUCT MAY HAVE TO BE INSULATED TO PREVENT CONDENSATION ON OUTER SURFACE.
- FOR HIGH PRESSURE GAS (14" W.C. TO 25 PSI INLET) A HIGH PRESSURE REGULATOR & GAS COCK MUST BE USED
- ALLOW FOR UNIT EXPANSION & CONTRACTION WHEN MOUNTING UNIT & MAKING CONNECTIONS

REVISIONS		
NO.	DATE	BY
1		
2		
3		
4		
5		
6		
7		

DETROIT RADIANT PRODUCTS CO.
1297 TERMINAL DETROIT, MICHIGAN 48214

TYPICAL MOUNTING DETAIL WITH OUTSIDE AIR SUPPLY

TOLERANCES (Except were noted)	DRAWN BY	SCALE NONE
DECIMAL ±	DATE	DRAWING NO.
FRACTIONAL ±	CHK'D / APP'D	
ANGULAR ±		



DTH MODEL	MBH INPUT	MAX. STACK LENGTH OPT. EXTENSION INCL
20	40	25'
	50	30'
	60	35'
	75	35'
40	40	10'
	50	10'
	60	15'
	75	15'
	100	15'

REVISIONS		
NO.	DATE	BY
1		
2		
3		
4		
5		
6		
7		

DETROIT RADIANT PRODUCTS CO.
1297 TERMINAL DETROIT, MICHIGAN 48214

OPTIONAL INSTALLATION DATA

TOLERANCES (Except were noted)	DRAWN BY	SCALE NONE
DECIMAL ±	DATE	DRAWING NO.
FRACTIONAL ±	CHK'D / APP'D	
ANGULAR ±		