FOR YOUR SAFETY

If you smell gas:

1. **Open windows.**
2. **DO NOT try to light any appliance.**
3. **DO NOT use electrical switches.**
4. **DO NOT use any telephone in your building.**
5. **Leave the building.**
6. **Immediately call your local gas supplier after leaving the building. Follow the gas supplier's instructions.**
7. **If you cannot reach your gas supplier, call the Fire Department.**

⚠ WARNING

Fire Hazard

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

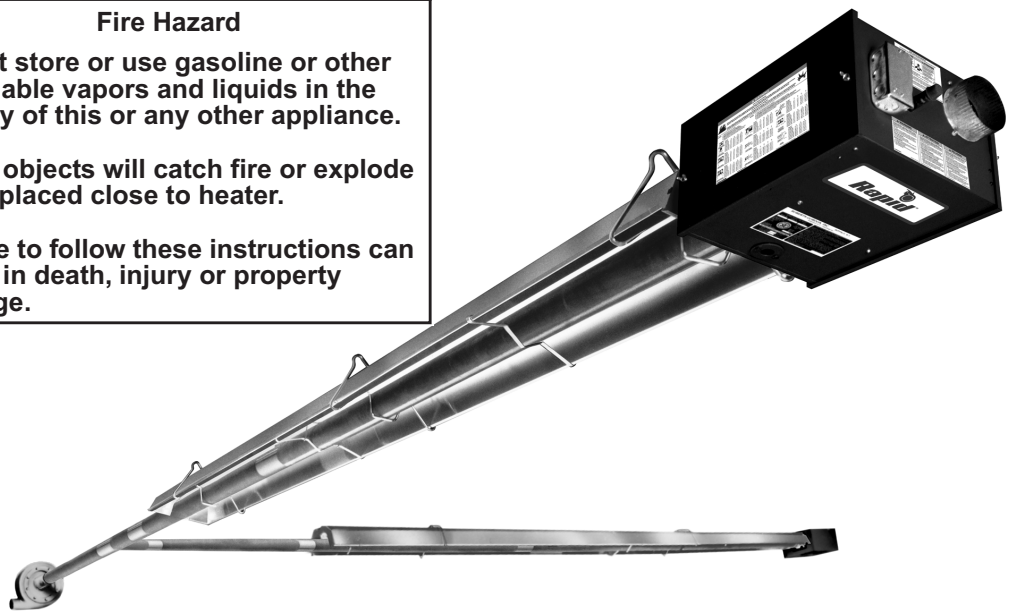
Some objects will catch fire or explode when placed close to heater.

Failure to follow these instructions can result in death, injury or property damage.

Rapid Engineering™

RAPID™ NP

Negative Pressure Unitary or Multiburner Infrared Heater Installation, Operation & Service Manual



CTHN-40
CTHN-60
CTHN-80
CTHN-100
CTHN-125
CTHN-150
CTHN-175
CTHN-200

⚠ WARNING

Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the Installation, Operation and Service Manual thoroughly before installing or servicing this equipment.

Installation must be done by a contractor qualified in the installation and service of gas-fired heating equipment or your gas supplier.

Installer

Please take the time to read and understand these instructions prior to any installation. Installer must give a copy of this manual to the owner.

Owner

Keep this manual in a safe place in order to provide your serviceman with necessary information.

DESIGN CERTIFIED ®

CERTIFIED ®

Rapid Engineering
1100 Seven Mile Road NW
Comstock Park, MI 49321
Telephone: 616.784.0500
Toll Free: 800.536.3461
Fax: 616.784.1910

www.rapidengineering.com

P/N RPNP152101NA Rev A 04/08

TABLE OF CONTENTS

Printed in U.S.A.

TABLE OF FIGURES

SECTION 1: HEATER SAFETY

Your Safety is Important to Us! This symbol is used throughout the manual to notify you of possible fire, electrical or burn hazards. Please pay special attention when reading and following the warnings in these sections.

Installation, service and annual inspection of heater must be done by a contractor qualified in the installation and service of gas-fired heating equipment.

Read this manual carefully before installation, operation or service of this equipment.

This heater is designed for heating nonresidential indoor spaces. Do not install in residential spaces. These instructions, the layout drawing, local codes and ordinances, and applicable standards that apply to gas piping, electrical wiring, venting, etc. must be thoroughly understood before proceeding with the installation.

Thin sheet metal parts, including the aluminum reflector and the various venting components, have sharp edges. To prevent injury, the use of work gloves is recommended. The use of gloves will also prevent the transfer of body oils from the hands to the surface of the reflector.

Before installation, check that the local distribution conditions, nature of gas and pressure, and adjustment of the appliance are compatible.

1.1 Manpower Requirements

To prevent personal injury and damage to the heater, two persons will be required for installation.

SECTION 2: INSTALLER RESPONSIBILITY

The installer is responsible for the following:

- To install the heater, as well as the gas and electrical supplies, in accordance with applicable specifications and codes. Rapid Engineering recommends the installer contact a local Building Inspector or Fire Marshal for guidance.
- To use the information given in a layout drawing and in the manual together with the cited codes and regulations to perform the installation.
- To install the heater in accordance with the clearances to combustibles requirements.
- To furnish all needed materials not furnished as standard equipment.
- To plan location of supports.
- To provide access to burners on all sides for burner servicing and removal.
- To provide the owner with a copy of this Installation, Operation and Service Manual.
- To never use heater as a support for a ladder or other access equipment and never hang or suspend anything from heater.
- To ensure there is adequate air circulation around the heater and to supply air for combustion, ventilation and distribution in accordance with local codes.
- To safely and adequately install heater using materials with a minimal working load of 75 lbs (33 kg).

2.1 Wall Tag

A laminated wall tag is available for the heater as a permanent reminder of the safety instructions and the importance of the required clearances to combustibles. Please contact Rapid Engineering or your RAPID™ independent distributor to obtain the wall tag. Affix the tag by peeling off the backing of the adhesive strips on the rear surface and position the tag on a wall near the heater (e.g. thermostat).

A copy of the wall tag (P/N 91037920) is illustrated on the back cover. For an immediate solution, you may affix this copy on the wall near the heater.

Know your model number and installed configuration. Model number and installed configuration are found on the burner and in the Installation, Operation and Service Manual. *See Page 4, Figure 1 through Page 7, Figure 10*. Write the proper clearance dimensions in permanent ink according to your model number and configuration in the open spaces on the tag.

2.2 .....Corrosive Chemicals

⚠ CAUTION

Do not use heater in an area containing corrosive chemicals.

Avoid the use of corrosive chemicals to ensure a longer life of the burner, tubing and other parts.

Failure to follow these instructions can result in property damage.

Rapid Engineering cannot be responsible for ensuring that all appropriate safety measures are undertaken prior to installation; this is entirely the responsibility of the installer. It is essential that the contractor, the sub-contractor, or the owner identifies the presence of combustible materials, corrosive chemicals or halogenated hydrocarbons* anywhere in the premises.

** **Halogenated Hydrocarbons** are a family of chemical compounds characterized by the presence of halogen elements (fluorine, chlorine, bromine, etc.). These compounds are frequently used in refrigerants, cleaning agents, solvents, etc. If these compounds enter the air supply of the burner, the life span of the heater components will be greatly reduced. An outside air supply must be provided to the burners whenever the presence of these compounds is suspected. Warranty will be invalid if the heater is exposed to halogenated hydrocarbons.*

2.3 National Standards and Applicable Codes

All appliances must be installed in accordance with the latest revision of the applicable standards and national codes. This refers also to the electric, gas and venting installation. Note: Additional standards for installations in public garages, aircraft hangars, etc. may be applicable.

SECTION 3: CLEARANCES TO COMBUSTIBLES

3.1 Required Clearances to Combustibles

Clearances are the required distances that combustible objects must be away from the heater to prevent fire hazards. Combustible materials that may catch fire include common items such as wood, paper, rubber, fabric, etc. **Maintain clearances to combustibles at all times for safety.**

Clearances for all heater models are located on the burner of the heater and *on Page 4, Figure 1 through Page 7, Figure 10* in this manual. Check the clearances on each burner for the model heater being installed to make sure the product is suitable for your application and the clearances are maintained. Read and follow the safety guidelines below:

- Keep gasoline or other combustible materials including flammable objects, liquids, dust or vapors away from this heater or any other appliance.
- The stated clearance to combustibles represents a surface temperature of 90° F (32°C) 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.
- Maintain clearances from heat sensitive equipment and workstations.
- Maintain clearances from vehicles parked below the heater.
- Maintain clearances from swinging and overhead doors, overhead cranes, vehicle lifts, partitions, storage racks, hoists, building construction, etc.
- In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain required clearances from the heater to the combustibles. Signs must be posted adjacent to the heater thermostat. In the absence of a thermostat, signs must be posted in a conspicuous location.
- Consult local Fire Marshal, Fire Insurance Carrier or other authorities for approval of proposed installation when there is a possibility of exposure to combustible airborne materials or vapors.
- Hang heater in accordance to the minimum suspension requirements *on Page 11, Figure 12*.

⚠ WARNING

Fire Hazard

Some objects will catch fire or explode when placed close to heater.

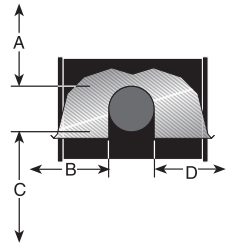
Keep all flammable objects, liquids and vapors the required clearances to combustibles away from heater.

Failure to follow these instructions can result in death, injury or property damage.

- If the radiant tubes must pass through the building structure, be sure that adequate sleeving and fire stop is installed to prevent scorching and/or fire hazard.

NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

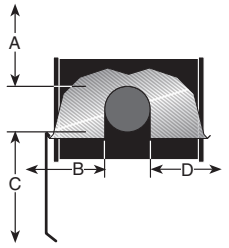
FIGURE 1: STANDARD REFLECTOR



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	20	41	20	13	51	104	51
CTHN-60	5	27	51	27	13	69	130	69
CTHN-80	5	30	58	30	13	76	147	76
CTHN-100	5	32	60	32	13	81	152	81
CTHN-125	5	35	65	35	13	89	165	89
CTHN-150	5	39	71	39	13	99	180	99
CTHN-175	8	44	74	44	20	112	188	112
CTHN-200	8	47	76	47	20	119	193	119

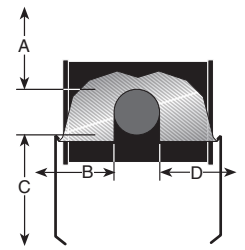
.

FIGURE 2: ONE SIDE REFLECTOR



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	6	46	35	13	15	117	88
CTHN-60	5	6	55	44	13	15	140	110
CTHN-80	5	6	64	49	13	15	163	123
CTHN-100	5	6	66	51	13	15	168	128
CTHN-125	5	6	69	58	13	15	175	145
CTHN-150	5	6	75	60	13	15	191	150
CTHN-175	8	6	77	68	20	15	196	170
CTHN-200	8	6	79	70	20	15	201	175

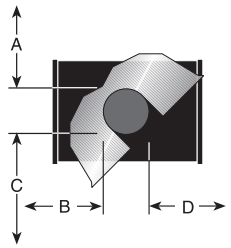
FIGURE 3: TWO SIDE REFLECTORS



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	16	47	16	13	41	119	41
CTHN-60	5	18	56	18	13	46	142	46
CTHN-80	5	21	65	21	13	53	165	53
CTHN-100	5	23	68	23	13	58	173	58
CTHN-125	5	26	73	26	13	66	185	66
CTHN-150	5	30	76	30	13	76	193	76
CTHN-175	8	32	88	32	20	81	224	81
CTHN-200	8	33	90	33	20	84	229	84

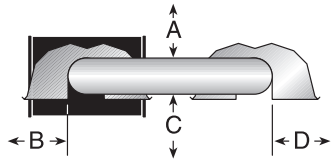
NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

FIGURE 4: 45° TILT REFLECTOR



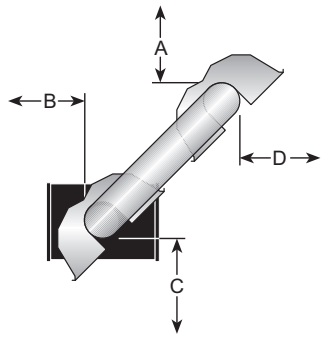
Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	8	4	35	43	20	10	89	109
CTHN-60	8	4	45	45	20	10	114	114
CTHN-80	9	4	54	55	23	10	137	140
CTHN-100	10	4	57	56	25	10	145	142
CTHN-125	10	4	63	58	25	10	160	147
CTHN-150	10	4	66	61	25	10	168	155
CTHN-175	10	4	69	68	25	10	175	173
CTHN-200	10	4	73	71	25	10	185	180

FIGURE 5: U-TUBE, STANDARD REFLECTOR



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	- UNAPPROVED -				- UNAPPROVED -			
CTHN-60	5	27	56	19	13	69	142	48
CTHN-80	5	30	61	20	13	76	155	51
CTHN-100	5	32	63	20	13	81	160	51
CTHN-125	5	35	66	20	13	89	168	51
CTHN-150	5	39	73	21	13	99	185	53
CTHN-175	8	44	75	26	20	112	191	66
CTHN-200	8	47	76	30	20	119	193	76

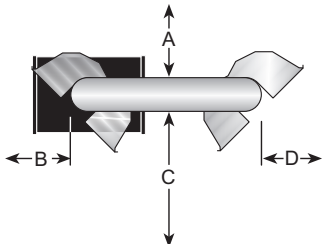
FIGURE 6: U-TUBE, 45°



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	- UNAPPROVED -				- UNAPPROVED -			
CTHN-60	8	4	47	40	20	10	119	102
CTHN-80	8	4	54	46	20	10	137	117
CTHN-100	8	4	57	48	20	10	145	122
CTHN-125	8	4	63	53	20	10	160	135
CTHN-150	8	4	66	56	20	10	168	142
CTHN-175	8	4	69	59	20	10	175	150
CTHN-200	8	4	73	63	20	10	185	160

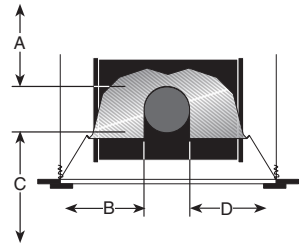
NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

FIGURE 7: U-TUBE, OPPOSITE 45° REFLECTOR



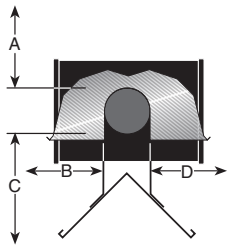
Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	- UNAPPROVED -				- UNAPPROVED -			
CTHN-60	8	45	45	10	20	114	114	25
CTHN-80	9	55	54	10	23	140	137	25
CTHN-100	10	56	57	10	25	142	145	25
CTHN-125	10	58	63	10	25	147	160	25
CTHN-150	10	61	66	20	25	155	168	51
CTHN-175	10	68	69	20	25	173	175	51
CTHN-200	10	71	73	20	25	180	185	51

FIGURE 8: 2-FOOT DECO GRILLE, 1-FOOT DECO GRILLE AND PROTECTIVE GRILLE



Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	20	41	20	13	51	104	51
CTHN-60	5	27	51	27	13	69	130	69
CTHN-80	5	30	58	30	13	76	147	76
CTHN-100	5	32	60	32	13	81	152	81
CTHN-125	5	35	65	35	13	89	165	89
CTHN-150	5	39	71	39	13	99	180	99
CTHN-175	8	44	74	44	20	112	188	112
CTHN-200	8	47	76	47	20	119	193	119

FIGURE 9: LOWER CLEARANCE SHIELD*

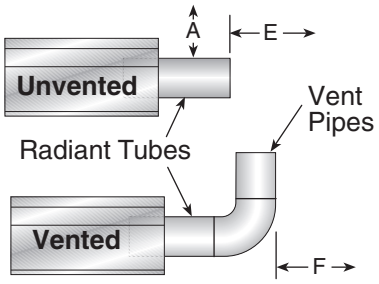


Model	(inches) A	B	C	D	(centimeters) A	B	C	D
CTHN-40	5	25	22	25	13	64	56	64
CTHN-60	5	30	27	30	13	76	69	76
CTHN-80	5	37	37	37	13	94	94	94
CTHN-100	5	39	39	39	13	99	99	99
CTHN-125	5	41	41	41	13	104	104	104
CTHN-150	5	43	50	43	13	109	127	109
CTHN-175	- UNAPPROVED -				- UNAPPROVED -			
CTHN-200	- UNAPPROVED -				- UNAPPROVED -			

*When installed in the first 10' (3 m).

NOTE: 1. All dimensions are from the surfaces of all tubes, couplings and elbows.
2. Clearances B, C and D can be reduced by 50% after 25' (7.5 m) of tubing downstream from where the burner and burner tube connect.

FIGURE 10: VENTING



Model	(inches) A	E	F	(centimeters) A	E	F
CTHN-40	14	18	18	36	46	46
CTHN-60	14	18	18	36	46	46
CTHN-80	20	24	18	51	61	46
CTHN-100	20	24	18	51	61	46
CTHN-125	20	24	18	51	61	46
CTHN-150	20	30	18	51	76	46
CTHN-175	20	30	18	51	76	46
CTHN-200	20	30	18	51	76	46

SECTION 4: NATIONAL STANDARDS AND APPLICABLE CODES

4.1 Gas Codes

The type of gas appearing on the nameplate must be the type of gas used. Installation must comply with national and local codes and requirements of the local gas company.

United States: Refer to NFPA 54/ANSI Z223.1 - latest revision, National Fuel Gas Code.

Canada: Refer to CSA B149.1 Natural Gas and Propane Installation Code.

4.2 Aircraft Hangars

Installation in aircraft hangars must be in accordance with the following codes:

United States: Refer to Standard for Aircraft Hangars, ANSI/NFPA-409 - latest revision.

Canada: Refer to Standard CSA B149.1 Natural Gas and Propane Installation Code.

- In aircraft storage and servicing areas, heaters shall be installed at least 10' (3 m) above the upper surface of wings or of engine enclosures of the highest aircraft which may be housed in the hangar. The measurement shall be made from the wing or engine enclosure (whichever is higher from the floor) to the bottom of the heater.
- In shops, offices and other sections of aircraft hangars communicating with aircraft storage or servicing areas, heaters shall be installed not less than 8' (2.4 m) above the floor.
- Suspended or elevated heaters shall be so located in all spaces of aircraft hangars that they shall not be subject to injury by aircraft, cranes, movable scaffolding or other objects. Provisions shall be made to assure accessibility to suspended heaters for recurrent maintenance purposes.

4.3 Public Garages

Installation in garages must be in accordance with the following codes:

United States: Standard for Parking Structures NFPA-88A - latest revision or the Code for Motor Fuel Dispensing Facilities and Repair Garages, NFPA-30A - latest revision. Canada: Refer to CSA B149.1 Natural Gas and Propane Installation Code.

- Heaters must not be installed less than 8' (2.4 m) above the floor. Minimum clearances to combustibles must be maintained from vehicles parked below the heater.
- When installed over hoists, minimum clearances to combustibles must be maintained from the upper most point of objects on the hoist.

4.4 Electrical

The heater must be electrically grounded in accordance with the following codes:

United States: Refer to National Electrical Code®, NFPA 70 - latest revision. Wiring must conform to the most current National Electrical Code®, local ordinances, and any special diagrams furnished.

Canada: Refer to Canadian Electrical Code, CSA C22.1 Part 1 - latest revision.

4.5 Venting

The venting must be installed in accordance with the requirements within this manual and the following codes:

United States: Refer to NFPA 54/ANSI Z223.1 - latest revision, National Fuel Gas Code.

Canada: Refer to CSA B149.1 Natural Gas and Propane Installation Code.

4.6 High Altitude

These heaters are approved for installations up to 2000' (610 m)(US), 4500' (1370 m)(Canada) without modification. Consult factory if US installation is above 2000' (610 m) or Canadian installation is above 4500' (1370 m).

SECTION 5: HEATER DESCRIPTIONS

5.1 Unitary vs. Multiburner

CTHN-Series burners may be used for unitary heaters or for multiburner systems.

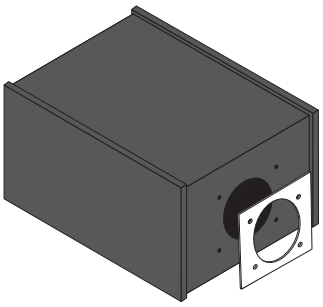
Unitary heaters consist of a single burner, a single run of radiant tubing and a single fan assembly. *See Page 15, Figure 13* or *See Page 18, Figure 16* for details.

Multiburner systems consist of more than one burner and more than one run of radiant tubing. The runs of radiant tubing are connected together by manifold tubing. The manifold tubing connects to a single pump that exhausts the flue gases outdoors. *See Page 33, Figure 19 through Page 36, Figure 23* for common multiburner system layouts.

Since this manual addresses installation of both unitary heaters and multiburner systems, pay close attention to section and figure titles to verify relevance to unitary heaters or multiburner systems.

SECTION 6: MAJOR COMPONENTS

FIGURE 11: Major Component Descriptions



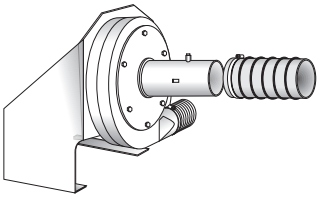
Burner with Tube Gasket
Must be installed with the flame observation window facing down.

Reflector (Aluminum or Stainless Steel)
Alternate overlap as shown *on Page 16, Figure 14* or *on Page 19, Figure 17*. Minimum overlap is 6'' (16 cm).

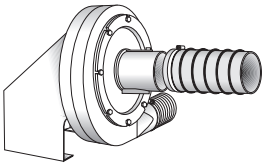
Burner Tube
Supplied in 10' (3 m) lengths. Burner tube is always the first tube after the burner.

Tube
Hot rolled or heat treated aluminized tube supplied in 10' (3 m) lengths.

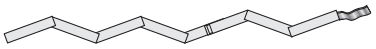
Coupling Assembly with Lock



EP-100 Pump Package -
For more information, refer to the EP-100 Installation, Operation and Service Manual.

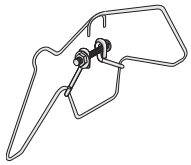


EP-201 Pump Package -
For more information, refer to the EP-200 Series Installation, Operation and Service Manual.

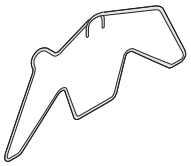


Turbulator
Turbulator must be installed in the last standard section of tube.Turbulator is only required on the CTHN-40, 60 and 80. For installation, *See Page 22, Step 8.8*.

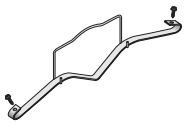
Flex Gas Line with Shut Off Cock



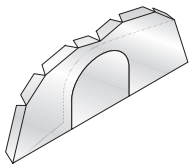
Tube and Reflector Hanger with Clamp Package
Position this hanger no more than 4'' (10 cm) away from the burner assembly.



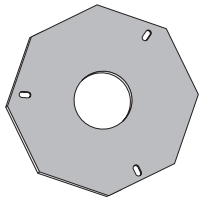
Tube and Reflector Hanger
Suspend system from these hangers.



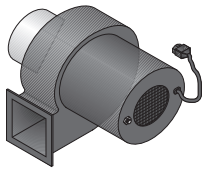
Reflector Support Strap & Wire Form



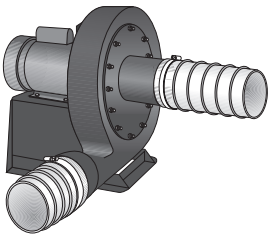
Reflector End Cap
Punch out center section to accommodate tube.



Restrictor Plate
Used at fan assembly inlet for unitary heaters only. See fan assembly below.



Fan Assembly



EP-300 Series
Pump Package -
For more information, refer to the EP-300 Series Installation, Operation and Service Manual.

SECTION 7: GENERAL SUSPENSION DETAILS

⚠ WARNING

Suspension Hazard

Burner is secured to burner tube by bolts and lockwashers.

Hang heater with materials with a minimum working load of 75 lbs (33 kg).

Failure of the supports can result in death, injury or property damage.

To ensure your safety and comply with the terms of the warranty, all units must be installed in accordance with these instructions.

The gas or the electrical supply lines must not be used to support the heater.

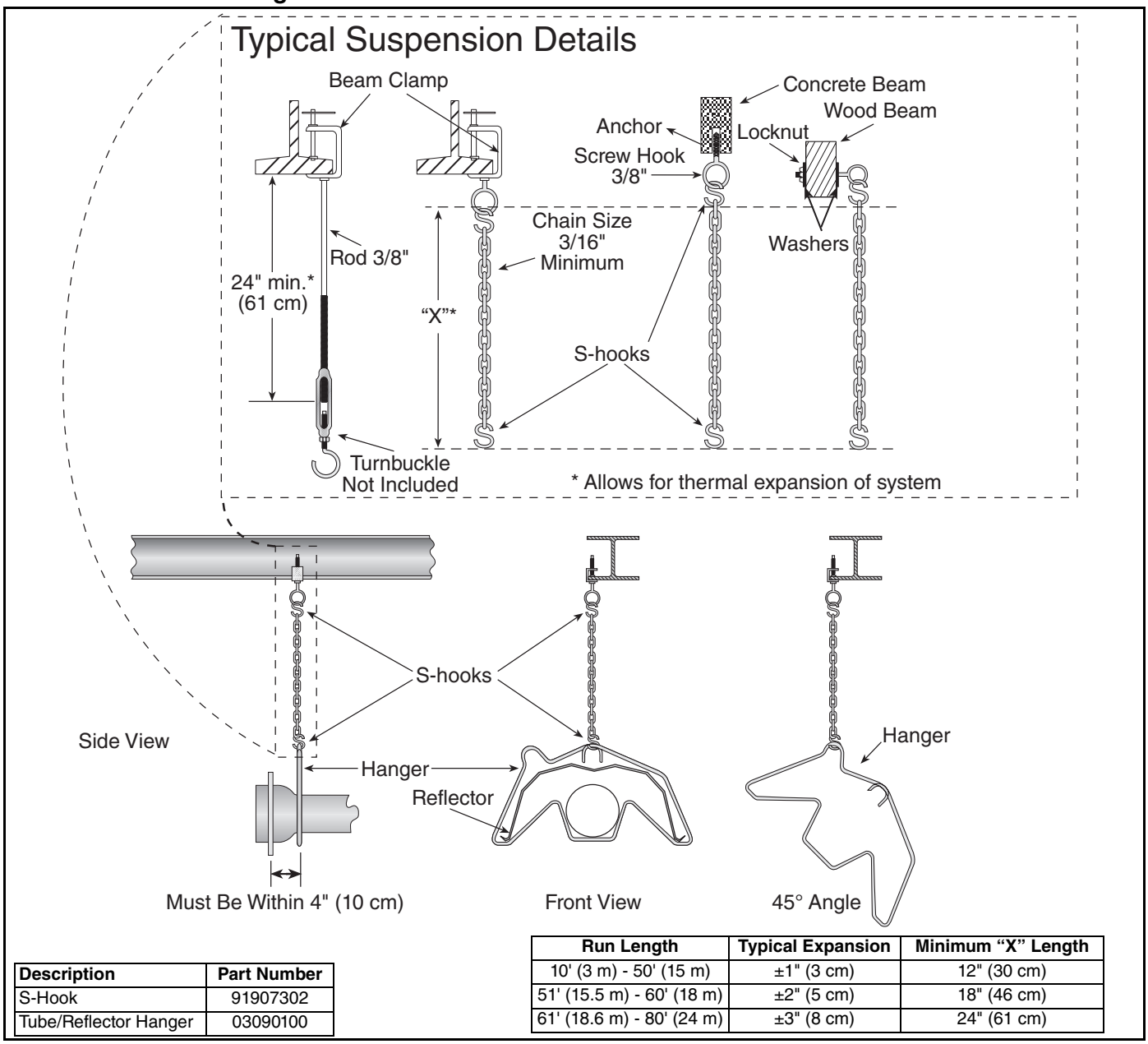
Do not locate the gas or electric supply lines directly over the path of the flue products from the heater.

The heater must be installed in a location that is readily accessible for servicing.

The heaters must be installed in accordance with clearances to combustibles as indicated on the rating plate and in this instruction manual.

The minimum and maximum gas inlet pressures must be maintained as indicated on the rating plate.Typical installation configurations are shown in *Figure 12*.

FIGURE 12: Critical Hanger Placement



Description	Part Number
S-Hook	91907302
Tube/Reflector Hanger	03090100

Run Length	Typical Expansion	Minimum "X" Length
10' (3 m) - 50' (15 m)	±1" (3 cm)	12" (30 cm)
51' (15.5 m) - 60' (18 m)	±2" (5 cm)	18" (46 cm)
61' (18.6 m) - 80' (24 m)	±3" (8 cm)	24" (61 cm)

SECTION 8: UNITARY LINEAR & U-TUBE HEATER INSTALLATION

8.1 Standard Parts

Table 1: Contents of CTHN Burner Carton

Part No.	Description	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
RP52XXXXX	Burner (Rate and Fuel Varies)	1	1	1	1	1	1	1	1
07730400	Restrictor Plate 1.25" (3.2 cm) dia.	1	-	-	-	-	-	-	-
07730100	Restrictor Plate 1.50" (3.8 cm) dia.	-	1	-	-	-	-	-	-
07730500	Restrictor Plate 2.25" (5.7 cm) dia.	-	-	-	1	1	-	-	-
07730600	Restrictor Plate 2.50" (6.4 cm) dia.	-	-	-	-	-	-	1	-
07730700	Restrictor Plate 2.75" (7 cm) dia.	-	-	-	-	-	1	-	-
03051503	Turbulator Adapter	1	1	1	-	-	-	-	-
03051504	Turbulator Section	2	4	4	-	-	-	-	-
03051505	Turbulator Section, Stainless Steel	1	-	-	-	-	-	-	-
*91412200	Flexible Stainless Steel Gas Hose , 1/2" NPT (US Models Only)	1	1	1	1	1	-	-	-
*91412203	Flexible Stainless Steel Gas Hose , 3/4" NPT (US Models Only)	-	-	-	-	-	1	1	1
02568200	Gasket (Burner to Burner Tube)	1	1	1	1	1	1	1	1
94273914	Hex Head Cap Screw 5/16" -18 x 7/8"	4	4	4	4	4	4	4	4
96411600	Split Lock Washer	4	4	4	4	4	4	4	4
91201708	Pipe Nipple 1/2" NPT x 4"	1	1	1	1	1	1	1	1
RPNP152101NA	Installation, Operation and Service Manual	1	1	1	1	1	1	1	1

**Canadian Models: Rubber (Type 1) Gas Hoses available as an accessory.* *See Page 67, Section 16.*

Table 2: Contents of Core and Extension Packages

		Core Packages							Extension Packages							
		Hot Rolled			Aluminized				Hot Rolled				Aluminized			
Part No.	Description	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)
91409300	Tube, Hot Rolled Steel, 10' (3 m)	1	2	3	-	-	-	-	1	2	3	4	-	-	-	-
91409408	Tube, HT Aluminized, 10' (3 m)	-	-	-	-	1	2	3	-	-	-	-	1	2	3	4
03051101	Burner Tube, ALUMI-THERM® Steel, 10' (3 m)	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
03051601	Burner Tube, HT ALUMI-THERM® Steel, 10' (3 m)	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
01312700	Coupling Assembly	1	2	3	-	1	2	3	1	2	3	4	1	2	3	4
02750303	Standard Reflector, 8' (2.4 m)	3	4	6	2	3	4	6	2	3	4	6	2	3	4	6
02750800	End Cap	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-
03090100	Tube and Reflector Hanger	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
91907302	S-hook	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
03050010	Reflector Support Package (Strap, Wire Form, Screws)	2	3	5	1	2	3	5	2	3	4	6	2	3	4	6
91107720	U-clip Package	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90502700	Vent Adapter (Not used on CTHN)	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-
01318901	Tube Clamp Package	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-

Table 3: Component Package Guide

Model	Tubing Length	Core Packages	
	Minimum	Standard	Aluminized
CTHN-40	10' (3 m)	CP10ALUM	CP10ALUM
CTHN-60	20' (6 m)	CP20HRS	CP20ALUM
CTHN-80	20' (6 m)	CP20HRS	CP20ALUM
CTHN-100	30' (9 m)	CP30HRS	CP30ALUM
CTHN-125	40' (12 m)	CP40HRS	CP40ALUM
CTHN-150	40' (12 m)	CP40HRS	CP40ALUM
CTHN-175	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM
CTHN-200	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM

Additional tubing length may be added to heater.
Any additional tubing lengths are considered as vent length for length determination.
Maximum venting length for unitary heater is 45' (13.7 m).
For manifold tubing on multiburner systems, heat-treated aluminized tubing is required.

Table 4: Common CTHN-Series Components

Part No.	Description
Tubing and Related Accessories	
01312700	Coupling, 4" (10 cm) Plain
01312706	Coupling, 6" (15 cm) Plain
01331900	Coupling, 4" (10 cm) Damper
E0009356	Coupling, 6" (15 cm) Damper
01330203	Tee, 4" (10 cm) Aluminized
01330204	Tee, 6" (15 cm) Aluminized
01330903	Cross, 4" (10 cm) Aluminized
01330904	Cross, 6" (15 cm) Aluminized
01335801	Elbow, 4" (10 cm) Aluminized 90°
T0100320	Elbow, 6" (15 cm) Aluminized 90°
01336101	Elbow, 4" (10 cm) Aluminized 45°
91409300	Tube, 4" (10 cm) dia Hot Rolled Steel 10' (3 m)
91409403	Tube, 4" (10 cm) dia Non-Heat Treated Aluminized 10' (3 m)
91409408	Tube, 4" (10 cm) dia Heat Treated Aluminized 10' (3 m)
91409420	Tube, 6" (15 cm) dia Non-Heat Treated Aluminized 10' (3 m)
E0009105	Tube, 6" (15 cm) dia 10' (3 m) Heat Treated Aluminized
91418200	Tube Adapter, 6" (15 cm) dia x 4"(10 cm) dia Aluminized
91240010	Tube Hanger, 6" (15 cm)
91308001	Pipe Compound, High Temperature 1lb can

Venting Accessories	
01324401	Air Supply Takeoff, 4" (10 cm) Outside
90707501	Air Supply Blower/Power Venter
91409601	Air Flex Duct, 4" (10 cm) Outside (Box of 8 - 8' (2.4 m) sections)

Reflectors and Related Accessories	
01329910	Reflector Side Extension Support
03050010	Reflector Support Package (Tubing)
02712700	Reflector Side Extension, 2 Clips, 2 Screws
02750303	Reflector, Aluminum
027503SS	Reflector, Stainless Steel
02750800	Reflector End Cap, Aluminum
027508SS	Reflector End Cap, Stainless Steel
027508SH	Reflector End Cap, Stainless Steel with Hole
02750900	Reflector Joint
027509SS	Reflector Joint, Stainless Steel
027127SS	Reflector Side Extension, Stainless Steel
03090100	Tube and Reflector Hanger
91907302	S-hook
91903201	Turnbuckle
91903300	Spring Hook
91903202	Turnbuckle with Eyebolt

Control Packages and Thermostats	
05023000	Load Relay Package
90417600	Transformer Relay - SPST (12 A)
90436300	Transformer Relay - DPST (12 A)
90423000	Thermostat, 24 V Low Voltage (Marked 1-5)
90424300	Thermostat Guard

Deco Grille (1' x 8' [.3 m x 2.4 m])	
01363003	Bracket
01365901	End Piece
01326801	Reinforcement
01365903	Joint Piece
91406700	1' x 8' (.3 m x 2.4 m) Protective Grille

Deco Grille (2' x 4' [.6 m x 1.2 m])	
01365900	Shield Frame
01370408	Reflector Side Extension 8" x 48" (20 cm x 122 cm)
01370412	Reflector Side Extension 12" x 48" (30 cm x 122 cm)
01370416	Reflector Side Extension 16" x 48" (40 cm 122 cm)
91407000	Grille, Aluminum 2' x 4' (.6 m x 1.2 m)

Protective Grille	
08050001	Grille, 40" (102 cm) Protective
08050002	Protective Grille End Cap

Fan and Pump Packages	
05220000	Fan Package 40-150
05221000	Fan Package 175-200
02719105	**EP-100 Pump Package**
02719100	EP-100 Pump
02724700	Accessory Package
02716305	**EP-201 Pump Package**
01312001	EP-201 Pump
01317805	Accessory Package
02712034	**EP-203 Pump Package**
01312002	EP-203 Pump
01317805	Accessory Package
02723014	**EP-301 Pump Package 4"** (10 cm)
02730101	EP-301 Pump Assembly
02730104	Accessory Package
02723016	**EP-301 Pump Package 6"** (15 cm)
02730101	EP-301 Pump Assembly
02730106	Accessory Package
02723034	**EP-303 Pump Package 4"** (10 cm)
02730103	EP-303 Pump Assembly
02730104	Accessory Package
02723036	**EP-303 Pump Package 6"** (15 cm)
02730103	EP-303 Pump Assembly
02730106	Accessory Package

Pump Accessories	
90430600K	Pressure Switch

Starters and Contactors	
10050001	Starter, 120 Vac for EP-203, 3 Ø
10050003	Starter, 120 Vac for EP-201, 1 Ø
10050008	Starter, 120 Vac for EP-301, 1 Ø
10050009	Contactor Package- 120 Vac Coil for EP-301, 230 V, 2 HP
10050010	Starter, 120 Vac for EP-303, 3 Ø

8.2 Unitary Heater Requirements

CTHN unitary heaters are typically shipped as a burner package, fan assembly and a tube and accessory package. The tube and accessory packages contain enough tube, reflector and hanging parts for one unitary CTHN heater. Elbows, u-tubes, controls, and any other parts must be purchased separately.

See Page 15, Figure 13 for a general overview of a CTHN unitary heater. CTHN unitary heaters are controlled by thermostat.

Table 5 summarizes the design requirements for a CTHN unitary heater.

Table 5: Unitary Heater Design Requirements

Burner Model:	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
Maximum Number of Burners Allowed per Fan Assembly (P/N 05220000)	1	1	1	1	1	1	-	-
Maximum Number of Burners Allowed per Fan Assembly (P/N 05221000)	-	-	-	-	-	-	1	1
Minimum Radiant Tube Length	10' (3 m)	20' (6 m)	20' (6 m)	30' (9 m)	40' (12 m)	40' (12 m)	50' (15 m)	50' (15 m)
Minimum Distance from Burner to Elbow or U-Tube	10' (3 m)	10' (3 m)	10' (3 m)	15' (4.5 m)	15' (4.5 m)	20' (6 m)	20' (6 m)	20' (6 m)

8.3 Unitary Linear Heater Layouts

FIGURE 13: Linear Heater Assembly Overview

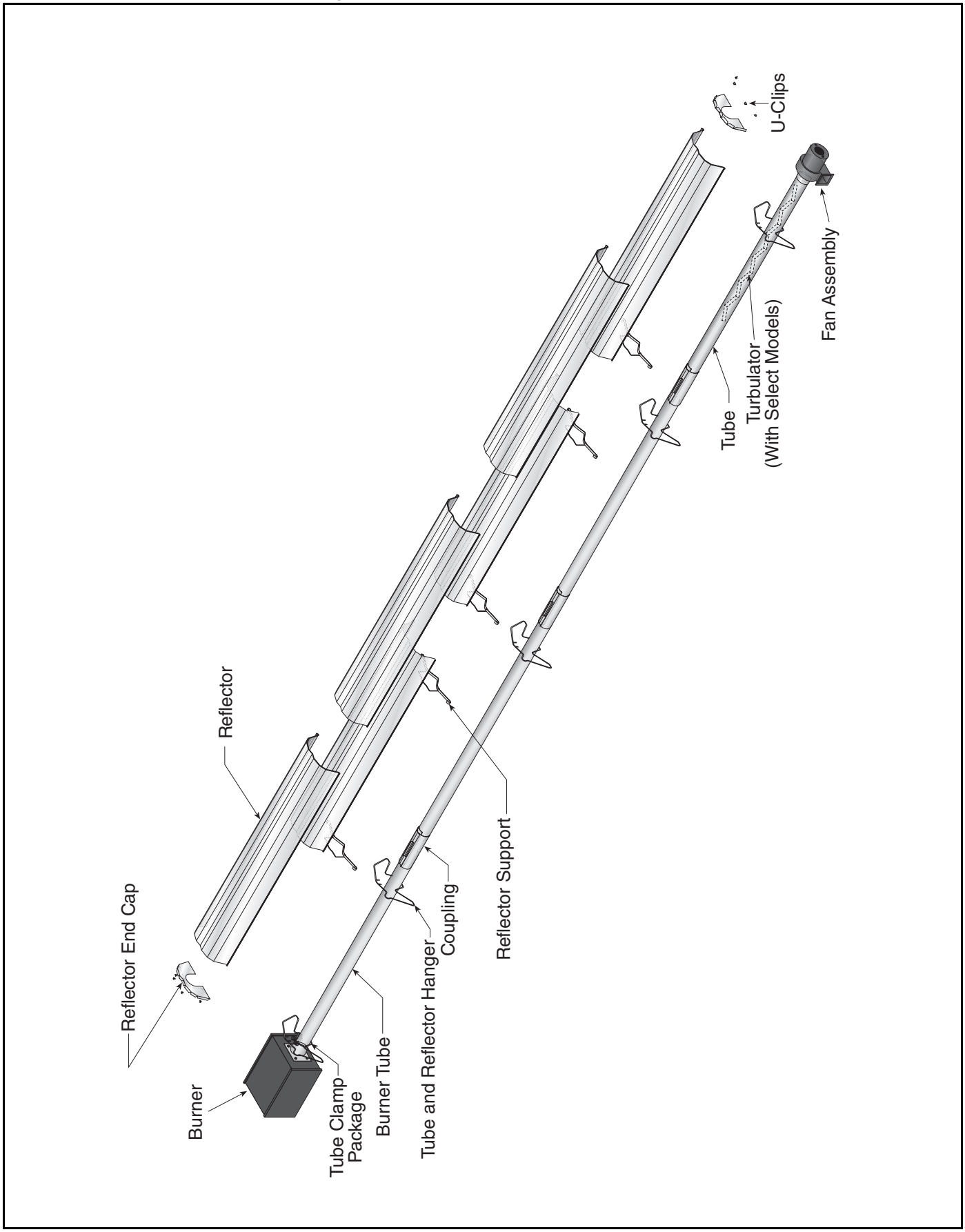


FIGURE 14: Unitary Linear Layout Overviews

LEGEND

- Burner
- Reflector
- Tube
- Tube/Reflector Hanger
- Coupling Assembly
- Fan Assembly

a = 14" (36 cm)
reflector width (not shown)

b = 2" (5 cm)
end cap to burner/fan

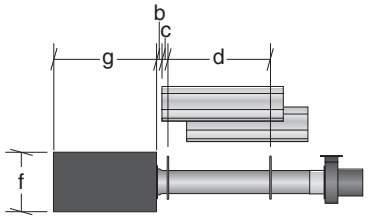
c = 2" (5 cm)
end cap to hanger

d = 7'6" (229 cm)
distance first hanger

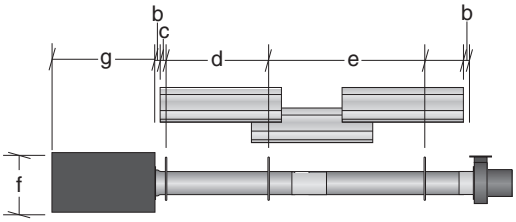
e = 10' (305 cm)
distance between hangers

f = 9.5" (24 cm)
burner height

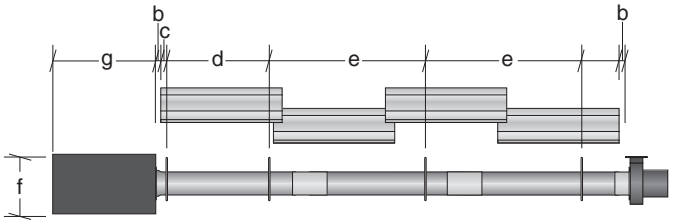
g = 17.5" (44 cm)
burner length



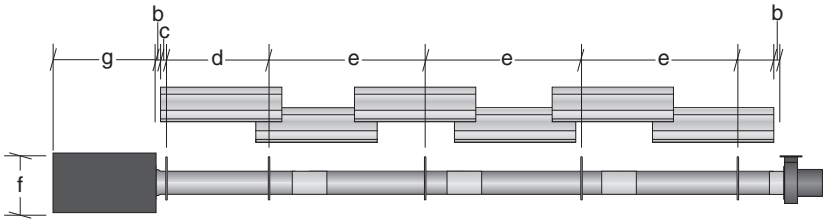
10' (3 m) Tube Length



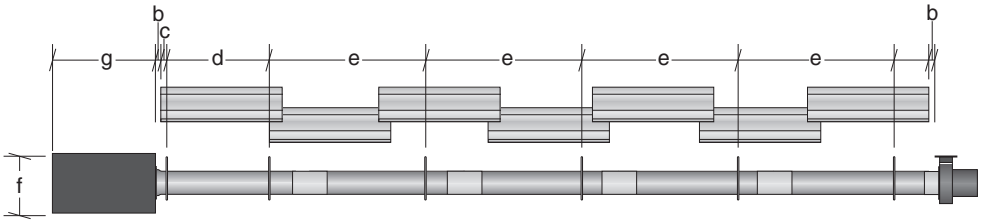
20' (6 m) Tube Length



30' (9 m) Tube Length

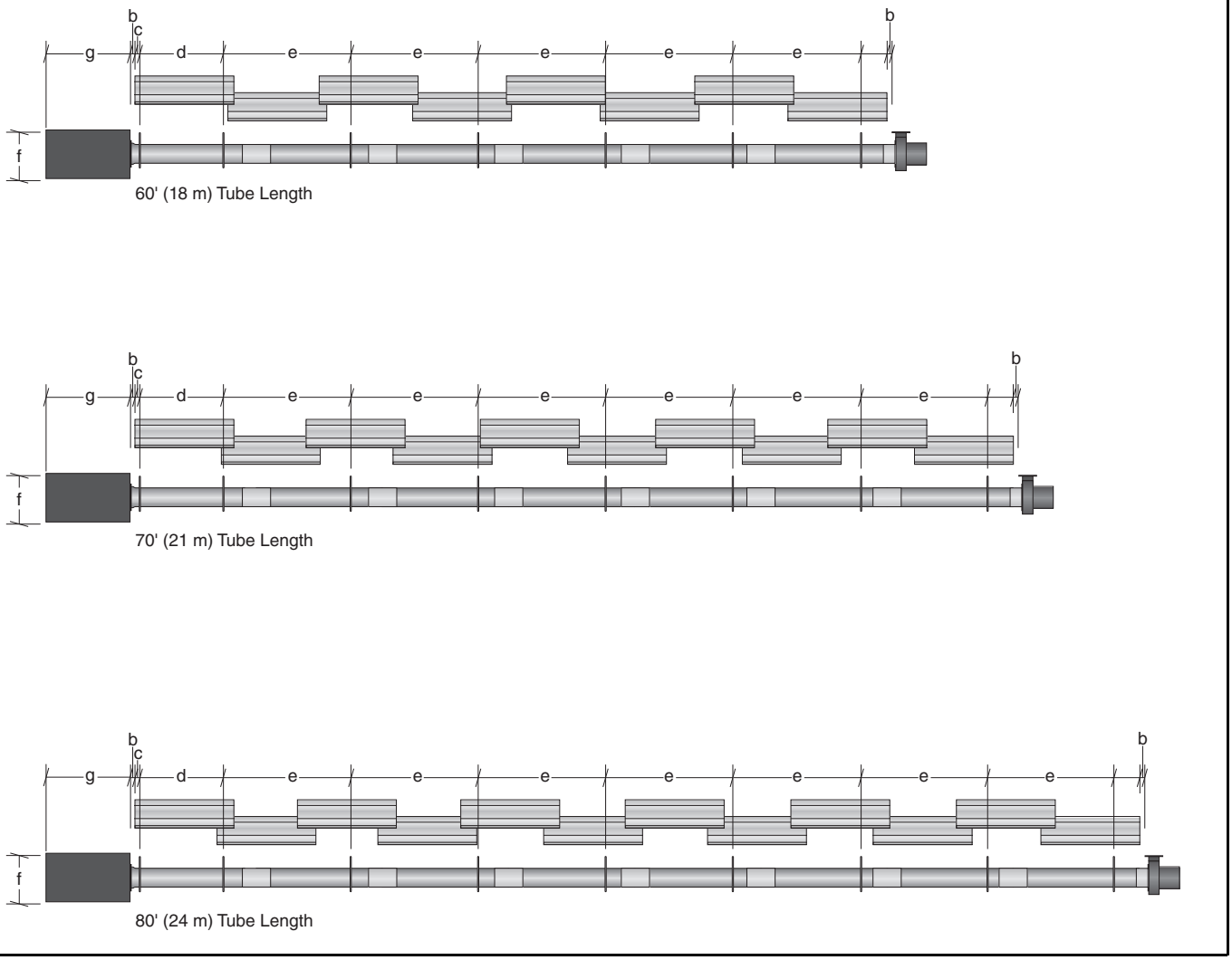


40' (12 m) Tube Length



50' (15 m) Tube Length

FIGURE 15: Unitary Linear Layout Overviews (Continued)



8.4 Unitary U-tube Heater Layouts

CTHN-Series heaters (except CTHN-40) are approved for optional u-tube configurations.

The u-tube may be installed in either a standard horizontal position, 45° position or in an opposite 45° position as shown *on Page 5, Figure 5 through Figure 7*. When using a u-tube configuration, the following additional rules must be adhered to:

- A minimum of 10' (3 m) on CTHN-60/80, a minimum of 15' (4.5 m) on CTHN-100/125, and a minimum of 20' (6 m) on CTHN-150/175/200 is required between the burner and the u-tube.
- For turbulator installation, *See Page 22, Step 8.8*.
- The burner must never be operated in a tilted position.

The heater must be properly supported at all locations. *See Page 11, Figure 12*.

FIGURE 16: U-tube Assembly Overview

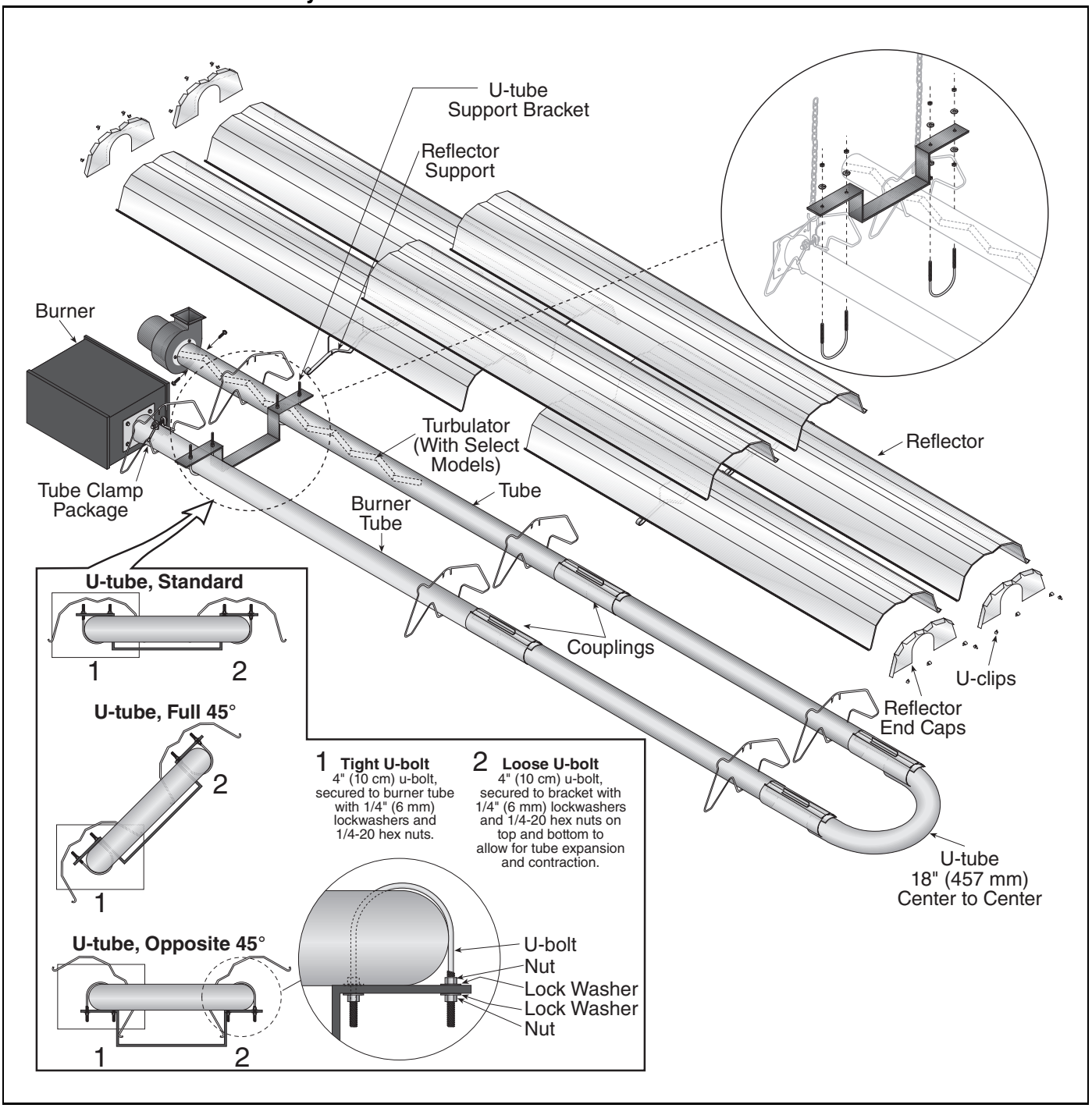
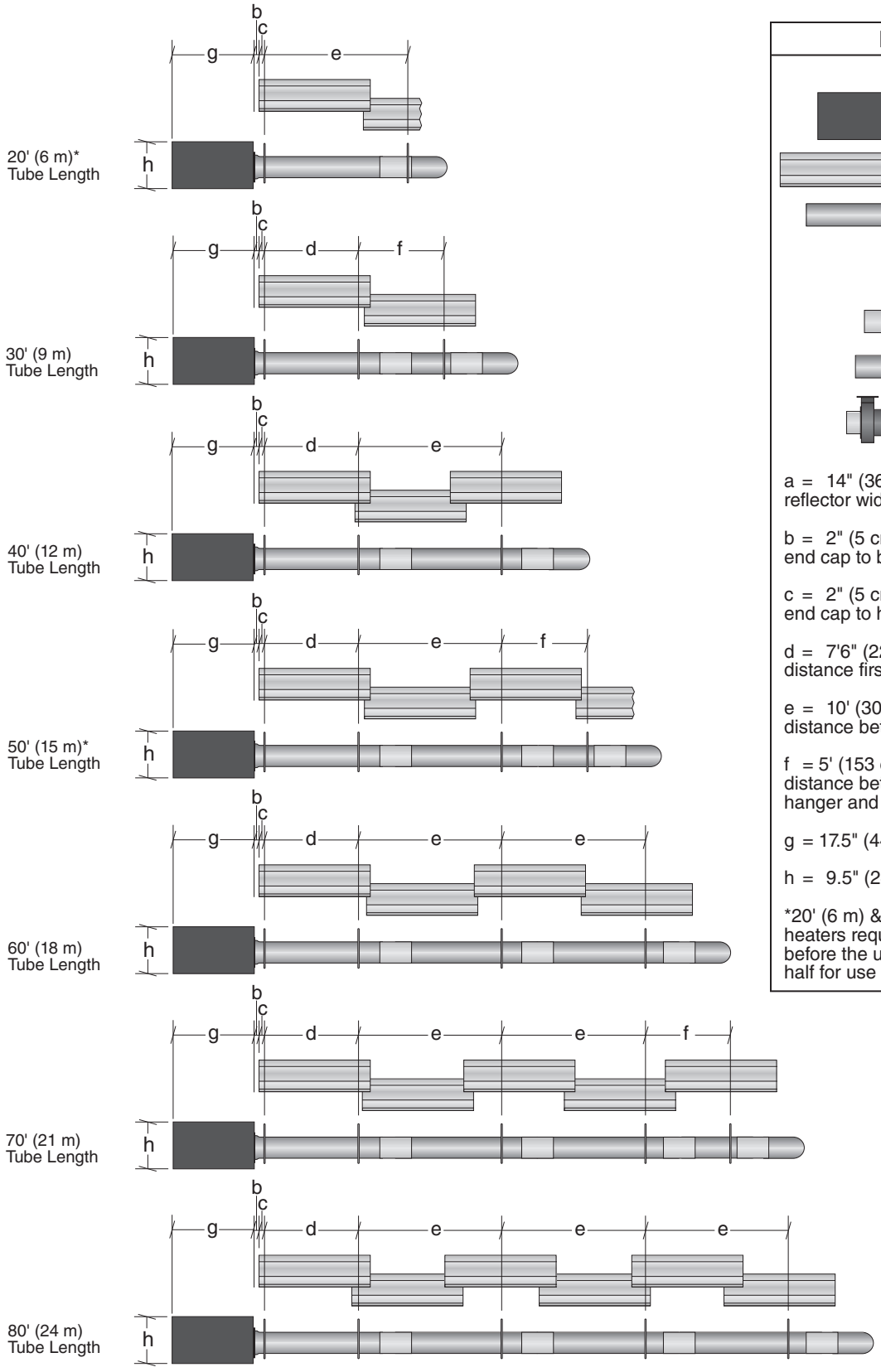


FIGURE 17: Unitary U-tube Layout Overviews



LEGEND

- Burner
- Reflector
- Tube
- Tube/Reflector Hanger
- Coupling Assembly
- U-tube
- Fan Assembly (not shown)

a = 14" (36 cm)
reflector width (not shown)

b = 2" (5 cm)
end cap to burner

c = 2" (5 cm)
end cap to hanger

d = 7'6" (229 cm)
distance first hanger

e = 10' (305 cm)
distance between hangers

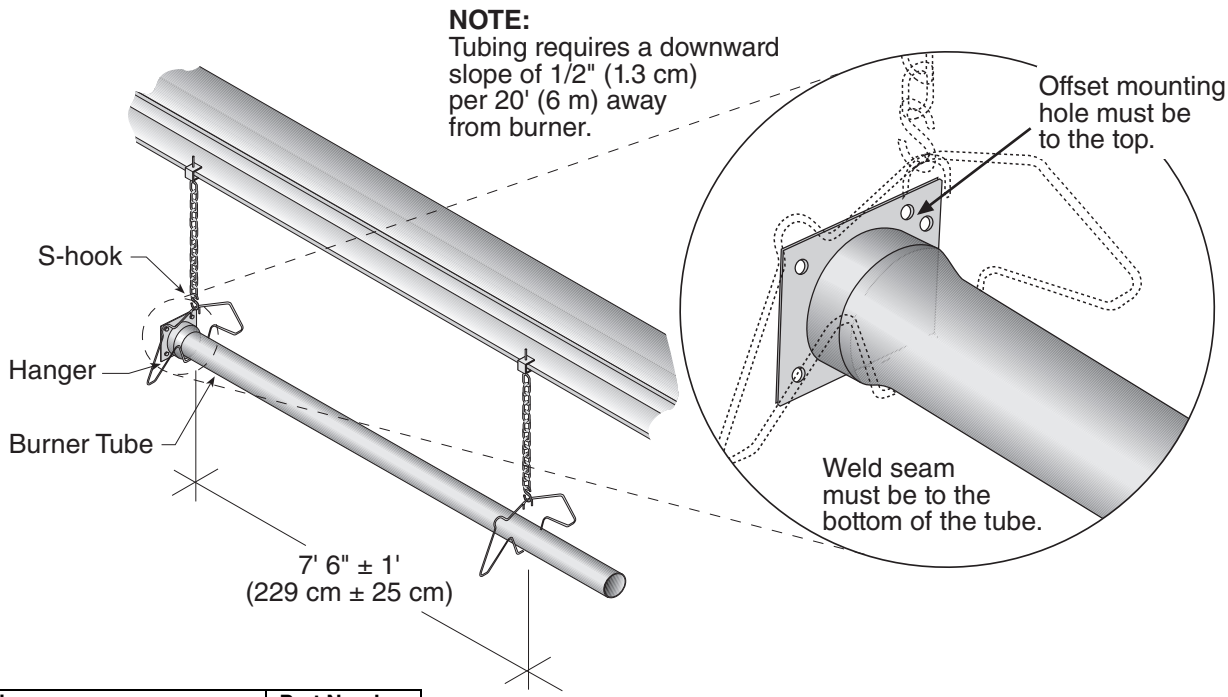
f = 5' (153 cm)
distance between last full tube hanger and half tube hanger

g = 17.5" (44 cm) burner length

h = 9.5" (24 cm) burner height

*20' (6 m) & 50' (15 m) tube length heaters require the last reflector before the u-tube to be cut in half for use on both sides.

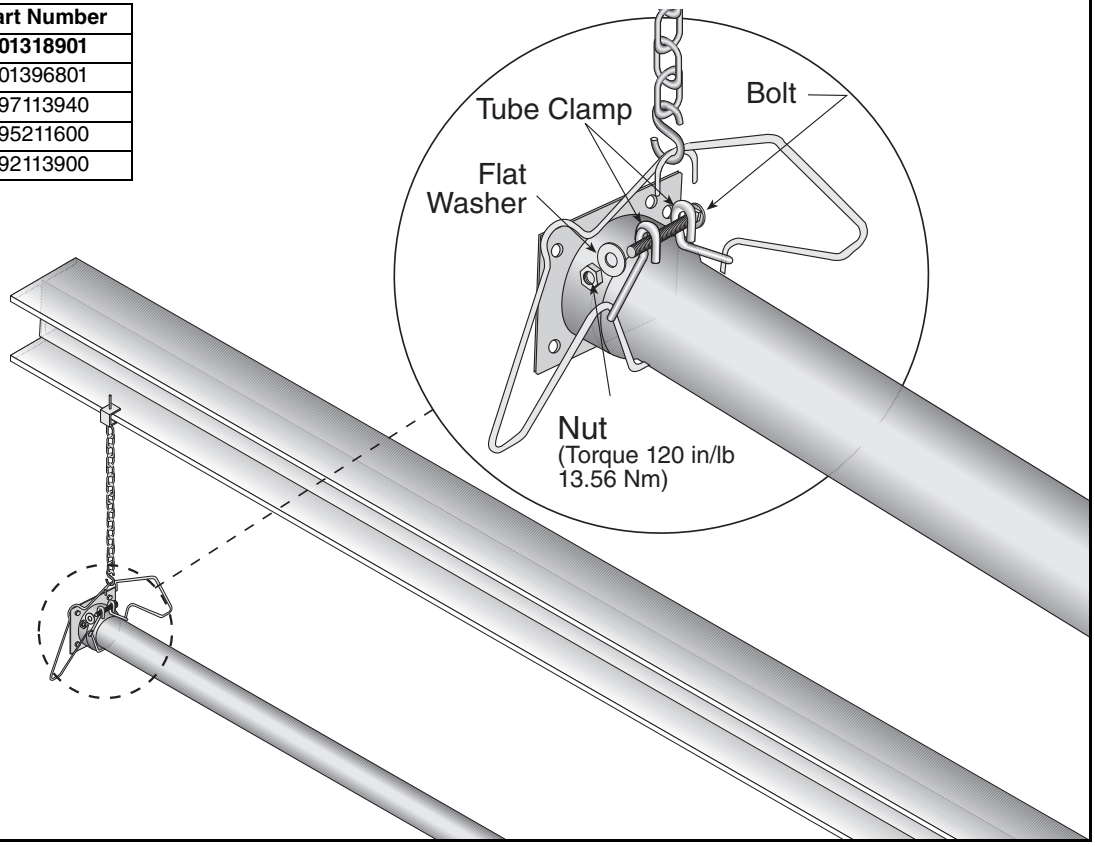
Step 8.5 Burner Tube Installation



Description	Part Number
Burner Tube	03051XXX
S-hook	91907302
Tube/Reflector Hanger	03090100

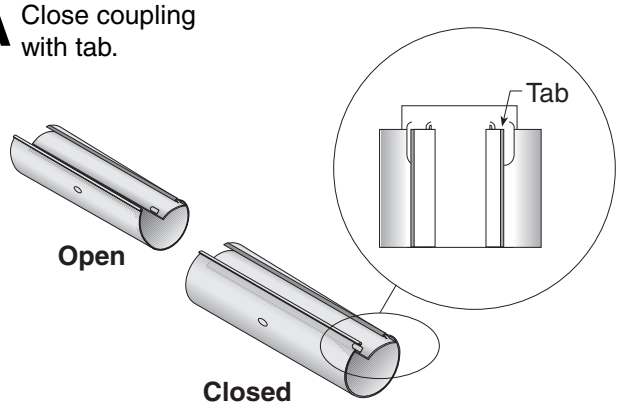
Step 8.6 Tube Clamp Package Installation

Description	Part Number
Tube Clamp Package	**01318901**
Tube Clamp	01396801
Bolt	97113940
Flat Washer	95211600
Nut	92113900

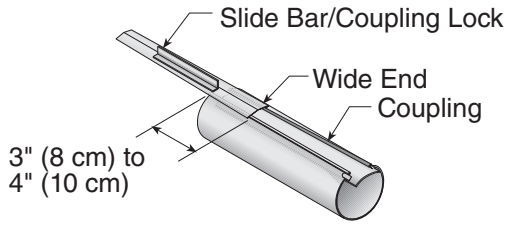


Step 8.7 Coupling and Tube Assembly

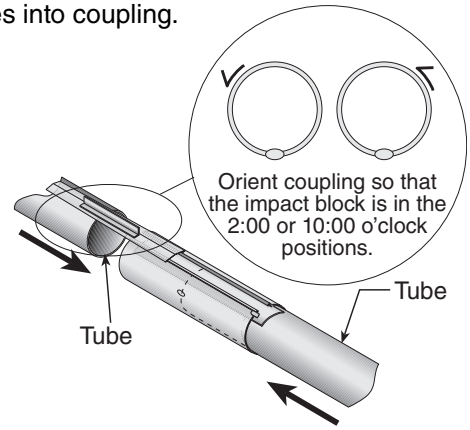
A Close coupling with tab.



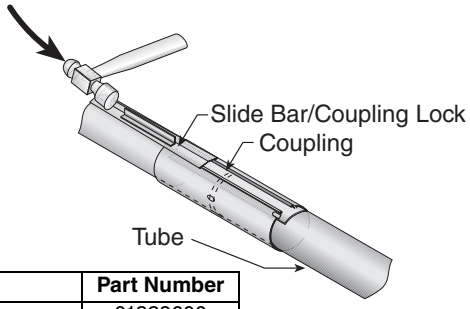
B Start slide bar/coupling lock onto coupling.



C Insert tubes into coupling.



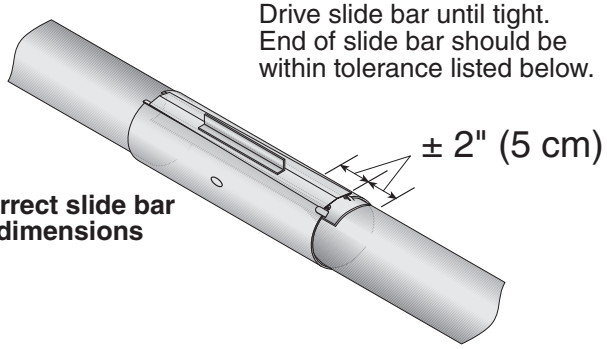
D Tighten coupling to join tubes.

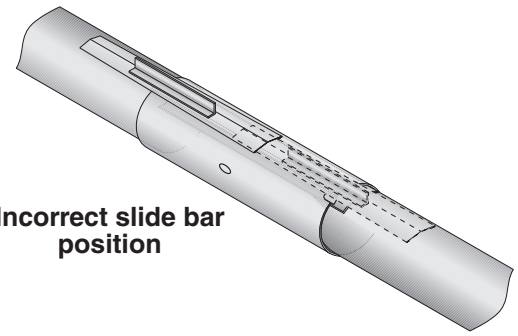


Description	Part Number
Coupling	01329600
Slide Bar/Coupling Lock	01329700
Tube	91409XXX

Step 8.7.1 Coupling and Tube Assembly (Continued)

Tighten slide bar as shown below.

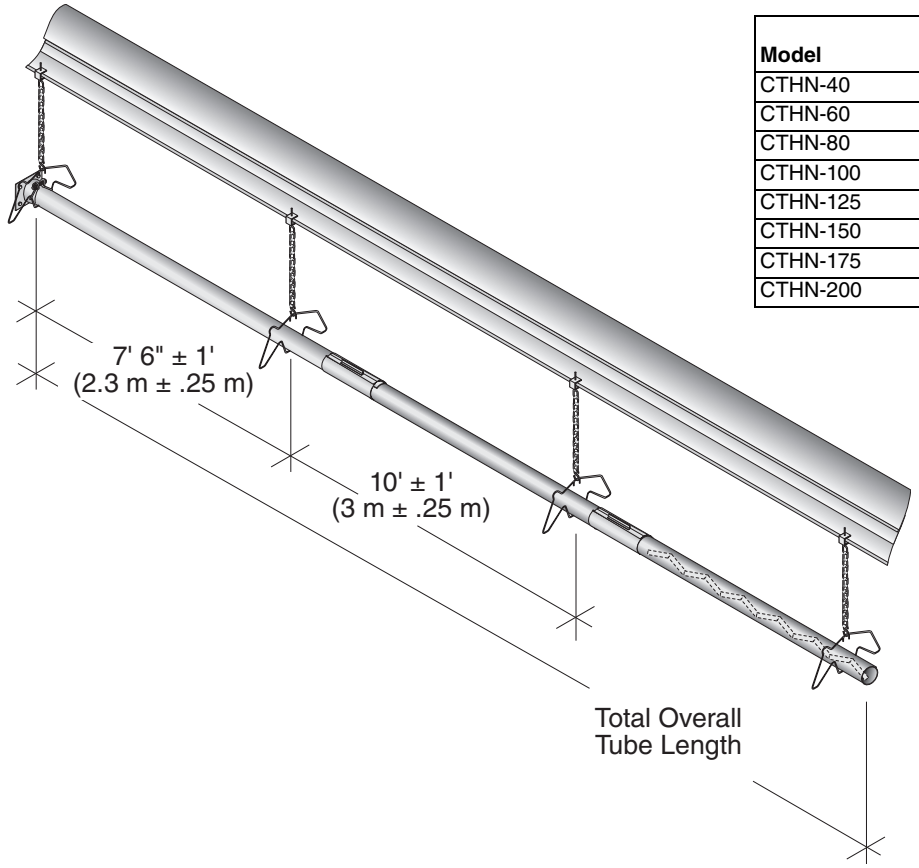




- **Repeat Step 8.7, A - D until all tubes are assembled.** *See Page 22, Step 8.7.2***.**

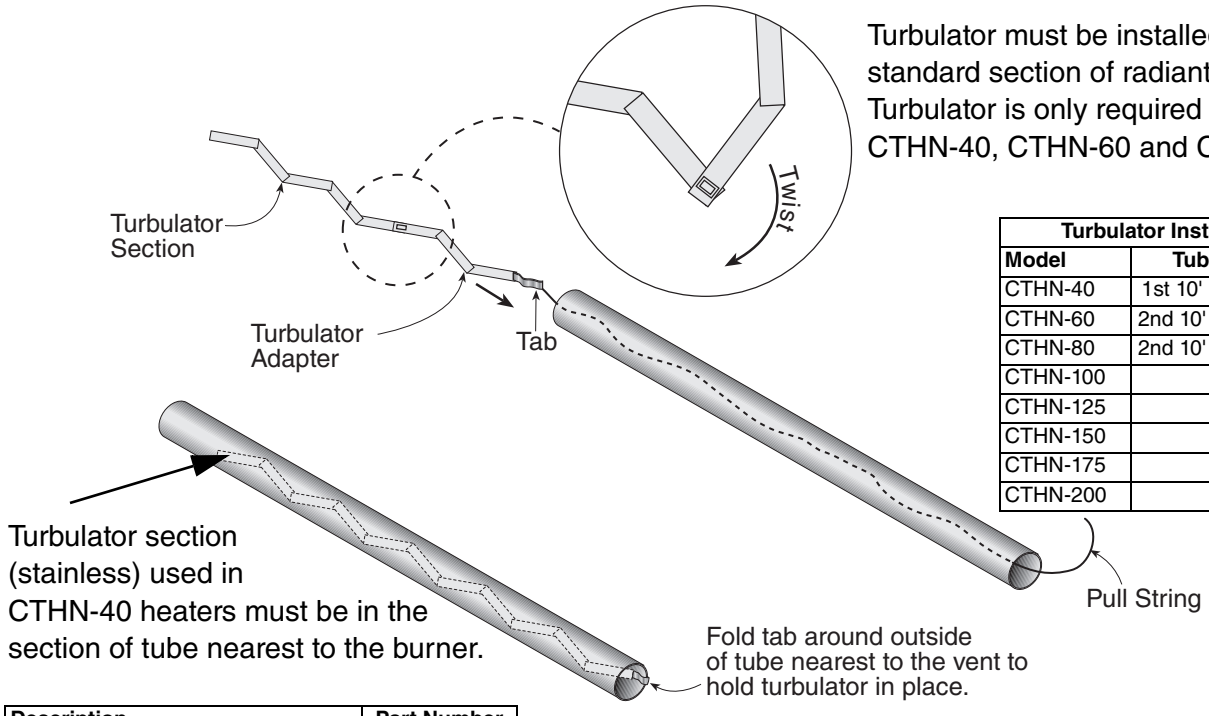
NOTE: If coupling is not tight, loss of vacuum can occur.

Step 8.7.2 Coupling and Tube Assembly (Continued)



Model	Radiant Tube Length
CTHN-40	10' (4.5 m)
CTHN-60	20' (6 m)
CTHN-80	20' (6 m)
CTHN-100	30' (9 m)
CTHN-125	40' (12 m)
CTHN-150	40' (12 m)
CTHN-175	50' (18 m)
CTHN-200	50' (18 m)

Step 8.8 Turbulator Installation



Turbulator must be installed in the last standard section of radiant tube. Turbulator is only required on the CTHN-40, CTHN-60 and CTHN-80.

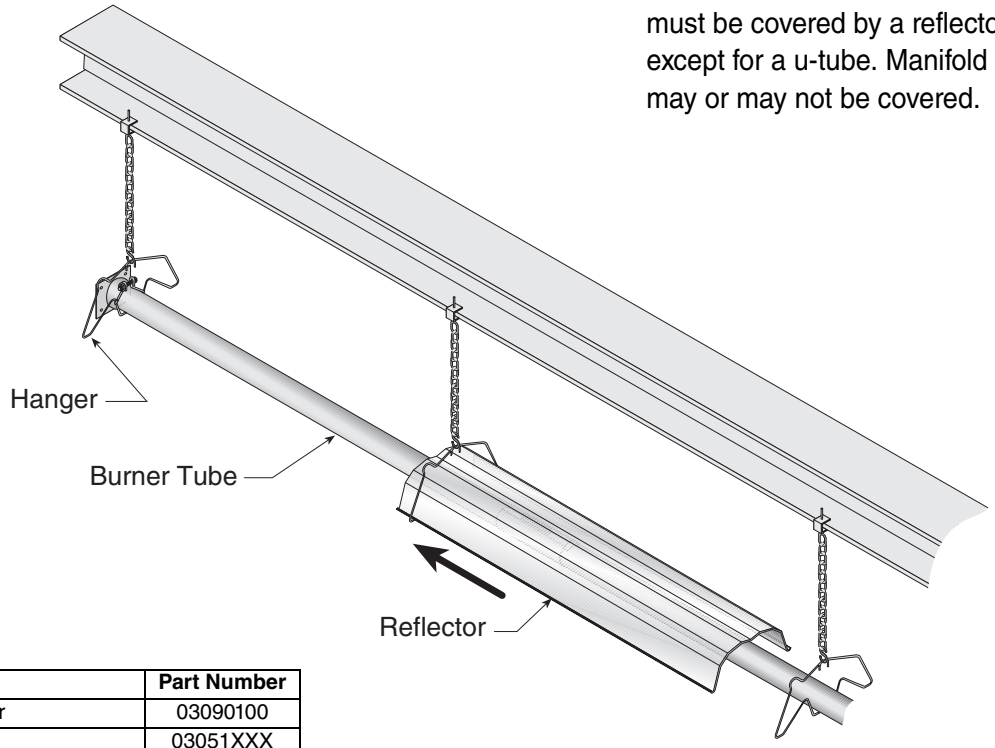
Turbulator Installation	
Model	**Tube Section**
CTHN-40	1st 10' (3 m) Section
CTHN-60	2nd 10' (3 m) Section
CTHN-80	2nd 10' (3 m) Section
CTHN-100	N/A
CTHN-125	N/A
CTHN-150	N/A
CTHN-175	N/A
CTHN-200	N/A

Turbulator section (stainless) used in CTHN-40 heaters must be in the section of tube nearest to the burner.

Description	Part Number
Turbulator Adapter	03051503
Turbulator Section	03051504
Turbulator Section (Stainless)	03051505
Tube	91409XXX

Step 8.9 Reflector Installation

NOTE: All radiant tube surfaces must be covered by a reflector, except for a u-tube. Manifold tube may or may not be covered.



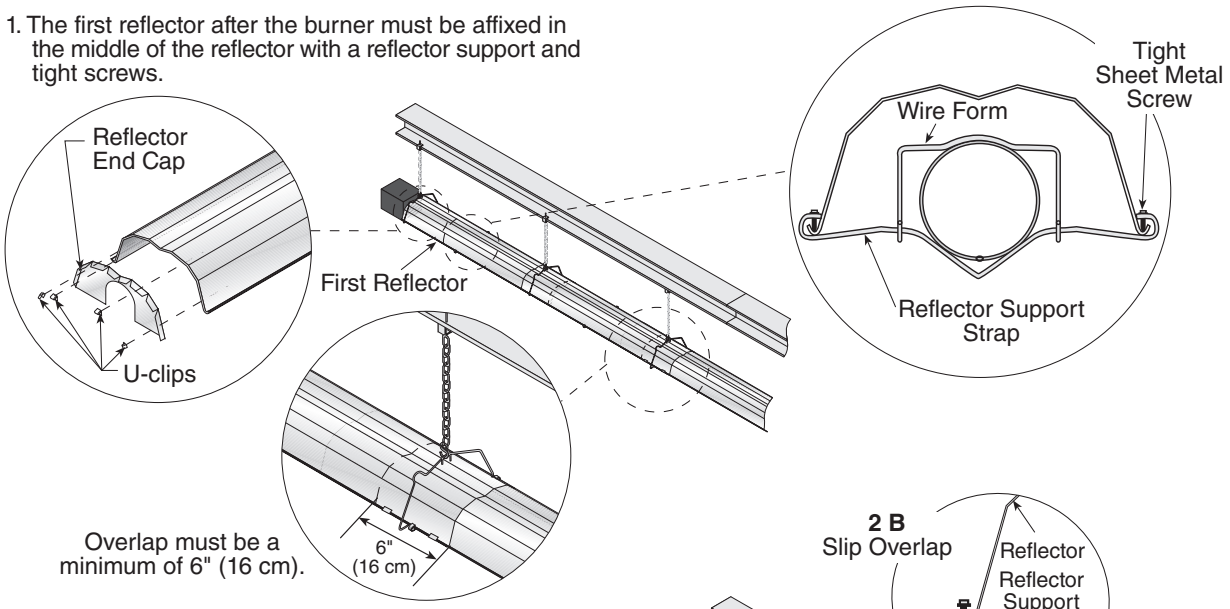
Description	Part Number
Tube/Reflector Hanger	03090100
Burner Tube	03051XXX
Reflector	02750303

Step 8.9.1 Reflector, U-clip and Reflector Support Installation

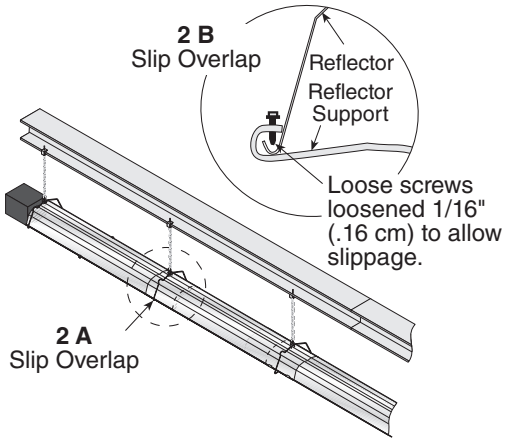
The pictorial drawings of the heater construction in *Section 8* are schematic only and provide a general guideline of where hangers, reflector supports and u-clips are to be installed.

To ensure proper expansion and contraction movement of the reflectors, a combination of u-clips and reflector supports are used. The positioning of reflector supports and u-clips depend on the individual installation. Use either pop rivets or sheet metal screws instead of u-clips when installing end caps and joint pieces in areas where impact and high wind may be a factor. The following rules must be observed.

1. The first reflector after the burner must be affixed in the middle of the reflector with a reflector support and tight screws.

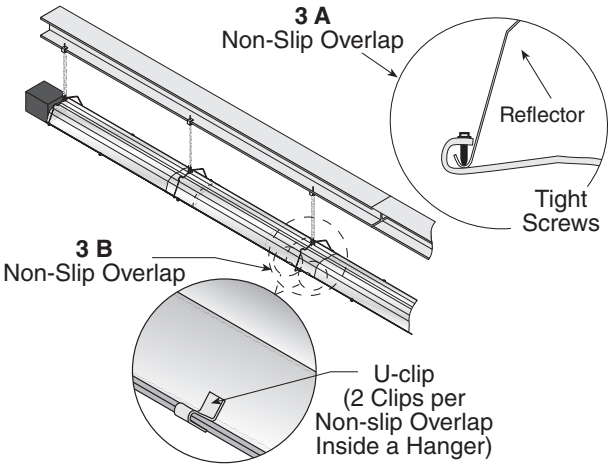


2. The overlap at the first and second reflector is a **slip overlap.** Thereafter, every third reflector joint is a slip overlap. A slip overlap is achieved by either:
   a.) both reflectors lay inside a hanger. (No reflector support needed.)
   b.) using a reflector support with loose screws at the reflector overlap.



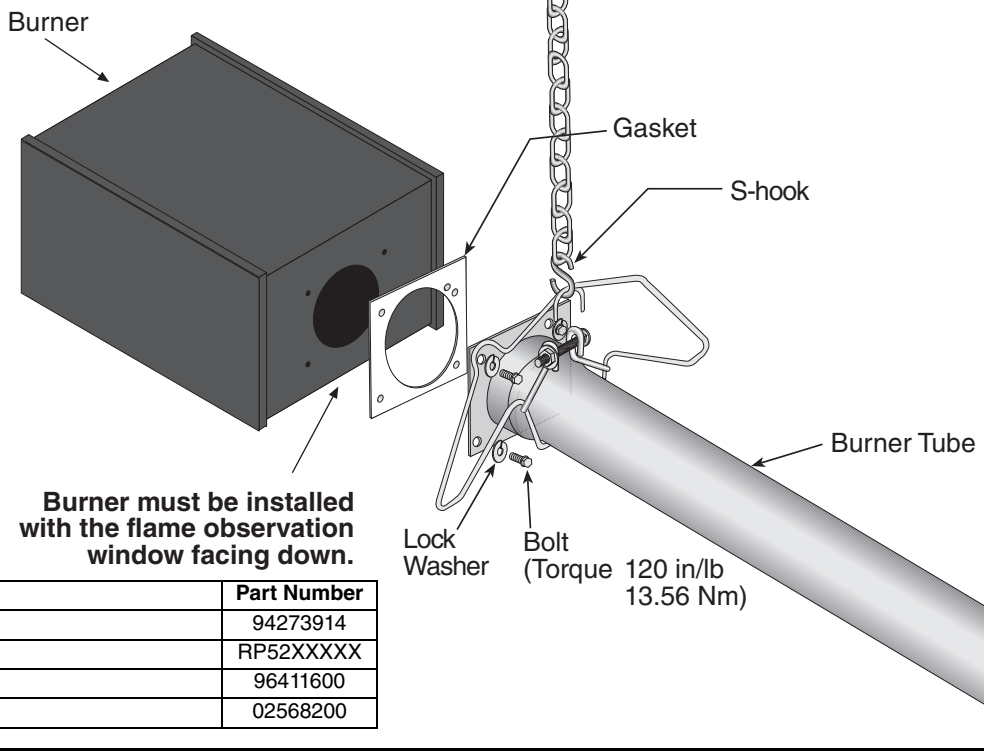
3. The remaining reflector overlaps require a **non-slip overlap** connection. To affix the reflectors together in a non-slip overlap either:
   a.) use reflector support and tight screws.
   b.) if both reflectors lay inside a hanger, u-clips or sheet metal screws may be used.

   This section of three reflectors joined together must be affixed to the tube with at least one reflector support with tight screws.



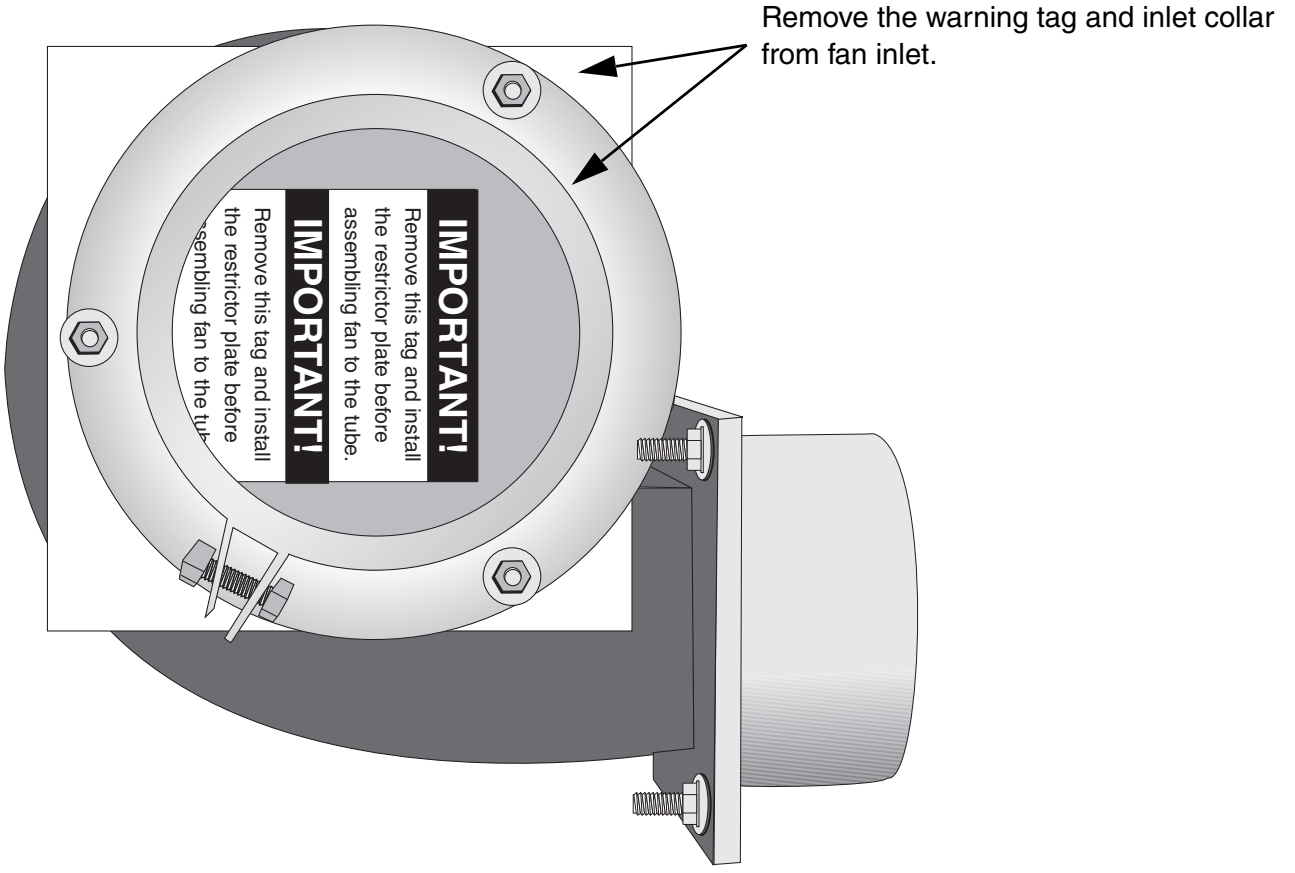
Description	Part Number
Reflector Support Package	**03050010**
Wire Form	91908004
Reflector Support Strap	03050000
Screw #8 x 3/4	94320812
U-clip Package	91107720
Reflector End Cap	027508XX

Step 8.10 Burner Installation



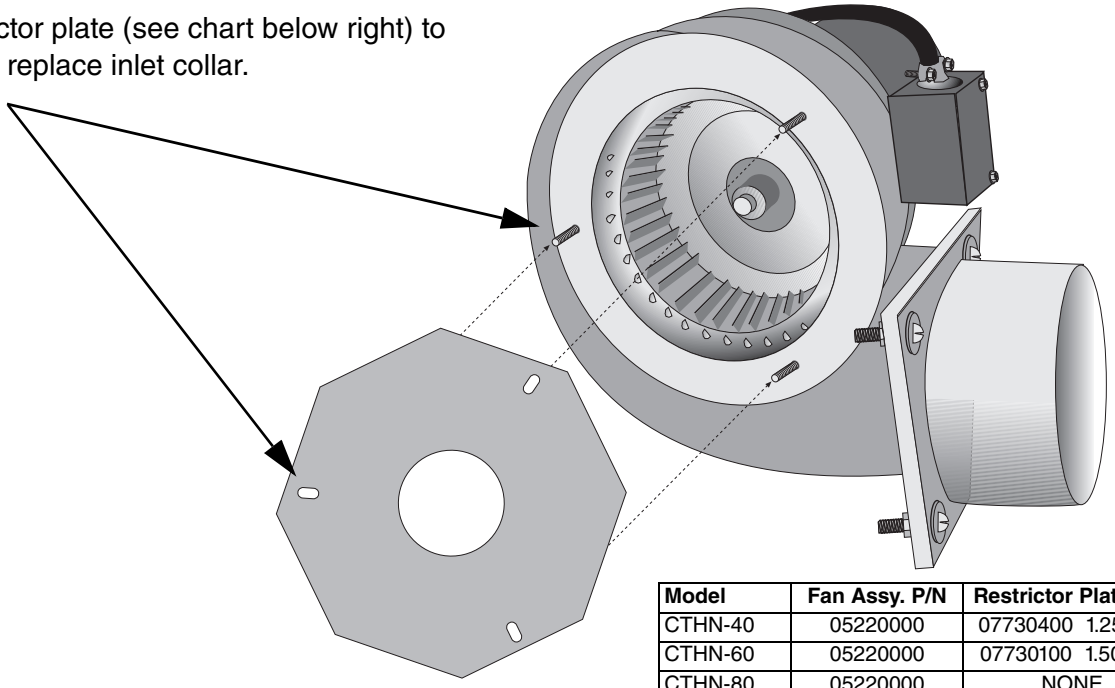
Description	Part Number
Bolt	94273914
Burner	RP52XXXXX
Lock Washer	96411600
Gasket	02568200

Step 8.11 Fan Inlet Plate and Warning Tag



Step 8.12 Restrictor Plate Installation

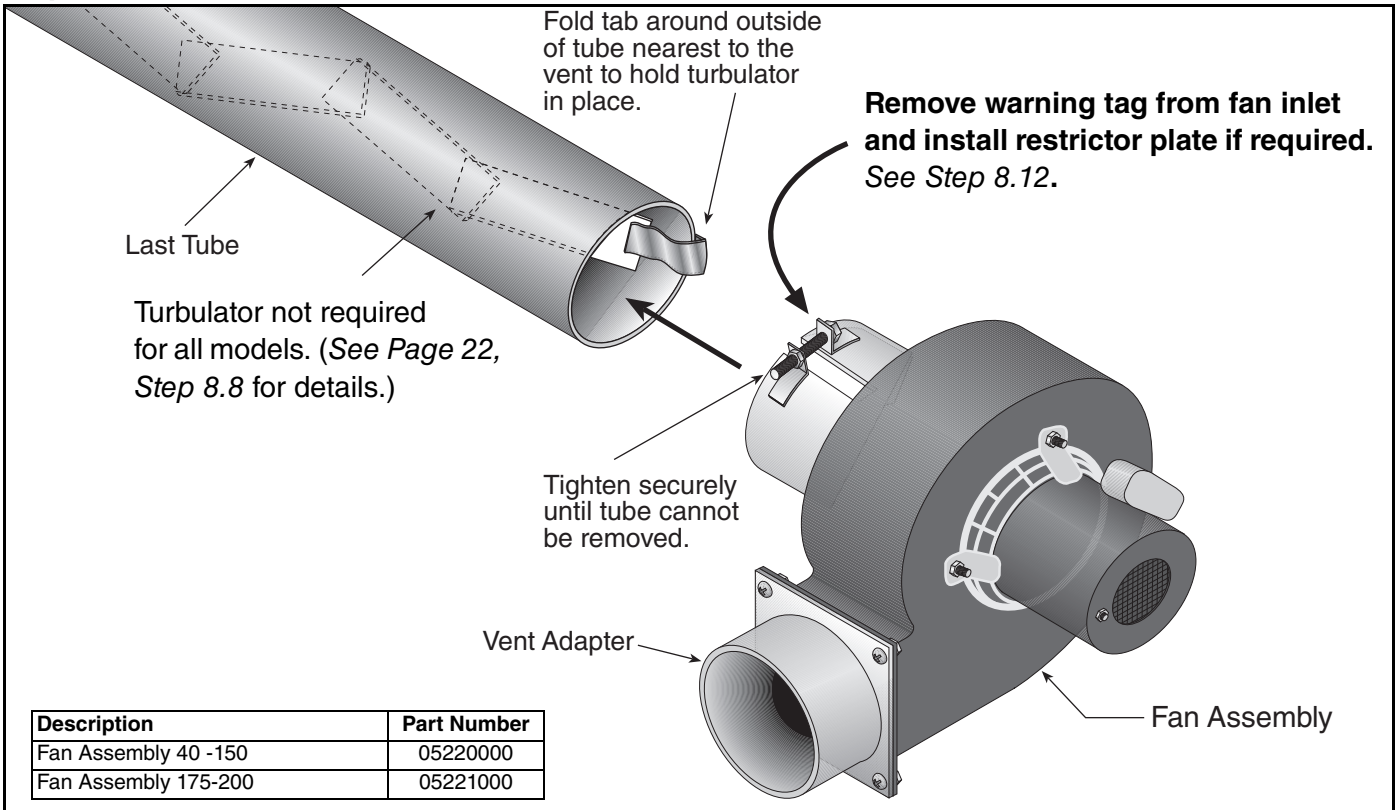
Attach restrictor plate (see chart below right) to fan inlet and replace inlet collar.



Description	Part Number
Restrictor Plate	07730XXX

Model	Fan Assy. P/N	Restrictor Plate P/N
CTHN-40	05220000	07730400 1.25" dia
CTHN-60	05220000	07730100 1.50" dia
CTHN-80	05220000	NONE
CTHN-100	05220000	07730500 2.25" dia
CTHN-125	05220000	07730500 2.25" dia
CTHN-150	05220000	07730700 2.75" dia
CTHN-175	05221000	07730600 2.50" dia
CTHN-200	05221000	NONE

Step 8.13 Fan Installation



Description	Part Number
Fan Assembly 40 -150	05220000
Fan Assembly 175-200	05221000

SECTION 9: MULTIBURNER HEATER INSTALLATION

9.1 Standard Parts

Table 6: Contents of CTHN Burner Carton

Part No.	Description	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
RP52XXXXX	Burner (Rate and Fuel Varies)	1	1	1	1	1	1	1	1
07730400	Restrictor Plate 1.25" (3.2 cm) dia.	1	-	-	-	-	-	-	-
07730100	Restrictor Plate 1.50" (3.8 cm) dia.	-	1	-	-	-	-	-	-
07730500	Restrictor Plate 2.25" (5.7 cm) dia.	-	-	-	1	1	-	-	-
07730600	Restrictor Plate 2.50" (6.4 cm) dia.	-	-	-	-	-	-	1	-
07730700	Restrictor Plate 2.75" (7 cm) dia.	-	-	-	-	-	1	-	-
03051503	Turbulator Adapter	1	1	1	-	-	-	-	-
03051504	Turbulator Section	2	4	4	-	-	-	-	-
03051505	Turbulator Section, Stainless Steel	1	-	-	-	-	-	-	-
*91412200	Flexible Stainless Steel Gas Hose , 1/2" NPT (US Models Only)	1	1	1	1	1	-	-	-
*91412203	Flexible Stainless Steel Gas Hose , 3/4" NPT (US Models Only)	-	-	-	-	-	1	1	1
02568200	Gasket (Burner to Burner Tube)	1	1	1	1	1	1	1	1
94273914	Hex Head Cap Screw 5/16" -18 x 7/8"	4	4	4	4	4	4	4	4
96411600	Split Lock Washer	4	4	4	4	4	4	4	4
91201708	Pipe Nipple 1/2" NPT x 4"	1	1	1	1	1	1	1	1
RPNP152101NA	Installation, Operation and Service Manual	1	1	1	1	1	1	1	1

*Canadian Models: Rubber (Type 1) Gas Hoses available as an accessory. *See Page 67, Section 16*.

Table 7: Contents of Core and Extension Packages

		Core Packages							Extension Packages							
		Hot Rolled			Aluminized				Hot Rolled				Aluminized			
Part No.	Description	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)	10' (3m)	20' (6m)	30' (9m)	40' (12m)
91409300	Tube, Hot Rolled Steel, 10' (3 m)	1	2	3	-	-	-	-	1	2	3	4	-	-	-	-
91409408	Tube, HT Aluminized, 10' (3 m)	-	-	-	-	1	2	3	-	-	-	-	1	2	3	4
03051101	Burner Tube, ALUMI-THERM® Steel, 10' (3 m)	-	1	1	-	-	1	1	-	-	-	-	-	-	-	-
03051601	Burner Tube, HT ALUMI-THERM® Steel, 10' (3 m)	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-
01312700	Coupling Assembly	1	2	3	-	1	2	3	1	2	3	4	1	2	3	4
02750303	Standard Reflector, 8' (2.4 m)	3	4	6	2	3	4	6	2	3	4	6	2	3	4	6
02750800	End Cap	2	2	2	2	2	2	2	-	-	-	-	-	-	-	-
03090100	Tube and Reflector Hanger	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
91907302	S-hook	3	4	5	2	3	4	5	1	2	3	4	1	2	3	4
03050010	Reflector Support Package (Strap, Wire Form, Screws)	2	3	5	1	2	3	5	2	3	4	6	2	3	4	6
91107720	U-clip Package	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
90502700	Vent Adapter (Not used on CTHN)	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-
01318901	Tube Clamp Package	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-

Table 8: Component Package Guide

Model	Tubing Length	Core Packages	
	Minimum	Standard	Aluminized
CTHN-40	20' (6 m)	CP20HRS	CP20ALUM
CTHN-60	30' (9 m)	CP30HRS	CP30ALUM
CTHN-80	30' (9 m)	CP30HRS	CP30ALUM
CTHN-100	40' (12 m)	CP40HRS	CP40ALUM
CTHN-125	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM
CTHN-150	50' (15 m)	CP30HRS + EXP20HRS	CP30ALUM + EXP20ALUM
CTHN-175	60' (18 m)	CP30HRS + EXP30HRS	CP30ALUM + EXP30ALUM
CTHN-200	60' (18 m)	CP30HRS + EXP30HRS	CP30ALUM + EXP30ALUM

Additional tubing length may be added to heater.
Any additional tubing lengths are considered as manifold tube length for length determination, *See Page 30, Section 9.2 through Page 32, Section 9.6*, design requirements and allowed manifold tube lengths.
For manifold tubing on multiburner systems, heat-treated aluminized tubing is required.

Table 9: Common CTHN-Series Components

Part No.	Description
Tubing and Related Accessories	
01312700	Coupling, 4" (10 cm) Plain
01312706	Coupling, 6" (15 cm) Plain
01331900	Coupling, 4" (10 cm) Damper
E0009356	Coupling, 6" (15 cm) Damper
01330203	Tee, 4" (10 cm) Aluminized
01330204	Tee, 6" (15 cm) Aluminized
01330903	Cross, 4" (10 cm) Aluminized
01330904	Cross, 6" (15 cm) Aluminized
01335801	Elbow, 4" (10 cm) Aluminized 90°
T0100320	Elbow, 6" (15 cm) Aluminized 90°
01336101	Elbow, 4" (10 cm) Aluminized 45°
91409300	Tube, 4" (10 cm) dia Hot Rolled Steel 10' (3 m)
91409403	Tube, 4" (10 cm) dia Non-Heat Treated Aluminized 10' (3 m)
91409408	Tube, 4" (10 cm) dia Heat Treated Aluminized 10' (3 m)
91409420	Tube, 6" (15 cm) dia Non-Heat Treated Aluminized 10' (3 m)
9141030D	Tube, 4" (10 cm) dia Coated 10' (3 m)
E0009105	Tube, 6" (15 cm) dia 10' (3 m) Heat Treated Aluminized
91418200	Tube Adapter, 6" (15 cm) dia x 4"(10 cm) dia Aluminized
91240010	Tube Hanger, 6" (15 cm)
91308001	Pipe Compound, High Temperature 1lb can

Venting Accessories	
01324401	Air Supply Takeoff, 4" (10 cm) Outside
90707501	Air Supply Blower/Power Venter
91409601	Air Flex Duct, 4" (10 cm) Outside (Box of 8 - 8' (2.4 m) sections)

Reflectors and Related Accessories	
01329910	Reflector Side Extension Support
03050010	Reflector Support Package (Tubing)
02712700	Reflector Side Extension, 2 Clips, 2 Screws
02750303	Reflector, Aluminum
027503SS	Reflector, Stainless Steel
02750800	Reflector End Cap, Aluminum
027508SS	Reflector End Cap, Stainless Steel
027508SH	Reflector End Cap, Stainless Steel with Hole
02750900	Reflector Joint
027509SS	Reflector Joint, Stainless Steel
027127SS	Reflector Side Extension, Stainless Steel
03090100	Tube and Reflector Hanger
91907302	S-hook
91903201	Turnbuckle
91903300	Spring Hook
91903202	Turnbuckle with Eyebolt

Thermostats	
05023000	Load Relay Package
90417600	Transformer Relay - SPST (12 A)
90436300	Transformer Relay - DPST (12 A)
90423000	Thermostat, 24 V Low Voltage (Marked 1-5)
90424300	Thermostat Guard

Deco Grille (1' x 8' [.3 m x 2.4 m])	
01363003	Bracket
01365901	End Piece
01326801	Reinforcement
01365903	Joint Piece
91406700	1' x 8' (.3 m x 2.4 m) Protective Grille

Deco Grille (2' x 4' [.6 m x 1.2 m])	
01365900	Shield Frame
01370408	Reflector Side Extension 8" x 48" (20 cm x 122 cm)
01370412	Reflector Side Extension 12" x 48" (30 cm x 122 cm)
01370416	Reflector Side Extension 16" x 48" (40 cm 122 cm)
91407000	Grille, Aluminum 2' x 4' (.6 m x 1.2 m)

Protective Grille	
08050001	Grille, 40" (102 cm) Protective
08050002	Protective Grille End Cap

Fan and Pump Packages	
05220000	Fan Package 40-150
05221000	Fan Package 175-200
02719105	**EP-100 Pump Package**
02719100	EP-100 Pump
02724700	Accessory Package
02716305	**EP-201 Pump Package**
01312001	EP-201 Pump
01317805	Accessory Package
02712034	**EP-203 Pump Package**
01312002	EP-203 Pump
01317805	Accessory Package
02723014	**EP-301 Pump Package 4"** (10 cm)
02730101	EP-301 Pump Assembly
02730104	Accessory Package
02723016	**EP-301 Pump Package 6"** (15 cm)
02730101	EP-301 Pump Assembly
02730106	Accessory Package
02723034	**EP-303 Pump Package 4"** (10 cm)
02730103	EP-303 Pump Assembly
02730104	Accessory Package
02723036	**EP-303 Pump Package 6"** (15 cm)
02730103	EP-303 Pump Assembly
02730106	Accessory Package

Pump Accessories	
90430600K	Pressure Switch

Starters and Contactors	
10050001	Starter, 120 Vac for EP-203, 3 Ø
10050003	Starter, 120 Vac for EP-201, 1 Ø
10050008	Starter, 120 Vac for EP-301, 1 Ø
10050009	Contactor Package- 120 Vac Coil for EP-301, 230 V, 2 HP
10050010	Starter, 120 Vac for EP-303, 3 Ø

9.2 Multiburner System Design Requirements

A CTHN multiburner system has a number of radiant tube sections interconnected by manifold tube to a pump to form a complete system. Reflectors can be used over the manifold tube but are not required. The system design parameters are such that the manifold sections are not subjected to condensate when the system is fully heated up. It is required that heat-treated aluminized tubing is used for the manifold to increase system life and to handle initial condensation during start-up. Damper couplings may be necessary to balance system vacuum.

Design requirements for a CTHN multiburner system are summarized *on Page 31, Table 10*.

CTHN multiburner heaters are typically shipped as burner packages and tube and accessory packages. The tube and accessory packages contain enough tube, reflector and hanging parts for the radiant section of one CTHN heater. Elbows, tees, manifold tube, pumps, controls, damper couplings and any other parts used beyond the burner, radiant tube and reflector must be purchased separately. See *Figure 18* for a general overview of a simple CTHN multiburner system. Depending on system requirements, CTHN multiburner systems may be controlled by a relay system.

FIGURE 18: Typical CTHN Multiburner System Installation

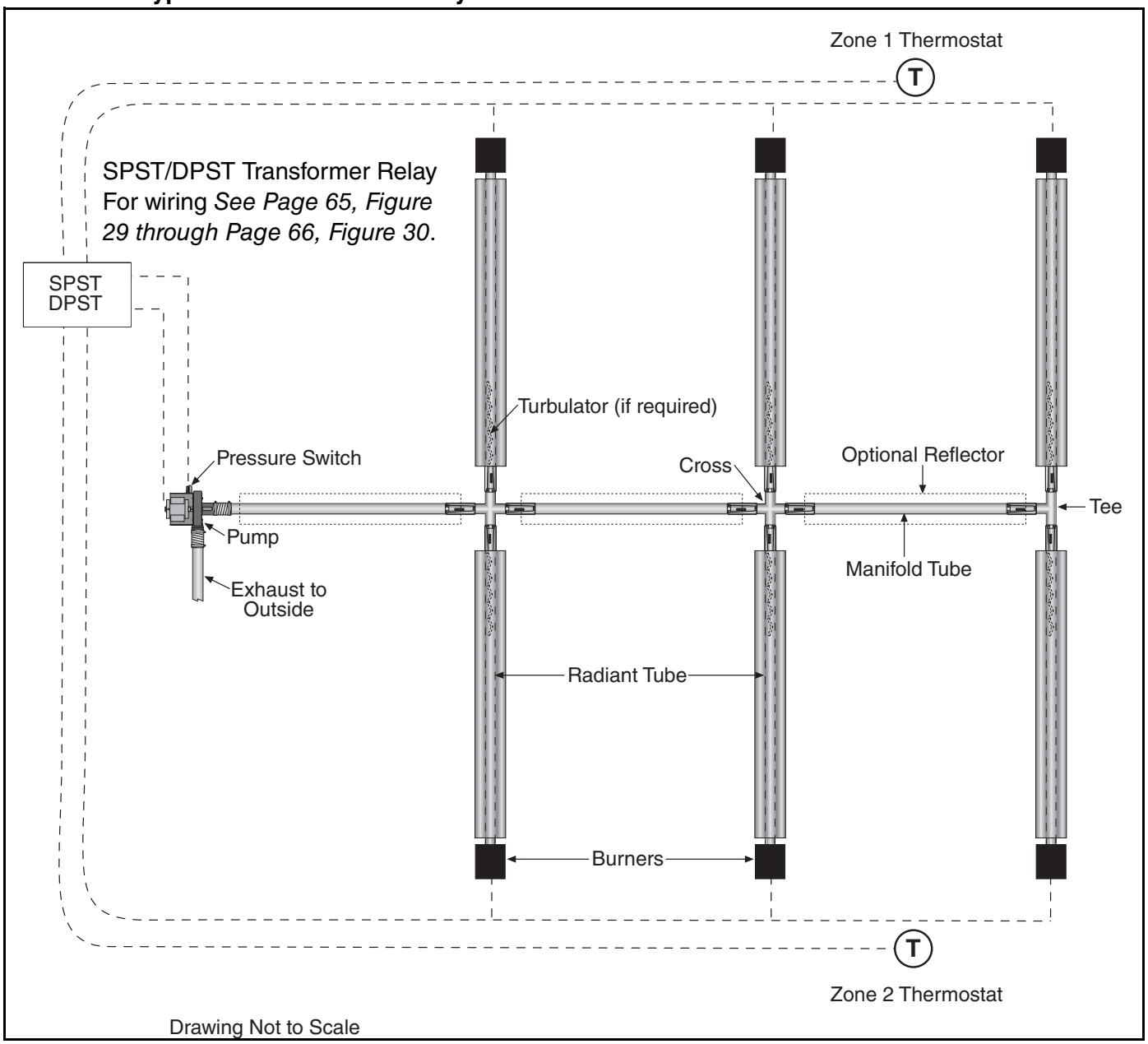


Table 10: Multiburner Design Requirements

Burner Model:	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
Radiant Tube Length	20' (6 m)	30' (9 m)	30' (9 m)	40' (12 m)	50' (15 m)	50' (15 m)	60' (18 m)	60' (18 m)
Minimum Manifold Tube Length per Burner	3' (1 m)	3' (1 m)	3' (1 m)	6' (2 m)	6' (2 m)	10' (3 m)	10' (3 m)	10' (3 m)
Maximum Manifold Tube Length per Burner	30' (9 m)	35' (10.5 m)	40' (12 m)	45' (13.5 m)	50' (15 m)	55' (16.5 m)	60' (18 m)	60' (18 m)
Minimum Distance from Burner to Elbow or U-tube	10' (3 m)	10' (3 m)	10' (3 m)	15' (4.5 m)	15' (4.5 m)	20' (6 m)	20' (6 m)	20' (6 m)
Elbows Allowed per Burner*	2	2	2	2	2	2	2	2

* U-tube = 2 elbows

9.3 Burners Per Pump

1. The maximum number of burners per pump is shown in *Table 11*.
2. **When combining different burner inputs** in a system, the number of burners per pump (0' - 2,000' altitude) is given by the sum of their inputs:
   a. EP-100 up to 500,000 Btu/h max, but not more than 4 burners.
   b. EP-200 up to 750,000 Btu/h max, but not more than 6 burners.
   c. EP-300 up to 1,600,000 Btu/h max, number of burners is limited to the maximum number of burners listed in *Table 11* for the largest input model used.

Table 11: Number of Burners Allowed Per Pump

Pump Model	Altitude	CTHN-40	CTHN-60	CTHN-80	CTHN-100	CTHN-125	CTHN-150	CTHN-175	CTHN-200
EP-100	0' - 2,000'	4	4	4	4	4	3	2	2
	2,001' - 3,000'	4	4	4	4	3	3	2	2
	3,001' - 4,000'	4	4	4	4	3	2	2	2
	4,001' - 5,000'	4	4	4	4	3	2	2	2
	5,001' - 6,000'	4	4	4	4	3	2	2	2
	6,001' - 7,000'	4	4	4	3	3	2	2	2
	7,001' - 8,000'	4	4	4	3	3	2	2	1
	8,001' - 9,000'	4	4	4	3	2	2	2	1
EP-200 Series	0' - 2,000'	6	6	6	6	6	5	4	4
	2,001' - 3,000'	6	6	6	6	6	5	4	3
	3,001' - 4,000'	6	6	6	6	5	4	4	3
	4,001' - 5,000'	6	6	6	6	5	4	4	3
	5,001' - 6,000'	6	6	6	6	5	4	3	3
	6,001' - 7,000'	6	6	6	6	5	4	3	3
	7,001' - 8,000'	6	6	6	6	5	4	3	3
	8,001' - 9,000'	6	6	6	6	5	4	3	3
EP-300 Series	0' - 2,000'	16	16	14	12	12	10	8	8
	2,001' - 3,000'	16	16	14	12	12	9	8	7
	3,001' - 4,000'	16	16	14	12	11	9	8	7
	4,001' - 5,000'	16	16	14	12	10	9	7	6
	5,001' - 6,000'	16	16	14	12	10	8	7	6
	6,001' - 7,000'	16	16	14	12	10	8	7	6
	7,001' - 8,000'	16	16	14	12	10	8	6	6
	8,001' - 9,000'	16	16	14	12	10	8	6	6

9.4 Radiant Tube Length

The radiant tube length fixed for each burner is shown *on Page 31, Table 10*.

9.5 Manifold Tube

Any tube beyond the radiant tube length is considered manifold. Manifold tube can be used to lengthen tube runs beyond the radiant tube length; to connect multiple runs of tubing and connect the system to the pump. **Minimum and maximum manifold tube lengths are shown** *on Page 31, Table 10***. The table must be used in conjunction with the additional rules for the diameter and length of manifold in a system, as described** *on Page 32, Section 9.5.1 through Page 36, Section 9.6.3***.**

9.5.1 Manifold Diameter

1. Manifold diameter for systems containing less than 320,000 Btu/h input can be 4" (10 cm) or 6" (15 cm).
2. Manifold diameter for systems containing 320,000 Btu/h input and greater must be 6" (15 cm).
   Exception: If total manifold tube length is 70' (21 m) or less, 4" (10 cm) diameter manifold tube can be used for systems up to 800,000 Btu/h.

9.6 Multiburner System Layouts and Manifold Tube Length Rules

Most CTHN multiburner layouts can be classified as one of the following five layout types:

Flag, Modified In-Series, T, Fork or Herringbone. Please refer to *Page 32, Section 9.6.1 through Page 36, Section 9.6.3* for explanation of manifold rules and basic diagrams of each layout type. The diagrams show very simple examples of each layout type. Actual layouts will vary in total number of burners in the system as well as the overall shape of the system. Additional pieces such as elbows may change the overall layout appearance but are usually considered a variant of one of the five multiburner layout types.

9.6.1 Flag and Modified In-Series Layouts and Manifold Tube Length Rules

See Page 33, Figure 19 through Page 33, Figure 20 for diagrams of Flag and Modified In-Series layouts. Minimum and maximum manifold tube length applies to all tubing between the end of a radiant tube run and a tee or cross; all tubing between any tees and/or crosses; and all tubing between the last tee or cross and the pump. *See Page 31, Table 10*.

Example: Consider a Flag or Modified In-Series layout with five CTHN-100 burners. *Page 31, Table 10* shows a minimum of 6' (2 m) and a maximum of 45' (13.5 m) of manifold tube required per burner. Therefore the entire five-burner system must have between 30' (10 m) and 225' (69 m) of manifold tubing. The manifold tubing is in addition to the 40' (12 m) of radiant tube per burner. Radiant tube may end at a tee, or runs may be lengthened by adding some manifold tube between the end of the radiant tube and a tee. Each burner in the system (except for the burner furthest from the pump) must use a damper coupling to properly adjust the vacuum at each burner. The damper coupling may be placed anywhere between the end of the radiant pipe and the tee.

FIGURE 19: Flag Layout

Multiple rows of burners:
pump placed at the end of the manifold tube.

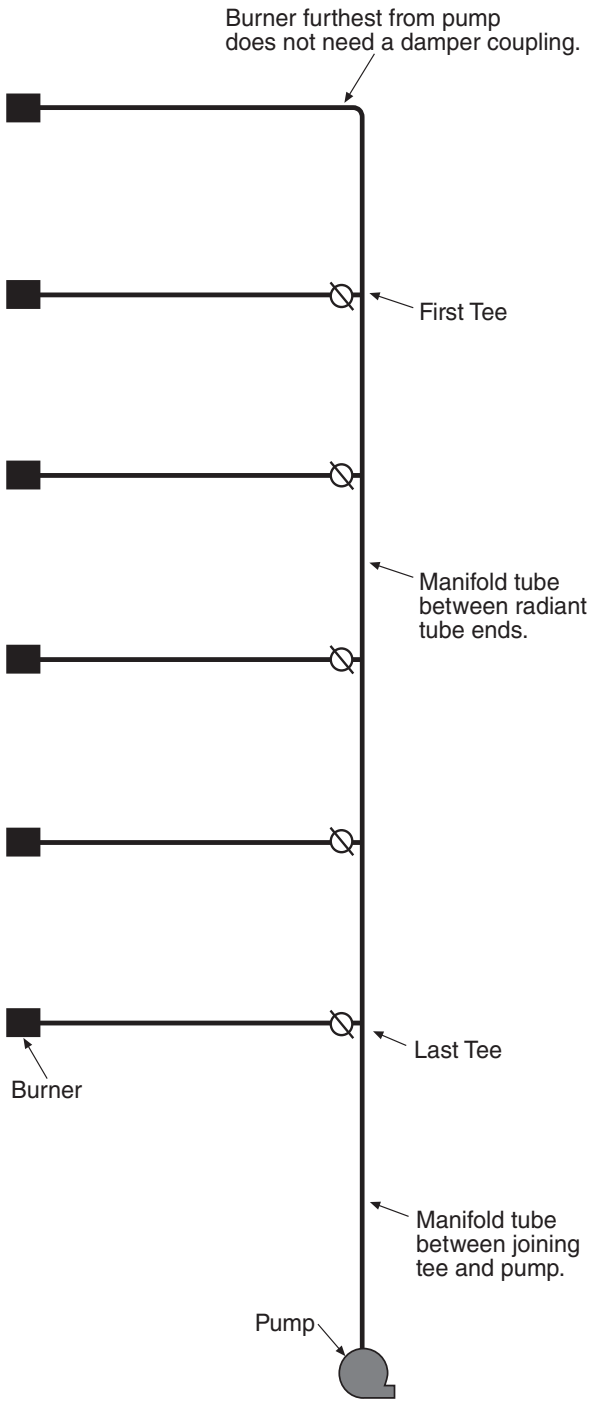
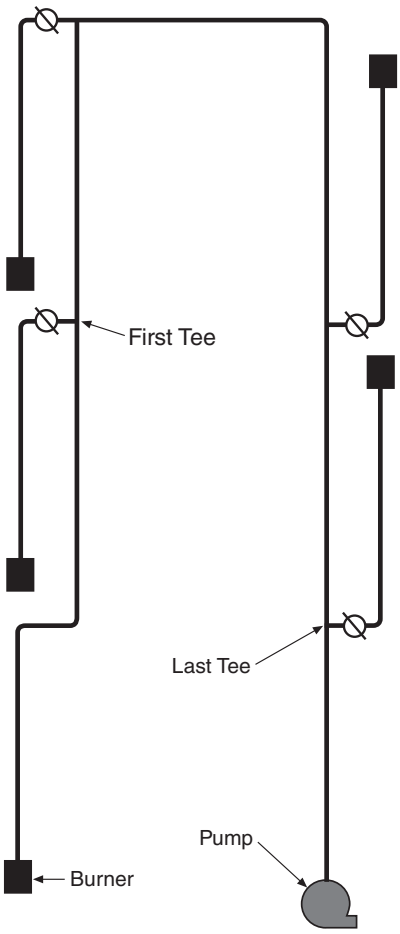


FIGURE 20: Modified In-Series Layout

Multiple burners:
pump placed at the end of the manifold tube.
A variation on the flag layout.



9.6.2 T and Fork Layouts and Manifold Tube Length Rules

See Page 34, Figure 21 through Page 35, Figure 22 for diagrams of T and Fork layouts. The T and Fork layouts have a tee or cross (called the "last tee" or "last cross") where the combustion gases in the system enter the tee or cross with directly opposing flow directions, which creates an added source of pressure drop in the system. This additional source of pressure drop requires some difference in how the allowed manifold length is calculated. In this case, we have to differentiate manifold tube that is located between the radiant pipe and the last tee (or cross) from manifold tube that is located between the last tee (or cross) and the pump.

First determine the length of manifold tube between the radiant tube end and the last tee (or cross). Do not count any tube length twice. Now refer to *Page 31, Table 10* and find the maximum manifold tube length for each burner. Add together the maximum manifold tube length on the table for each burner in the system, this is the maximum manifold tube length for the entire system.

To determine the maximum manifold tube allowed between the last tee (or cross) and the pump: Subtract the manifold tube length between the radiant tube and the last tee (or cross) from the maximum manifold length for the entire system, then divide that number by 1.5.

Example: Consider a T layout with two CTHN-100 burners. *See Page 34, Figure 21*. Assume that 15' (4.5 m) of manifold was used from each radiant tube end to the last tee. *Page 31, Table 10* indicates that each CTHN-100 burner can have a maximum of 45' (13.5 m) of manifold tube. Therefore the maximum manifold tube length amount allowed between the last tee and the pump in this case is ([45' + 45']-[15' x 2])/1.5 = **40'** or in metric, ([13.5 m + 13.5 m]-[4.5 m x 2])/1.5 = **12 m**.

FIGURE 21: T Layout

One pair of burners.

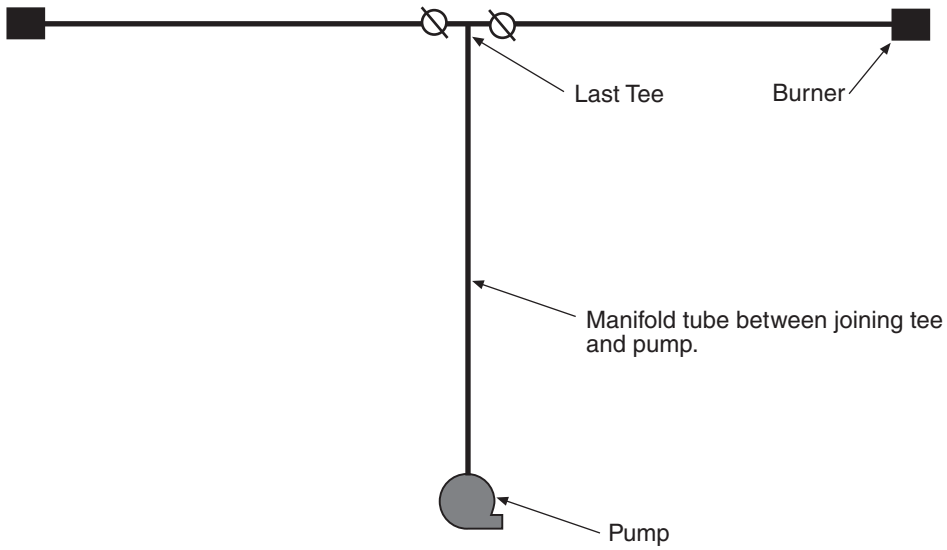
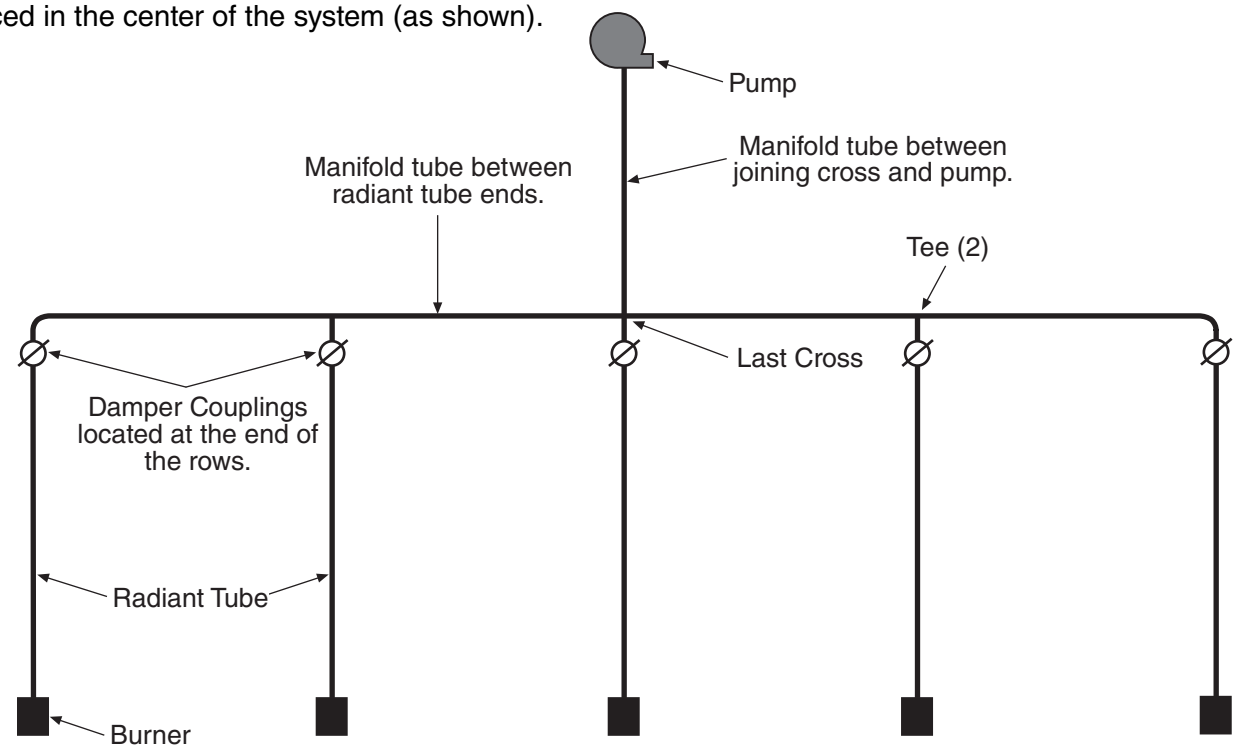


FIGURE 22: Fork Layout

Multiple rows of burners:
Manifold tube between the last tee or cross and the pump is perpendicular to the manifold tube joining the rows. Pump is not required to be placed in the center of the system (as shown).



9.6.3 Herringbone Layout and Manifold Tube Length Rules

The herringbone layout is essentially several T layouts stacked together. Therefore, the same principle for manifold tube calculation as used for T layouts is used for herringbone layouts, with one exception. In a herringbone layout, the manifold tube length between tees (or crosses) as well as between the last tee (or cross) and the pump is calculated by dividing by 1.5 as shown in the T example *on Page 34, Section 9.6.2*. The only manifold tube length in a herringbone layout that is not divided by 1.5 is any manifold tube length located between the end of the radiant tube and a tee or cross.

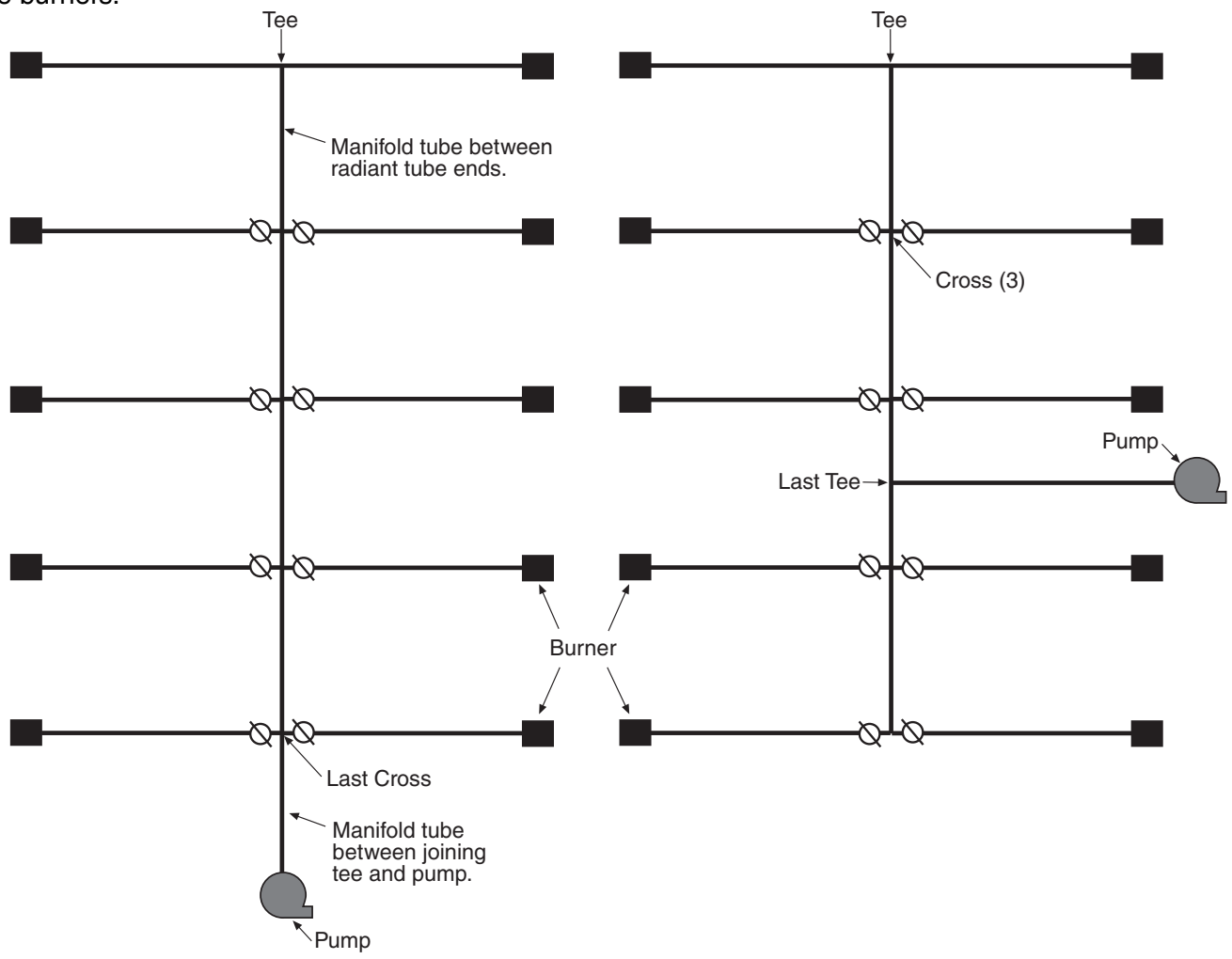
Example: Consider a herringbone layout similar to the layout on the left in *Figure 23*, having ten CTHN-100 burners. Assume that each heater has 40' (12m) of radiant tube and 10'(3m) of manifold tube before the connecting tee or cross.

According to *Table 10* each burner must have at least 40' (12m) of radiant tube, also each burner must have between 6' (2m) and 45' (13.5m) of manifold tube. Each burner has already met the minimum manifold pipe requirement due to the 10' (3m) of manifold tube before the connecting tees and crosses. The maximum manifold tube length for the entire system is 10 burners X 45' (13.5m) = 450' (135m). Subtract the 100' (30m) that has already been used before the connecting tees/crosses and 350' (105m) remains.

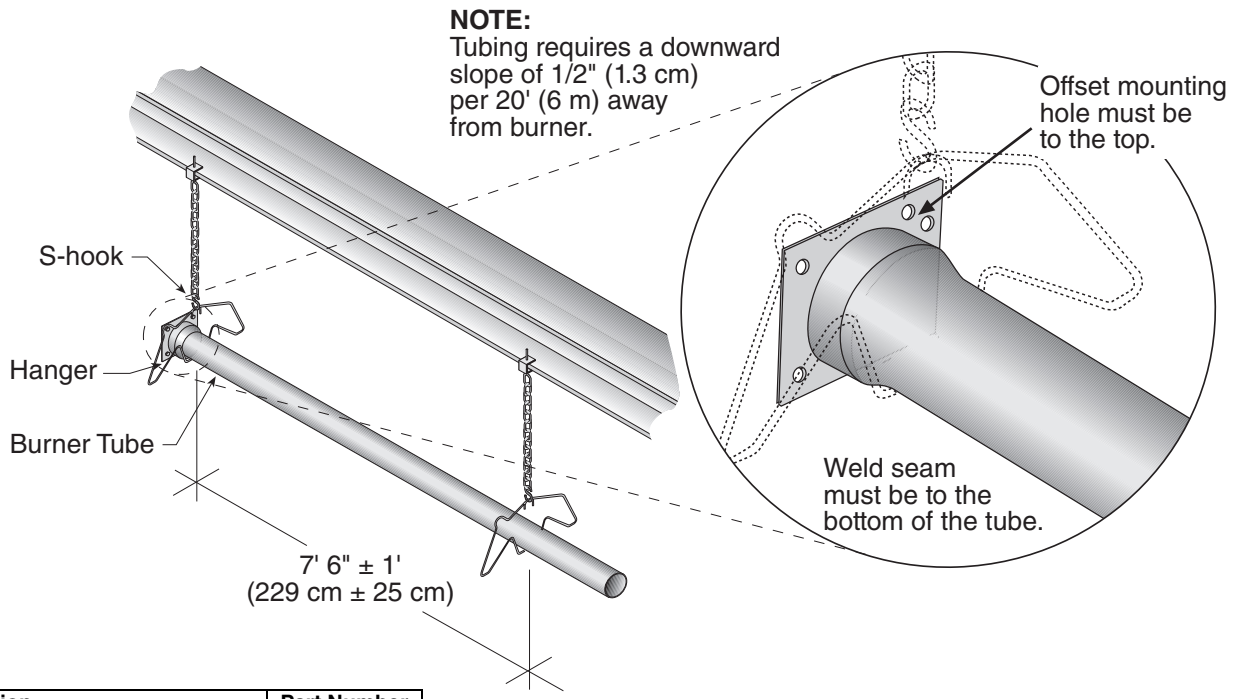
Since the remaining manifold is located either between or after connecting tees or crosses, the manifold length must be divided by 1.5. 350' (105m)/ 1.5 = 233' (70m). Therfore, up to 233' (70m) can be used between the branches and also between the last cross and the pump.

FIGURE 23: Herringbone Layout

Multiple opposing rows of burners: pump placed at the end of the manifold tube or somewhere between the burners.



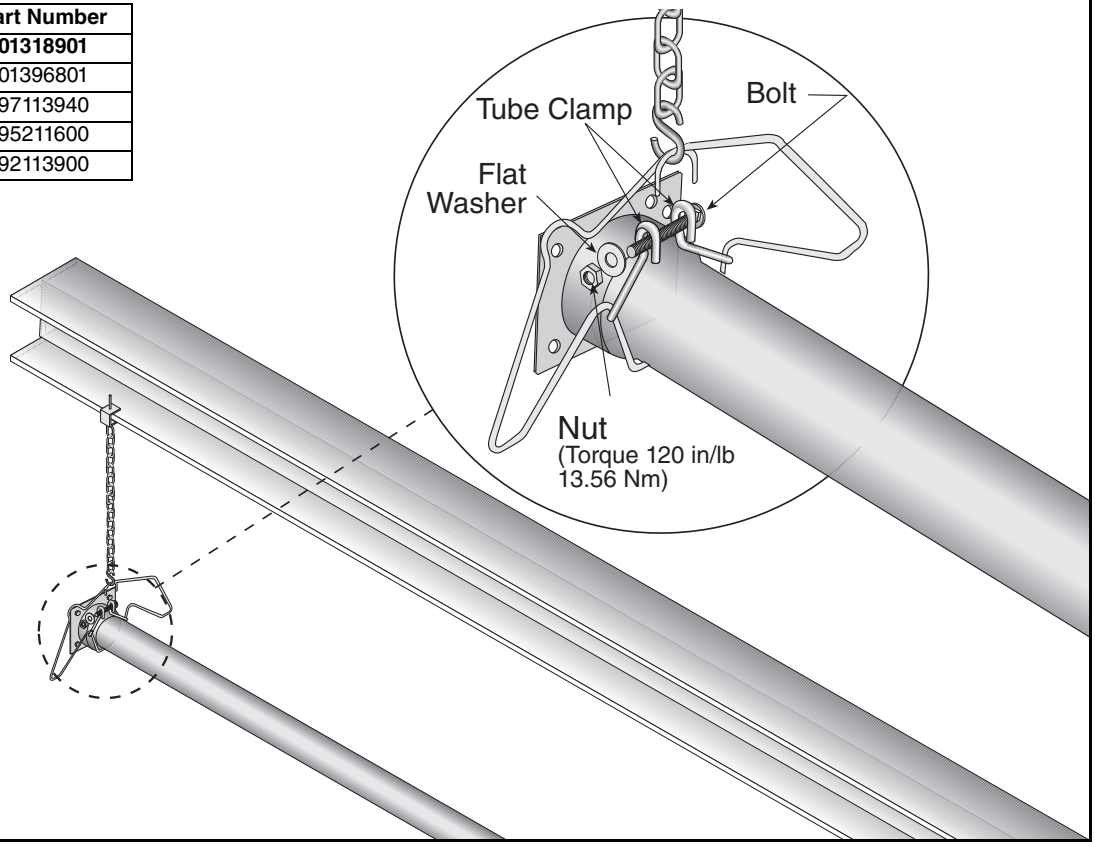
Step 9.7 Burner Tube Installation



Description	Part Number
Burner Tube	03051XXX
S-Hook	91907302
Tube/Reflector Hanger	03090100

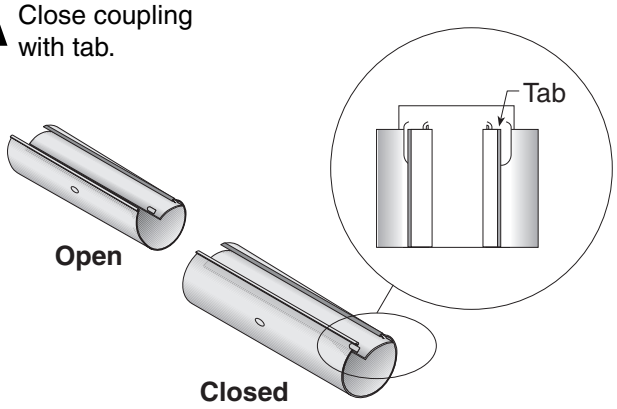
Step 9.8 Tube Clamp Package Installation

Description	Part Number
Tube Clamp Package	**01318901**
Tube Clamp	01396801
Bolt	97113940
Flat Washer	95211600
Nut	92113900

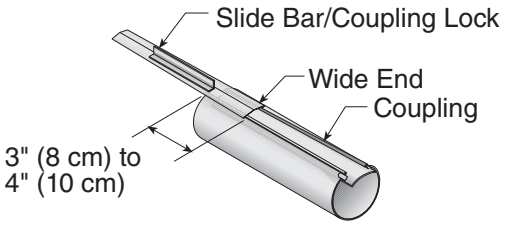


Step 9.9 Coupling and Tube Assembly

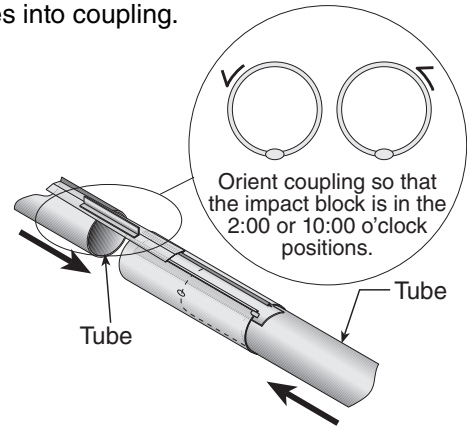
A Close coupling with tab.



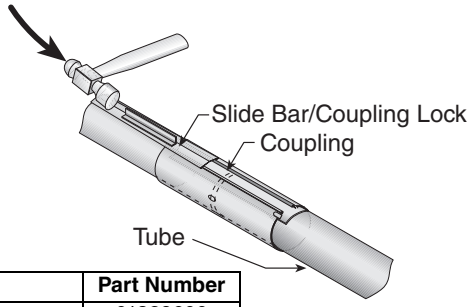
B Start slide bar/coupling lock onto coupling.



C Insert tubes into coupling.



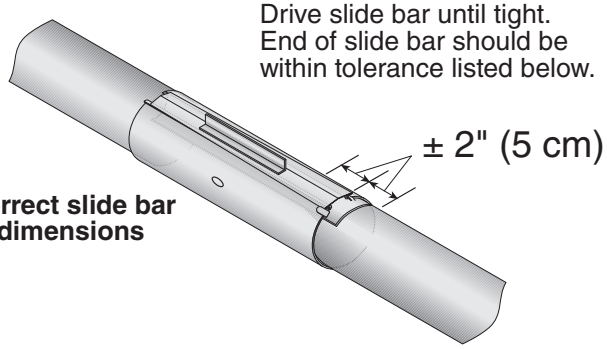
D Tighten coupling to join tubes.

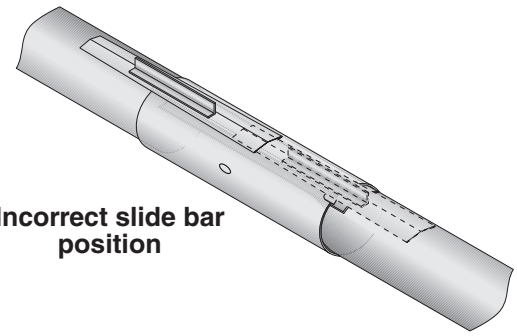


Description	Part Number
Coupling	01329600
Slide Bar/Coupling Lock	01329700
Tube	91409XXX

Step 9.9.1 Coupling and Tube Assembly (Continued)

Tighten slide bar as shown below.

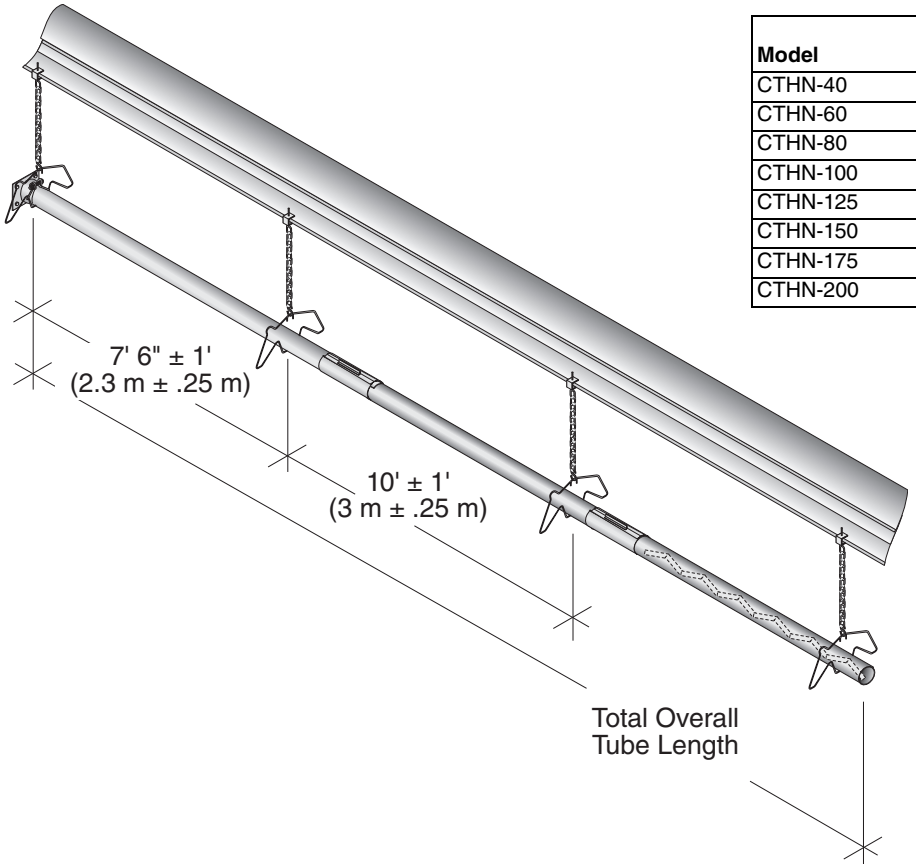




- **Repeat** *Step 9.9 on Page 38*, **A - D until all tubes are assembled.** *See Page 39, Step 9.9.2*.

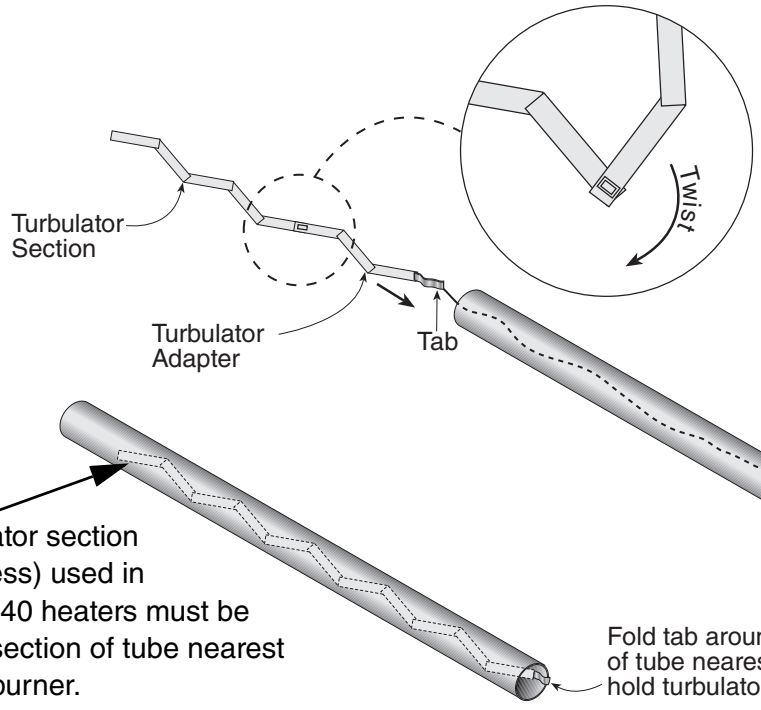
NOTE: If coupling is not tight, loss of vacuum can occur.

Step 9.9.2 Coupling and Tube Assembly (Continued)



Model	Radiant Tube Length
CTHN-40	10' (4.5 m)
CTHN-60	20' (6 m)
CTHN-80	20' (6 m)
CTHN-100	30' (9 m)
CTHN-125	40' (12 m)
CTHN-150	40' (12 m)
CTHN-175	50' (18 m)
CTHN-200	50' (18 m)

Step 9.10 Turbulator Installation



Turbulator must be installed in the last standard section of radiant tube. Turbulator is only required on the CTHN-40, CTHN-60 and CTHN-80.

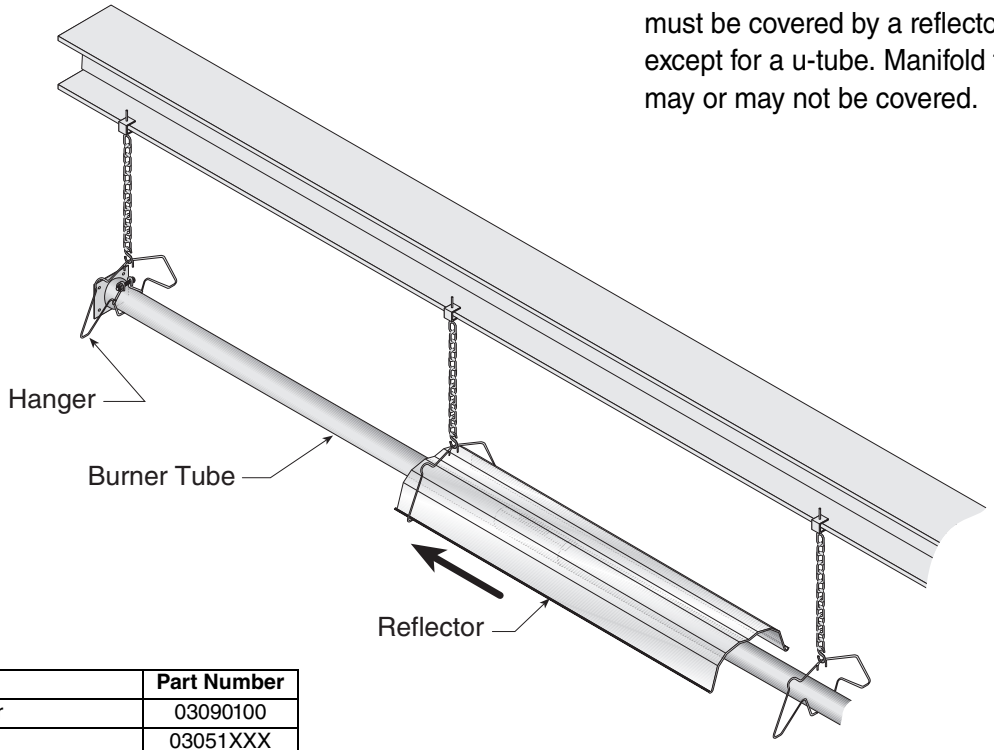
Turbulator Installation	
Model	**Tube Section**
CTHN-40	1st 10' (3 m) Section
CTHN-60	2nd 10' (3 m) Section
CTHN-80	2nd 10' (3 m) Section
CTHN-100	N/A
CTHN-125	N/A
CTHN-150	N/A
CTHN-175	N/A
CTHN-200	N/A

Turbulator section (stainless) used in CTHN-40 heaters must be in the section of tube nearest to the burner.

Description	Part Number
Turbulator Adapter	03051503
Turbulator Section	03051504
Turbulator Section (Stainless)	03051505
Tube	91409XXX

Step 9.11 Reflector Installation

NOTE: All radiant tube surfaces must be covered by a reflector, except for a u-tube. Manifold tube may or may not be covered.



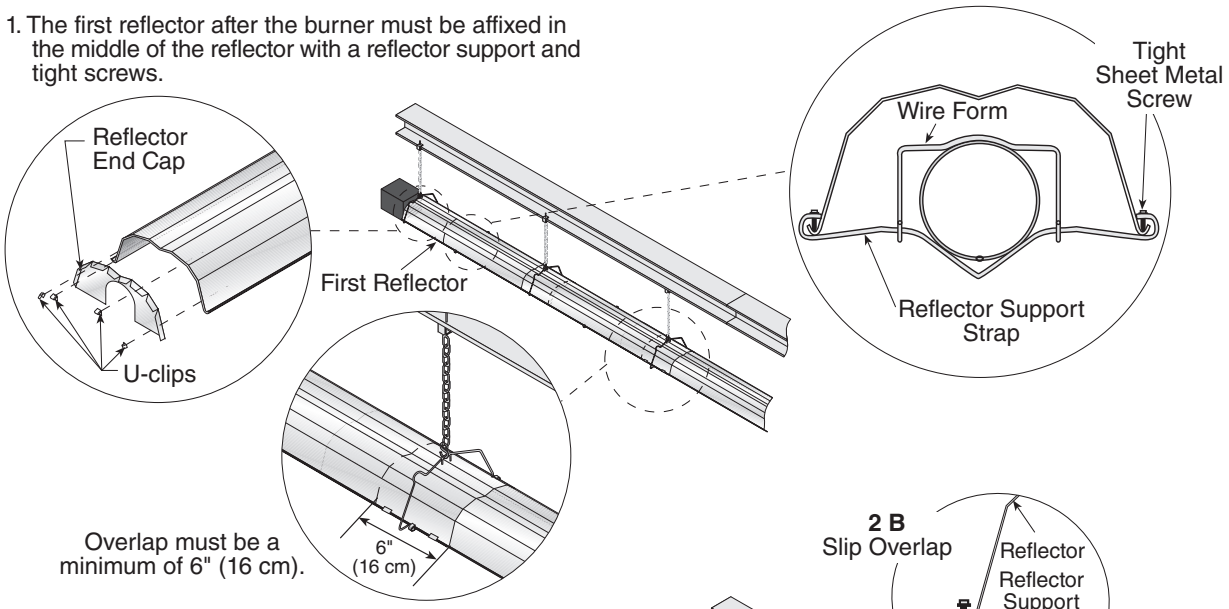
Description	Part Number
Tube/Reflector Hanger	03090100
Burner Tube	03051XXX
Reflector	02750303

Step 9.11.1 Reflector, U-clip and Reflector Support Installation

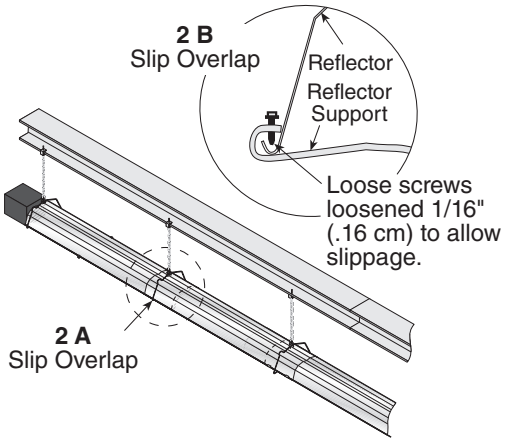
The pictorial drawings of the heater construction in *Section 9* are schematic only and provide a general guideline of where hangers, reflector supports and u-clips are to be installed.

To ensure proper expansion and contraction movement of the reflectors, a combination of u-clips and reflector supports are used. The positioning of reflector supports and u-clips depend on the individual installation. Use either pop rivets or sheet metal screws instead of u-clips when installing end caps and joint pieces in areas where impact and high wind may be a factor. The following rules must be observed.

1. The first reflector after the burner must be affixed in the middle of the reflector with a reflector support and tight screws.

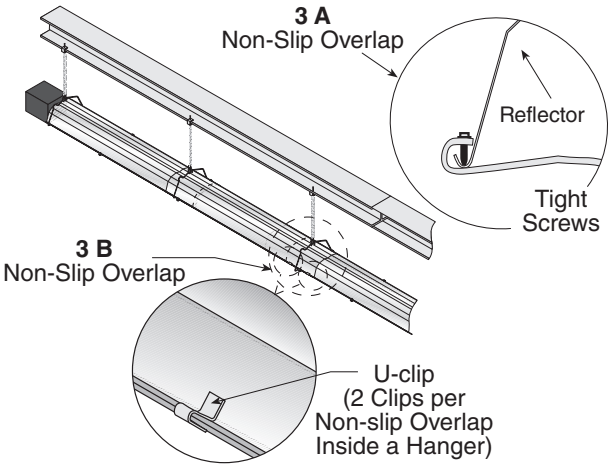


2. The overlap at the first and second reflector is a **slip overlap.** Thereafter, every third reflector joint is a slip overlap. A slip overlap is achieved by either:
   a.) both reflectors lay inside a hanger. (No reflector support needed.)
   b.) using a reflector support with loose screws at the reflector overlap.



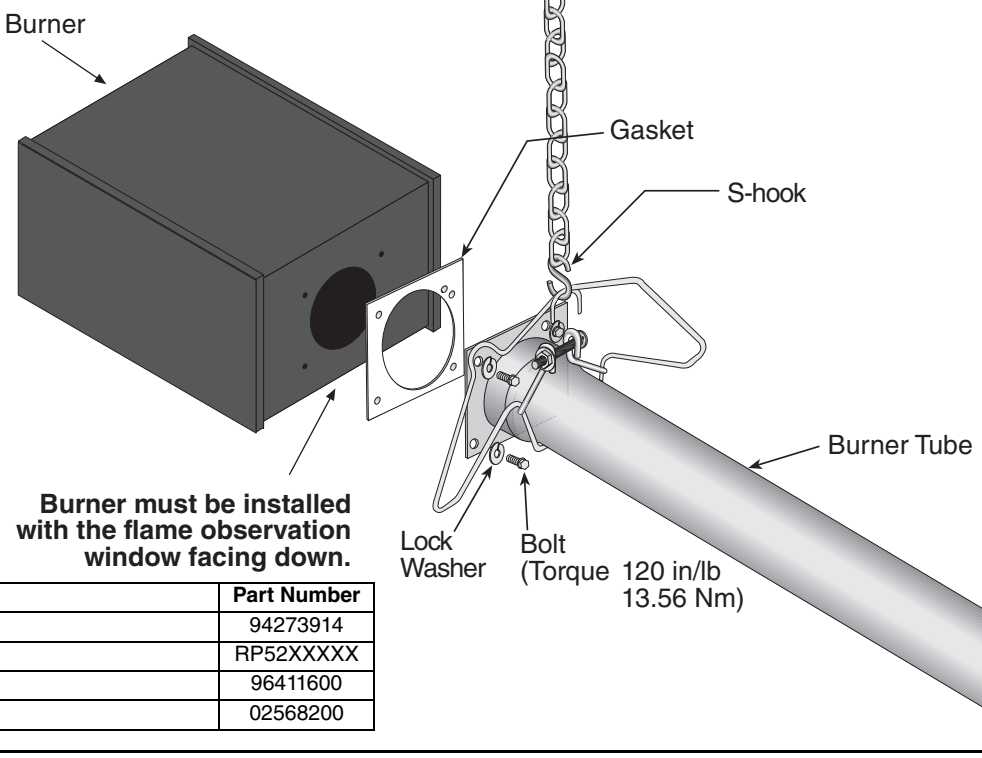
3. The remaining reflector overlaps require a **non-slip overlap** connection. To affix the reflectors together in a non-slip overlap either:
   a.) use reflector support and tight screws.
   b.) if both reflectors lay inside a hanger, u-clips or sheet metal screws may be used.

   This section of three reflectors joined together must be affixed to the tube with at least one reflector support with tight screws.



Description	Part Number
Reflector Support Package	**03050010**
Wire Form	91908004
Reflector Support Strap	03050000
Screw #8 x 3/4	94320812
U-clip Package	91107720
Reflector End Cap	027508XX

Step 9.12 Burner Installation

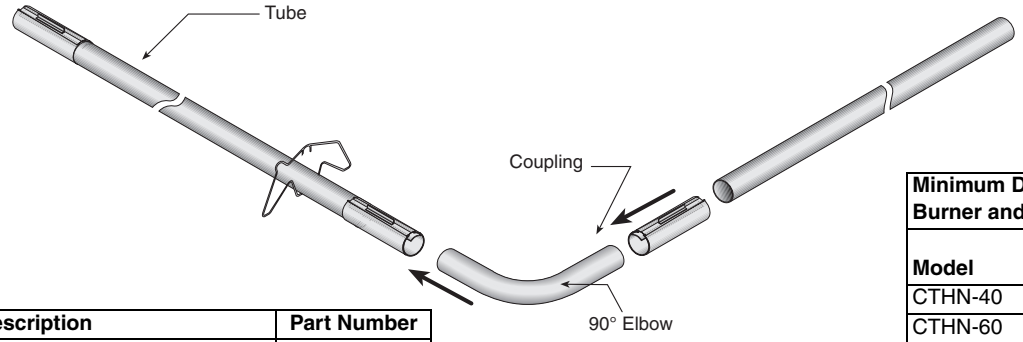


Description	Part Number
Bolt	94273914
Burner	RP52XXXXX
Lock Washer	96411600
Gasket	02568200

SECTION 10: OPTIONAL HEATER ACCESSORIES

10.1 Elbow Package Configuration

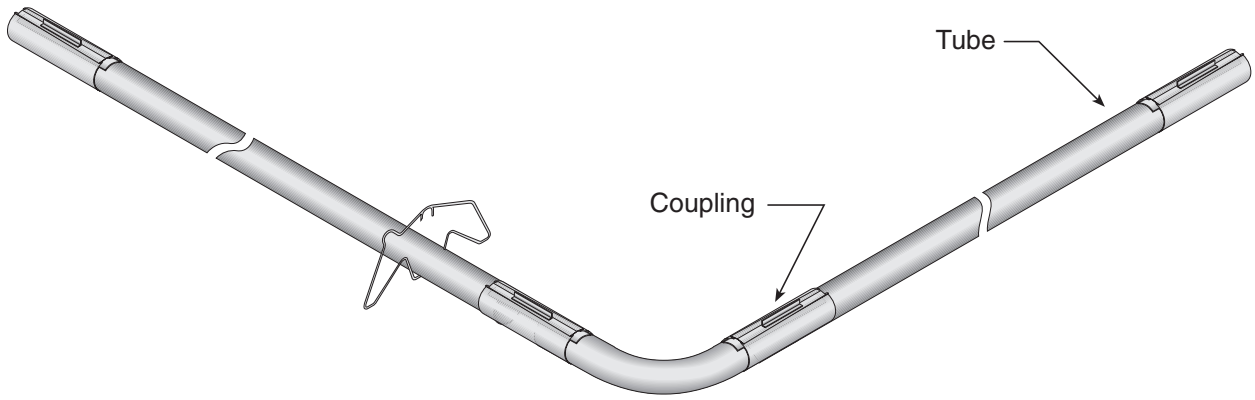
Step 10.1.1 Elbow Installation



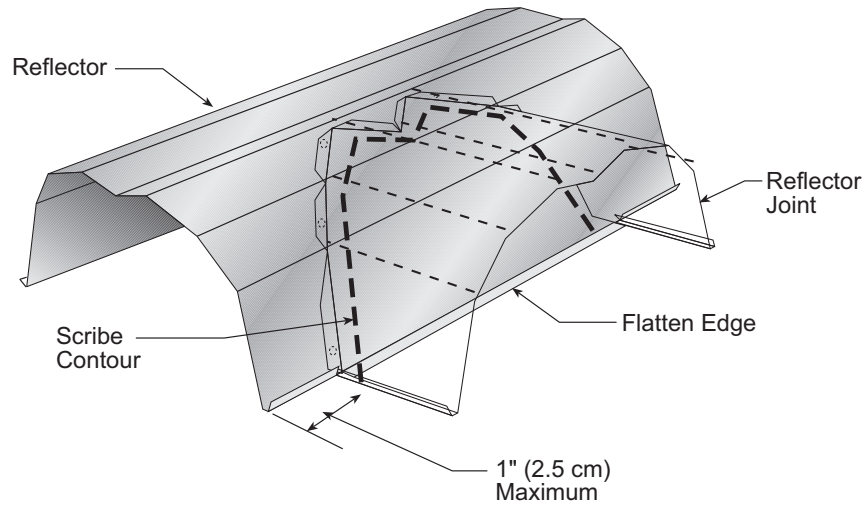
Description	Part Number
Elbow Package	**02718702**
90° Elbow	01335801
Coupling	01312700
Reflector End Cap	02750800
Reflector Joint Piece	02750900
U-Clip Package	91107720

Minimum Distance Required Between Burner and Elbow	
Model	**Minimum Distance**
CTHN-40	10' (3 m)
CTHN-60	10' (3 m)
CTHN-80	10' (3 m)
CTHN-100	15' (4.5 m)
CTHN-125	15' (4.5 m)
CTHN-150	20' (6 m)
CTHN-175	20' (6 m)
CTHN-200	20' (6 m)

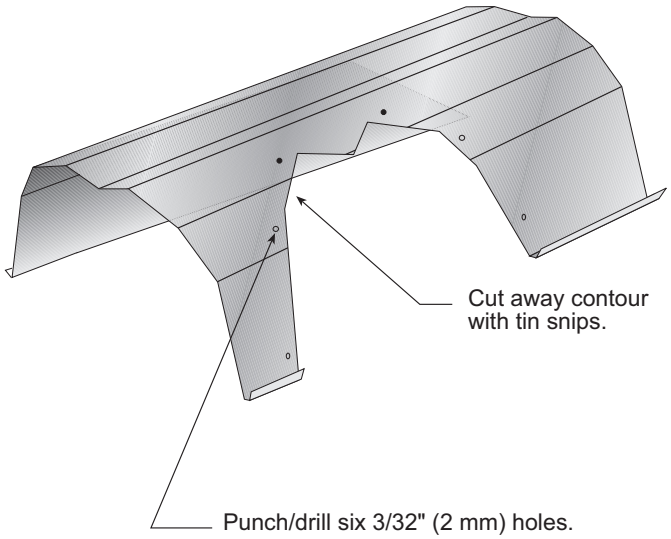
Step 10.1.2 Elbow Installation



Step 10.1.3 Reflector Joint Installation



Step 10.1.4 Reflector Joint Installation



Step 10.1.5 Reflector Joint Detail

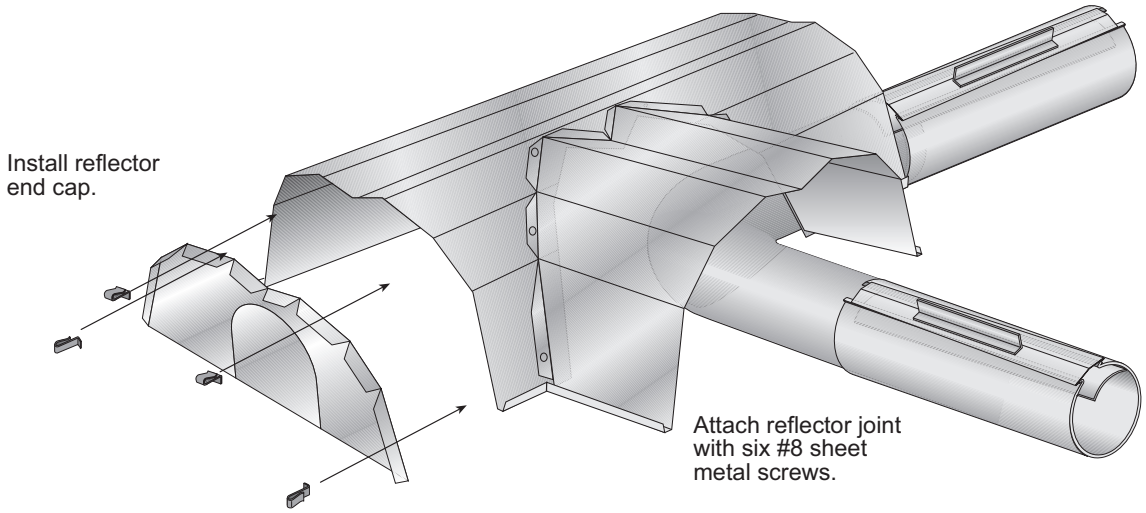
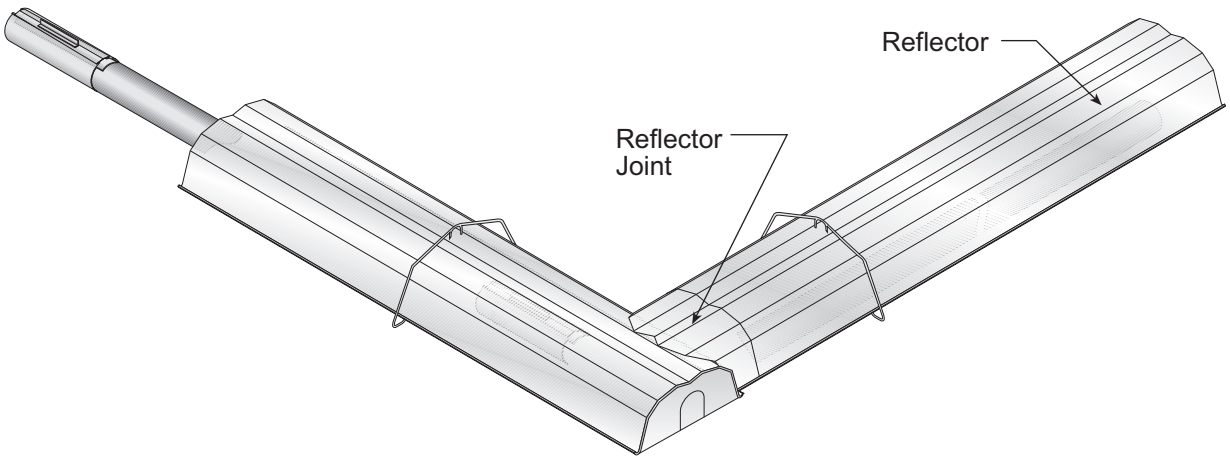
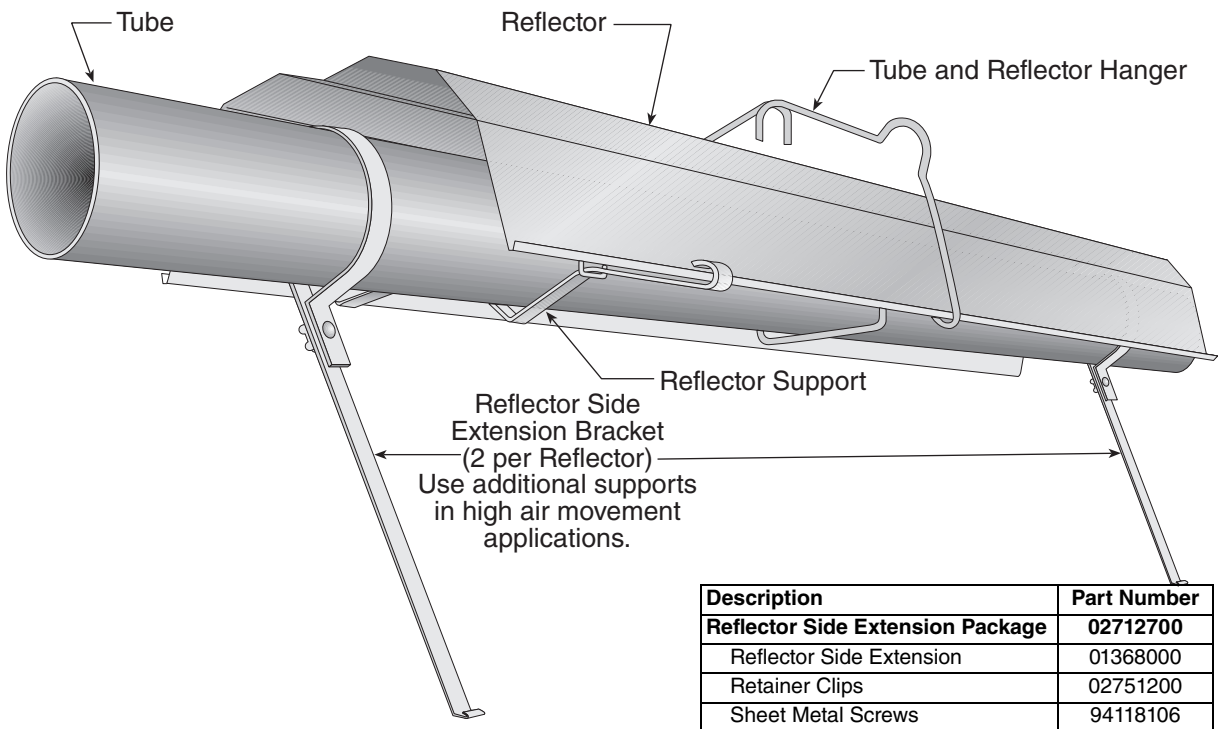


FIGURE 24: Reflector Joint Detail



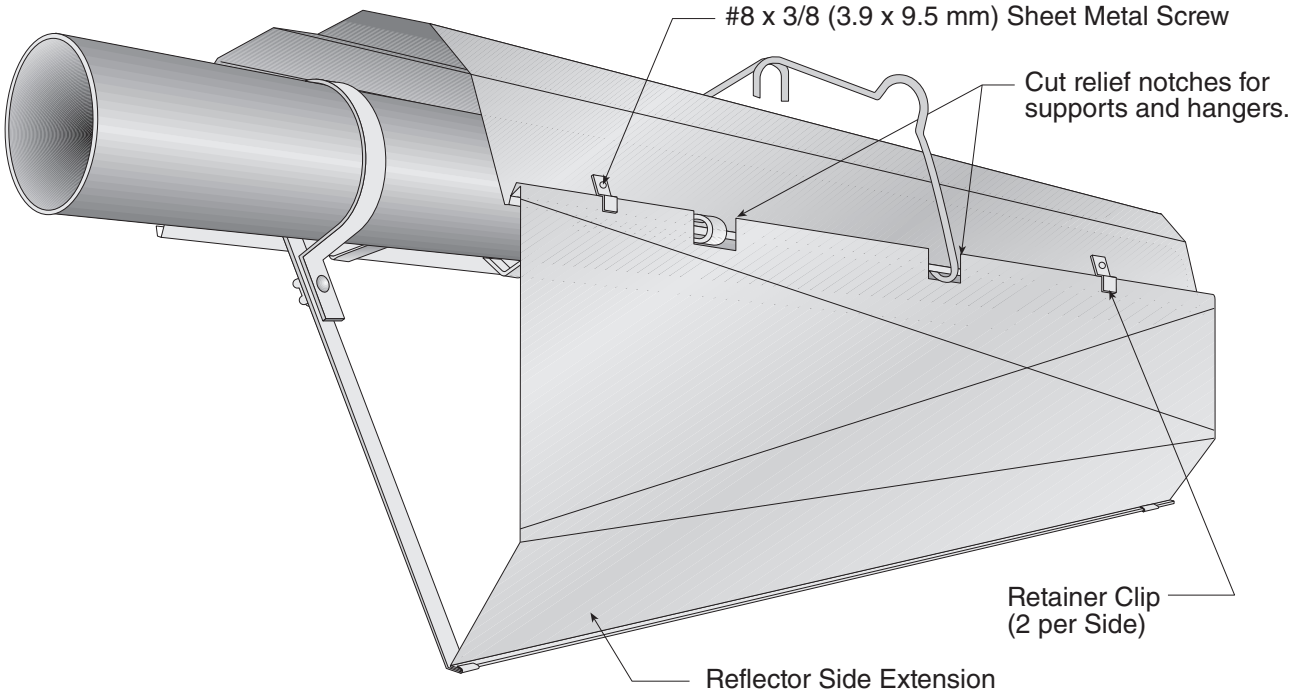
10.2 Reflector Side Extension

Step 10.2.1 Bracket Installation



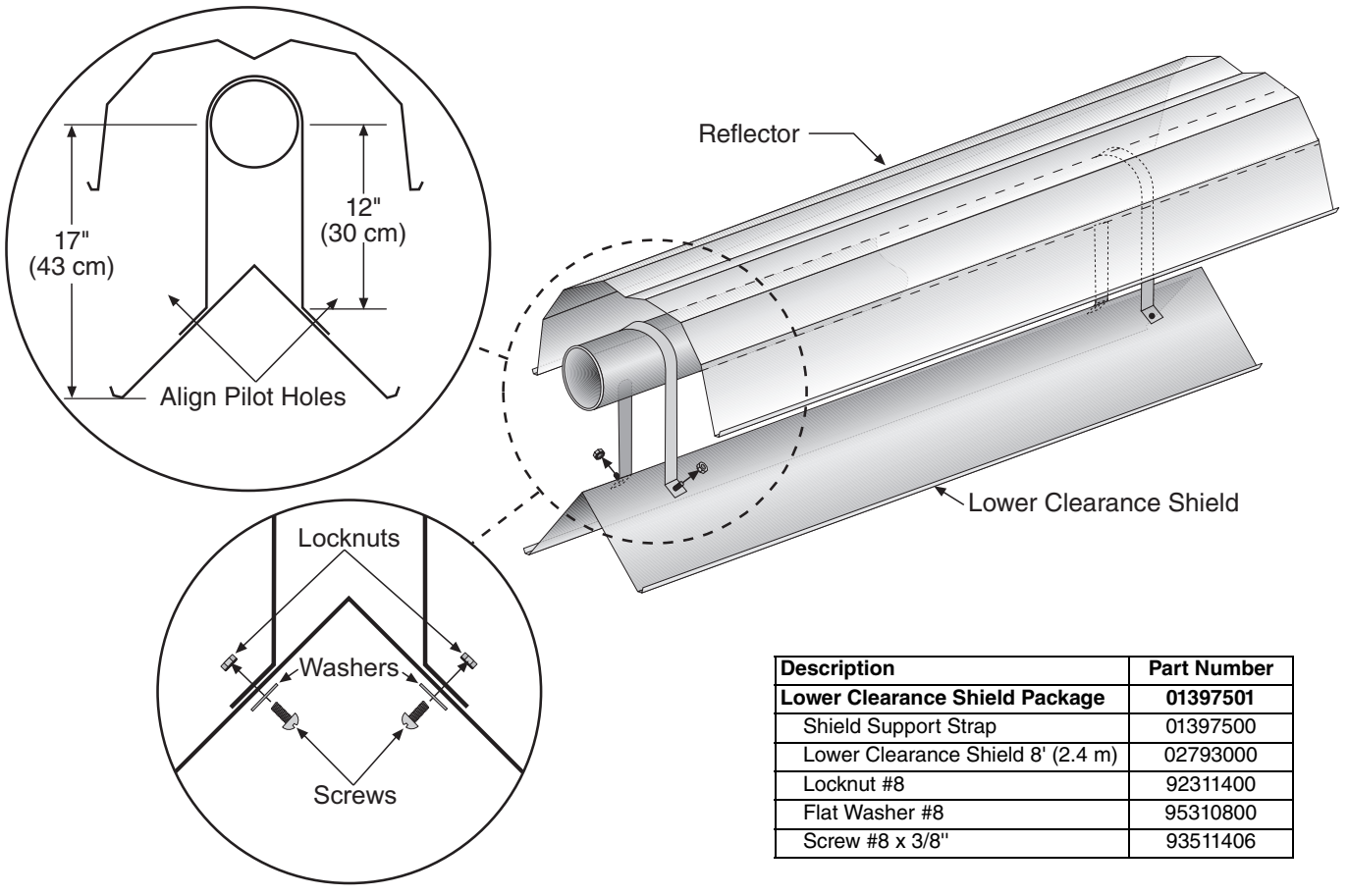
Description	Part Number
Reflector Side Extension Package	**02712700**
Reflector Side Extension	01368000
Retainer Clips	02751200
Sheet Metal Screws	94118106
Order Separately	
Reflector Side Extension Bracket	01329910

Step 10.2.2 Side Reflector Installation



10.3 Lower Clearance Shield Installation

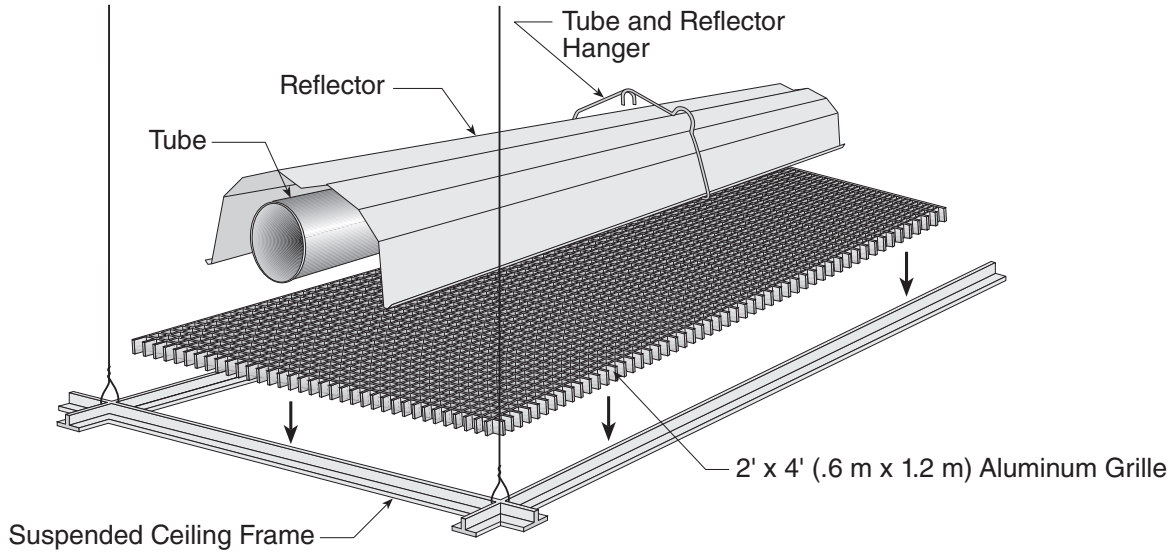
Step 10.3.1 Shield Support Strap Assembly



Description	Part Number
Lower Clearance Shield Package	**01397501**
Shield Support Strap	01397500
Lower Clearance Shield 8' (2.4 m)	02793000
Locknut #8	92311400
Flat Washer #8	95310800
Screw #8 x 3/8''	93511406

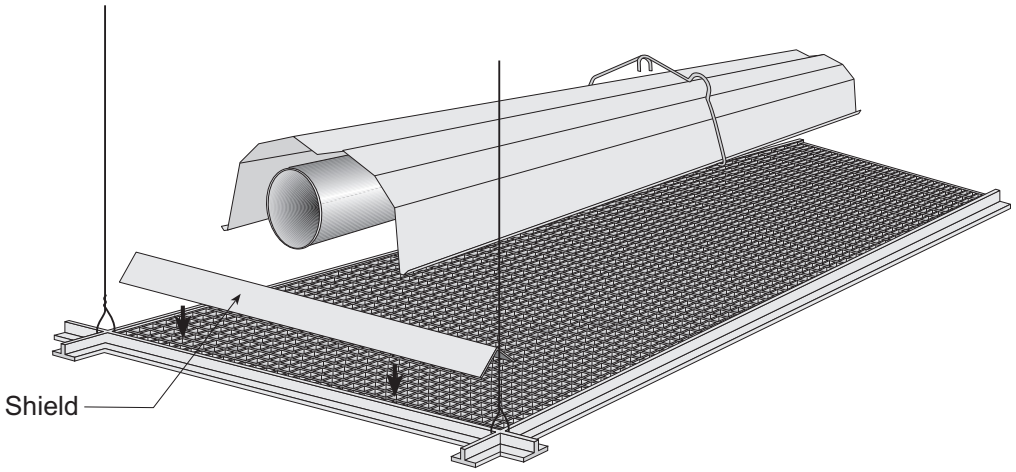
10.4 Two-Foot Decorative Grille Installation

Step 10.4.1 Grille Installation



Description	Part Number
Aluminum Grille 2' x 4' (.6 m x 1.2 m)	91407000

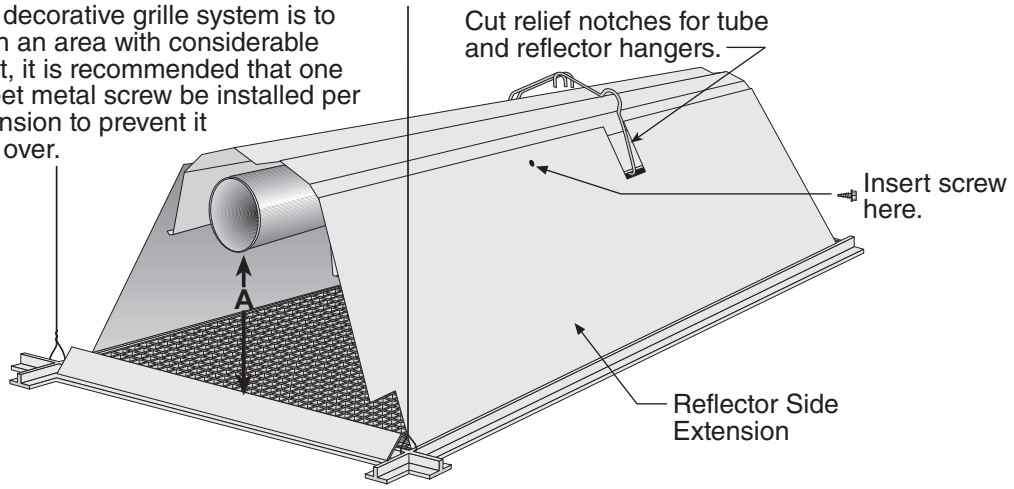
Step 10.4.2 Frame Shield Installation



Description	Part Number
Deco Grille Shield	01365900

Step 10.4.3 Reflector Side Extension Installation for Decorative Grilles

NOTE: If the decorative grille system is to be installed in an area with considerable air movement, it is recommended that one #8 x 3/8" sheet metal screw be installed per reflector extension to prevent it from blowing over.

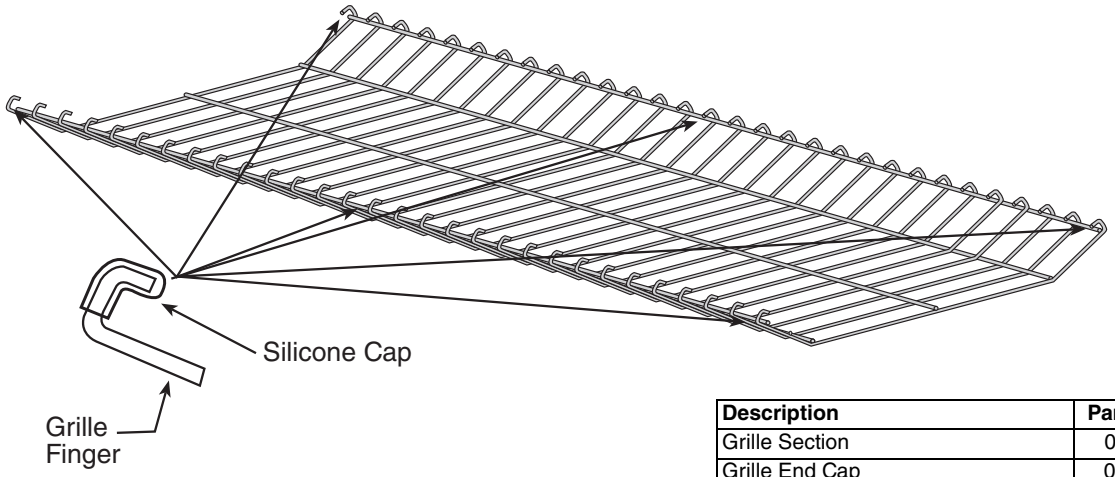


Distance "A"		Extension	
Minimum	Maximum	Part No.	Width
2" (4 cm)	6" (15 cm)	01370408	8" (20 cm)
6" (15 cm)	10" (26 cm)	01370412	12" (30 cm)
10" (26 cm)	14" (37 cm)	01370416	16" (40 cm)

Description	Part Number
Reflector Side Extension	01370412

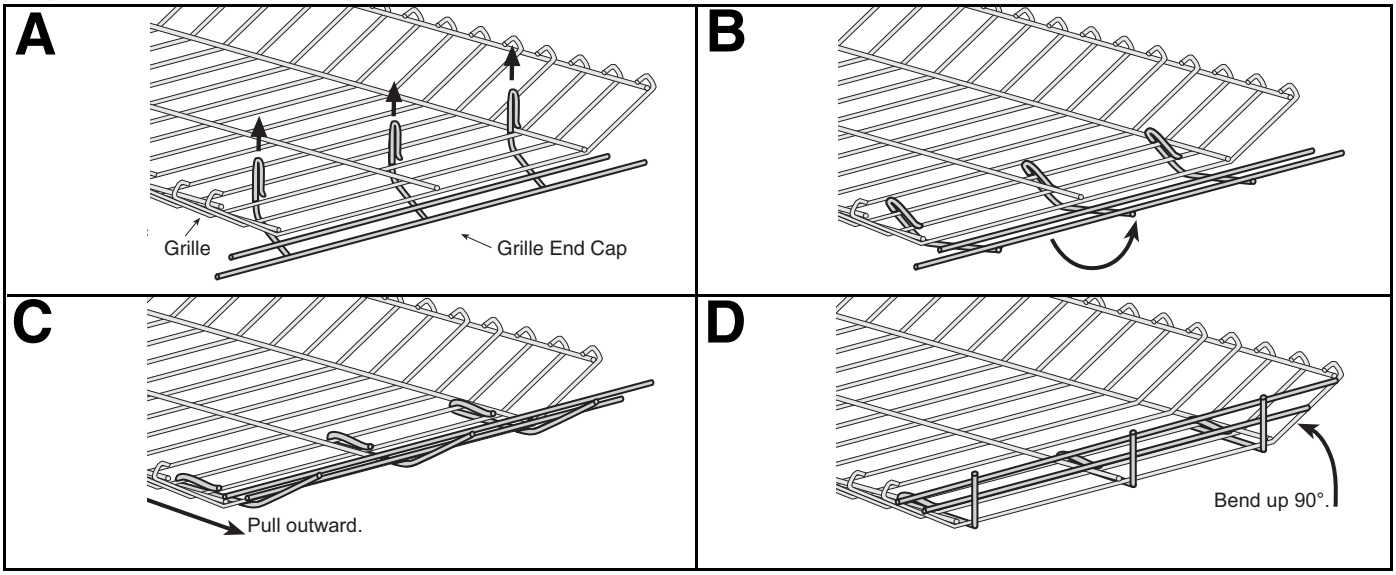
10.5 Protective Grille Installation

Step 10.5.1 Silicone Cap Installation

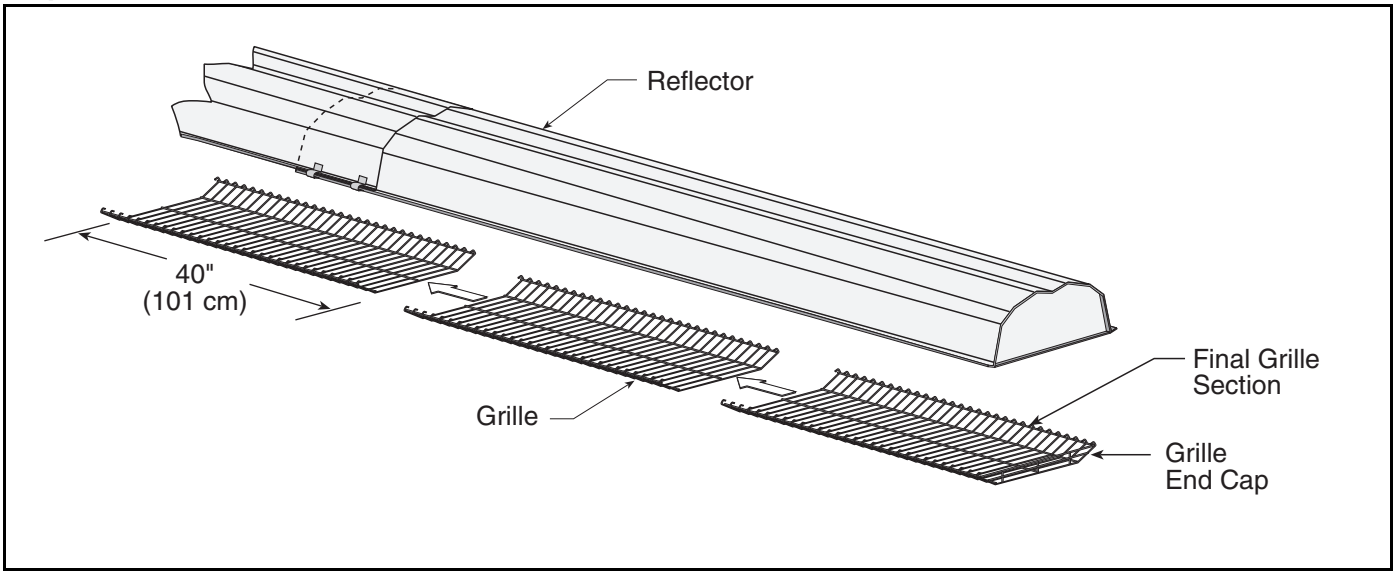


Description	Part Number
Grille Section	08050001
Grille End Cap	08050002
Silicone Cap	91915951-6P

Step 10.5.2 Grille End Cap Installation



Step 10.5.3 Grille Installation



SECTION 11: VENTING - GENERAL

⚠ WARNING

Carbon Monoxide Hazard

Multiburner systems are not approved for unvented use and must be vented outdoors.

Unitary heaters installed unvented must be interlocked with sufficient building exhaust.

Heaters must be installed according to the installation manual.

Failure to follow these instructions can result in death or injury.

11.1 General Venting Requirements

This heater must be vented in accordance with the rules contained in this manual and with the following national codes and any state, provincial or local codes which may apply: **United States:** Refer to ANSI Z223.1 (NFPA 54) - latest revision; **Canada:** Refer to CSA B149.1 - latest revision.

In brooder installations, affix brooder ventilation wall tag (P/N 91039300) adjacent to the heater thermostat. In the absence of a thermostat, the wall tag must be posted in a conspicuous location.

Any portion of vent pipe passing through a combustible wall must have an approved thimble to conform with the above listed codes.

Vent pipe must be sloped downward away from the burner 1/2'' (1 cm) for every 20' (6 m).

The bottom of the vent or air intake terminal shall not be located less than 1' (.3 m) above grade level.

The vent shall not terminate less than 7' (2.1 m) above grade where located adjacent to public walkways.

Vent terminal must be installed at a height sufficient to prevent blockage by snow and building materials protected from degradation by flue gases.

Secure all joints with #8 x 3/8 sheet metal screws. Seal all joints with high temperature silicone sealant.

Vent terminal must be beyond any combustible overhang.
For vertical venting, vent shall not extend less than 2' (.6 m) above the highest point where it passes through a flat roof of a building.

11.1.1 United States Requirements

Vent must terminate at least 3' (.9 m) above any forced air inlet located within 10' (3.1 m).

Vent must terminate at least 4' (1.2 m) below, 4' (1.2 m) horizontally from, or 1' (.3 m) above any door, operable window, or gravity air inlet into any building.

11.1.2 Canadian Requirements

The vent shall not terminate within 6' (1.8 m) of a mechanical air supply inlet to any building.

The vent shall not terminate within 3' (.9 m) of a window or door that can be opened in any building, any non-mechanical air supply inlet to any building, or of the combustion air inlet of any other appliance.

SECTION 12: VENTING - UNITARY HEATER

All general venting requirements apply.
See Page 49, Section 11.
Exhaust end of fan will accept a 4" (10 cm) vent pipe. To prevent leakage of condensation, seal all the vent joints using a high temperature silicone sealant.

The heater may be individually vented or common vented. When venting horizontally, a maximum of two heaters can be commonly vented. *See Page 52, Section 12.9*. When venting vertically, a maximum of four heaters can be commonly vented. *See Page 53, Section 12.10*.

The CTHN unitary heater may also be installed unvented in certain circumstances according to building ventilation codes. Refer to the codes on *Page 49, Section 11.1* and *Section 12.1* for further information. Unvented operation also requires compliance with the clearances to combustibles given *on Page 7, Figure 10*.

12.1 Unvented Operation

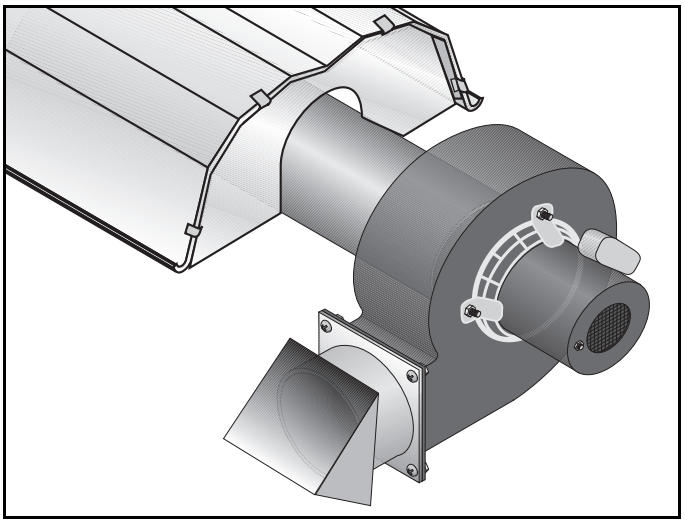
Sufficient ventilation must be provided in the amount of 4 cfm per 1000 Btu/h firing rate (United States); 3 cfm per 1000 Btu/h firing rate (Canada).

WARNING: *Combustion by-products contain a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.*

12.2 Unvented Operation Termination

For unvented operation, turndown type vent terminal with a screen must be installed at the exhaust end of the fan. Vent terminal design shall not incorporate backdraft flap.

FIGURE 25: Fan Termination



12.3 Horizontal Venting

In noncombustible walls only, vent terminal (P/N 02537801-1P) may be used.

For 4" (10 cm) vents in either combustible or noncombustible walls, use Tjernlund VH1-4 (P/N 90502100) or equivalent, insulated vent terminal. Follow the manufacturer's instructions for proper installation.

For 6" (15 cm) common vents in either combustible or noncombustible walls, use Tjernlund VH1-6 (P/N 90502101) or equivalent, insulated vent terminal. Follow the manufacturer's instructions for proper installation.

12.4 Vertical Venting

For 4" (10 cm), an approved vent cap (P/N 90502300) must be used.

For 6" (15 cm) common vent, an approved vent cap (P/N 90502302) must be used.

For common vertical venting of more than two heaters, *See Page 53, Section 12.10*.

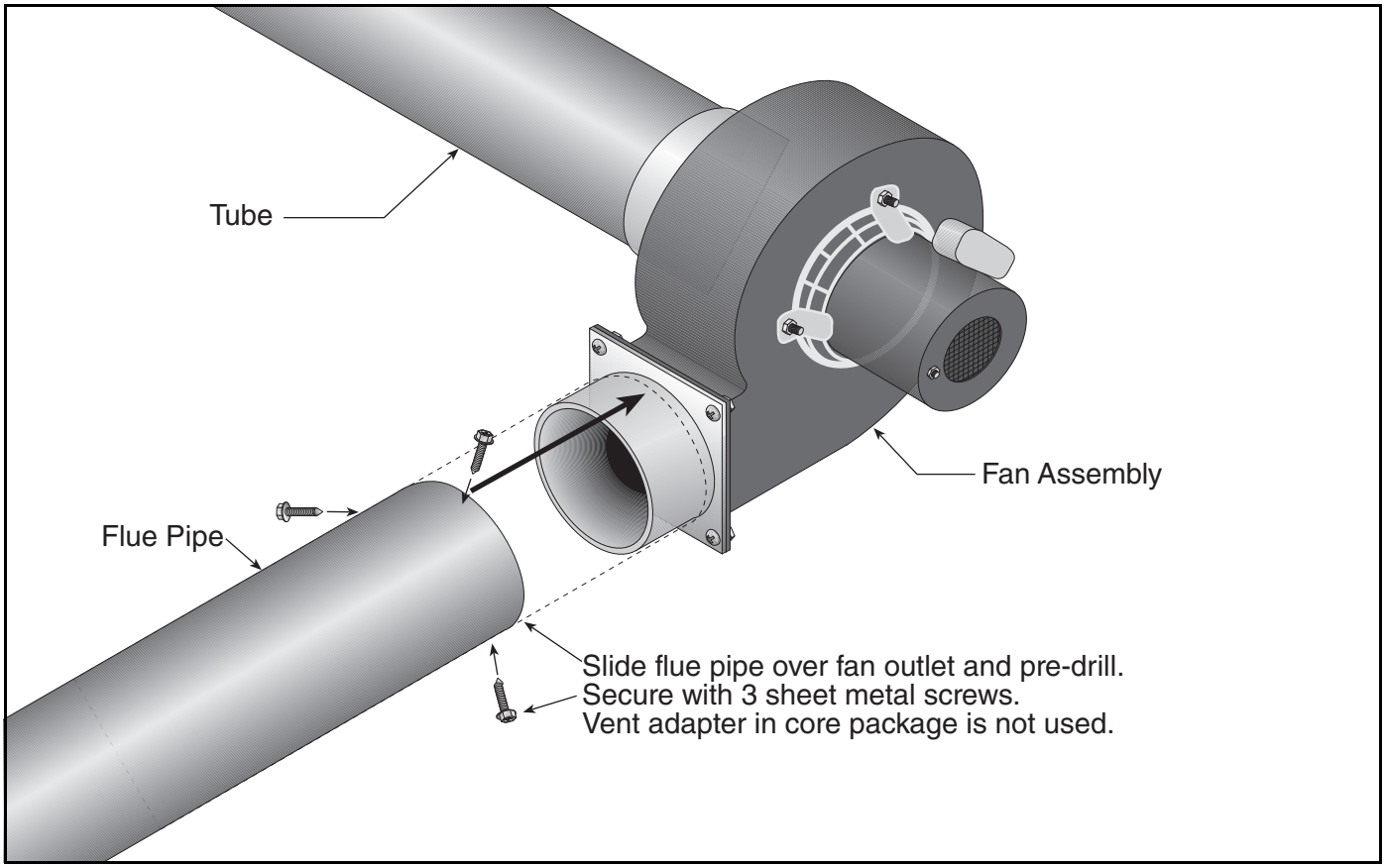
12.5 Length Requirements

The maximum vent length allowed is 45' (13.7 m). The maximum outside air supply duct length allowed is 45' (13.7 m).

The total vent length, plus outside air duct length and any extensions to minimum heat exchanger lengths, cannot exceed 65' (19.8 m).

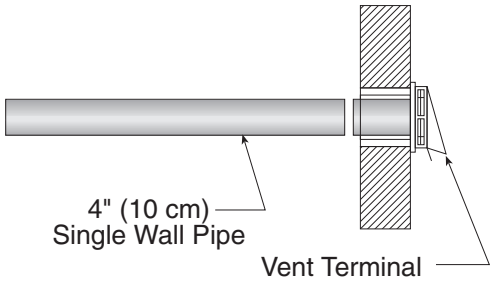
Vent length should be limited to less than 20' (6 m). If using extended heater lengths or vent lengths greater than 20' (6 m), condensation will form in the vent pipe. Insulation and additional sealing measures (high temperature silicone at all seams) are required. Optional heat exchanger beyond minimum lengths is considered as vent length for length determination. Subtract 15' (4.6 m) of maximum allowed vent or duct length per vent elbow if more than two are used.

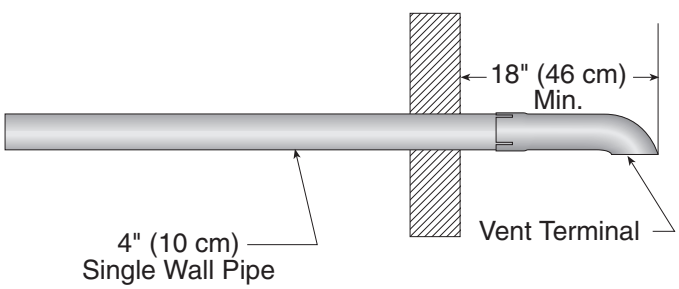
12.6 Flue Connection Detail



12.7 Horizontal Ventilation 4" (10 cm) Pipe

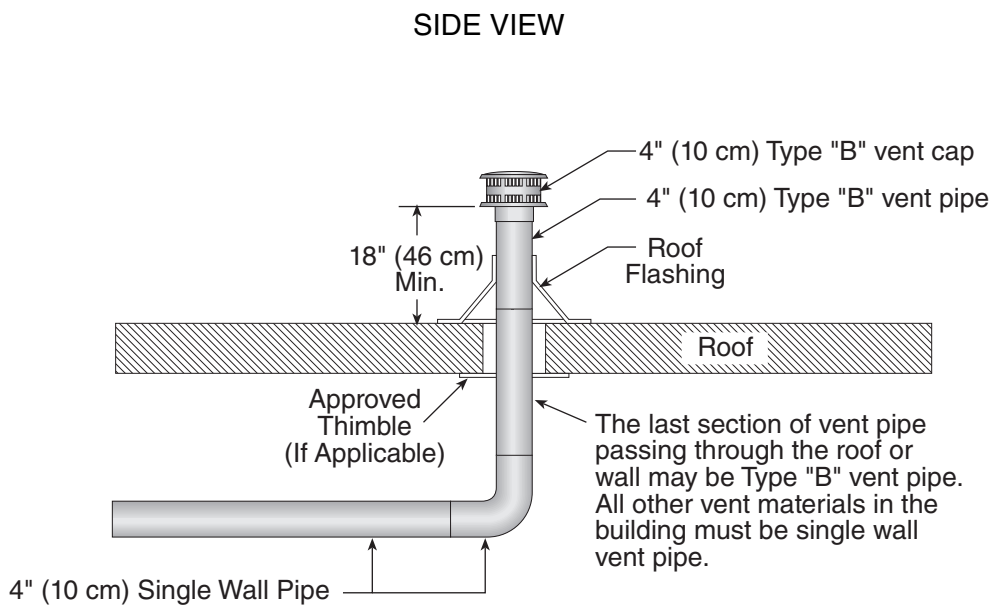
SIDE VIEW





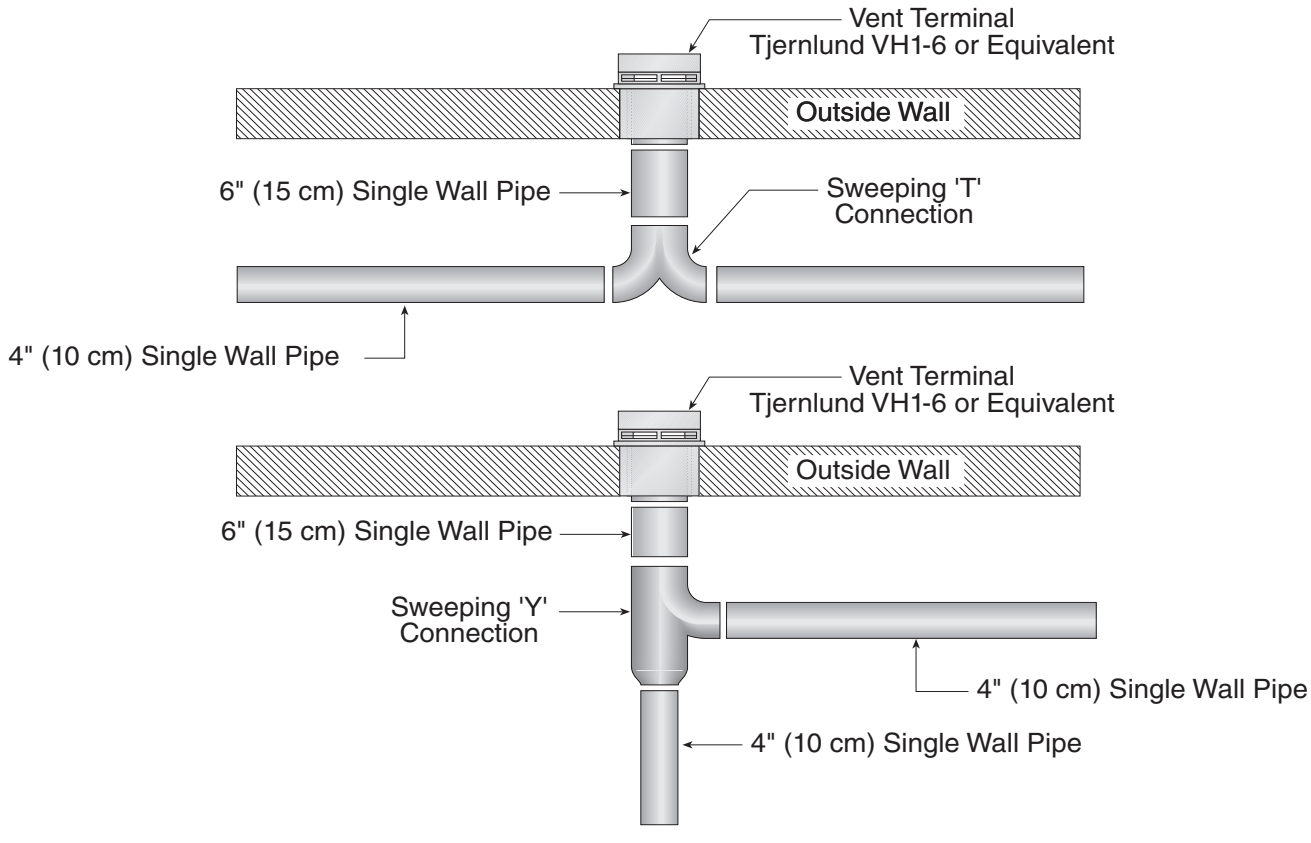
Description	Part Number
Vent Terminal (Comb. Wall)	90502100
Vent Terminal	02537801-XX
Wall Thimble	90505600

12.8 Vertical Ventilation 4" (10 cm) Pipe

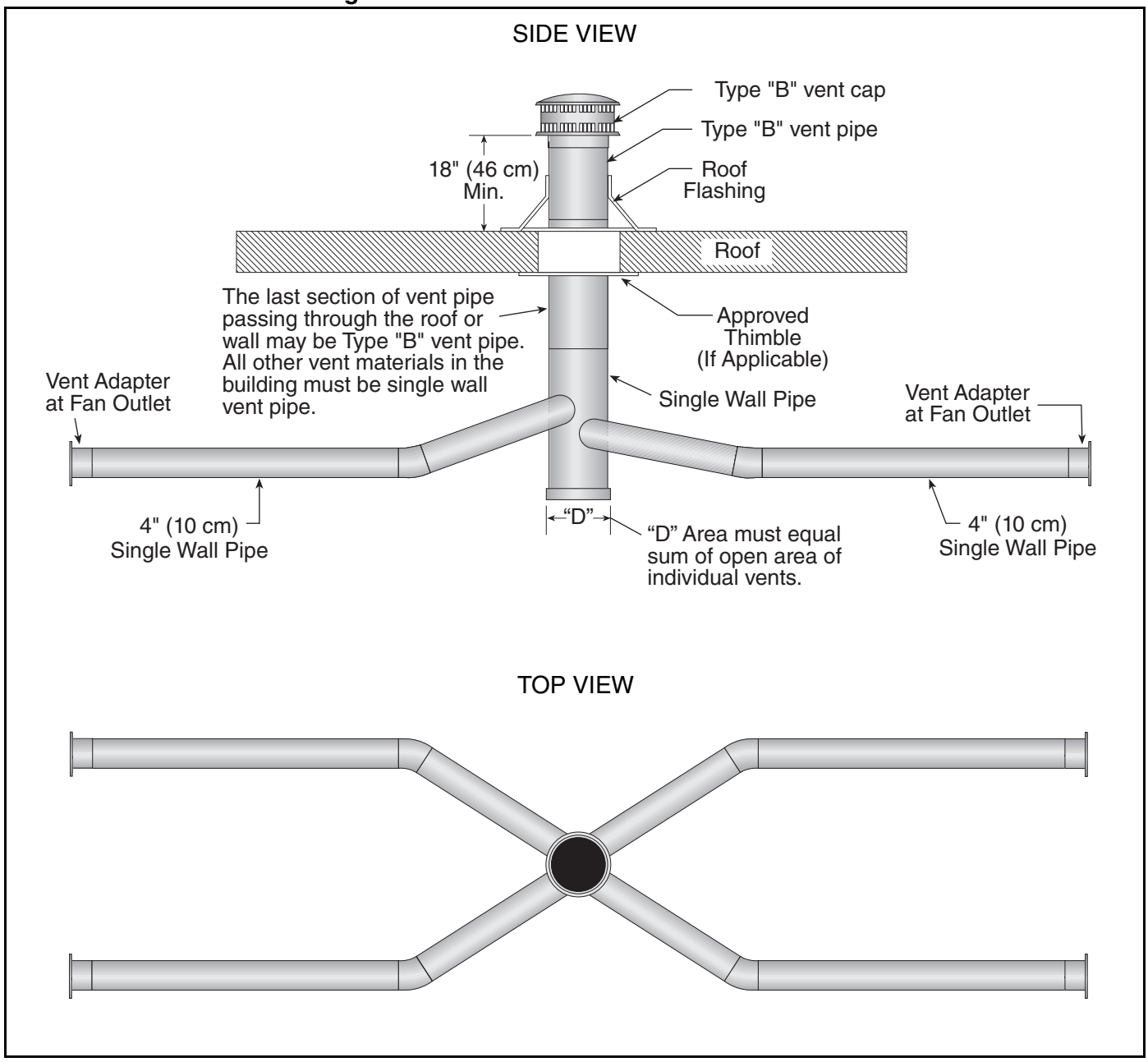


Description	Part Number
Vent Cap 4" (10 cm)	90502300
Vent Cap 6" (15 cm)	90502302

12.9 Common Sidewall Venting



12.10 Common Vertical Venting



SECTION 13: VENTING - MULTIBURNER SYSTEMS

13.1 General Requirements

See Page 49, Section 11.1. All general venting requirements apply.

⚠ WARNING

Carbon Monoxide Hazard

Multiburner systems are not approved for unvented use and must be vented outdoors.

Vented heaters must be installed according to the installation manual.

Failure to follow these instructions can result in death or injury.

13.2 Manifold Tube Requirements

Manifold tube is used to connect radiant tubing to the pump. When more than one burner is connected to a pump, a special connection fitting is utilized, such as a cross or tee section. *See Figure 26*. It is recommended that 4" (10.2 cm) O.D. or 6" (15.2 cm) O.D. aluminized tubing be used for manifold pipe. Reflectors are not required, but may be used over 4" (10.2 cm) manifold pipe. Manifold pipe must be supported properly, with at least one hanger per 10' (3 m) section. Refer to *Page 27, Section 9* for manifold length design requirements.

13.3 Venting the Pump

The exhaust connection from the pump is 4" (10.2 cm) or 6" (15.2 cm) diameter. Connect one of the flexible isolation boots provided to the flue pipe. Connections to the flue pipe larger than the pump outlet diameter will require the use of an appropriate adapter (not supplied).

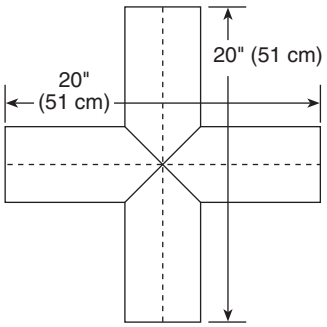
Venting from the pump may discharge either horizontally or vertically; corrosion resistant pipe is required. *See Page 56, Figure 28* for pump vent length requirements.

The layout drawing shows the general location of the pump. Specific pump location and discharge details must meet general venting requirements (see *Page 49, Section 11* and *Section 13.1*) as well as the following criteria:

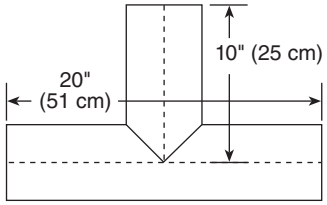
- To avoid staining the building wall, extend discharge 3' (1 m) from the building if possible.
- Horizontal discharge is preferred, *see Page 56, Figure 28*. Vertical discharge must be arranged as shown in *see Page 55, Figure 27*.

If the vent pipe is over 20' (6 m) long, insulate it to minimize condensation. Seal all discharge pipe joints with high-temperature silicone or equivalent.

FIGURE 26: Tailpipe Connection Points



Description	Part Number
Porcelain Coated Cross, 4" (10.2 cm) dia	0133092D
Aluminized Steel Cross, 4" (10.2 cm) dia	01330903
Aluminized Steel Cross, 6" (15.2 cm) dia	01330904



Description	Part Number
Porcelain Coated Tee, 4" (10.2 cm) dia	0133022D
Aluminized Steel Tee, 4" (10.2 cm) dia	01330203
Aluminized Steel Tee, 6" dia (15.2 cm)	01330204

13.4 EP-100 Pump Models

See EP-100 Installation, Operation and Service Manual (P/N 127201NA) for assembly details.

13.5 EP-200 Pump Series

See EP-200 Installation, Operation and Service Manual (P/N 127200NA) for assembly details.

13.6 EP-300 Pump Series

See EP-300 Series Installation, Operation and Service Manual (P/N 127202NA) for assembly details.

13.7 Installation Precautions

⚠ WARNING

Severe Injury Hazard

Pumps are shipped partially assembled.

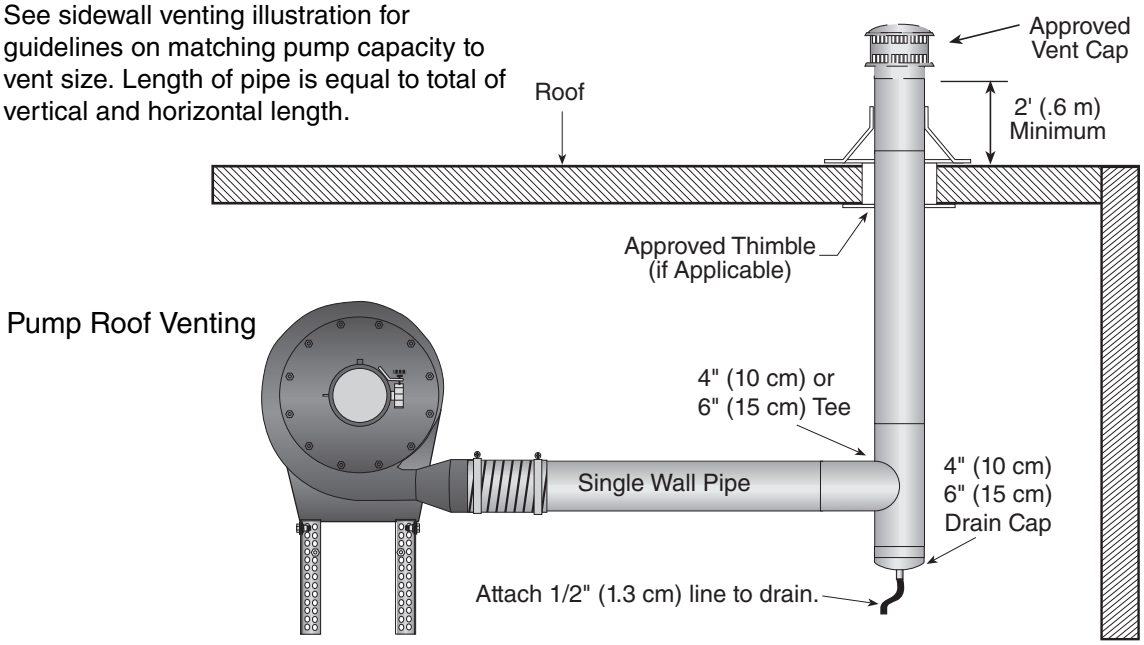
Do not operate a partially assembled pump.

Failure to follow these instructions can result in property damage, injury or death.

The pump scroll attaches to the pump frame (*See Page 56, Figure 28*) with either right- or left-hand discharge as the job requires. Please note that the motor must be wired differently depending on discharge direction. The discharge must be bottom horizontal. Any other arrangement will permit condensate to collect in the scroll.

FIGURE 27: Roof Venting of Pump

See sidewall venting illustration for guidelines on matching pump capacity to vent size. Length of pipe is equal to total of vertical and horizontal length.

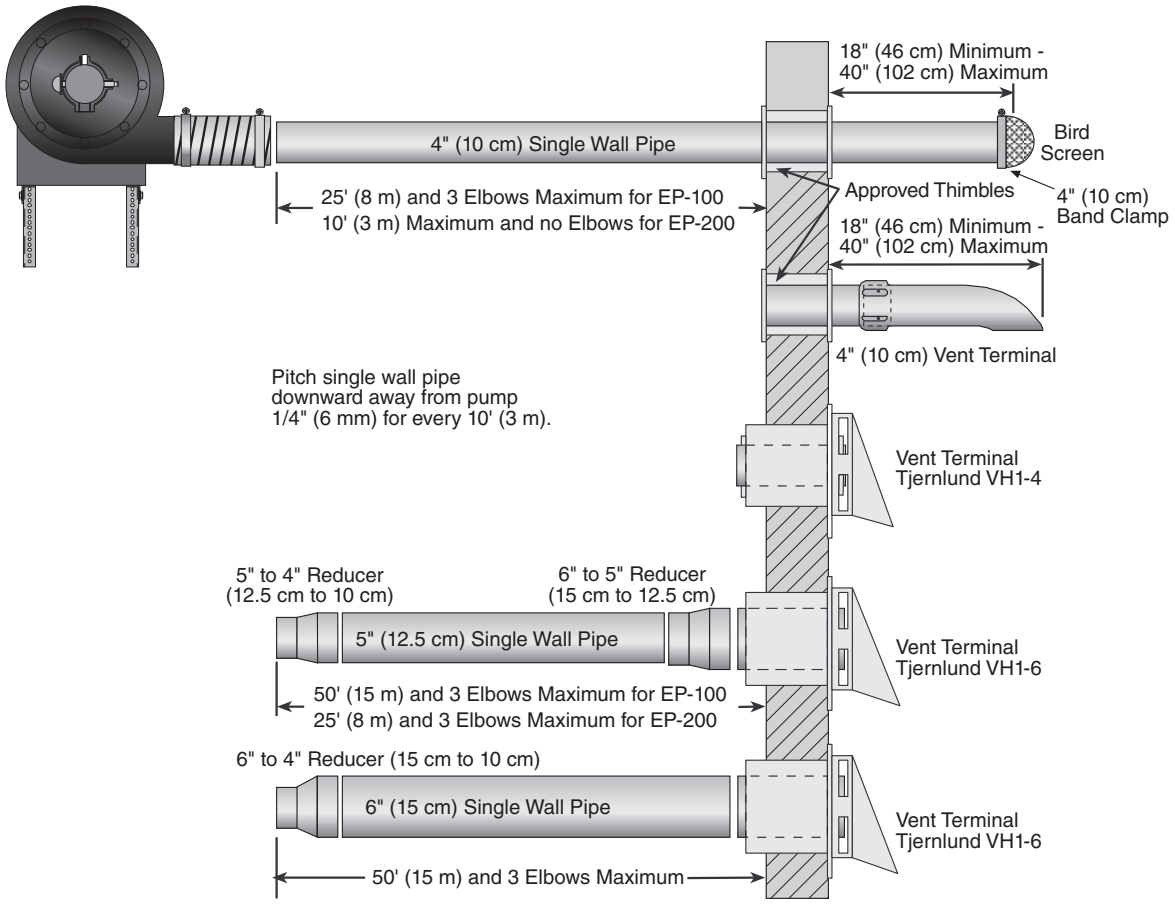


Description	Part Number
Drain Cap, 4" (10.2 cm) dia	02718851
Drain Cap, 6" (15.2 cm) dia	02718852
Tee, 4" (10.2 cm)	01330203
Tee, 6" (15.2 cm)	01330204

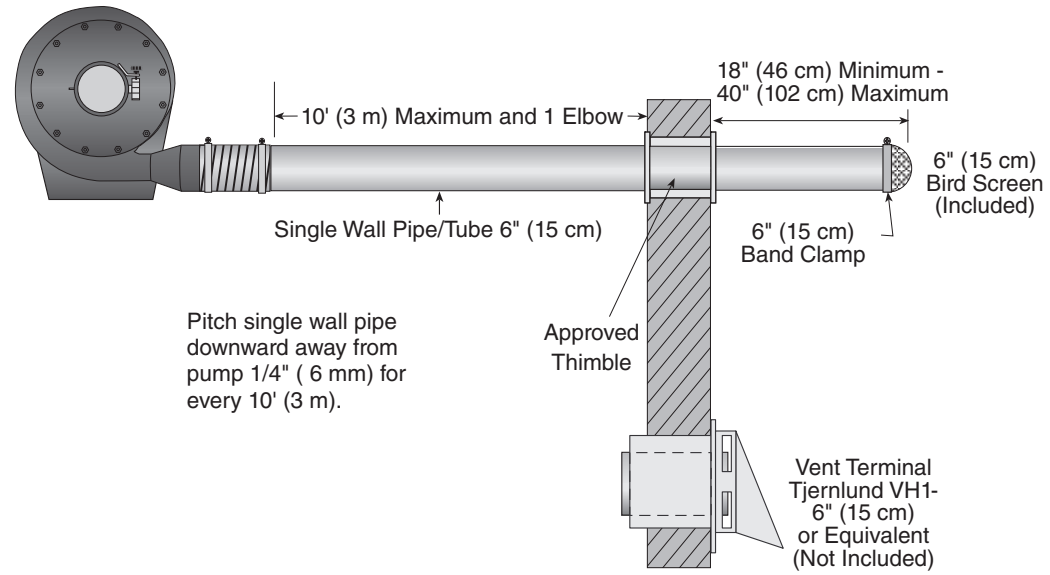
Description	Part Number
Vent Cap, 4" (10.2 cm)	90502300
Vent Cap, 6" (15.2 cm)	90502302
Wall Thimble, 4" (10.2 cm)	90505600

FIGURE 28: Side Wall Venting Configurations

EP-100 or EP-200 Pump Side Wall Venting



EP-300 Vacuum Pump Side Wall Venting



Description	Part Number
Bird Screen 4" (10 cm)	01365400
Bird Screen, 6" (15 cm)	01397400
Band Clamp, 4" (10 cm)	91901300
Band Clamp, 6" (15 cm)	91913703

Description	Part Number
Wall Thimble, 4" (10 cm)	90505600
Vent Terminal, 4" (10 cm)	02537801-IP
Vent Terminal, Tjernlund VH1-4	90502100
Vent Terminal, Tjernlund VH1-6	90502101

SECTION 14: OUTSIDE COMBUSTION AIR SUPPLY

IMPORTANT: If the building has a slight negative pressure or corrosive contaminants (such as halogenated hydrocarbons) are present in the air, an outside combustion air supply to the heater is required. Seal all combustion air pipe joints.

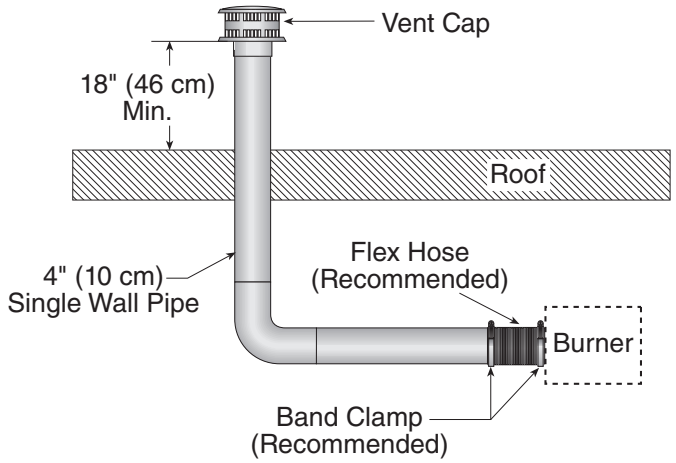
Use of optional outside combustion air is not recommended with unvented heaters.

The air supply duct may have to be insulated to prevent condensation on the outer surface. The outside air terminal must not be more than 1' (31 cm) above the vent terminal.

14.1 Length Requirements

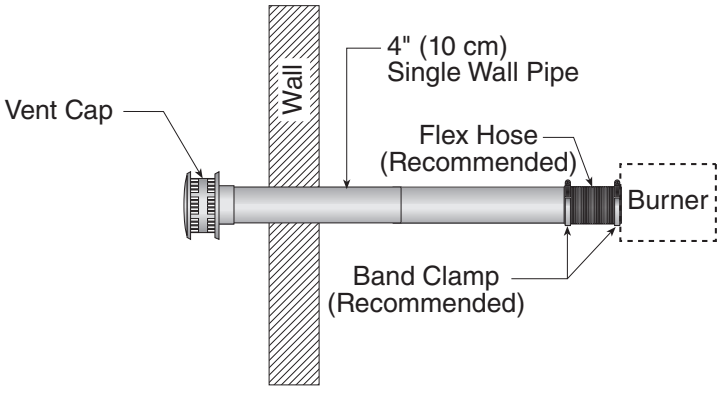
Follow the constraints listed *on Page 50, Section 12.5*.

14.2 Vertical Non-Pressurized Outside Air Supply for Single Heater Installation



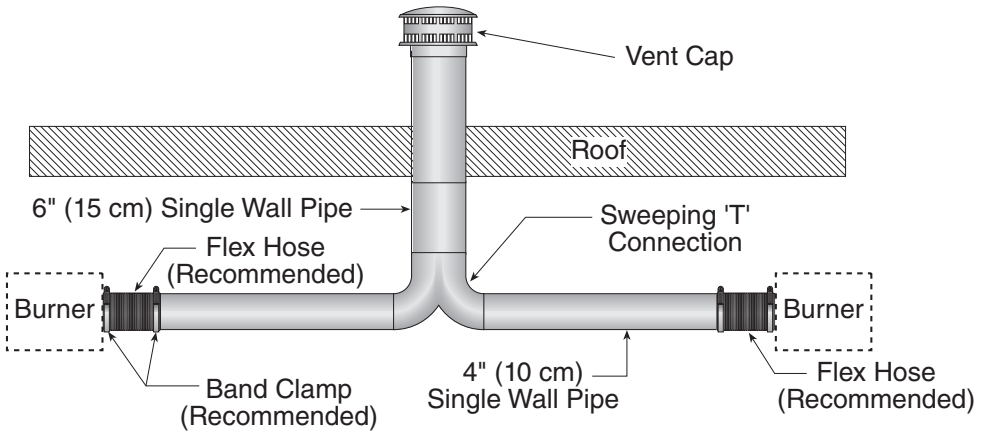
Description	Part Number
Vent Cap 4" (10 cm)	90502300

14.3 Horizontal Non-Pressurized Outside Air Supply for Single Heater Installation



Description	Part Number
Vent Cap 4" (10 cm)	90502300

14.4 Vertical Non-Pressurized Outside Air Supply for Double Heater Installation

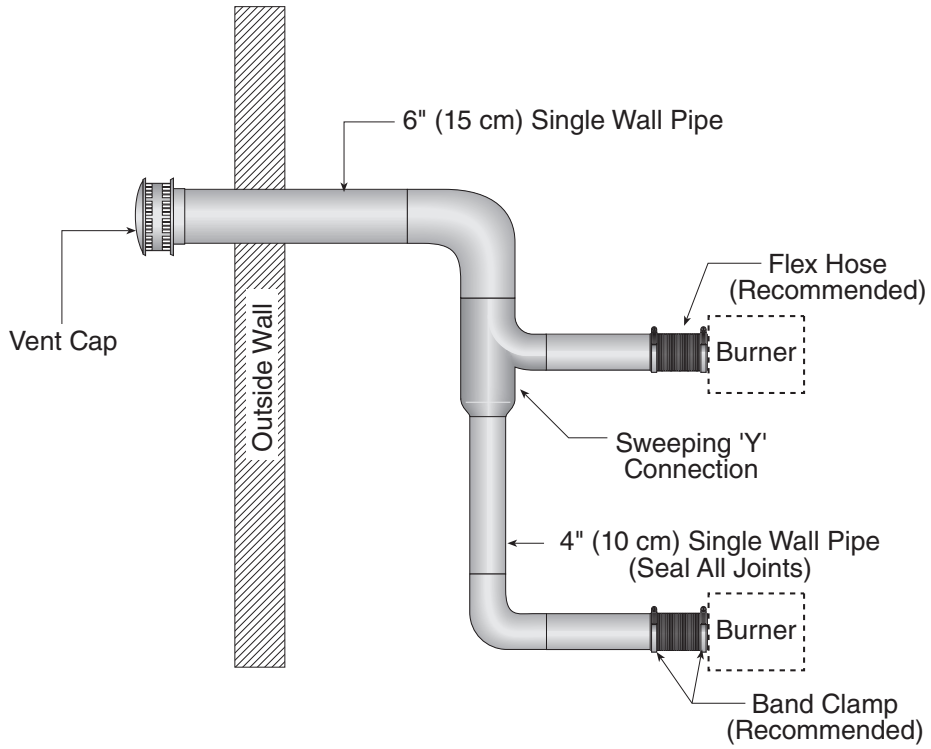


Description	Part Number
Vent Cap 6" (15 cm)	90502302

Requirements:

- Heaters must be controlled by a common thermostat.

14.5 Horizontal Non-Pressurized Outside Air Supply for Double Heater Installation

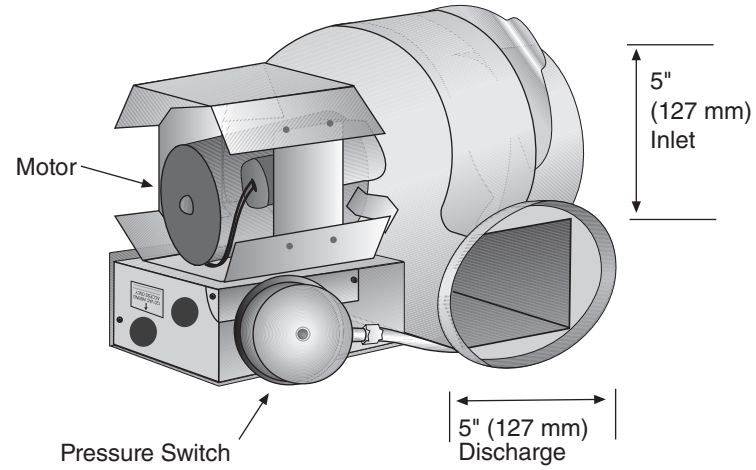


Description	Part Number
Vent Cap 6" (15 cm)	90502302

Requirements:

- Heaters must be controlled by a common thermostat.

14.6 Pressurized Outside Air Supply



If used, the outside air supply blower (P/N 90707501) should be wired in parallel with the pump, and in accordance with the National Electric Code and local ordinances. The blower air pressure switch must be wired in series with the pressure switch on the pump.

All joints and seams in the air supply system must be airtight. See above instructions on attaching duct to the burner. Mount the blower according to the manufacturer's instructions. Additional mounting materials are provided by the contractor.

SECTION 15: WIRING

⚠ WARNING

Electrical Shock Hazard

Disconnect electrical power and gas supply before servicing.

This appliance must be connected to a properly grounded electrical source.

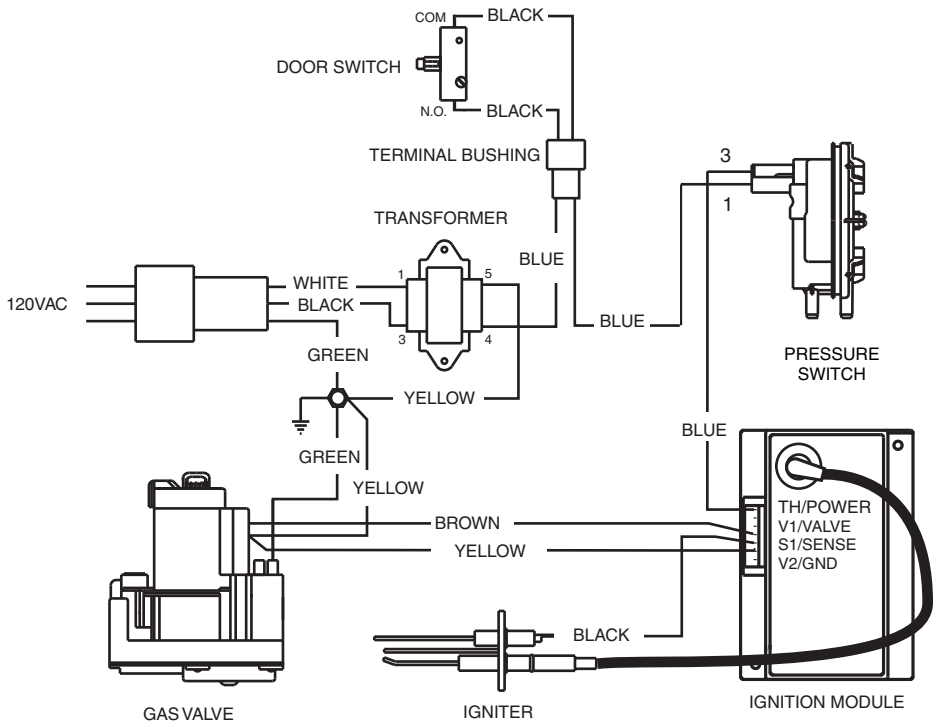
Failure to follow these instructions can result in death or electrical shock.

15.1 Internal Wiring

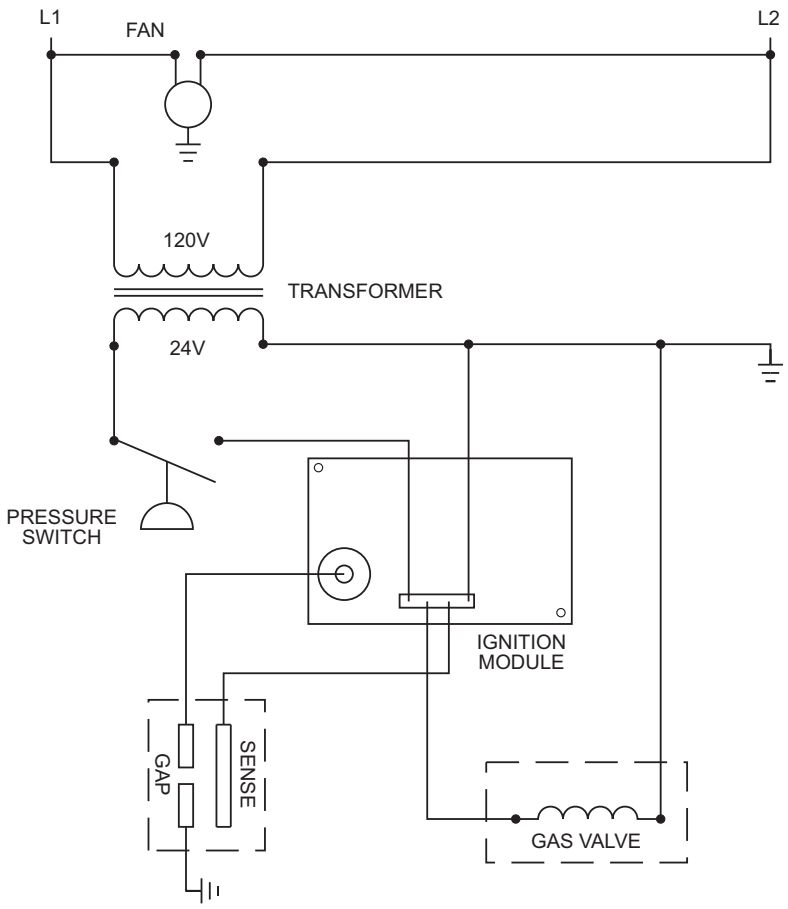
Heaters must be grounded in accordance with applicable codes: United States: refer to National Electrical Code® NFPA 70 - latest revision Canada: refer to Canadian Electrical Code, CSA C22.1 Part I - latest revision.

If any of the original internal wiring must be replaced, it must be replaced with wiring materials having a temperature rating of at least 105°C and 600 volts.

15.2 Internal Wiring



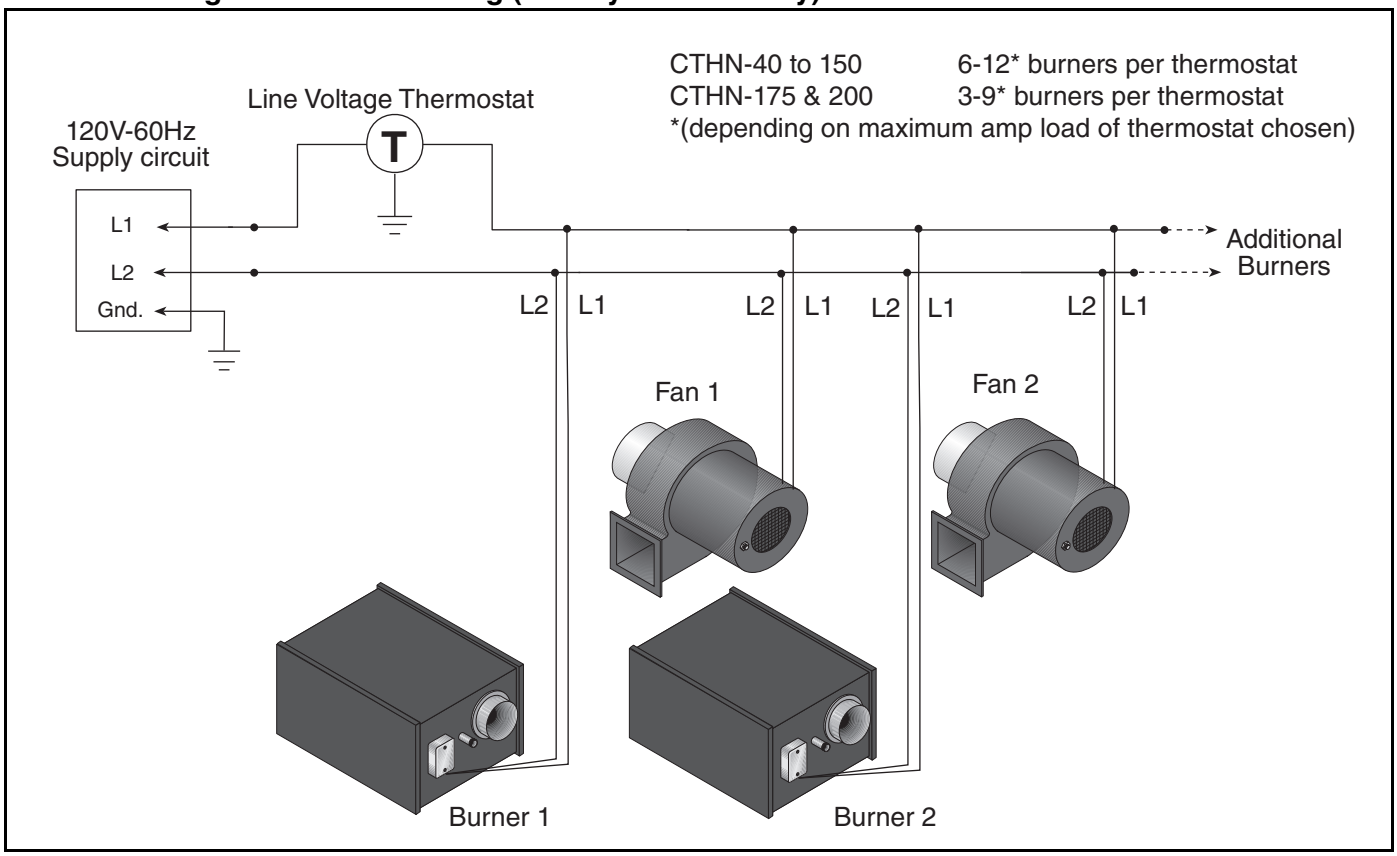
15.3 Ladder Diagram



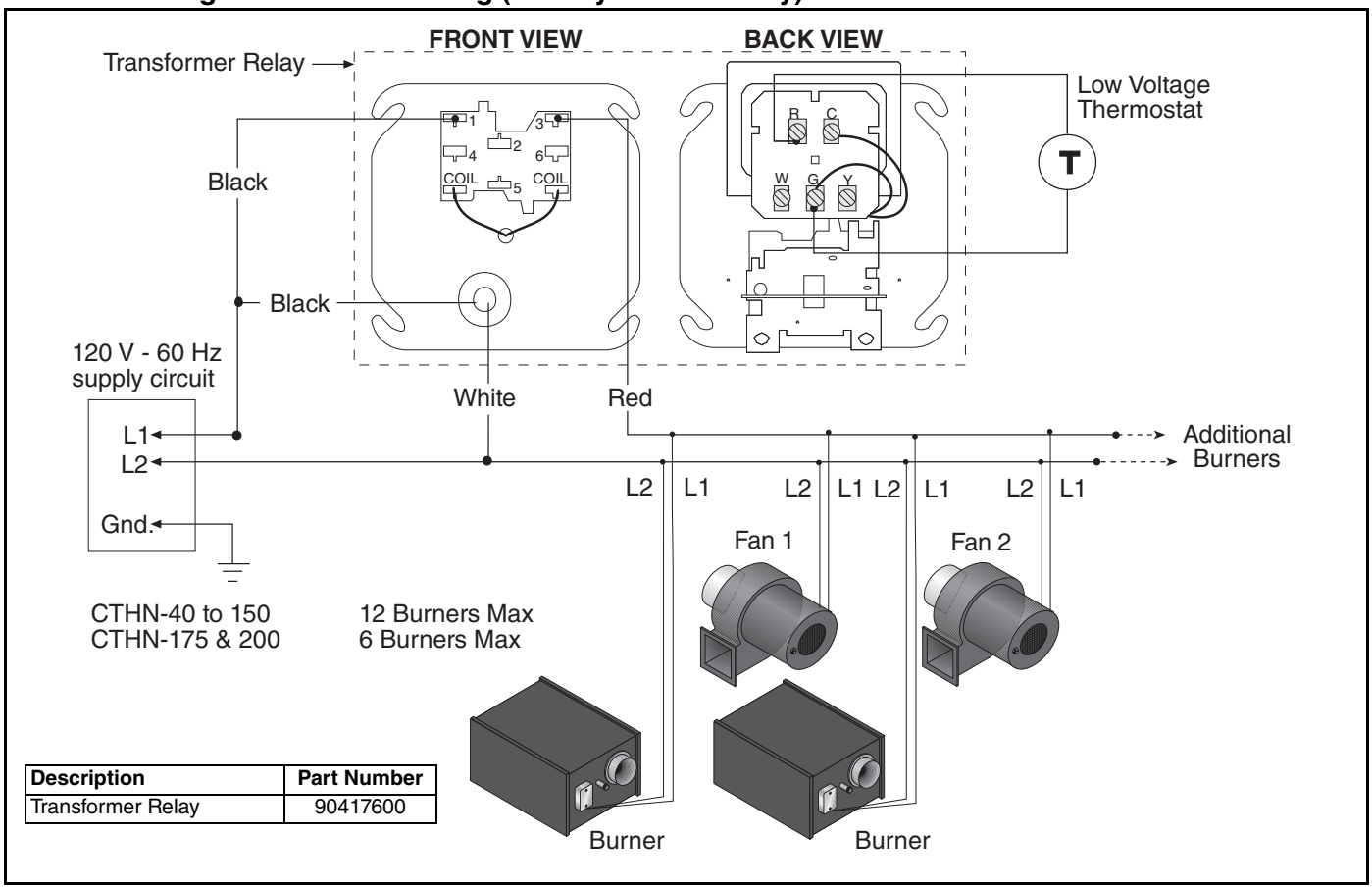
15.4 External Wiring (Unitary Heaters Only)

Heaters can be controlled using several methods. Normally thermostats are used to control the heaters, but they can also be controlled by an energy management system. *Page 62, Section 15.5* illustrates the connection for heaters controlled by a line voltage thermostat. For single or multiple heaters on one low voltage thermostat, *see Page 63, Section 15.6*.

15.5 Line Voltage Thermostat Wiring (Unitary Heaters Only)



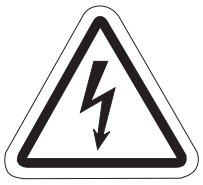
15.6 Low Voltage Thermostat Wiring (Unitary Heaters Only)



Description	Part Number
Transformer Relay	90417600

15.7 System Control Methods and External Multiburner Wiring

⚠ WARNING



Electrical Shock Hazard

Disconnect electrical power and gas supply before servicing.

This appliance must be connected to a properly grounded electrical source.

Failure to follow these instructions can result in death or electrical shock.

There are several methods of controlling CTHN-Series systems. The options are as follows:

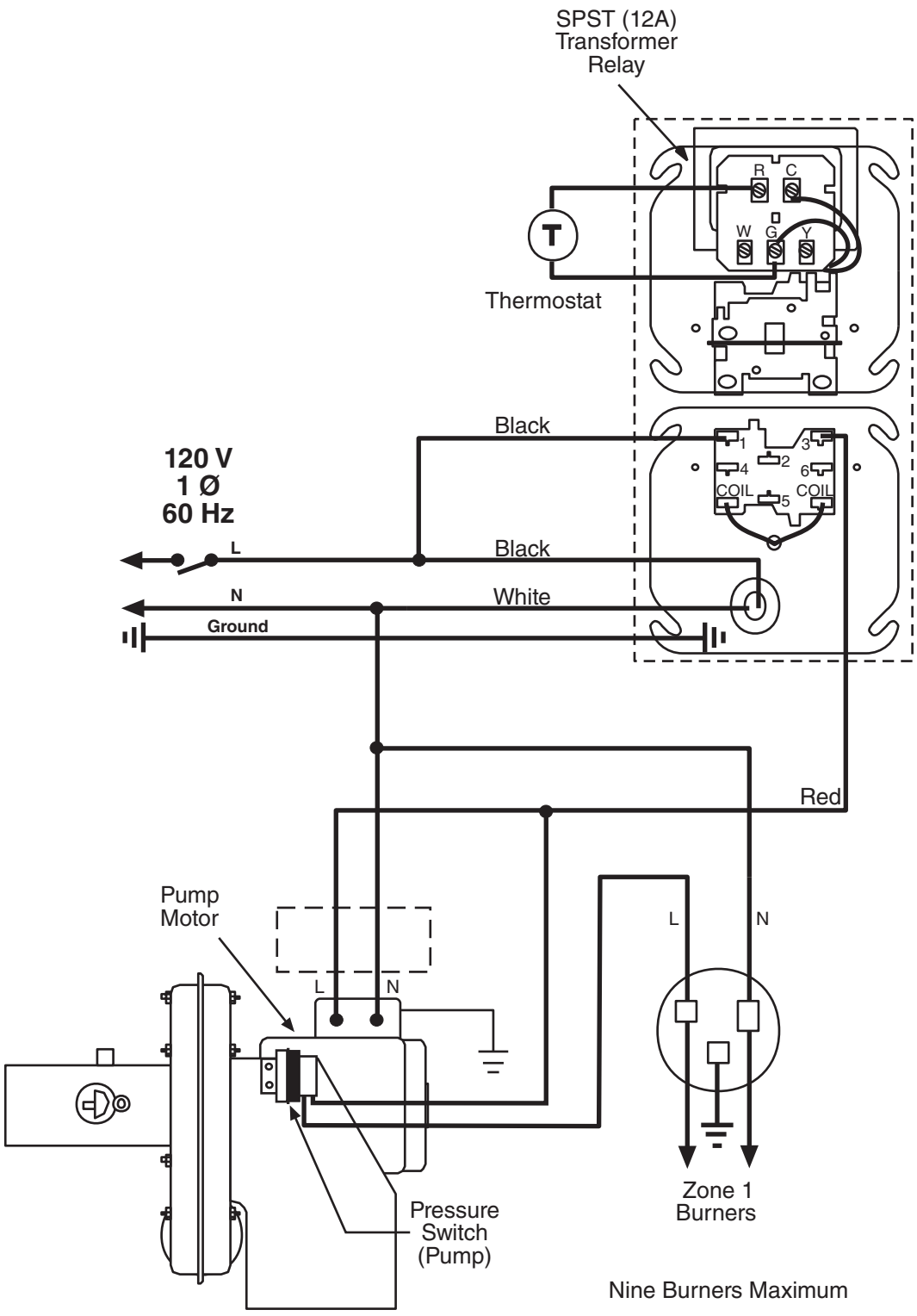
15.7.1 SPST Transformer Relay (P/N 90417600)

The transformer relay wiring diagram is shown *on Page 65, Figure 29*. The transformer relay can be used to control an EP-100 or EP-201 pump CTHN system. The single pole relay can only be used to control one zone of burners.
The electrical circuit is a 120V AC (20 A) supply. The transformer 24V AC output for the thermostat is rated at 40VA. Thermostats used with the transformer must not exceed this power requirement. A transformer relay operated system will not give any post purge pump operation to completely exhaust products of combustion from the system or provide indication of operating conditions.

15.7.2 DPST Transformer Relay (P/N 90436300)

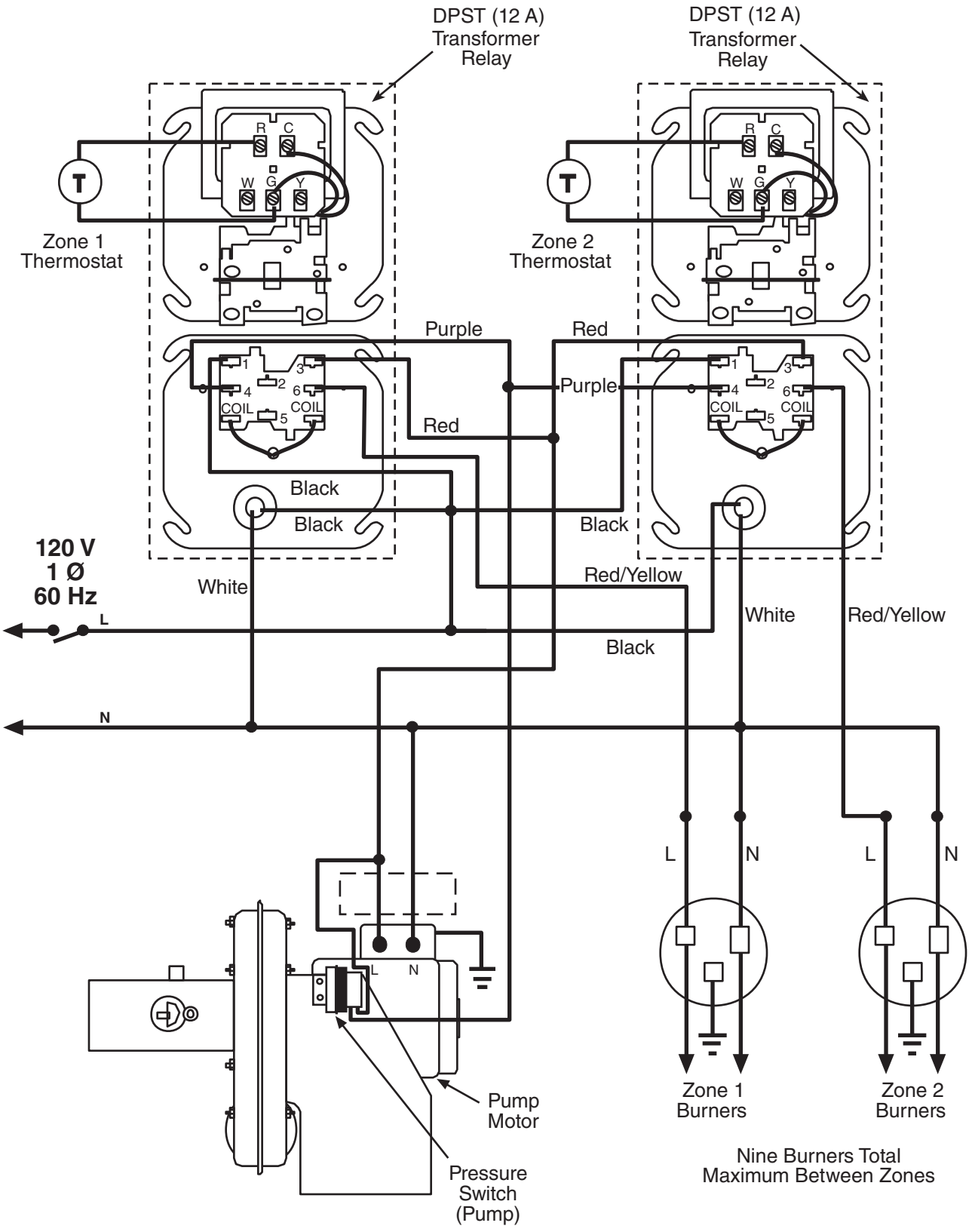
The transformer relay wiring diagram is shown *on Page 66, Figure 30*. The transformer relay can be used to control an EP-100 or EP-201 pump CTHN system. The double pole relay can only be used to control two zones of burners.
The electrical circuit is a 120V AC (20 A) supply. The transformer 24V AC output for the thermostat is rated at 40VA. Thermostats used with the transformer must not exceed this power requirement. A transformer relay operated system will not give any post purge pump operation to completely exhaust products of combustion from the system or provide indication of operating conditions.

FIGURE 29: One Zone Operation without Control Panel (Multiburner)



Description	Part Number
SPST Transformer Relay	90417600

FIGURE 30: Two Zone Operation without Control Panel (Multiburner)



Description	Part Number
DPST Transformer Relay	90436300

SECTION 16: GAS PIPING

⚠ WARNING

Fire Hazard

Tighten gas hose fittings to connect gas supply according to *Figure 31*.

Gas hose can crack when twisted.

Gas hose moves during normal operation.

Failure to follow these instructions can result in death, injury or property damage.

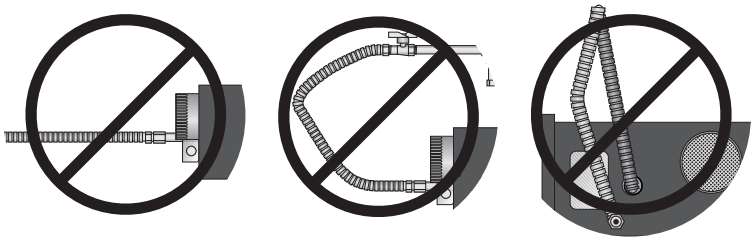
Install the gas hose as shown in *Figure 31*. The flex gas hose connector accommodates expansion of the heating system and allows for easy installation and service of the burner. Before connecting the burners to the supply system, verify that all high pressure testing of the gas piping has been completed.

There is an expansion of the tube with each firing cycle. This will cause the burner to move with respect to the gas line. This can cause a gas leak resulting in an unsafe condition if the gas connection is not made strictly in accordance with *Figure 31*.

Meter and service must be large enough to handle all the burners being installed plus any other connected load. The gas line which feeds the system must be large enough to supply the required gas with a maximum pressure drop of 1/2" wc When gas piping is not included in the layout drawing, the local gas supplier will usually help in planning the gas piping.

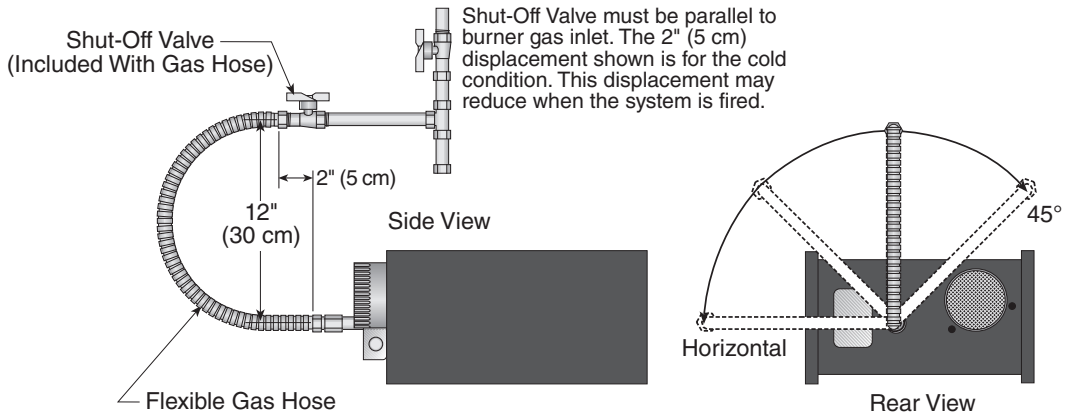
- **Do not high pressure test the gas piping with the burner connected. Failure to follow these instructions can result in property damage.**
- **Check the pipe and tubing ends for leaks before placing heating equipment into service. When checking for gas leaks, use a soap and water solution; never use an open flame.**

FIGURE 31: Gas Connection with Flexible Gas Hose



Hold gas nipple securely with pipe wrench when attaching the gas hose.

Failure to follow these instructions can result in product damage.



Description	Part Number
1/2" Flexible Stainless Steel Gas Hose (US Models)	91412200
3/4" Flexible Stainless Steel Gas Hose (US Models)	91412203
1/2" Rubber (Type 1) Gas Hose (Canadian Models)	91412206
3/4" Rubber (Type 1) Gas Hose (Canadian Models)	91412207

SECTION 17: OPERATION AND MAINTENANCE

The CTHN-Series heater is equipped with a direct spark ignition system.

⚠ WARNING

Explosion Hazard

Service and annual inspection must be done by a contractor qualified in the installation and service of gas-fired heating equipment or your gas supplier.

Turn off gas and electrical supplies before performing service or maintenance.

Failure to follow these instructions can result in death, injury or property damage.

17.1 Checking the Gas Line

1. Open main valve and verify that no gas is flowing through the gas meter.
2. Purge the line if this was not done following pressure testing with air.
3. Verify that the gas pressure is not above 14" wc (1/2 PSIG)
4. Close main gas valve.

17.2 Unitary Heater Sequence of Operation

1. Turn the thermostat up. When the thermostat calls for heat, the blower motor will energize.
2. When the fan motor achieves normal running RPM, the pressure switch within the burner closes and energizes the ignition module.
3. After a 45 second pre-purge, the ignition module then opens the gas valve and energizes the electrode. When the flame is established, the sparking sequence ceases.
4. If the flame is not established during the ignition sequence, the ignition module closes the gas valve and purge begins. The ignition module will try 2 additional times for ignition (with purge between). If ignition is not established, the module will lock-out.
   NOTE: After 1 hour, the module will reset automatically and return to steps 3 and 4.
5. If a flame is detected, the gas valve remains open. When the call for heat is satisfied the thermostat turns off the burner and fan power supply.
6. If the flame extinguishes during operation, the ignition module will attempt to re-establish the flame as described in the preceding step. If ignition is not re-established, the module will lock-out.
7. After lock-out, the control must be reset by turning down the thermostat for five seconds, then raising it again to the desired temperature, or by disconnecting and re-connecting power to the control.

17.2.1 To Shut Off Heater - Unitary

Set thermostat to lowest setting.

Turn OFF electric power to heater.

Turn OFF manual gas valve in the heater supply line.

17.2.2 To Start Heater - Unitary

Turn gas valve and electric power OFF and wait five minutes for unburned gases to vent from heater.

Turn ON main gas valve.

Turn ON electric power.

Set thermostat to desired temperature. Burner should light automatically.

Once the heater is operating, keep away from heater. Do not touch any part of the heater because it is very hot.

17.3 Multiburner System Operation

17.3.1 Checking the Electrical System

1. Set all thermostats below room temperature.
2. Turn on power supply to the system controls.
3. Check to see that no part of the system (i.e. burners, pump, outside air supply blower) is powered.
4. Individually check each zone by energizing the thermostats separately. Each zone thermostat should start the pump immediately. When the pump reaches the nominal running RPM, the

pressure switch closes and activates the ignition module. A pre-purge period will precede burner ignition trial.

5. If more than one system is installed, be sure that no part of one system is affected by the controls of a different system.
6. Make a preliminary vacuum check at burners in branches which have an adjustable damper coupling. *See Page 70, Figure 32* for vacuum measuring instructions. This check is to ensure that all dampers are open before the system is fired. The vacuum measured in the burner control housing should be more than .75" wc.

17.3.2 Starting the System - Multiburner

Note: During the initial firing, the protective oil on the tube may smoke for 30 to 60 minutes and adequate ventilation should be provided.

1. Start with all thermostats below room temperature.
2. Open main gas valve.
3. Turn up thermostats one at a time, waiting to see that all burners in a zone start. When the burner ignites, a blue flame will be observed through the viewer window.
4. If any abnormal operation occurs, *see Page 74, Section 18*.

17.3.3 Sequence of Operation - Multiburner

1. Thermostat, on a call for heat, signals the control panel or relay contacts to energize the pump motor. The pump (and outside air supply blower, if used) are activated.
2. When the pump motor achieves normal running RPM, the pressure switch at the pump inlet closes.
3. After a minimum 45-60 second pre-purge delay (system control only), the zone relay corresponding to the thermostat calling for heat is energized (system control only), and line voltage is directed to the burners in the zone.
4. When sufficient vacuum differential (*see Page 69, Section 17.3.6*) is available at the burner and the control system is supplying line voltage to the burner, the pressure switch within the burner closes and energizes the ignition module.
5. After a 45 second pre-purge, the ignition module opens the gas valve and energizes the electrode. When the flame is established, the sparking sequence ends.
6. If the flame is not established during the ignition sequence, the ignition module closes the gas valve and purge begins. The ignition module will try 2 additional times for ignition (with purge between). If ignition is not established, the module will lock-out.
   NOTE: After 1 hour, the module will reset automatically and return to steps 5 and 6.
7. If a flame is detected, the gas valve remains open. When the call for heat is satisfied, the system control or relay de-energizes the burner and pump power supply. When using the system control, the pump turns off after a post-purge period.
8. If the flame extinguishes during operation, the ignition module will attempt to re-establish the flame. If ignition is not re-established, the module will lock-out.
9. After lock-out, the control must be reset by turning down the thermostat for five seconds, then raising it again to the desired temperature, or by disconnecting and re-connecting power to the control.

17.3.4 To Shut Off Heater - Multiburner

See Page 68, Section 17.2.1.

17.3.5 To Start Heater - Multiburner

See Page 68, Section 17.2.2

17.3.6 Setting the Vacuum - Multiburner

1. Set thermostats above room temperature. See that all burners are operating properly.
2. Allow at least one-half hour operation for temperature to normalize before checking system vacuum balance. Vacuum differential can be measured by connecting a manometer across the “tee” tappings inside the control

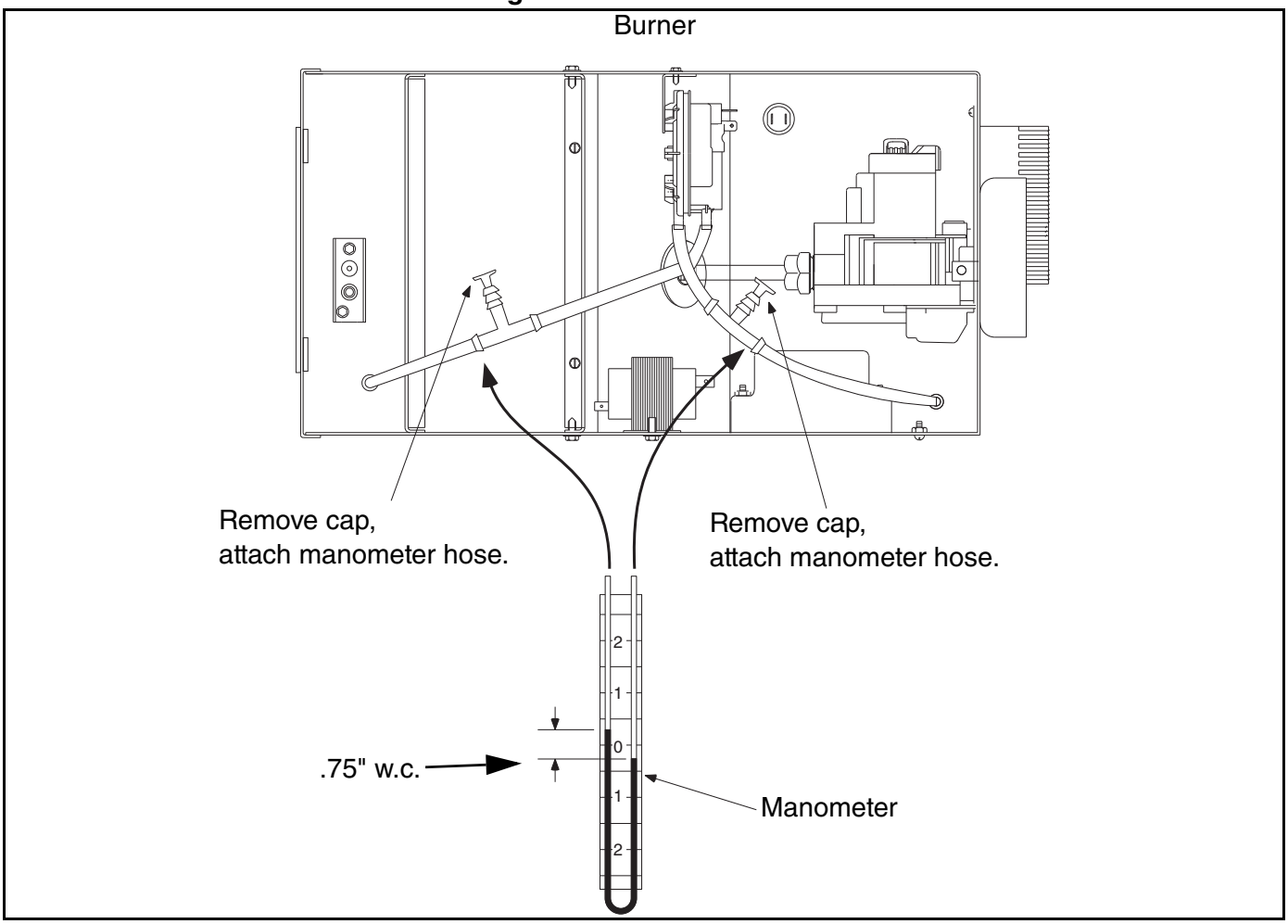
housing (after measurement, the caps must be installed on the “tees” to prevent leakage). See *Figure 32* for manometer connection to burner control housing.

3. Approximately 1.0'' of vacuum differential is required at the burner when the system is cold. Normal operating (hot) differential of the burners should be adjusted to .75" wc.

Vacuum adjustments are made by means of the pump inlet damper and the adjustable damper coupling(s). Check the vacuum differential at all burners, then adjust the damper coupling to obtain equal vacuum differential readings. Adjust the pump inlet damper until vacuum differentials at the burners are as given above. With systems designed to capacity, it may not be possible to obtain vacuum differential readings at slightly above 1" wc (when cold). If so, adjust damper couplings to maximum but approximately equal vacuum readings. Be sure to lock all dampers securely after adjustment.

4. Reset thermostats to desired room temperature.
5. If heat is not required, turn off main switch and close main gas valve.

FIGURE 32: Vacuum Differential Reading



17.4 Maintenance

17.4.1 Pre-Season Maintenance and Annual Inspection

⚠ WARNING

Explosion Hazard

Service and annual inspection must be done by a contractor qualified in the installation and service of gas-fired heating equipment or your gas supplier.

Turn off gas and electrical supplies before performing service or maintenance.

Failure to follow these instructions can result in death, injury or property damage.

To ensure your safety and years of trouble-free operation of the heating system, service and annual inspections must be done by a contractor qualified in the installation and service of gas-fired heating equipment.

Turn off gas and electric supplies before performing service or maintenance. Allow heater to cool before servicing.

Before every heating season, a contractor qualified in the installation and service of gas-fired heating equipment must perform a thorough safety inspection of the heater.

For best performance, the gas, electrical, thermostat connections, tubing, venting, suspensions and overall heater condition should be thoroughly inspected.

NOTE: Gas flow and burner ignition are among the first things that should be inspected.
Please *see Page 72, Section 17.5* for suggested items to inspect.

17.5 Maintenance Checklist

⚠ WARNING

Explosion Hazard

Service and annual inspection must be done by a contractor qualified in the installation and service of gas-fired heating equipment or your gas supplier.

Turn off gas and electrical supplies before performing service or maintenance.

Failure to follow these instructions can result in death, injury or property damage.

Installation Code and Annual Inspections:
All installations and service of RAPID™ equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Rapid Engineering and conform to all requirements set forth in the RAPID™ manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment.

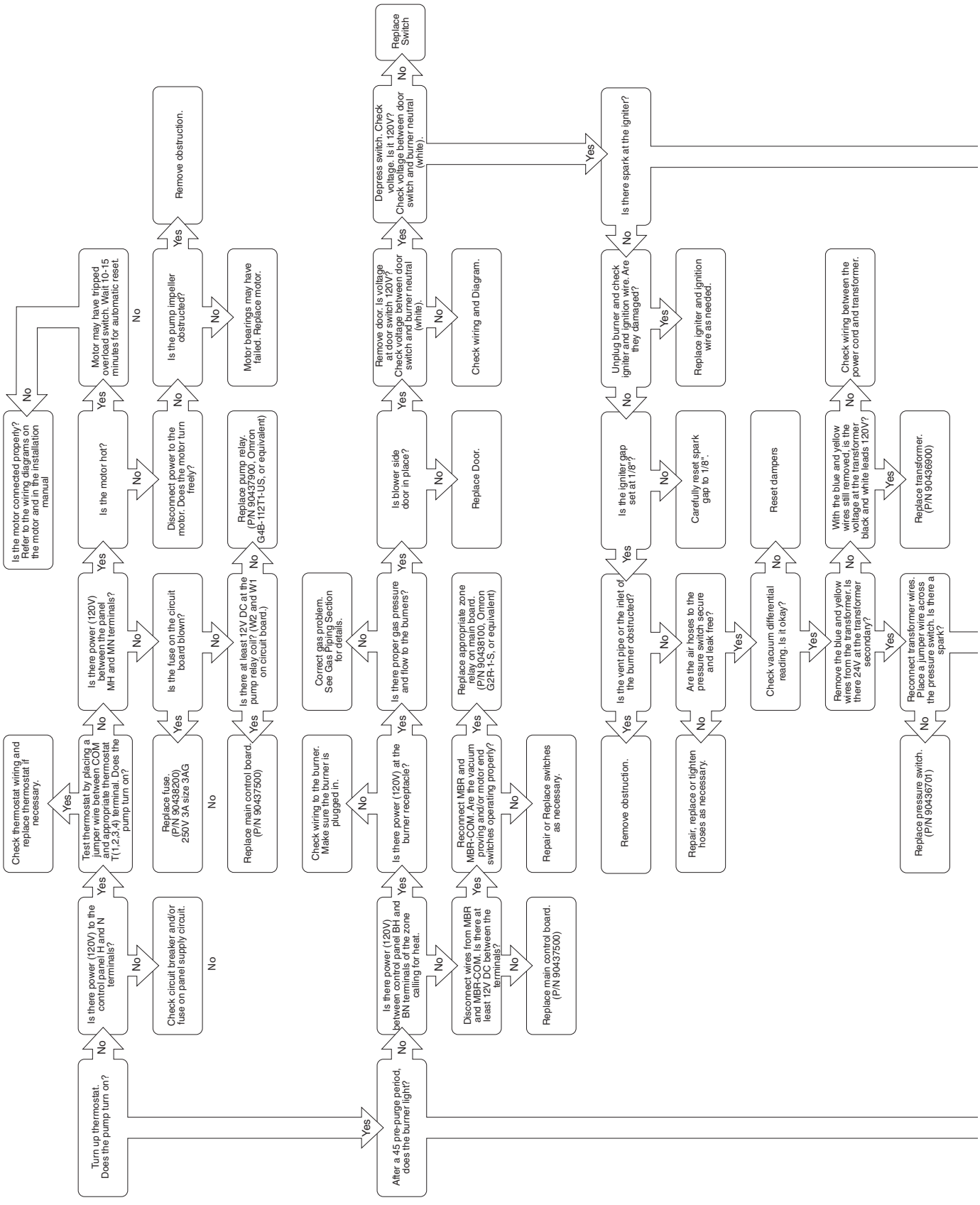
To help facilitate optimum performance and safety, Rapid Engineering recommends that a qualified contractor annually inspect your RAPID™ equipment and perform service where necessary, using only replacement parts sold and supplied by Rapid Engineering.

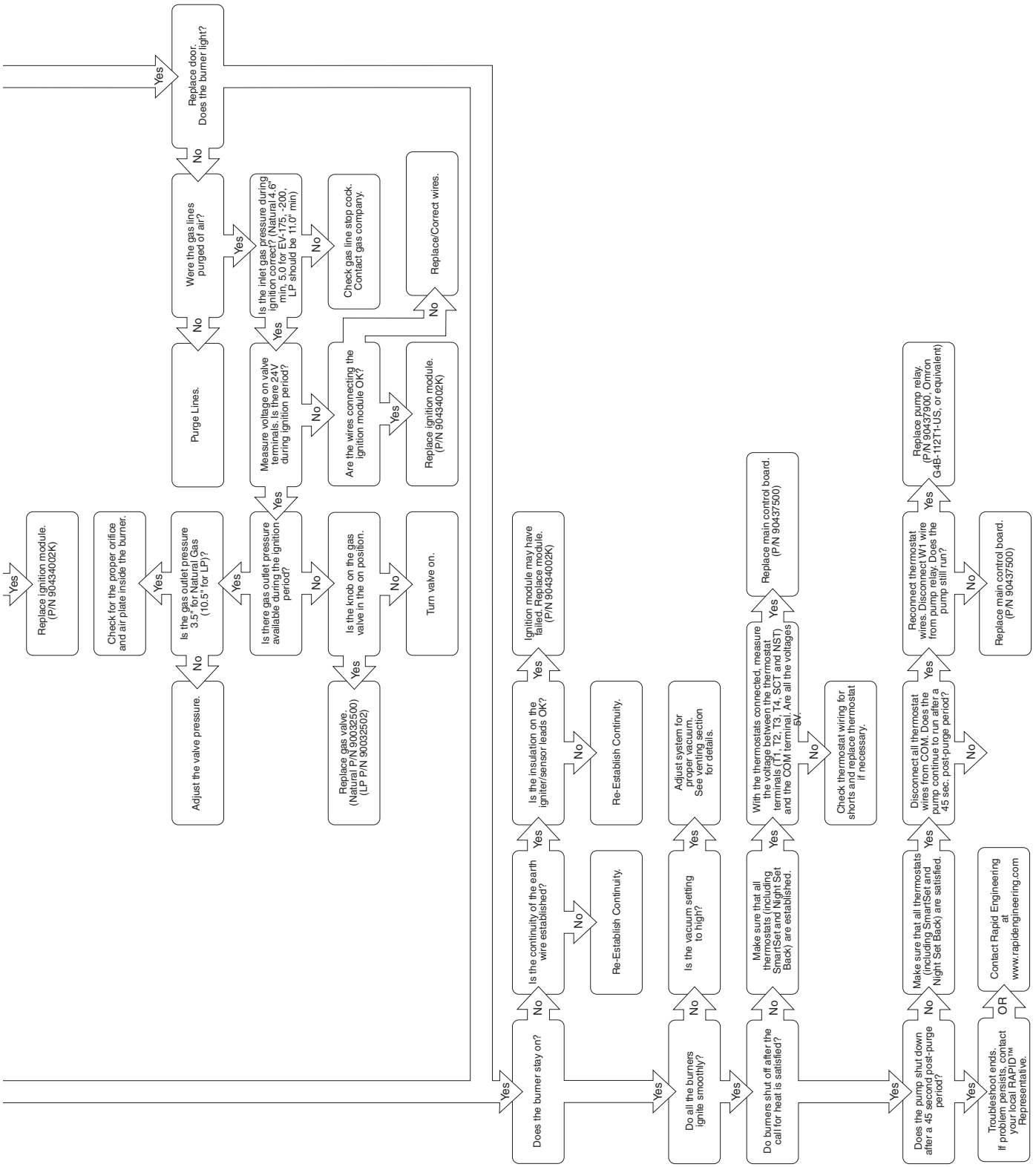
The Vicinity of the Heater	Do not store or use flammable objects, liquids or vapors near the heater. Immediately remove these items if they are present. *See Page 3, Section 3*.
Vehicles and Other Objects	Maintain the clearances to combustibles. Do not hang anything from, or place anything on, the heater. Make sure nothing is lodged underneath the reflector, in between the tubes or in the decorative or protective grilles (included with select models). Immediately remove objects in violation of the clearances to combustibles. *See Page 3, Section 3*.
Reflector	Make sure there is no dirt, sagging, cracking or distortion. Do not operate if there is sagging, cracking or distortion. Make sure reflectors are correctly overlapped. *See Page 24, Section 8.9.1*. Clean outside surface with a damp cloth.
Vent Pipe	Venting must be intact. Using a flashlight, look for obstructions, cracks on the pipe, gaps in the sealed areas or corrosion. The area must be free of dirt and dust. Remove any carbon deposits or scale using a wire brush. Inspect pump and flue pipe for soot or dirt or any obstruction to the outdoors. After cleaning as necessary, reattach the flue pipe to the heater. Inspect acoustical boots for cracks and leaks. Replace as necessary. *See Page 49, Section 11*.
Outside Air Inlet	Inlet must be intact. Look for obstructions, cracks on the pipe, gaps in the sealed areas or corrosion. The area must be free of dirt and dust. Clean and reinstall as required.

Tubes	Make sure there are no cracks. Make sure tubes are connected and suspended securely. *See Page 11, Figure 12*. Make sure there is no dirt, sagging, bending or distortion. Clean or replace as required.
Gas Line	Check for gas leaks. *See Page 67, Section 16*.
Burner Observation Window	Make sure it is clean and free of cracks or holes. Clean or replace as required.
Blower Scroll, Wheel and Motor	Compressed air or a vacuum cleaner may be used to clean dust and dirt.
Burner Cup and Orifice	Make sure it is clear of obstructions (even spider webs will cause problems). Carefully remove any dust and debris from the burner.
Electrode	Replace if there are cracked ceramics, excessive carbon residue, or erosion of the electrode. The electrode gap should be 1/8" (3.2 mm).
Thermostat	There should be no exposed wire or damage to the thermostat. *See Page 62, Section 15.5*.
Suspension Points	Make sure the heater is hanging securely. Look for signs of wear on the chain or ceiling. *See Page 11, Figure 12*.
Decorative and Protective Grille (optional)	The grille must be securely attached. Check that side reflector extensions are installed correctly and secured in place if necessary. (Decorative grille only.) *See Page 46, Section 10.4 through Page 48, Section 10.5* Make sure shield is installed correctly and secured in place if necessary. (Decorative grille only.) *See Page 47, Section 10.4.2*.
Lower Clearance Shield (optional)	The lower shield must be securely attached. *See Page 46, Section 10.3* . Make sure shield is installed correctly and secured in place if necessary. *See Page 46, Section 10.3.1*.

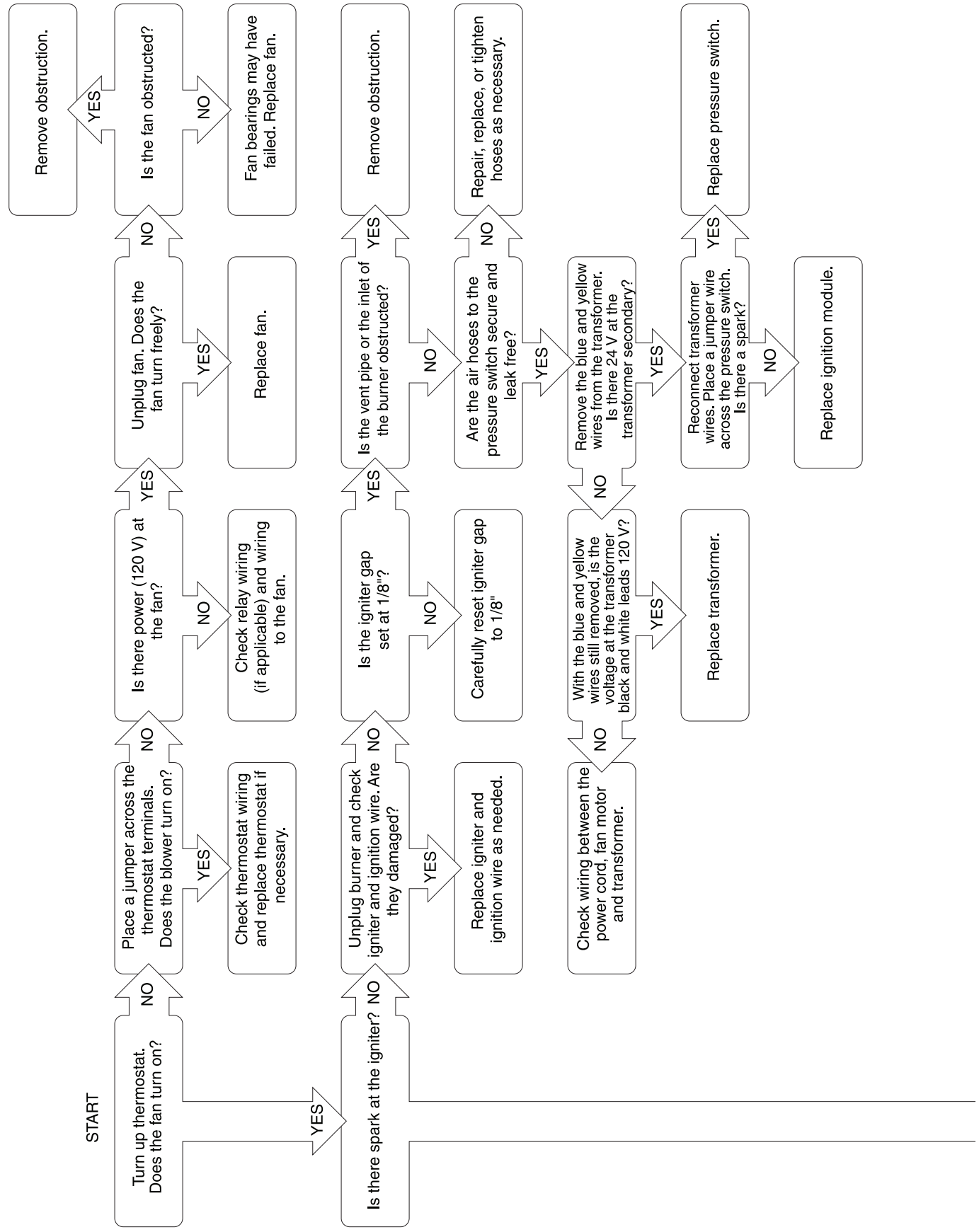
SECTION 18: TROUBLESHOOTING

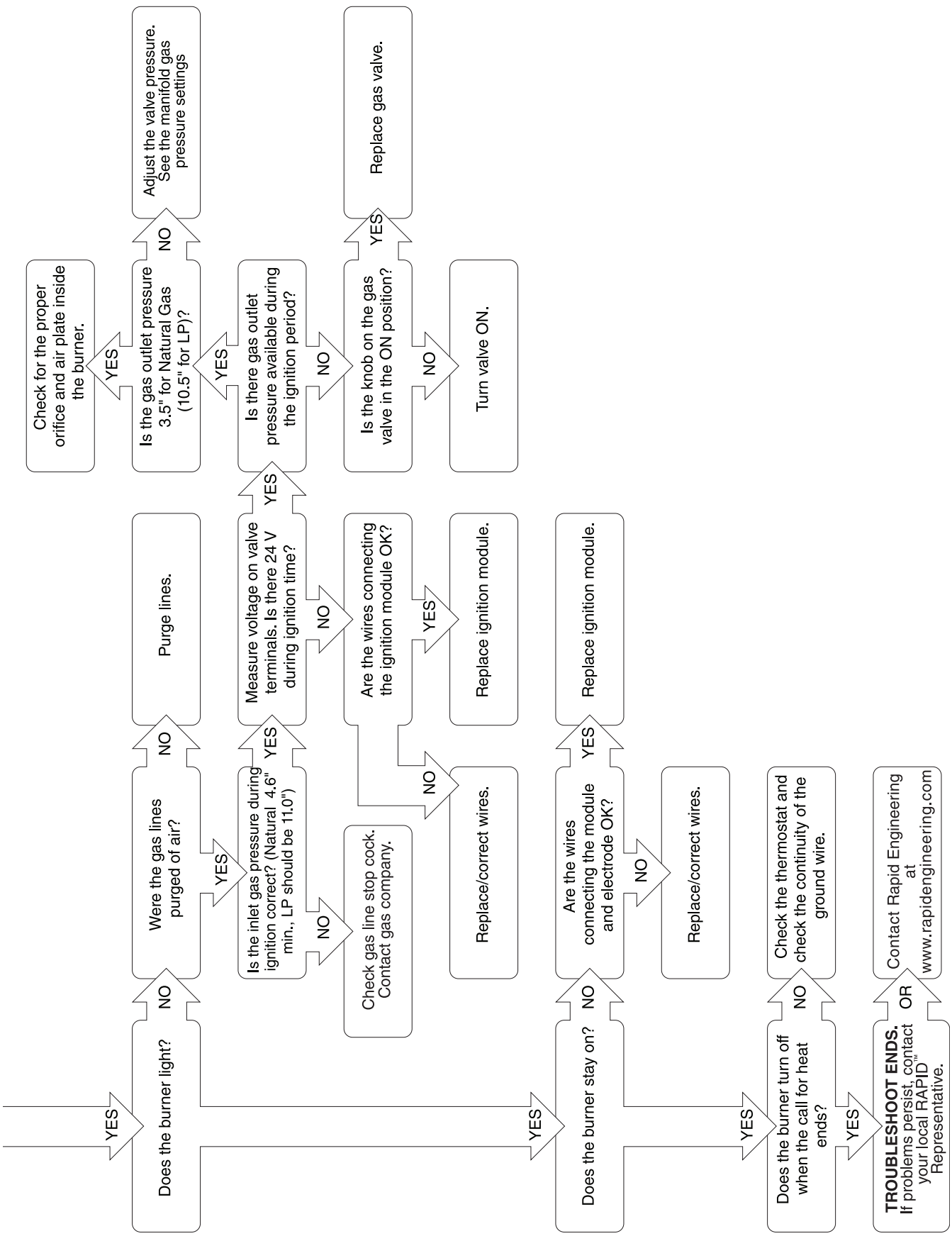
18.1 Troubleshooting Flow Chart - Unitary



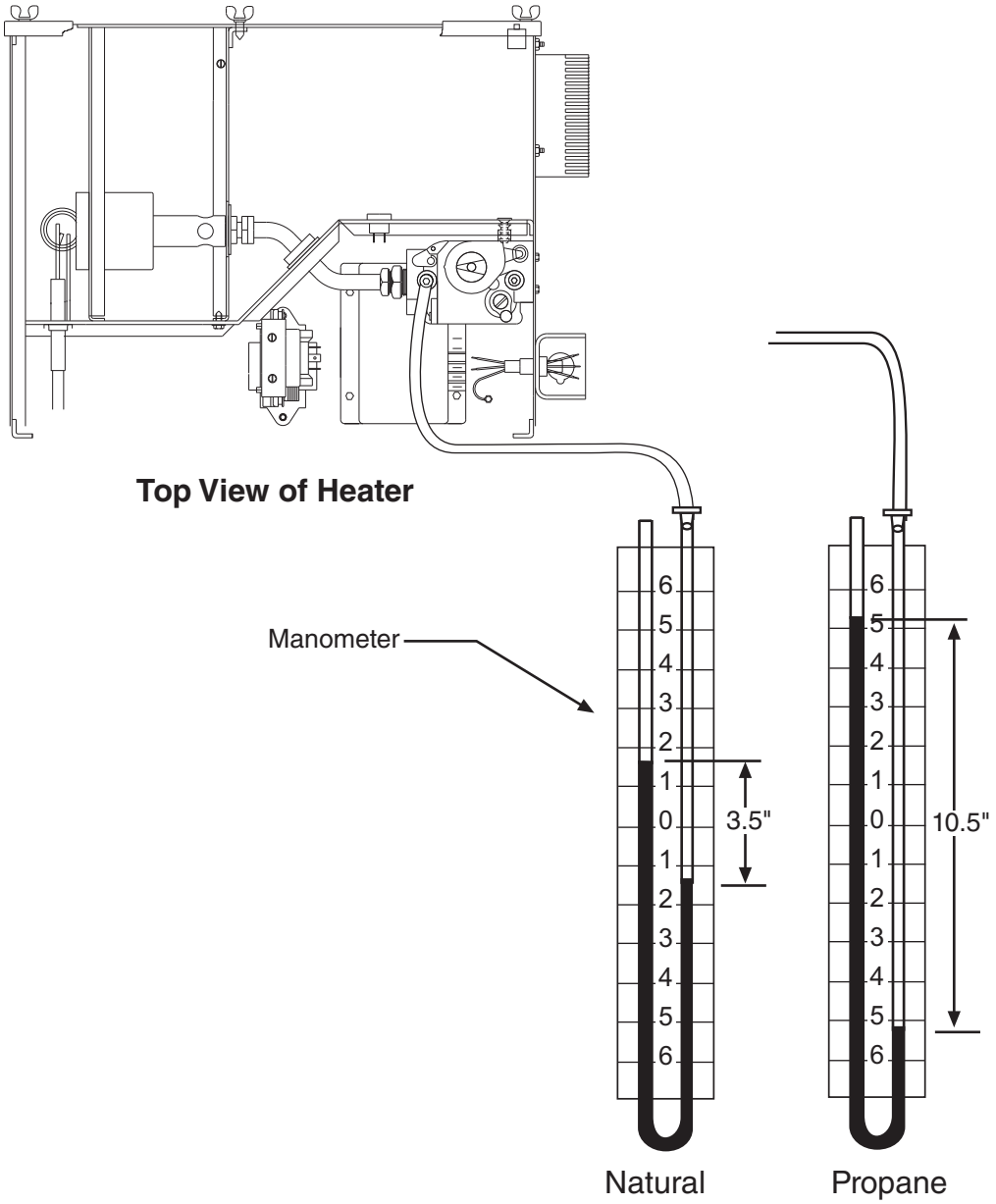

Does the burner stay on?
Yes
No
Is the continuity of the earth wire established?
Yes
No
Re-Establish Continuity.
Is the insulation on the igniter/sensor leads OK?
Yes
No
Re-Establish Continuity.
Ignition module may have failed. Replace module. (P/N 90434002K)
Do all the burners ignite smoothly?
Yes
No
Is the vacuum setting to high?
Yes
No
Adjust system for proper vacuum. See venting section for details.
Do burners shut off after the call for heat is satisfied?
Yes
No
Make sure that all thermostats (including SmartSet and Night Set Back) are established.
Yes
No
With the thermostats connected, measure the voltage between the thermostat terminals (T1, T2, T3, T4, SCT and NST) and the COM terminal. Are all the voltages 5V.
Yes
No
Replace main control board. (P/N 90437500)
Check thermostat wiring for shorts and replace thermostat if necessary.
Does the pump shut down after a 45 second post-purge period?
Yes
No
Make sure that all thermostats (including SmartSet and Night Set Back) are satisfied.
Yes
No
Disconnect all thermostat wires from COM. Does the pump continue to run after a 45 sec. post-purge period?
Yes
No
Reconnect thermostat wires. Disconnect W1 wire from pump relay. Does the pump still run?
Yes
No
Replace pump relay. (P/N 90437900, Omron G4B-1121T-US, or equivalent)
Replace main control board. (P/N 90437500)
Troubleshoot ends. If problem persists, contact your local RAPID™ Representative.
OR
Contact Rapid Engineering at www.rapidengineering.com
Yes
Replace ignition module. (P/N 90434002K)
Yes
Check for the proper orifice and air plate inside the burner.
Yes
Is the gas outlet pressure 3.5" for Natural Gas (10.5" for LP)?
Yes
No
Adjust the valve pressure.
Is there gas outlet pressure available during the ignition period?
Yes
No
Measure voltage on valve terminals. Is there 24V during ignition period?
Yes
No
Is the inlet gas pressure during ignition correct? (Natural 4.6" min, 5.0 for EV-175, -200, LP should be 11.0" min)
Yes
No
Check gas line stop cock. Contact gas company.
Were the gas lines purged of air?
Yes
No
Purge Lines.
Is the knob on the gas valve in the on position.
Yes
No
Turn valve on.
Replace gas valve. (Natural P/N 90032500) (LP P/N 90032502)
Are the wires connecting the ignition module OK?
Yes
No
Replace ignition module. (P/N 90434002K)
Replace/Correct wires.
Replace door. Does the burner light?
Yes
No

18.2 Troubleshooting Flow Chart - Multiburner



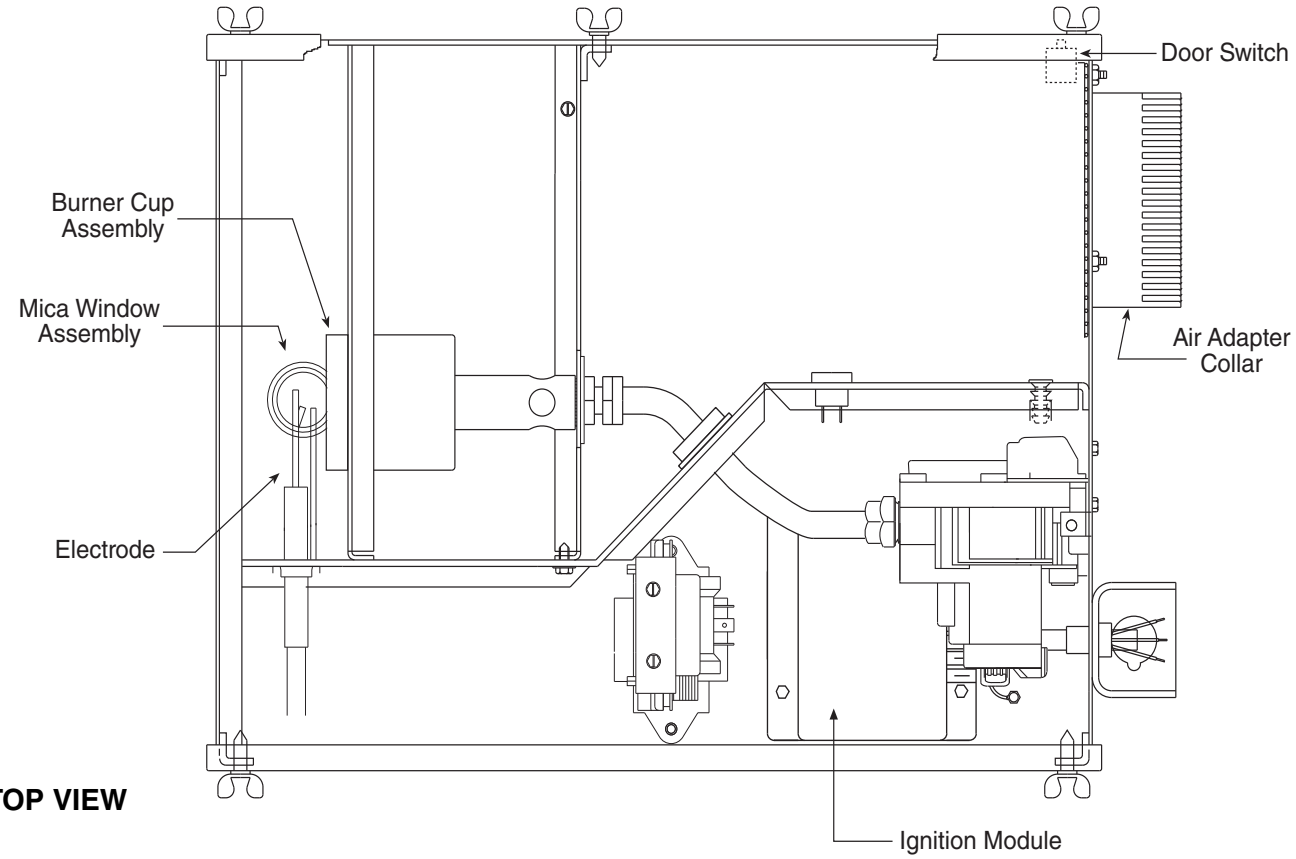

YES
Does the burner light?
NO
Were the gas lines purged of air?
NO
Purge lines.
YES
Is the inlet gas pressure during ignition correct? (Natural 4.6" min., LP should be 11.0")
NO
Check gas line stop cock. Contact gas company.
YES
Measure voltage on valve terminals. Is there 24 V during ignition time?
NO
Are the wires connecting the ignition module OK?
NO
Replace/correct wires.
YES
Replace ignition module.
YES
Is there gas outlet pressure available during the ignition period?
NO
Is the knob on the gas valve in the ON position?
NO
Turn valve ON.
YES
Replace gas valve.
YES
Is the gas outlet pressure 3.5" for Natural Gas (10.5" for LP)?
NO
Adjust the valve pressure. See the manifold gas pressure settings
YES
Check for the proper orifice and air plate inside the burner.
YES
Does the burner stay on?
NO
Are the wires connecting the module and electrode OK?
NO
Replace/correct wires.
YES
Replace ignition module.
YES
Does the burner turn off when the call for heat ends?
NO
Check the thermostat and check the continuity of the ground wire.
YES
TROUBLESHOOT ENDS.
If problems persist, contact your local RAPID™ Representative.
OR
Contact Rapid Engineering at www.rapidengineering.com

18.3 Manifold Gas Pressure Setting

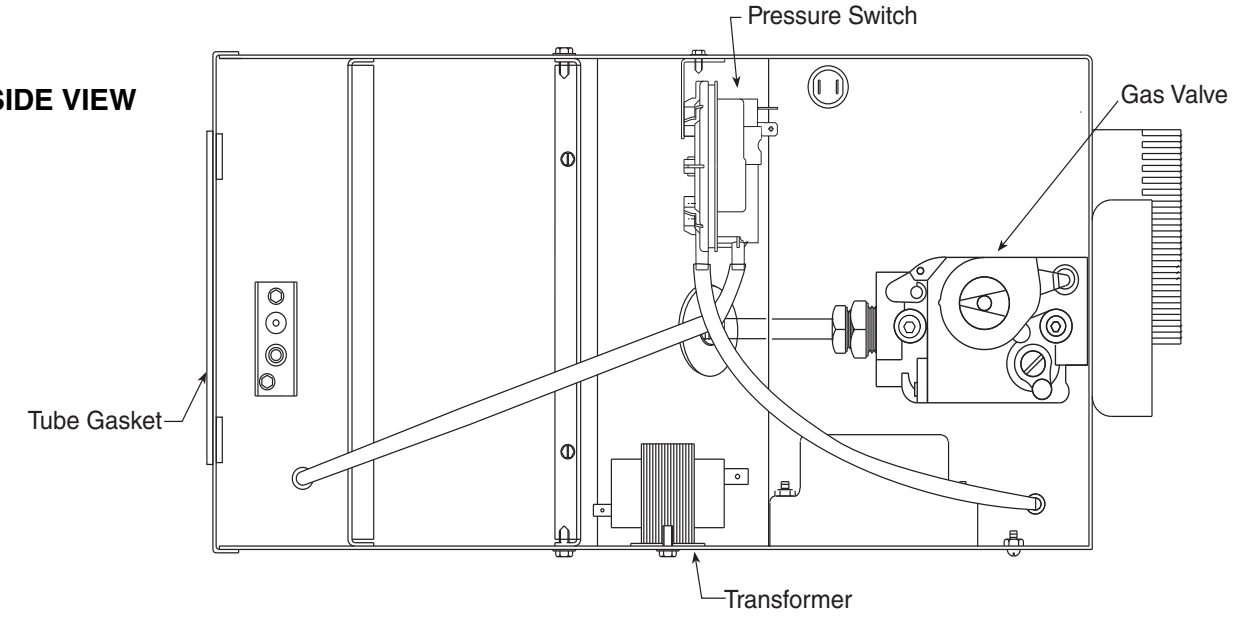


SECTION 19: REPLACEMENT PARTS LIST

Use only genuine RAPID™ replacement parts.
Use of parts not specified by Rapid Engineering voids warranty.
Failure to follow these instructions can result in property damage.



TOP VIEW



SIDE VIEW

Replacement Parts List (continued...)*

Description	Part Number
Burner	
Gas Valve (Natural)	90032500
Gas Valve (LP)	90032502
Burner Cup Assembly	03020100
Mica Window Assembly	02553203
Electrode	90427400
Electrode Gasket	02558501
Ignition Module	90439500K
Ignition Wire	90427706
Pressure Switch:	
(40, 80)	90439803K
(60, 100, 125, 150)	90439810K
(175,200)	90439802K
Transformer	90436900K
Door Switch	90436800
Air Adapter Collar	91911700
Tube Gasket	02568200
Outside Air Supply Blower	
Air Supply Blower/Power Venter	90707501

* For all other accessories, *see Page 12, Section 8.1*, *Page 27, Section 9.1*, *Page 13, Table 4* and *Page 28, Table 9*.

SECTION 20: GENERAL SPECIFICATIONS

20.1 Material Specification

20.1.1 Reflectors

.024 Aluminum
(Optional .024 Stainless Steel Type 304)

20.2 Heater Specifications

20.2.1 Control System

Fully automatic spark ignition with safety shut-off.

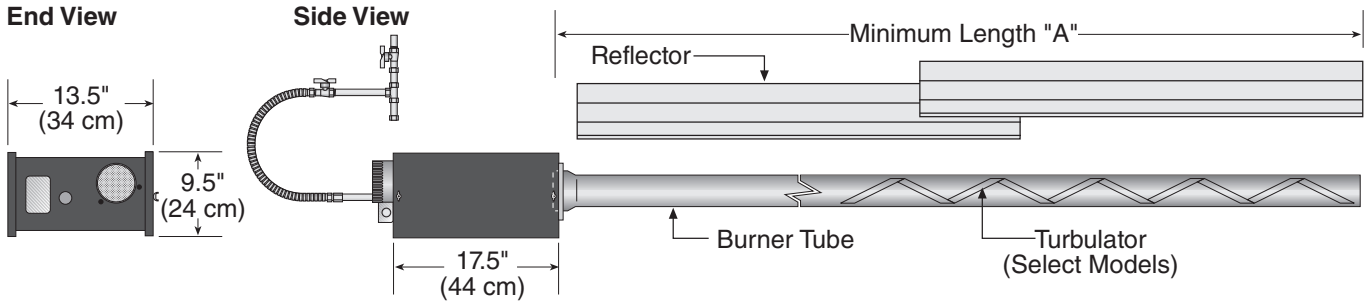
20.3 Suspension Specifications

Hang heater with materials with a minimum working load of 75 lbs (33 kg). *See Page 11, Figure 12*.

20.4 Controls Specifications

Time switches, thermostats, etc. can be wired into the electrical supply. External controls supplied as an optional extra.

General Specifications for the heaters are as follows:



Model	Heat Input Rate (Btu/h) x (1000)	Length "A" Minimum		Recommended Minimum Mounting Height*	
		Unitary	Multiburner	Space	Spot
CTHN-40	40	10' (3 m)	20' (6 m)	8'-10' (2.4 - 3 m)	8' (2.3 m)
CTHN-60	60	20' (6 m)	30' (9 m)	10'-12' (3 - 3.6 m)	9' (2.7 m)
CTHN-80	80	20' (6 m)	30' (9 m)	12'-15' (3.6 - 4.5 m)	11' (3.3 m)
CTHN-100	100	30' (9 m)	40' (12 m)	12'-15' (3.6 - 4.5 m)	12' (3.7 m)
CTHN-125	125	40' (12 m)	50' (15 m)	15'-20' (4.5 - 6 m)	15' (3.7 m)
CTHN-150	150	40' (12 m)	50' (15 m)	20'-25' (6 - 7.6 m)	20' (4.6 m)
CTHN-175	175	50' (15 m)	60' (18 m)	25' (7.6 m)	23' (6 m)
CTHN-200	200	50' (15 m)	60' (18 m)	25' (7.6 m)	25' (7.6 m)

**See Page 3, Section 3* for clearances to combustibles.

GAS PRESSURE AT MANIFOLD:

Natural Gas: 3.5" wc
LP Gas: 10.5" wc

PIPE CONNECTION:

1/2" NPT (for CTHN-40, 60, 80, 100, 125)
3/4" NPT (for CTHN-150,175 & 200)

DIMENSIONS:

Vent Connection Size: 4" (10 cm)
Outside Air Connection Size: 4" (10 cm)
Refer to figure above for dimensional information.

GAS INLET PRESSURE:

Natural Gas:

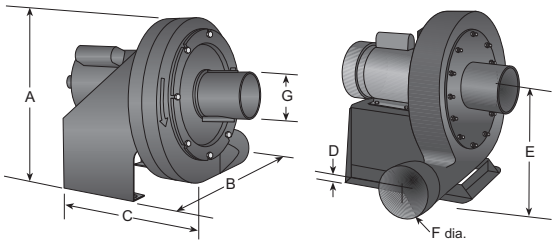
for CTHN-40, 60, 80, 100, 125, 150	4.6" wc Minimum
for CTHN-175, 200	5.0" wc Minimum
	14.0" wc Maximum
LP Gas: All Models	11.0" wc Minimum
	14.0" wc Maximum

ELECTRICAL RATING:

Unitary Models 40-150:	120 V - 60 Hz, 1 A
Unitary Models 175-200:	120 V - 60 Hz, 2 A
Multiburner All Models:	120 V - 60 Hz, 0.1 A

General Specifications for fans and pumps are as follows:

Pump Dimensional Data (in.)							
Model	**A**	**B**	**C**	**D**	**E**	**F**	**G**
EP-100	17	14.5	21	3.75	10	4	4
EP-201/203	17.75	17	20.25	3.25	10	4.5	4.5
EP-301/303	25.6	24.8	22.7	4.8	15.2	6	6



Fan and Pump Specifications

Model	05220000	05221000	EP-100	EP-201	EP-203	EP-301	EP-303
Horsepower (Hp)	.134	.23	1/3	3/4	3/4	2*	2*
Phase (Ø)	1	1	1	1	3	1	3
Hertz (Hz)	60	60	60	60	60	60	60
Voltage (V)	115	115	115/230	115/230	208-230/ 460	208-230	208-230/ 460
Full Load Amp (Amps)	.9	1.6	4.8/2.4	6.6/3.3	2.4-2.2/1.1	12.8-11.5	5.5-5.2/2.6
R.P.M.	3200	3200	3450	3450	3500	3450	3450
Motor Frame	-	-	56	56	56	90	90
Motor Enclosure	-	-	TENV	TENV	TEFC	TEFC	TEFC
Noise Level @ 5' (DBA)	-	-	-	70	70	-	-
Inlet/Outlet (In.)	4/4	4/4	4/4	4/4	4/4	6/6	6/6
Weight (lbs.)	10	12	62	112	112	170	170

** For starter, see National Electric Code (NEC) requirement for motors 1 hp or higher.*

Air Supply Blower Specifications	
Capacity	240 CFM @ 0.75 in wc
Power (W)	167
Phase	1
Hertz (Hz)	60
Voltage (V)	120
Full Load Amp (Amps)	1.5
R.P.M.	3000
Motor Enclosure	OPEN FC
Inlet/Outlet (In.)	5/5
Weight (lbs.)	10

SECTION 21: RAPID™ NP LIMITED WARRANTY

RAPID ENGINEERING WILL PAY FOR:

Within 42 months from date of shipment from Rapid Engineering, replacement parts will be provided free of charge for any part of the product which fails due to a manufacturing or material defect.

Rapid Engineering will require the part in question to be returned to the factory. Rapid Engineering will, at its sole discretion, repair or replace after determining the nature of the defect and disposition of part in question.

RAPID™ Replacement Parts are warranted for a period of 18 months from date of shipment from Rapid Engineering or the remaining RAPID™ NP warranty.

RAPID ENGINEERING WILL NOT PAY FOR:

Service trips, service calls and labor charges.

Shipment of replacement parts.

Claims where the total price of the goods have not been paid.

Damage due to:

- Improper installation, operation or maintenance.
- Misuse, abuse, neglect, or modification of the RAPID™ NP in any way.
- Use of the RAPID™ NP for other than its intended purpose.
- Incorrect gas or electrical supply, accident, fire, floods, acts of God, war, terrorism, or other casualty.
- Improper service, use of replacement parts or accessories not specified by Rapid Engineering.
- Failure to install or maintain the RAPID™ NP as directed in the Installation, Operation and Service manual.
- Relocation of the RAPID™ NP after initial installation
- The use of the RAPID™ NP in a corrosive atmosphere containing contaminants.
- The use of the RAPID™ NP in the vicinity of a combustible or explosive material.
- Any defect in the RAPID™ NP arising from a drawing, design, or specification supplied by or on behalf of the consumer.
- Damage incurred during shipment. Claim must be filed with carrier.

WARRANTY IS VOID IF:

The RAPID™ NP is not installed by an electrician qualified in the installation and service of control systems for heating equipment.

You cannot prove original purchase date and required annual maintenance history.

The data plate and/or serial number are removed, defaced, modified or altered in any way.

The ownership of the RAPID™ NP is moved or transferred. This warranty is nontransferable.

Rapid Engineering is not permitted to inspect the damaged controller and/or component parts.

READ YOUR INSTALLATION, OPERATION AND SERVICE MANUAL.

If you have questions about your controller, contact your installing professional. Should you need Replacement Parts or have additional questions, call or write Rapid Engineering:

U.S.A.

1100 Seven Mile Road NW
Comstock Park, MI 49321
Telephone: 616.784.0500
On the web at: www.rapidengineering.com

Rapid Engineering**'s liability, and your exclusive remedy, under this warranty or any implied warranty (including the implied warranties of merchantability and fitness for a particular purpose) is limited to providing replacement parts during the term of this warranty.** Some jurisdictions do not allow limitations on how long an implied warranty lasts, so this limitation may not apply to you. There are no rights, warranties or conditions, expressed or implied, statutory or otherwise, other than those contained in this warranty.

Rapid Engineering **shall in no event be responsible for incidental or consequential damages or incur liability for damages in excess of the amount paid by you for the RAPID™ NP .** Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so this limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from jurisdiction to jurisdiction.

Rapid Engineering shall not be responsible for failure to perform under the terms of this warranty if caused by circumstances out of its control, including but not limited to war, fire, flood, strike, government or court orders, acts of God, terrorism, unavailability of supplies, parts or power. No person is authorized to assume for Rapid Engineering any other warranty, obligation or liability.

LIMITATIONS ON AUTHORITY OF REPRESENTATIVES:

No representative of Rapid Engineering, other than an Executive Officer, has authority to change or extend these provisions. Changes or extensions shall be binding only if confirmed in writing by Rapid Engineering's duly authorized Executive Officer.

Attach this information to a wall near the RAPID™ heater.

Read the Installation, Operation, and Service Manual thoroughly before installation, operation, or service.

Know your model number and installed configuration.

Model number and installed configuration are found on the burner and in the Installation, Operation and Service Manual.

Write the largest clearance dimensions with permanent ink according to your model number and configuration in the open spaces below.

OPERATING INSTRUCTIONS

1. STOP! Read all safety instructions on this information sheet.
2. Open the manual gas valve in the heater supply line.
3. Turn on electric power to the heater.
4. Set the thermostat to desired setting.

TO TURN OFF THE HEATER

1. Set the thermostat to off or the lowest setting.

IF THE HEATER WILL NOT OPERATE, TO ENSURE YOUR SAFETY, FOLLOW THESE INSTRUCTIONS TO SHUT DOWN YOUR HEATER

1. Set the thermostat to off or the lowest setting.
2. Turn off electric power to the heater.
3. Turn off the manual gas valve in the heater supply line.
4. Call your registered installer/contractor qualified in the installation and service of gas-fired heating equipment.

⚠WARNING

Fire Hazard

Some objects can catch fire or explode when placed close to heater.

Keep all flammable objects, liquids and vapors the required clearances to combustibles away from heater.

Failure to follow these instructions can result in death, injury or property damage.

Maintain _____ clearance to the side and _____ clearance below the heater from vehicles and combustible materials.

Rapid Engineering
1100 Seven Mile Road, NW
Comstock Park, MI 49321
Telephone: 616.784.0500
Fax: 616.784.1910
Toll Free: 800.536.3461

Installation Code and Annual Inspections: All installations and service of RAPID™ equipment must be performed by a contractor qualified in the installation and service of equipment sold and supplied by Rapid Engineering and conform to all requirements set forth in the RAPID™ manuals and all applicable governmental authorities pertaining to the installation, service and operation of the equipment.

To help facilitate optimum performance and safety, Rapid Engineering recommends that a qualified contractor annually inspect your RAPID™ equipment and perform service where necessary, using only replacement parts sold and supplied by Rapid Engineering.

Further Information: Applications, engineering and detailed guidance on system design, installation and equipment performance is available through RAPID™ representatives. Please contact us for any further information you may require, including the Installation, Operation and Service Manual.

This product is not for residential use.

www.rapidengineering.com Printed in U.S.A. P/N 91037920 Rev A