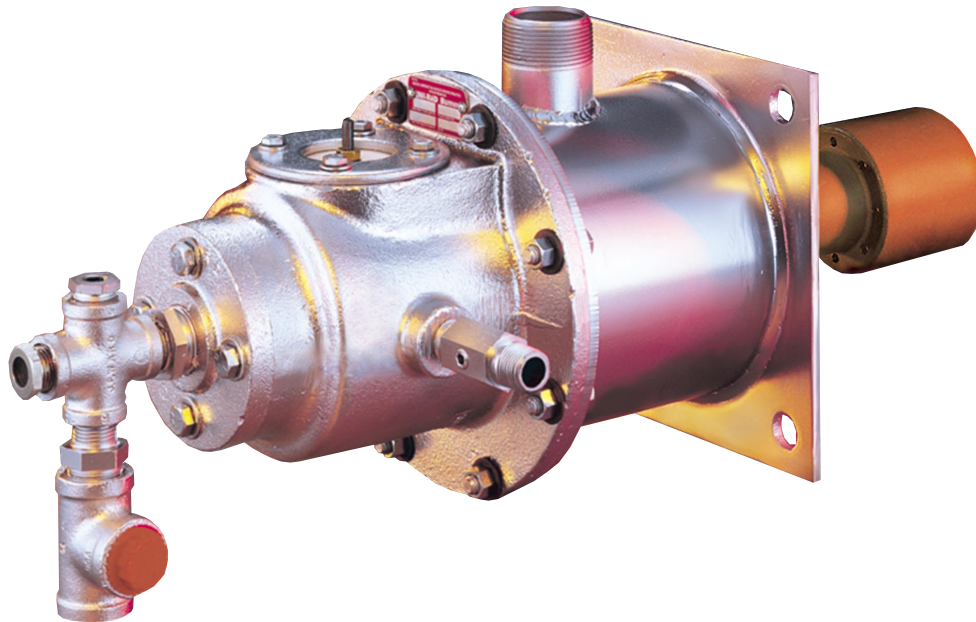


UNI-RAD[®]

Gas Fired Radiant Tube Burner System



The Maxon UNI-RAD[®] Burner System consists of two major components

UNI-RAD[®] Direct Spark Ignited Burner

MAX-SAVER[®] In-Situ Recuperator

When the above features are combined, they have shown:

- **Fuel savings ranging from 30% to 50% combined with:**
- **Increased alloy life** for decreased maintenance/rebuild costs
- **Improved furnace temperature uniformity** for better product quality
- **Improved production quality**

Features and Benefits

Maxon's UNI-RAD® Radiant Tube Burner produces an extremely stable and luminous flame envelope profile that maximizes heat transfer throughout the radiant tube. Flame ignition is maintained by a patented continuous spark system that ensures ignition each and every time. Options are available to operate with preheated combustion air to 1200°F (650°C) and the UNI-RAD® Burner fires on any clean fuel gas.

UNI-RAD® Features

- Plasma Type Ignition** Unlike most spark ignited burners, the UNI-RAD® Burner provides a zone of ionized air enriched with a small quantity of combustion gas to provide high energy ignition.
- Annular Ignition Electrodes** The UNI-RAD® Burner does not use a conventional spark plug; instead, the primary air and gas inlet tubes provide the electrical path for the ignition spark. This design feature provides many times the electrode area for extended life and positive burner ignition.
- Adjustable Flame Length** The flame length may be tailored to your specific needs by changing the combustion air to ignition air ratios. This simple adjustment allows the burner to obtain optimum tube temperature uniformity over a wide range of firing rates and preheated air temperatures.
- Wide Input Range** The unique design of the UNI-RAD® Burner allows it to operate over a large range of fuel gas inputs. Stability is maintained and flame length is controllable with firing rates ranging from as little as 80,000 Btu/hr input to as much as 700,000 Btu/hr.
- Instantaneous Ignition** The burner's continuous plasma spark provides instantaneous ignition allowing the burner to operate from the Duration Adjusting Type (DAT) output from a Proportional, Integral, Derivative (PID) Control Loop. When controlled using the appropriate valving, single point tube temperature variations may be reduced to as little as plus or minus 4° F (2.2°C).
- Flame Supervision** The UNI-RAD® Burner may be used in conjunction with UV flame supervision equipment.
- Super Forced Cooling** In applications requiring rapid cooling, the UNI-RAD® Burner has been used with secondary cooling manifolds to provide high rates of heat removal using conventional radiant tubes. The UNI-RAD® Burner can sustain radiant tube pressure in excess of 10 PSIG (0.7 bars).
- Radiant Tube Types** The UNI-RAD® System is suitable for use on **customer-supplied** pressure tubes, negative pressure tubes, and electrified radiant tubes.

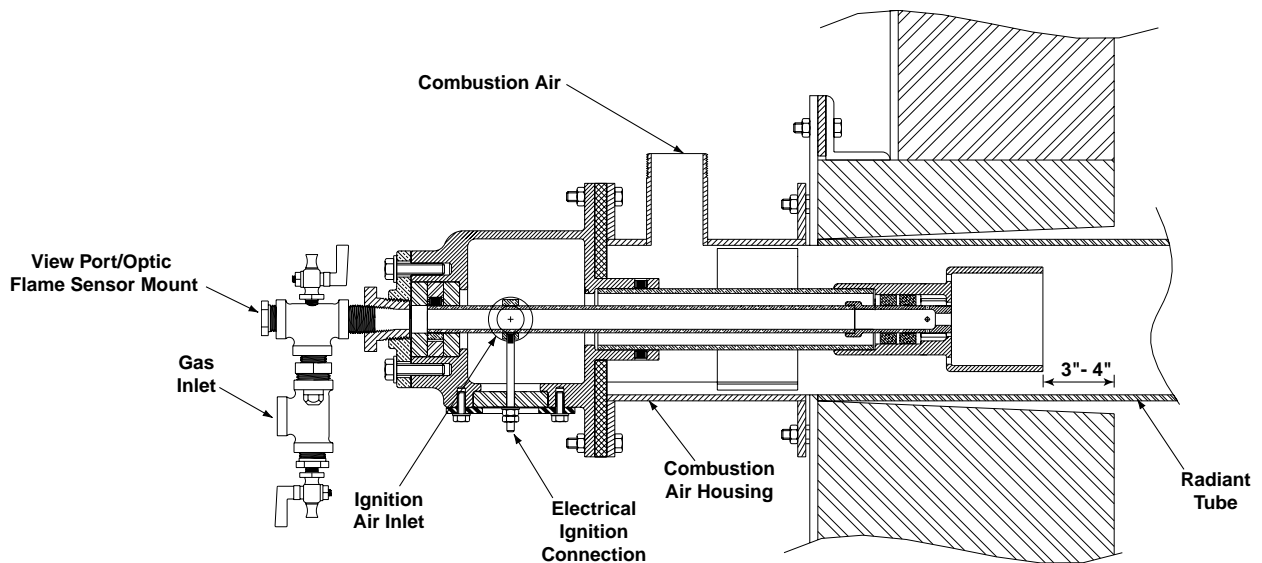
Modes Of Operation

The UNI-RAD® Burner can be operated in the following control modes:

- Proportional control over the entire firing rate range
- High-Low
- ON-OFF
- Pulse-Fired

The Pulse-Fired control mode is recommended, as it produces the tightest temperature control available while also maximizing furnace alloy life.

Burner Selection Criteria



Burner Selection

The UNI-RAD Burner can be used with various radiant tube sizes, tube configurations, heat inputs, etc. The following information should be supplied to assist Maxon in matching the correctly sized UNI-RAD Burner to your specific application:

1. Radiant tube inside and outside diameters
2. Radiant tube configuration
3. Furnace or process temperature
4. Radiant tube length
5. Radiant tube material
6. Method of mounting (standard flange, packing gland, etc.)
7. Furnace wall thickness (see page 4800-S-1 for mounting instructions)
8. Requirement for heat recuperation (if used)

Typical Burner Firing Rates

Housing Size (inches)	Natural Gas Flow (CFH) and Btu/hr Capacity x 1000 Btu/hr	Combustion Air CFM
4"	151	28
4.5"	170	31
5"	188	35
6"	226	41
7"	264	48
8"	302	55

Note: Burner firing rate is based on:

1. 1000 Btu/CF Natural Gas
2. 120" total "U" tube length within chamber
3. 2% excess oxygen and 0% combustibles
4. 100 Btu/sq.in. of tube surface area

The table at left gives typical maximum capacities for the conditions shown. The UNI-RAD Burner has been used with firing rates ranging from 80,000 Btu/hr to 700,000 Btu/hr, depending upon tube length and diameter.

Radiant Tube Life

Competitive burner systems stress the fuel savings obtained by the use of combustion air preheated to 800° to 1000° from waste heat energy. The fact that preheated air produces much higher flame temperatures, and consequently decreases furnace alloy life is generally ignored. The UNI-RAD system overcomes this problem through the use of pulse firing and has consistently shown increases in the furnace alloy life while saving fuel. An extensive number of UNI-RAD Burner users have increased their radiant tube life by as much as 300%.

UNI-RAD Burners have also successfully been applied to silicon carbide tubes. These tubes can handle higher operating temperatures than most alloy tubes, and allows for increased heat flux.

Construction

The UNI-RAD Burner is constructed of cast iron and carbon steel with internal components constructed of stainless steel. The air inlet tube length must be specified when ordering to provide for differences in the furnace wall thickness.

Burner Selection Criteria

Piping

The gas and air piping for the UNI-RAD Burner is simple and direct. As shown in the piping schematic below, each UNI-RAD Burner uses one fuel gas line, one primary ignition air line, and one main combustion air line.

Gas Metering

A custom drilled gas spud orifice on each burner sets the desired capacity. Typical gas pressure requirements at the burner range from 8" – 24" w.c. depending upon customer requirements.

Air Metering

Combustion air flow is metered with a Limiting Orifice Valve (LOV) located prior to the inlet of the recuperator. A minimum of supply air pressure of 10" w.c. at the inlet to the recuperator is usually required. Higher pressures may be necessary, depending upon burner capacity, or how the recuperator is sized.

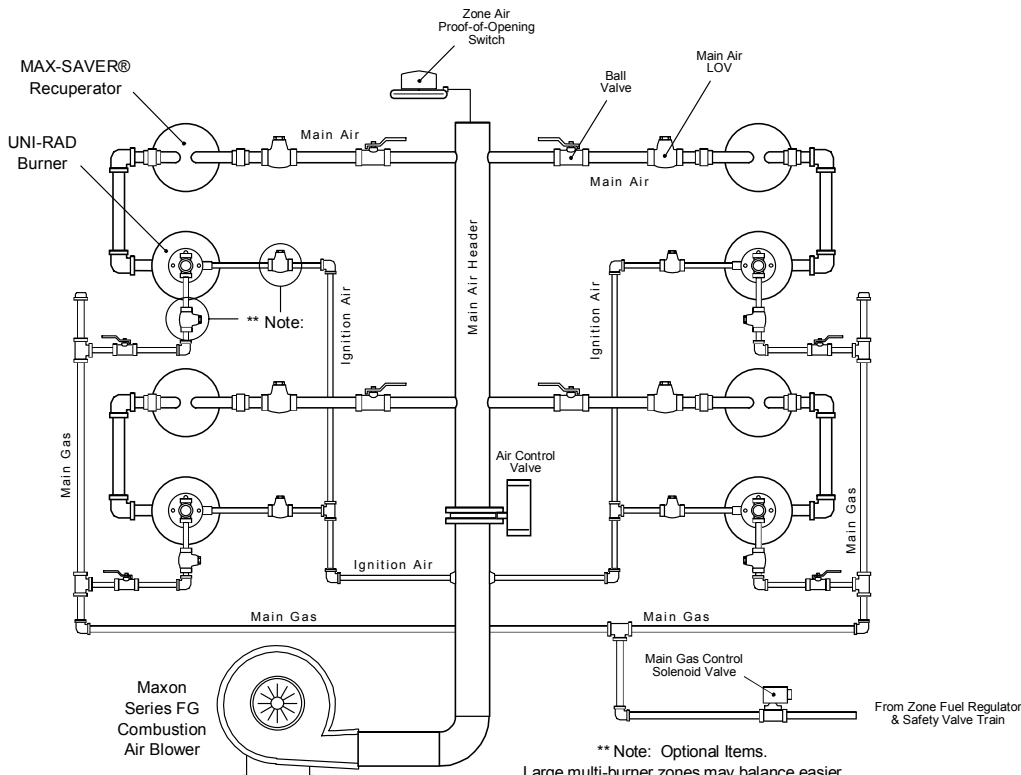
Primary ignition air is usually less than 7% of total air to the burner. The custom drilled air orifice in the ignition air pipe assembly sets the value. An LOV is sometimes used as a trim device to field optimize the burner ignition. The primary air is never throttled. It is kept on at all times.

CAUTION: If main air ball valve is inadvertently closed, raw gas may be delivered to the tube, possibly creating an explosive condition.

Conclusion

The UNI-RAD Burner system has been successfully applied to a variety of furnaces. Its success is due not only to the quality of our equipment, but also to a careful evaluation of each application. We work with our customers to assure that every aspect of their combustion system is designed for optimum performance. Please contact your local Maxon representative for assistance.

Typical Piping Schematic (Four Burners)



**** Note: Optional Items.**
 Large multi-burner zones may balance easier with individual main gas LOV's on each burner.
 Ignition air can be set easier with individual ignition air LOV 's on each burner.

MAX-SAVER® U-Shaped In-Situ Recuperator

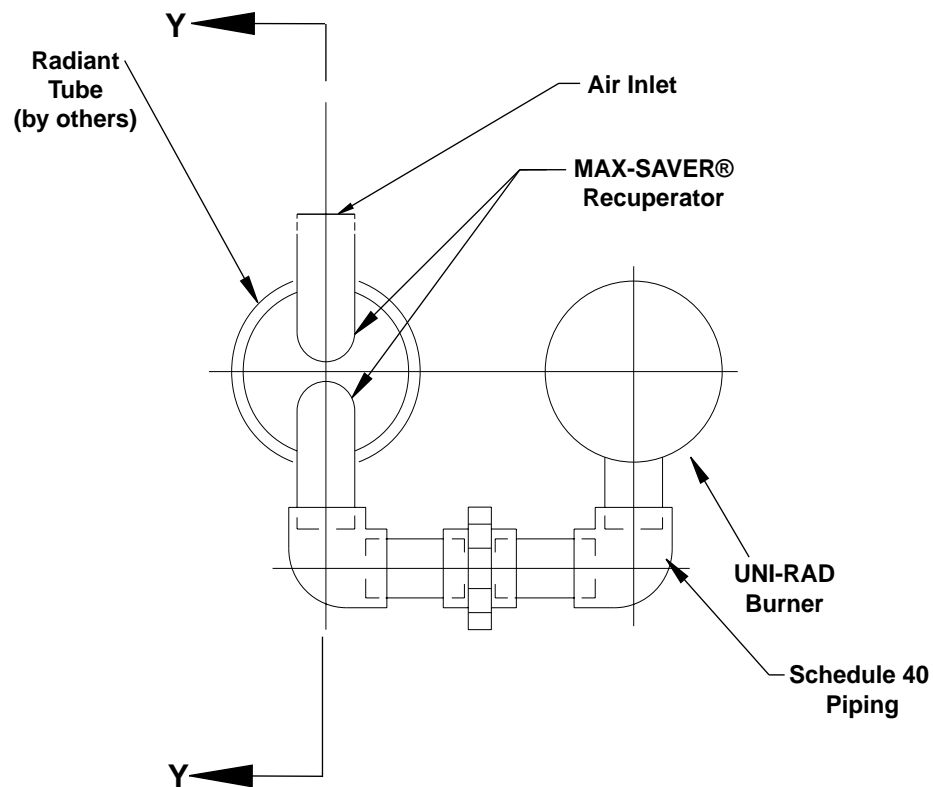
The Maxon UNI-RAD Burner System consists of two major components:

- UNI-RAD Direct Spark Ignited Burner
- MAX-SAVER® In-Situ Recuperator

When these features are combined, they provide the following advantages over existing systems:

- Fuel savings ranging from 25% to 50% over non-recuperative systems
- Increased alloy life
- Improved furnace temperature uniformity
- Improved production quality
- Long recuperator life

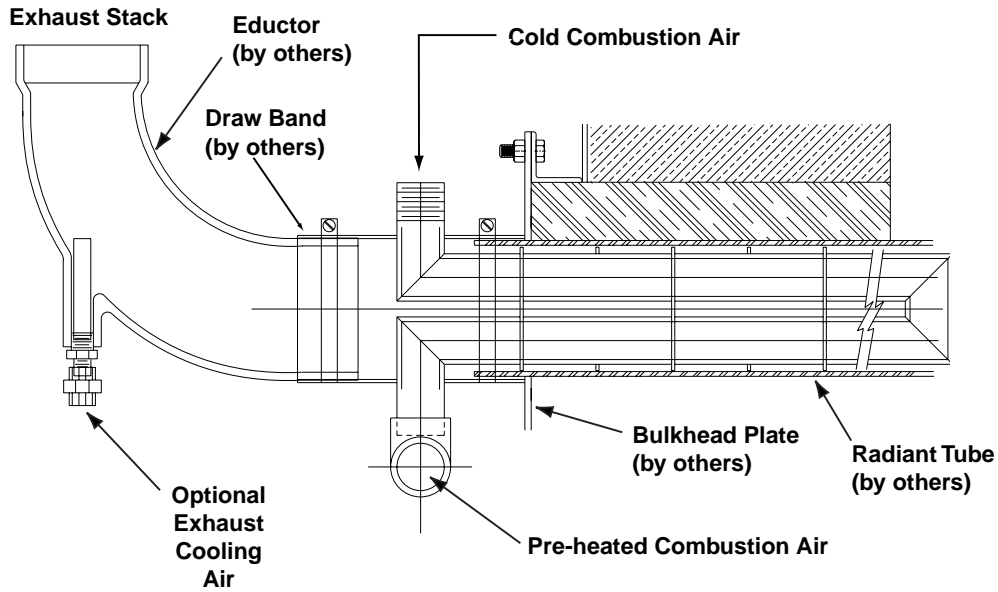
Typical Burner / Recuperator Layout



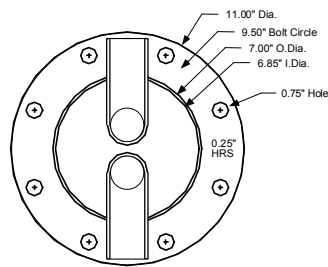
Section Y-Y shown on page 4806

MAX-SAVER[®] U-Shaped In-Situ Recuperator

Section View Y-Y

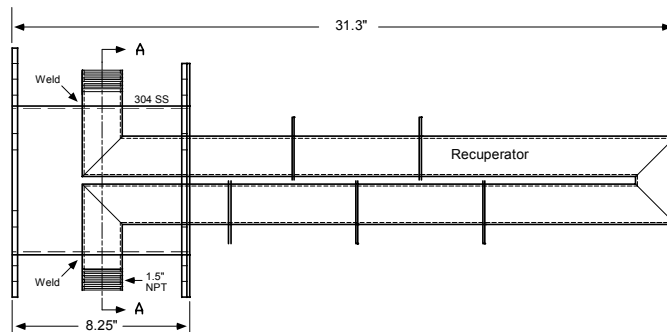


Draw Bands (by Maxon)



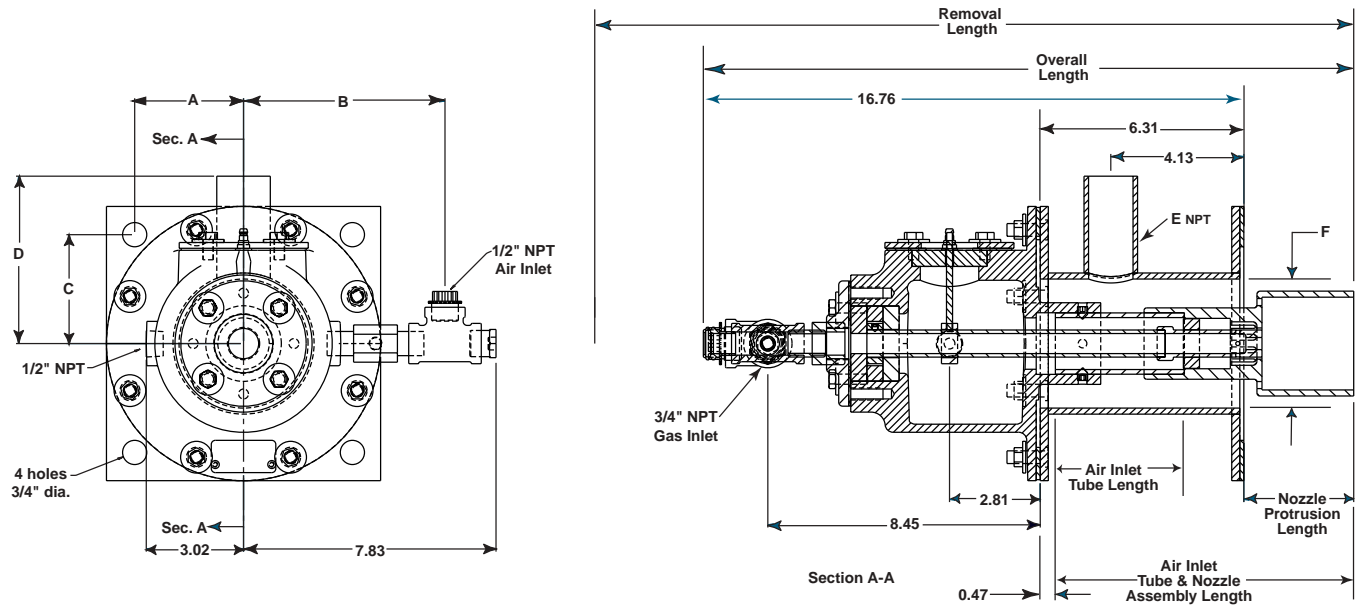
Custom draw band designs are available from Maxon by special request.

Section A - A



Dimensions (in inches)

UNI-RAD Burners - used with metal tubes



Housing Size*	A	B	C	D	E NPT	F I.D.
1.25 4 UR	3.38	6.25	3.38	5.19	1-1/4"	4.0
1.25 5 UR	3.38	6.25	3.38	5.19	1-1/4"	5.0
1.5 4 UR	3.38	6.23	3.38	5.19	1-1/2"	4.0
1.5 5 UR	3.38	6.23	3.38	5.19	1-1/2"	5.0
1.5 6 UR	3.38	6.23	3.38	5.19	1-1/2"	6.0
1.5 7 UR	3.38	6.23	3.38	5.19	1-1/2"	7.0
2 6 UR	3.63	6.25	3.63	7.19	2"	6.0
2 7 UR	3.63	6.25	3.63	7.19	2"	7.0
2 8 UR	3.63	6.25	3.63	7.19	2"	8.0

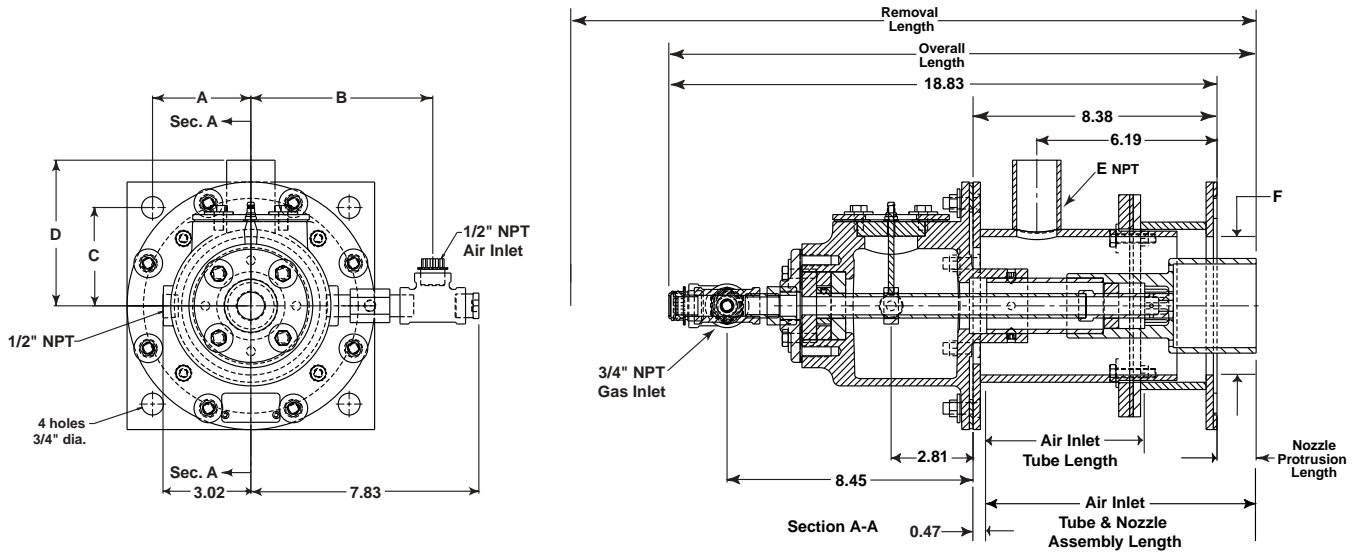
*Refers to size of burner housing; dimension "E" (NPT) and dimension "F" (inside diameter)

Air Inlet Tube Length	Removal Length	Overall Length	Nozzle Protrusion Length	Air Tube & Nozzle Assembly Length	Gas Tube Assembly
4.0"	29.0"	20.2"	3.4"	9.25"	11.75"
7.0"	32.0"	23.2"	6.4"	12.25"	14.75"
9.5"	34.5"	25.7"	8.9"	14.75"	17.25"
11.5"	36.5"	27.7"	10.9"	16.75"	19.25"
13.5"	38.5"	29.7"	12.9"	18.75"	21.25"
15.5" [1]	40.5"	31.7"	14.9"	20.75"	23.25"
17.5" [1]	42.5"	33.7"	16.9"	22.75"	25.25"

[1] Available by special request.

Dimensions (in inches)

UNI-RAD Burners - used with silicon carbide tubes



Housing* Size	A	B	C	D	E NPT	F I.D.
1.25 4.5C UR	3.38	6.25	3.38	5.19	1-1/4"	4.5
1.5 6C UR	3.38	6.25	3.27	5.19	1-1/2"	6.0

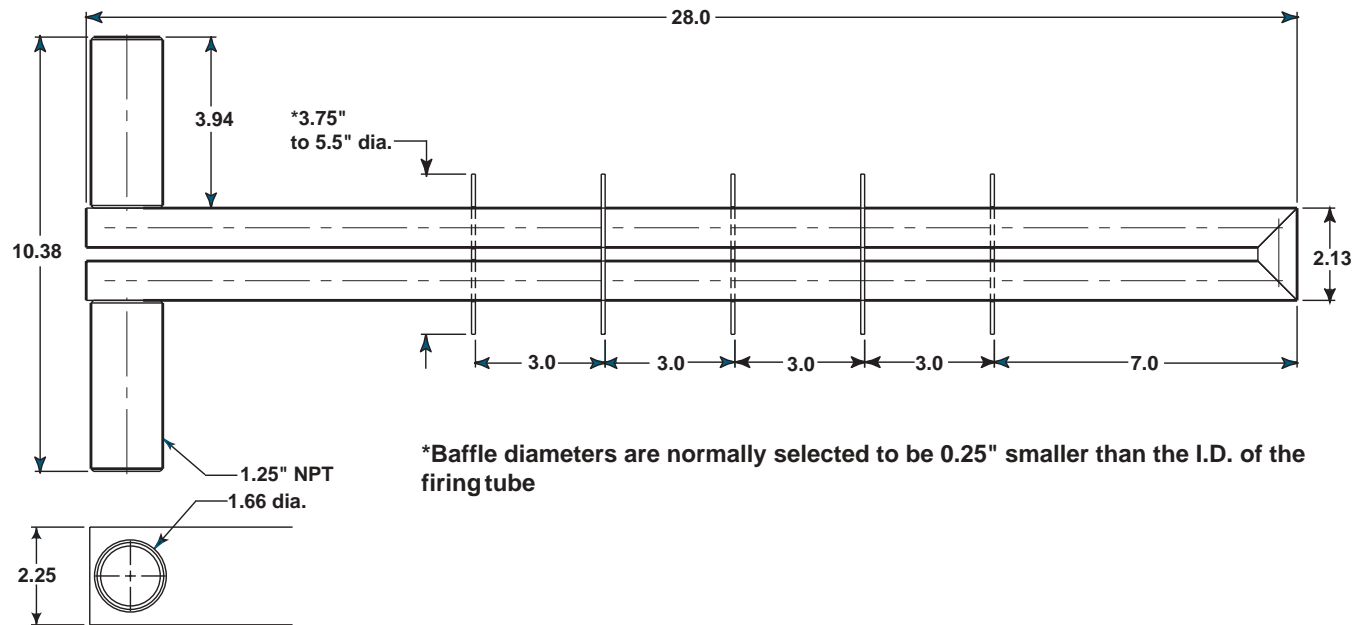
*Refers to size of burner housing; dimension "E" (NPT) and dimension "F" (inside diameter)

Air Inlet Tube Length	Removal Length	Overall Length	Nozzle Protrusion Length	Air Tube & Nozzle Assembly Length	Gas Tube Assembly
4.0"	31.0"	20.2"	1.3"	9.25"	11.75"
7.0"	34.0"	23.2"	4.3"	12.25"	14.75"
9.5"	36.5"	25.7"	6.8"	14.75"	17.25"
11.5"	38.5"	27.7"	8.8"	16.75"	19.25"
13.5"	40.5"	29.7"	10.8"	18.75"	21.25"
15.5" [1]	42.5"	31.7"	12.8"	20.75"	23.25"
17.5" [1]	44.5"	33.7"	14.8"	22.75"	25.25"

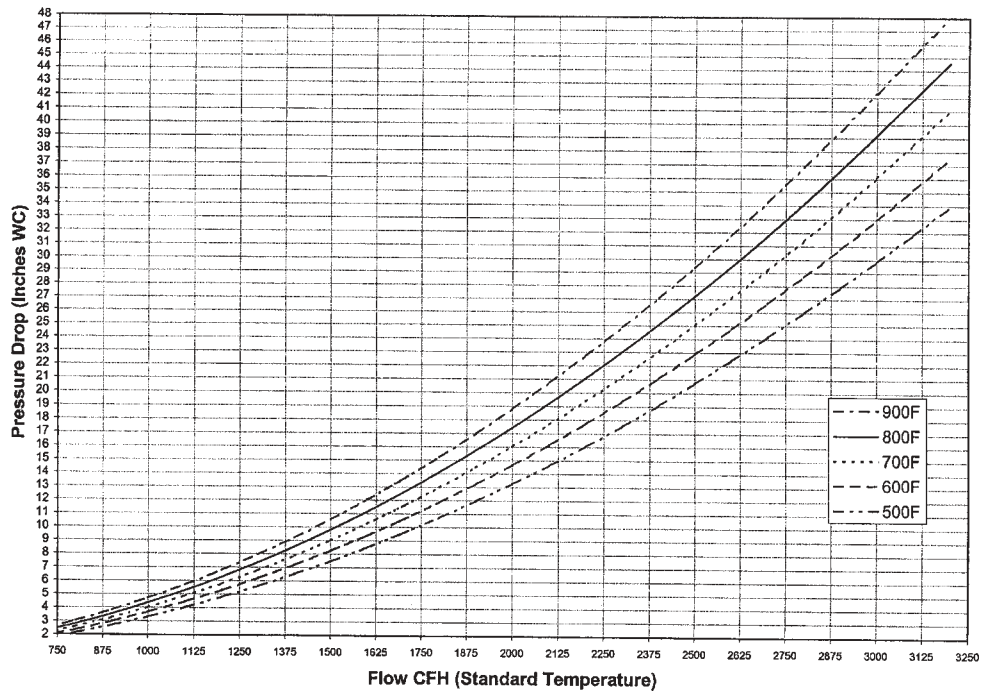
[1] Available by special request.

Dimensions (in inches)

MAX-SAVER Recuperator - 1.25"

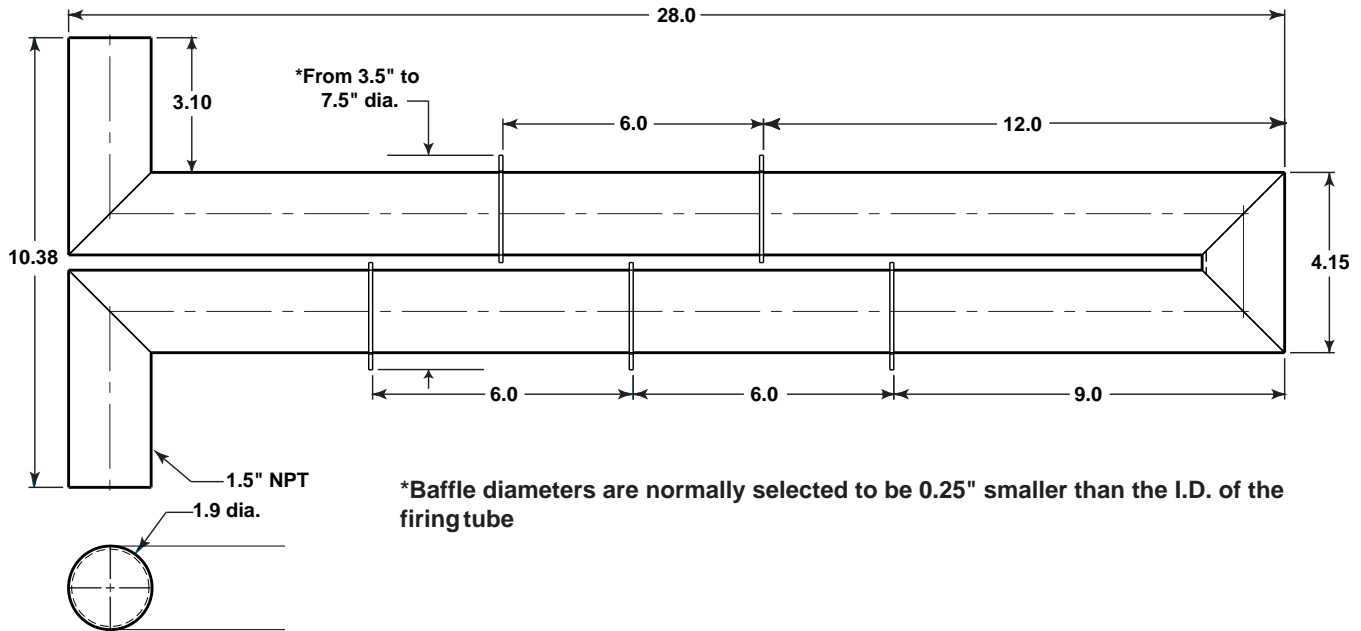


MaxSaver® 1.25" Recuperator
Pressure Drop vs. Flow at Various Preheat Temperatures

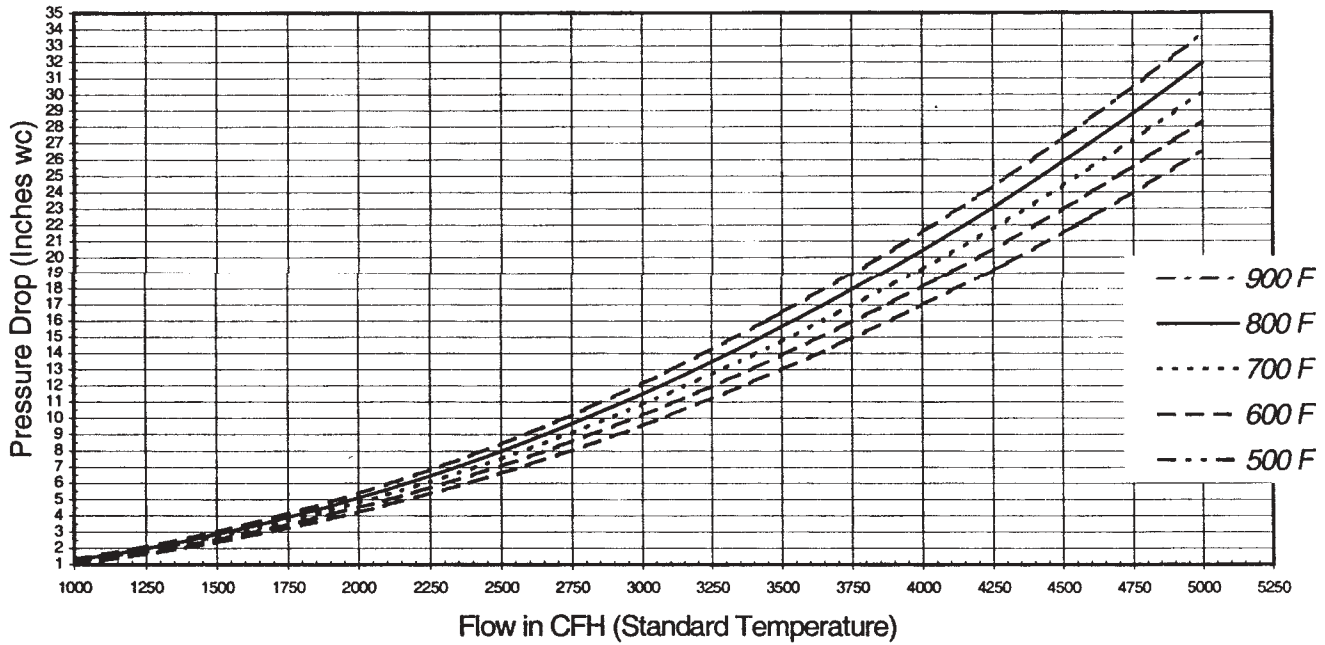


Dimensions (in inches)

MAX-SAVER Recuperator - 1.5"

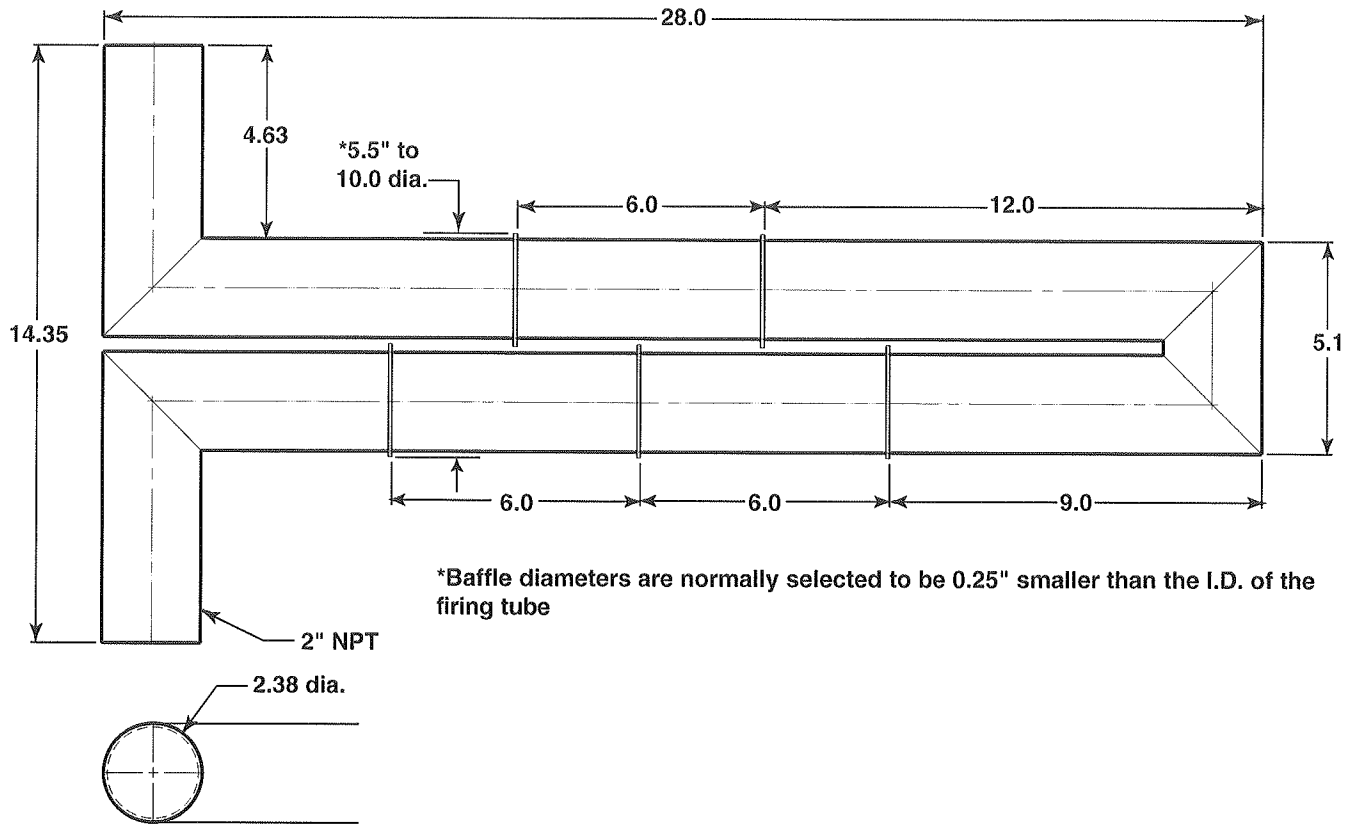


MaxSaver® 1.5" Recuperator
Pressure Drop vs. Flow at Various Preheat Temperatures

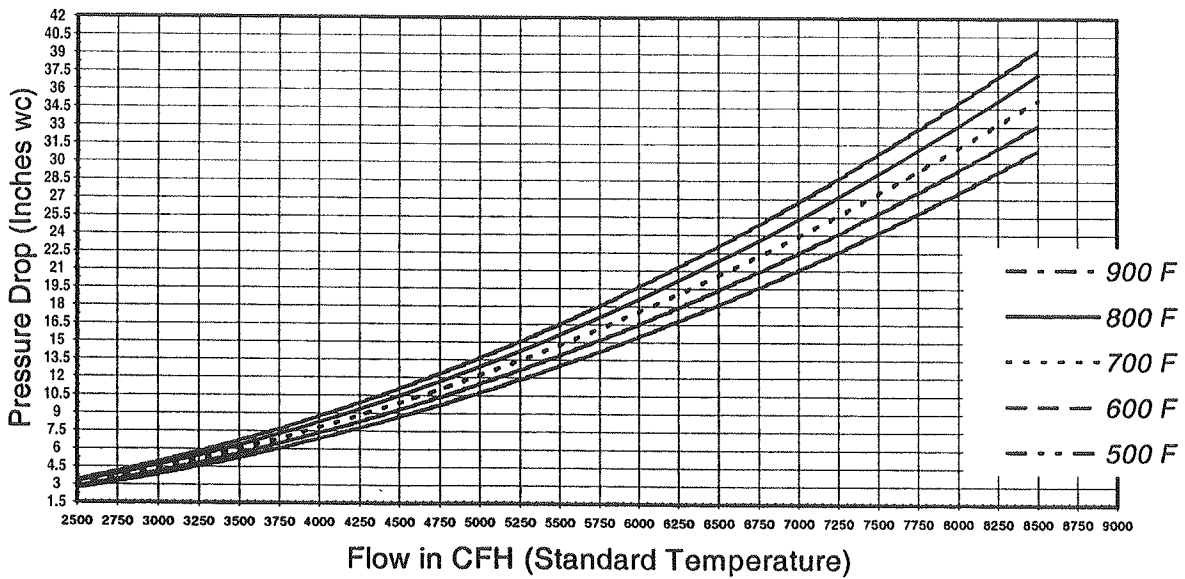


Dimensions (in inches)

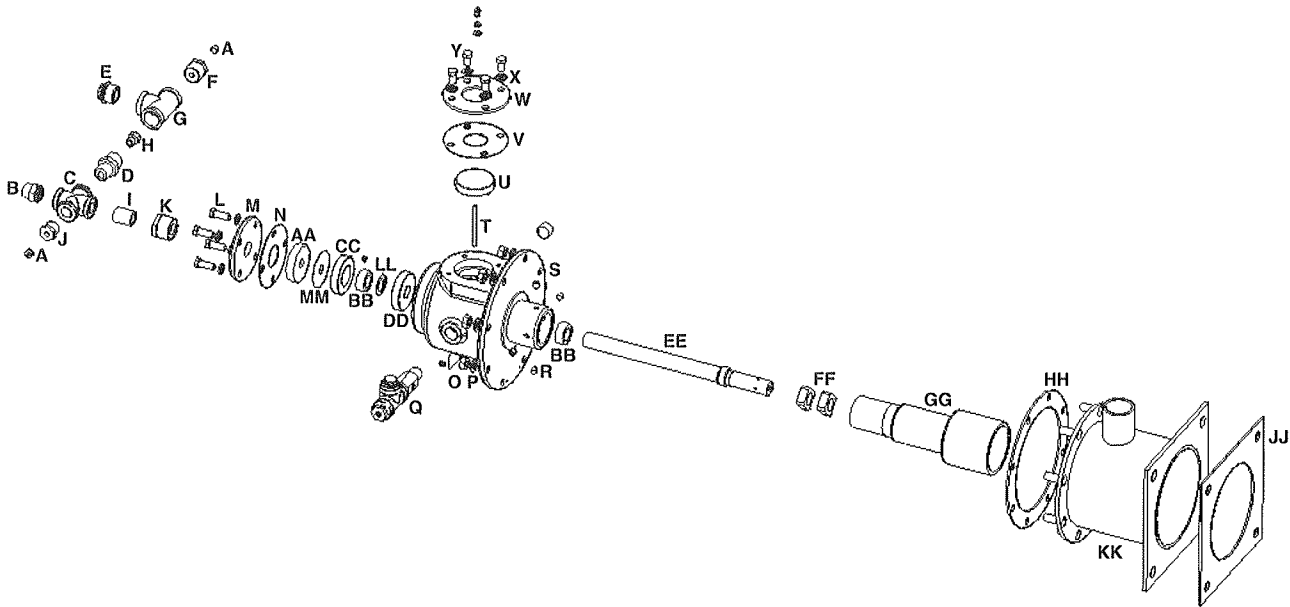
MAX-SAVER Recuperator - 2"



MaxSaver® 2" Recuperator
Pressure Drop vs. Flow at Various Preheat Temperatures



UNI-RAD Burner Component Identification

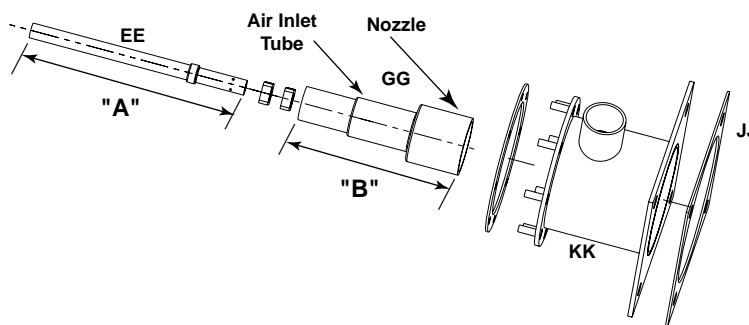


Item	Part Number	Description
A	20410	.125" HLW PIPE PLUG
B	19284	.5" NPT OBSVTN GL
C	57943	.5" MALL CR
D	57942	.5" -27 SPUD HLDR
E	20160	.75" CA-PLUG
F	57939	.75" X .125" STL HEX BSHG
G	26284	.75" X .75" X .75" MALL TEE
H	57940	.5" - 27 BR SPUD - MAIN GAS
I	20443	.5" BLK STL CLS NPL
J	21012	.5" X .125" STL HEX BSHG
K	37072	1" X .5" STL HEX BSHG
L	54510	M8 X 25 ISO4017 PLTD HEX
M	17318	1" FLG
N	1050577	UNI-RAD BRNR GSKT
O	54512	M8-1.25 PLTD FIN HEX NU
P	1039932	M8-PLN ISO 7089 WSHR CLS
Q	1053385	UNI-RAD IGN AIR PIPE ASY
R	1053397	M9X10 CONE PT SET SCR
S	1053214	BRNR HSG

Item	Part Number	Description
T	57956	IGN ROD
U	57968	.25" IDE INSL
V	1050577	UNI-RAD BRNR GSKT
W	57970	IGN INSL RETN FLG
X	1039932	M8-PLN ISO 7089 WSHR CLS
Y	1046010	M8X16 ISO4017 SS HEX HD
Z	53529	IGN TERM CAP
AA	1050671	.625" ID CRMC INSL
BB	57947	GAS INLT HLDG CLR
CC	57955	1.375" ID INSL
DD	57948	.875" ID INSL
EE	---	GAS INLT TB ASY
FF	57971	CRMC CNTRG SPDR
GG	---	AIR TUBE & NOZZLE ASY
HH	58030	BRNR CSTG GSKT
JJ	---	AIR INLT GSKT
KK	---	BRNR AIR INLT HSG
LL	1114783	UNI-RAD SM BRNR GSKT
MM	1114784	UNI-RAD LG BRNR GSKT

For part numbers of shaded items, see next page

UNI-RAD Burner Component Identification



Item "EE" - Gas Inlet Tube Assembly

Air Inlet Tube Length	Dimension "A" Gas Inlet Tube Assembly Length	EE GAS INLT TB ASY
4.0"	11.75	58058
7.0"	14.75	57959
9.5"	17.25	58050
11.5"	19.25	58054
13.5"	21.25	1041716
15.5" [1]	23.25	1053155
17.5" [1]	25.25	1053156

Item "GG" - Air Tube & Nozzle Assembly

Air Inlet Tube Length	Dimension "B" Air Tube & Nozzle Assembly Length	GG AIR TUBE & NOZZLE ASY
4.0"	9.25	58056
7.0"	12.25	57958
9.5"	14.75	58048
11.5"	16.75	58052
13.5"	18.75	1053137
15.5" [1]	20.75	1053138
17.5" [1]	22.75	1053139

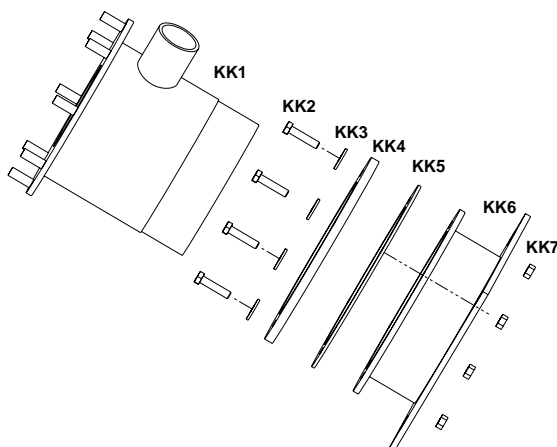
NOTE: Air tube and nozzle available only as an assembly, not separate items

Item "JJ" - Air Inlet Gasket

Housing Size	JJ AIR INLT GSKT
1.25 4 UR	57975
1.25 4.5C UR	57976
1.25 5 UR	57976
1.5 4 UR	57975
1.5 5 UR	57976
1.5 6 UR	58286
1.5 6C UR	58286
1.5 7 UR	58283
2 6 UR	1053360
2 7 UR	1053360
2 8 UR	1053360

Item "KK" - Burner Air Inlet Housing for alloy tubes (pictured above)

Housing Size	KK BRNR AIR INLT HSG
1.25 4 UR	1053164
1.25 5 UR	1053065
1.5 4 UR	1053166
1.5 5 UR	1053167
1.5 6 UR	1053068
1.5 7 UR	1053169
2 6 UR	1053170
2 7 UR	1053171
2 8 UR	1053172



Item "KK" - Burner Air Inlet Housing for silicon carbide tubes (pictured at left)

Tube Size	KK1 Housing	KK2 Screw	KK3 Washer	KK4 Ring	KK5 Gasket	KK6 Plg Gland	KK7 Nut
4.5" C	1053173	54630	1039932	1053232	1053250	1053233	54625
6" C	1053174	54630	1039932	1053236	1053251	1053235	54625

[1] Available by special request.

Notes

Installation Instructions

All instructions may be superceded by applicable NFPA codes.

General Instructions

Important: Do not discard packing material until all loose items are accounted for.

To prevent damage in transit, some components may be packed separately and shipped loose with your new Maxon UNI-RAD® Burner.

The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation.

Mounting

The UNI-RAD® Burner is mounted by bolting the air housing to the furnace shell, with the combustion air inlet nipple oriented for piping convenience. The burner body is then bolted onto the air housing which can also be oriented for piping convenience. The UNI-RAD® Burner is shipped with the air housing/burner body nuts installed loosely. These should be hand-tight before installation is complete.

Combustion Air Supply

Combustion air can be supplied either directly from a blower or pre-heated up to 800°F. Higher pre-heat temperatures may be available. Contact Maxon for more information. The UNI-RAD® Burner is a low pressure burner and typically requires 2 inches w.c.

combustion air supply pressure or less. The burners are typically piped into multiple burner zones using common air and gas manifolds. It is not uncommon to control 5 to 10 burners on the same zone.

Ignition Air

The UNI-RAD® Burner ignition air is a constant supply of air piped into the burner body and is typically between 2% and 7% of the total air required to complete combustion.

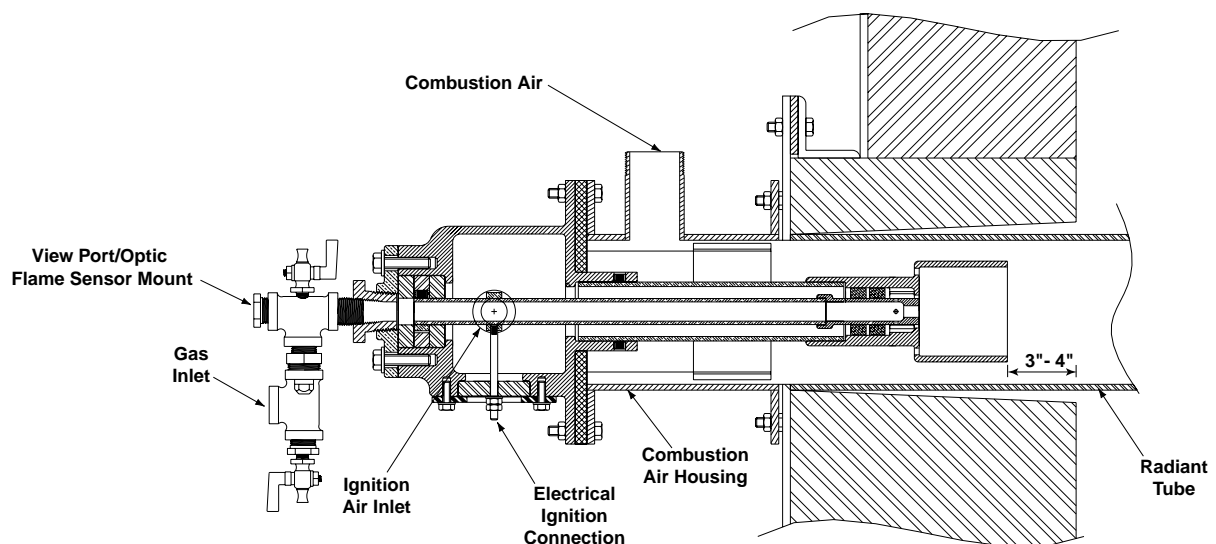
Ignition

The UNI-RAD® Burner ignition is provided by a continuous plasma arc inside the burner. The electrical energy to produce this arc is provided by a continuous duty ignition transformer mounted near the burner in a cool environment. The transformer is generally turned on via an auxiliary contact in the safety shut-off valve, assuring that whenever gas is available to the burner, the ignition transformer is on.

Flame Safety

The UNI-RAD® Burner generally operates without flame safety, but in those situations where it is required, UV and IR (infrared) scanners have been used successfully. Please contact Maxon for details.

CAUTION: When connecting optic flame sensors to gas tube/view port, a quartz isolation lens is recommended between the gas tube and optic flame sensors.



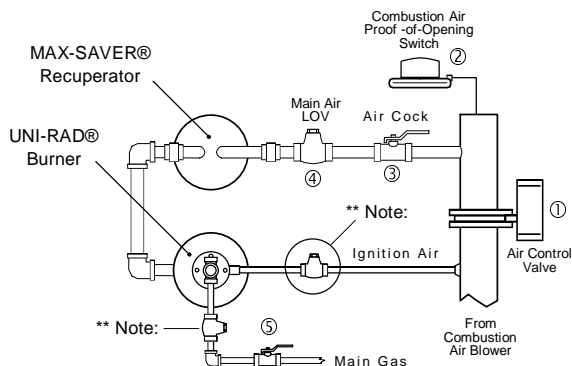
Start-up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burners take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.

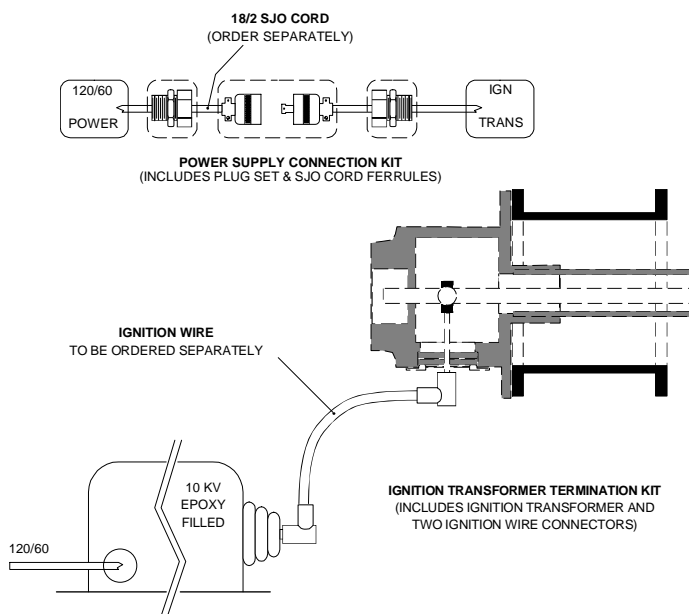
1. Close the main, zone and burner gas valves ⑤.
2. Turn on the main power supply.
3. Set the temperature control instrument to a sufficient set-point to ensure the burner is "on".
4. Start the combustion air blower. Check impeller rotation.
5. Verify that the combustion air pulse firing valve ① is fully open and then set the proof-of-opening switch ② so that the contact closes only when the air pulse firing valve is fully open.
6. Open the burner air shut-off valve ③ (ball valve or equivalent) and main air limiting orifice valve ④ to the fully open position.
7. Set the high and low gas pressure switches on the main fuel train to 5 inches w.c. above and below the main gas pressure regulator, respectively.
8. Open the main gas cocks in the main fuel train (not pictured).
9. Open the safety shut-off valve and verify that the ignition transformer is energized and that the high voltage lead is properly installed on the burner.
10. Open the zone gas cock (not pictured).
11. While looking into the burner sight glass, slowly open the burner gas valve ⑥. Ignition commencement should be immediate. Flame should be a light yellow to yellow-orange in appearance. Using some type of pressure measuring device, verify the gas pressure delivered to the burner spud.
12. Look into the exhaust leg of the radiant tube and look for the flame position. Open or close the limiting orifice valve ④ in the combustion air line until the flame length is maximized. Using an oxygen analyzer, adjust the combustion air limiting orifice valve ④ until 2-1/2% excess oxygen is measured in the exhaust. The exhaust gas sample should be taken approximately halfway up the MAX-SAVER® Recuperator, or to the inside edge of the refractory wall, if possible. If a MAX-SAVER® Recuperator is being used, it is desirable for the flame to bend all the way around the radiant tube and lick the end of the recuperator return bend when at operating temperature.
13. Oxygen settings should always be confirmed at operating conditions. O₂ readings will normally be lower when taken during hot operating conditions compared to cold start-up conditions.

Typical Piping Schematic (one burner shown)



** Note: Optional Items.
Large multi-burner zones may balance easier with individual main gas LOV's on each burner.
Ignition air can be set easier with individual ignition air LOV's on each burner.

Ignition Transformer



Maxon practices a policy of continuous product improvement. It reserves the right to alter specifications without prior notice.

CORPORATION
MUNCIE, INDIANA, USA

INDUSTRIAL COMBUSTION EQUIPMENT AND VALVES