# RadMax™ Burners


- **Durable, industrial-quality cast iron body construction** with stainless steel tile retainers
- **Direct spark/flame sensing port** for simple, reliable ignition and flame detection
- **Easy tile replacement —** spring clip assembly requires no tools for removal
- **Radiant face temperatures from 1050°F to 1650°F** deliver uniform heat for a variety of processes
- **Rapid heat up and cool down** eliminates the need to rotate burner heads away from product
- **Low profile design** operates in horizontal or vertical applications to accommodate limited space applications
- **No wire screens required** to stabilize combustion on the burner face
- **Low manifold pressures** for normal operation: 4.5" - 5" wc nominal (11.2 – 12.5 mbar)
- **Manifolds can be arranged to allow for multi-width/multi-length operation of burner sections**
- **Retrofit Maxon P/S Radiant II applications by installing RadMax™ on existing manifolds**
- **Can be used in ovens/chambers up to 500°F (260°C).**

MAXON®
CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone (765) 284-3304. Fax: (765) 286-8394

# RadMax™ Burners

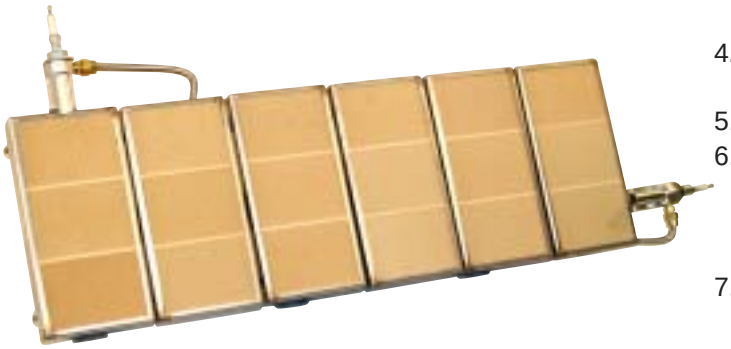
RadMax™ Burners are designed to deliver uniform, high intensity radiant energy for moisture removal in textile and paper ovens, paint drying, and powder coating, as well as many pre-heat, plastic forming, heat treating and annealing operations.

## Benefits

RadMax™ Burners can economically increase production rates, reduce seconds and defects caused by improper or uneven heating or drying, and reduce down time and maintenance costs when the need for service or repair arises.

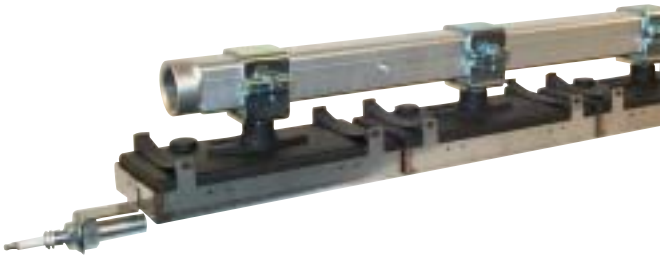
*Front view – Type 13 assembly*

*Front view – Type 25 (end-to-end) assembly*



*Front view – Type 50 (side-to-side) assembly with direct spark/flame sensing ports*

*Rear view – Type 50 assembly*



*Side view – Type 25 assembly*

## Specifications

1. RadMax™ Burners are full premix fuel/air and will operate on both natural and propane gas. Manifold mixture pressures at the burner range from 1" – 6" wc (2.5 – 15 mbar).
2. The three-tile burner heads have a nominal heat input of 25,000 Btu/hr (7.3 kW).
   **NOTE:** Most systems are designed to nominal capacities. Reduced or extended capacities are possible. Contact Maxon for more information.
3. Normal operating face temperatures range from 1050°F – 1650°F (565°C – 900°C).
4. Burner heads are cast iron bodies with stainless steel tile retainers.
5. Burner tiles are high efficiency, high emissivity tiles.
6. RadMax™ Burner heads have a quick connect feature to remove and replace individual burner heads without removing the whole manifold assembly from the oven.
7. Tiles in the burner head are held in place by spring clip retainer frames. **There are no bolts or nuts to be removed if tiles need to be replaced.**
8. Type 25 and Type 50 utilize the same burner heads. Type 25 are assembled end-to-end; Type 50 are assembled side-to-side.
9. Can be used in ovens/chambers up to 500°F (260°C).



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# Specifications / Design Details

## Radiant Energy - source and transfer

The quantity of radiant energy the RadMax™ Burner system is capable of supplying is a function of the surface area, emissivity and temperature of the burner tile(s). The effective surface area of a Type 25, Type 50 or Type 13 burner tile is **0.37 ft² (0.034 m²)**. Emissivity is defined as the measure of the ability of a material to radiate energy. It is expressed as a number from 0.0 – 1.0. The nominal emissivity for the RadMax™ Burner tile is **0.92** @ 1500°F (815°C) or **0.94** at room temperature. The maximum operating temperature for the RadMax™ Burner tile is 1650°F (900°C).

To determine the radiant heat transfer or heat flux from the RadMax™ Burner system to the work, the temperature and emissivity of the work must be known. Refer to the following table to determine the maximum heat flux between one square foot of RadMax™ Burner and the work at a given temperature. Correct for the emissivity of the work by multiplying the value from the table by the work's emissivity. (The table is corrected for the burner tile's emissivity.)

For example, if we assume the work temperature is 200°F and its emissivity is 0.80, the energy transfer rates per square foot at various tile temperatures are as illustrated below.

**RadMax™ Burner tile temperature = 1400°F**
From the table below, we determine
the heat flux to be 18,600 Btu/ft²/hr x 0.80 emissivity

**= 14,880 Btu/ft²/hr**

**RadMax™ Burner tile temperature = 1600°F**
From the table below, we determine
the heat flux to be 28,000 Btu/ft²/hr x 0.80 emissivity

**= 22,400 Btu/ft²/hr**

**Metric table appears on next page.**

## Radiant Heat Transfer Rate (in 1000's Btu/ft²/hr)

| Temperature of Work °F [1] | Temperature of RadMax™ Burner Tile (°F) (Emissivity corrected for temperature) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1100 | 1150 | 1200 | 1250 | 1300 | 1350 | 1400 | 1450 | 1500 | 1550 | 1600 | 1650 |
| 0 | 9.4 | 10.6 | 12.0 | 13.5 | 15.1 | 16.9 | 18.8 | 20.9 | 23.2 | 25.6 | 28.2 | 31.0 |
| 100 | 9.3 | 10.5 | 11.9 | 13.4 | 15.0 | 16.8 | 18.8 | 20.8 | 23.1 | 25.5 | 28.1 | 30.9 |
| 200 | 9.1 | 10.4 | 11.8 | 13.3 | 14.9 | 16.7 | 18.6 | 20.7 | 22.9 | 25.4 | 28.0 | 30.8 |
| 300 | 8.9 | 10.2 | 11.5 | 13.0 | 14.7 | 16.5 | 18.4 | 20.5 | 22.7 | 25.1 | 27.8 | 30.6 |
| 400 | 8.6 | 9.8 | 11.2 | 12.7 | 14.3 | 16.1 | 18.0 | 20.1 | 22.4 | 24.8 | 27.4 | 30.2 |
| 500 | 8.1 | 9.3 | 10.7 | 12.2 | 13.9 | 15.6 | 17.6 | 19.7 | 21.9 | 24.3 | 26.9 | 29.7 |
| 600 | 7.4 | 8.7 | 10.1 | 11.6 | 13.2 | 15.0 | 16.9 | 19.0 | 21.3 | 23.7 | 26.3 | 29.1 |
| 700 | 6.6 | 7.8 | 9.2 | 10.7 | 12.3 | 14.1 | 16.0 | 18.1 | 20.4 | 22.8 | 25.4 | 28.2 |
| 800 | 5.4 | 6.7 | 8.1 | 9.6 | 11.2 | 13.0 | 14.9 | 17.0 | 19.3 | 21.7 | 24.3 | 27.1 |
| 900 | 4.0 | 5.3 | 6.6 | 8.1 | 9.8 | 11.6 | 13.5 | 15.6 | 17.9 | 20.3 | 22.9 | 25.7 |
| 1000 | 2.2 | 3.5 | 4.8 | 6.4 | 8.0 | 9.8 | 11.7 | 13.8 | 16.1 | 18.5 | 21.1 | 24.0 |
| 1100 | --- | 1.3 | 2.7 | 4.2 | 5.8 | 7.6 | 9.6 | 11.7 | 13.9 | 16.4 | 19.0 | 21.8 |
| 1200 | --- | --- | --- | 1.5 | 3.2 | 5.0 | 6.9 | 9.0 | 11.3 | 13.7 | 16.4 | 19.2 |
| 1300 | --- | --- | --- | --- | --- | 1.8 | 3.8 | 5.9 | 8.1 | 10.6 | 13.2 | 16.0 |
| 1400 | --- | --- | --- | --- | --- | --- | --- | 2.1 | 4.4 | 6.8 | 9.5 | 12.3 |
| 1500 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 2.5 | 5.1 | 7.9 |
| 1600 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 2.8 |

[1] Emissivity = 1.0

# Specifications / Design Details

## Radiant Energy - source and transfer *(continued)*

To determine the radiant heat transfer or heat flux from the RadMax™ Burner system to the work, the temperature and emissivity of the work must be known. Refer to the following table to determine the maximum heat flux between one square meter of RadMax™ Burner and the work at a given temperature. Correct for the emissivity of the work by multiplying the value from the table by the work's emissivity. (The table is corrected for the burner tile's emissivity.)

For example, if we assume the work temperature is 93°C and its emissivity is 0.80, the energy transfer rates per square foot at various tile temperatures are as illustrated below.

**RadMax™ Burner tile temperature = 760°C**
From the table below, we determine
the heat flux to be 58 kW/m² x 0.80 emissivity

**= 46.6 kW/m²**

**RadMax™ Burner tile temperature = 870°C**
From the table below, we determine
the heat flux to be 87.6 kW/m² x 0.80 emissivity

**= 70 kW/m²**

### Radiant Heat Transfer Rate (in kW/m²)

| Temperature of Work °C [1] | Temperature of RadMax™ Burner Tile (°C) (Emissivity corrected for temperature) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 600 | 625 | 650 | 675 | 700 | 725 | 750 | 775 | 800 | 825 | 850 | 875 | 900 |
| 0 | 30.4 | 34.0 | 37.9 | 42.2 | 46.8 | 51.7 | 57.1 | 62.8 | 68.9 | 75.5 | 82.5 | 89.9 | 97.9 |
| 50 | 30.1 | 33.7 | 37.7 | 41.9 | 46.5 | 51.4 | 56.8 | 62.5 | 68.6 | 75.2 | 82.2 | 89.7 | 97.6 |
| 100 | 29.7 | 33.3 | 37.2 | 41.5 | 46.1 | 51.0 | 56.3 | 62.0 | 68.2 | 74.7 | 81.7 | 89.2 | 97.2 |
| 150 | 29.0 | 32.6 | 36.5 | 40.8 | 45.4 | 50.3 | 55.7 | 61.4 | 67.5 | 74.1 | 81.1 | 88.6 | 96.5 |
| 200 | 28.0 | 31.7 | 35.6 | 39.9 | 44.4 | 49.4 | 54.7 | 60.4 | 66.6 | 73.1 | 80.1 | 87.6 | 95.6 |
| 250 | 26.7 | 30.4 | 34.3 | 38.5 | 43.1 | 48.1 | 53.4 | 59.1 | 65.3 | 71.8 | 78.9 | 86.3 | 94.3 |
| 300 | 25.0 | 28.6 | 32.6 | 36.8 | 41.4 | 46.4 | 51.7 | 57.4 | 63.6 | 70.1 | 77.1 | 84.6 | 92.6 |
| 350 | 22.7 | 26.4 | 30.3 | 34.6 | 39.2 | 44.1 | 49.5 | 55.2 | 61.3 | 67.9 | 74.9 | 82.4 | 90.4 |
| 400 | 19.9 | 23.5 | 27.4 | 31.7 | 36.3 | 41.3 | 46.6 | 52.3 | 58.5 | 65.0 | 72.1 | 79.6 | 87.5 |
| 450 | 16.3 | 19.9 | 23.8 | 28.1 | 32.7 | 37.7 | 43.0 | 48.8 | 54.9 | 61.5 | 68.5 | 76.0 | 84.0 |
| 500 | 11.8 | 15.5 | 19.4 | 23.7 | 28.3 | 33.3 | 38.6 | 44.4 | 50.5 | 57.1 | 64.2 | 71.7 | 79.7 |
| 550 | 6.4 | 10.1 | 14.1 | 18.4 | 23.0 | 28.0 | 33.3 | 39.1 | 45.2 | 51.8 | 58.9 | 66.4 | 74.4 |
| 600 | --- | 3.7 | 7.6 | 11.9 | 16.6 | 21.6 | 26.9 | 32.7 | 38.9 | 45.5 | 52.5 | 60.0 | 68.1 |
| 650 | --- | --- | --- | 4.3 | 9.0 | 14.0 | 19.3 | 25.1 | 31.3 | 37.9 | 45.0 | 52.5 | 60.5 |
| 700 | --- | --- | --- | --- | --- | 5.0 | 10.4 | 16.2 | 22.4 | 29.0 | 36.1 | 43.7 | 51.7 |
| 750 | --- | --- | --- | --- | --- | --- | --- | 5.8 | 12.0 | 18.7 | 25.8 | 33.3 | 41.4 |
| 800 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 6.7 | 13.8 | 21.4 | 29.4 |
| 850 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 7.6 | 15.7 |

[1] Emissivity = 1.0

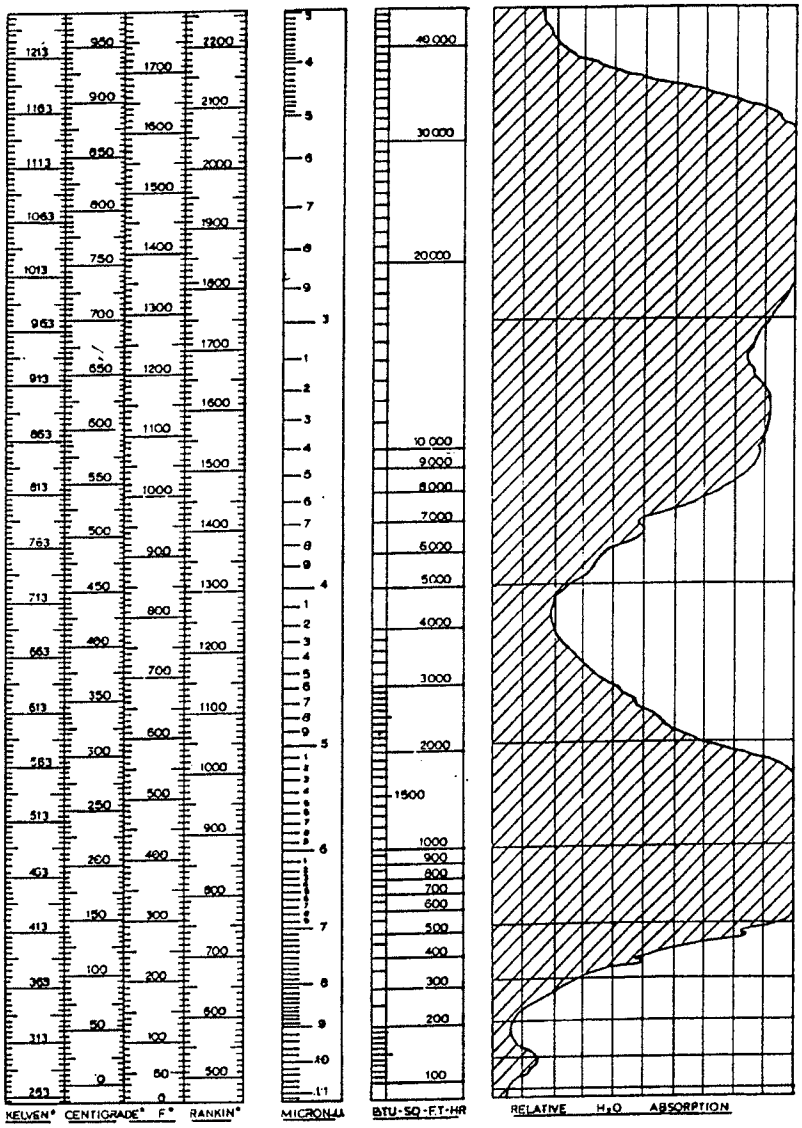
# Specifications / Design Details

## Absorption Charts and Wave Lengths

A second important consideration in any radiant application is the **wave length of radiation generated. As the heater surface temperature increases, the wave length of the radiant energy generated decreases.** To get the most efficiency from the radiant dryer, generate a wave length of infrared that will be absorbed by the product to be heated. It does little or no good to increase the generator surface temperature in order to get more energy released per square foot and generate wave lengths of radiation that passes through the product much like light passes through a window glass.

**Select the proper range of wave lengths by using a radiation absorption chart for the product to be heated.** The water absorption chart below will provide a graphic view of those wave lengths of infrared that will be most readily absorbed by water. As seen from the absorption curve, there are two ranges of wave length that fall under the maximum portion of the curve. The first range includes radiation from 5.3 to 7 microns in length and an emitter surface temperature range from 280°F to 530°F (140°C to 270°C). The second range of maximum efficiency is 2.55 to 2.9 microns in wave length and 1330°F to 1600°F (720°C to 870°C).

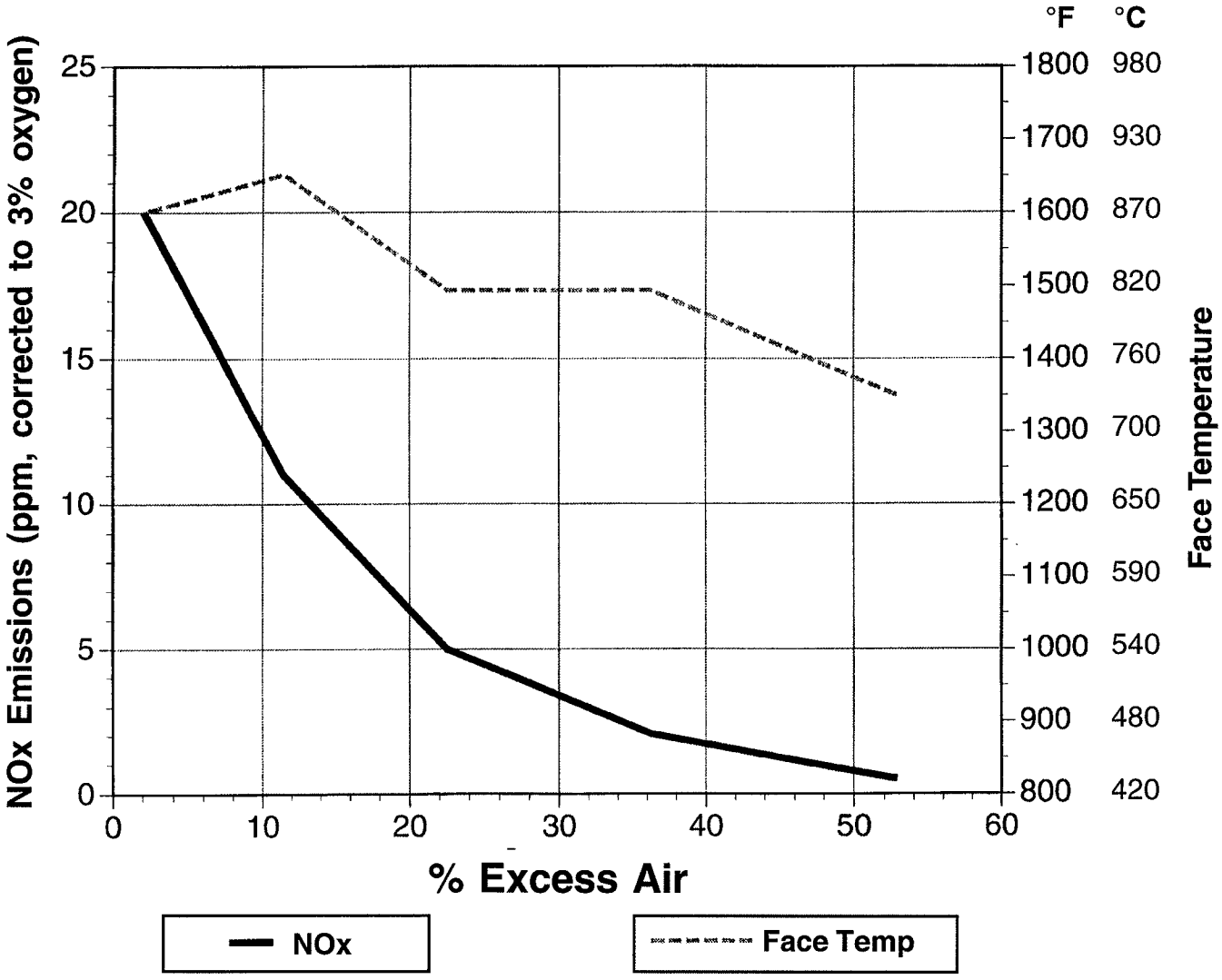
Many try to increase drying capacity by increasing the burner input and face temperature. As the chart indicates, system efficiency could drop by over 70% when going above 1600°F (870°).



# Specifications / Design Details

## NOx and Face Temperature vs. Excess Air

This chart represents the relationship between NOx emissions and face temperature versus percent of excess air. Actual readings may vary according to operating conditions.



# Specifications / Design Details

## Sample Calculations

The following is a sample set of calculations to show the steps required to determine the number of burner heads and burner rows in a given application.

**Typical application for Maxon RadMax™ Burner is preheating material for powder coating.**
Material to be heated: Steel Sheet Metal, 10 Ga.
Dimensions: 4 ft. x 10 ft.
Temperature Requirements: 65° F = initial temp
400° F = final temp
Time to reach final temp: 1 minute
Belt Speed: 20 feet/minute

***Step 1***
Select operating temperature of Maxon RadMax™ Burner of 1500° F. (The RadMax™ operates between 1050° and 1650° F. Selecting 1500° F allows for a good "mid-range" should the operating temperatures require adjustment after installation.)

***Step 2***
Determine the radiant energy transfer for the operating temperatures in Btu/ft² hr. According to the chart on page 1403, for a product temperature of 400° F and an emitter temperature of 1500° F, the radiant energy transfer is 22,400 Btu/ft² hr. Keep in mind that this energy transfer is for only **one** side of the product.

***Step 3***
Heating the material the thickness of 16 gauge only, determine the weight per square foot of the material. For 16 gauge (.0598") cold rolled steel sheet, this value is 2.50 lb/ft².

***Step 4***
Determine the specific heat of the product. For steel, $c_p$ = 0.11 Btu/lb °F.

***Step 5***
From the above information, we can now determine the heating capacity per square foot.

(2.50 lb/ft²)(0.11 Btu/lb °F)(400° F - 65° F) =
92.13 Btu/hr ft²

***Step 6***
Applying the heat-up time of 1 minute we get:

92.13 Btu/hr ft² x 60 min/hr = 5,528 Btu/ft²

This is based on an emissivity of 1.0, or 100% of the energy absorbed.

***Step 7***
Assuming an emissivity of 0.8, our design radiant density is (5,528 Btu/ft²)/0.5 = **6,910 Btu/ft²**
This is the radiant density required to heat our material from 65° F to 400° F in one minute.

***Step 8***
If we multiply this radiant density by the area of the material we get:

(6,910 Btu/ft²)x(4 ft)x(10 ft) = 276,400 Btu/hr

We then divide by the radiant energy transfer (from Step 2) to get:

(276,400 Btu/hr) / (22,400 Btu/ft² hr) = 12.3 ft² of burner **required per side**

**To determine the number of burner heads required,** simply divide the total area per side by the area of the burner head, which is 0.37 ft².

(12.3 ft²) / (0.37 ft²/burner head) = 33.2 burner heads per side

***Step 9***
Determine and identify the zoning of the burner system, if any.

***Step 10***
Select the burner type (i.e., type 13, 25, or 50). For this particular application we choose (7) rows of the 5-25 RadMax™ Burner per side. This provides us with 35 burner heads at a length of approximately 56 inches per row (see page 1409).

**NOTE: Powder coating requires material to be heated approximately the thickness of 16 gauge per side.**

***Step 11***
Determine the fuel input to the burners.

(35 burner heads)x(25,000 Btu/hr burner head) =

875,000 Btu/hr per side x 2 = 1,750,000 Btu/hr

This is the **input** required to the burner. Select an appropriate premix system to provide this heat input.

# Capacities and Specifications

## RadMax™ Type 13/25/50 Burner Head

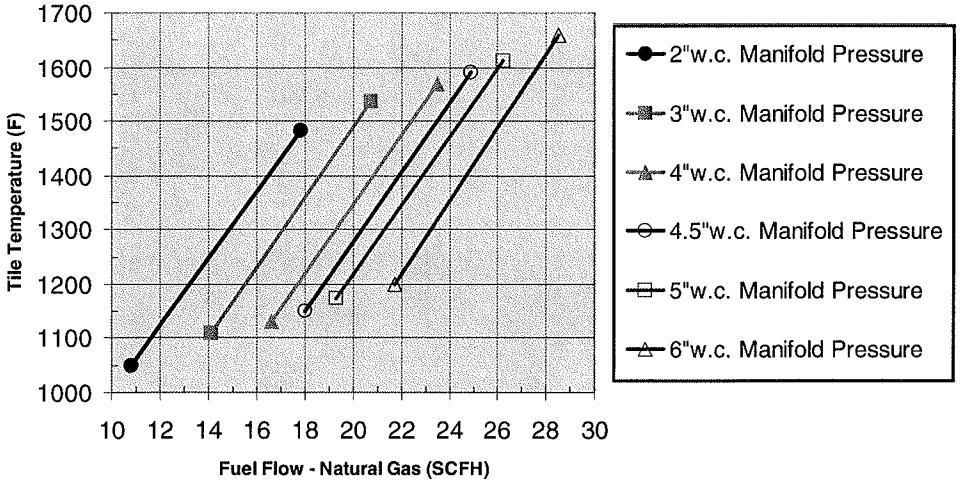
| Manifold Pressure | "w.c. | 2 | 3 | 4 | 4.5 (nominal) | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Combustion Air Flow | SCFH | 205 | 252 | 291 | 308 | 326 | 357 |
| Maximum Capacity | Btu/hr | 17,800 | 20,700 | 23,500 | 24,925 | 26,200 | 28,500 |
| Fuel Flow at Maximum | SCFH | 17.8 | 20.7 | 23.5 | 24.9 | 26.2 | 28.5 |
| Minimum Capacity | Btu/hr | 10,800 | 14,100 | 16,600 | 18,000 | 19,300 | 21,700 |
| Fuel Flow at Minimum | SCFH | 10.8 | 14.1 | 16.6 | 18.0 | 19.3 | 21.7 |
| Face Temperature Range | °F | 1050-1483 | 1110-1537 | 1130-1569 | 1150-1590 | 1173-1611 | 1200-1659 |
| **Direct Spark/Flame Sensor Port** | | | | | | | |
| Manifold Pressure | "w.c. | 2 | 3 | 4 | 4.5 (nominal) | 5 | 6 |
| Combustion Air Flow | SCFH | 66 | 77 | 87 | 93 | 97 | 106 |
| Maximum Capacity | Btu/hr | 5,340 | 6,210 | 7,050 | 7,478 | 7,860 | 8,550 |
| Fuel Flow at Maximum | SCFH | 5.3 | 6.2 | 7.1 | 7.5 | 7.9 | 8.6 |

## RadMax™ Type 13/25/50 Burner Head (metric data)

| Manifold Pressure | mbar | 5.0 | 7.5 | 10.0 | 11.2 (nominal) | 12.4 | 14.9 |
|---|---|---|---|---|---|---|---|
| Combustion Air Flow | (n)m³/hr | 5.80 | 7.15 | 8.25 | 8.72 | 9.23 | 10.12 |
| Maximum Capacity | kW | 5.2 | 6.1 | 6.9 | 7.3 | 7.7 | 8.4 |
| Fuel Flow at Maximum | (n)m³/hr | 0.50 | 0.59 | 0.67 | 0.71 | 0.74 | 0.81 |
| Minimum Capacity | kW | 3.2 | 4.1 | 4.9 | 5.3 | 5.7 | 6.4 |
| Fuel Flow at Minimum | (n)m³/hr | 0.31 | 0.40 | 0.47 | 0.51 | 0.55 | 0.61 |
| Face Temperature Range | °C | 566-806 | 599-836 | 610-854 | 621-866 | 634-877 | 649-904 |
| **Direct Spark/Flame Sensor Port** | | | | | | | |
| Manifold Pressure | mbar | 5.0 | 7.5 | 10.0 | 11.2 (nominal) | 12.4 | 14.9 |
| Combustion Air Flow | (n)m³/hr | 1.88 | 2.18 | 2.48 | 2.63 | 2.76 | 3.00 |
| Maximum Capacity | kW | 1.6 | 1.8 | 2.1 | 2.2 | 2.3 | 2.5 |
| Fuel Flow at Maximum | (n)m³/hr | 0.15 | 0.18 | 0.20 | 0.21 | 0.22 | 0.24 |

**NOTE:** Most systems are designed to nominal capacities. Reduced or extended capacities are possible. RadMax™ should not be installed in ovens/ chambers above 500°F. Contact Maxon for more information.

**Face Temperature Range for Various Firing Rates**



# Capacities and Specifications

## Type 13 RadMax™ Burners

| Inlet Size | Number of Burner Heads | Nominal Capacity (Btu/hr) | Type 13 (end-to-end) Assembly | | Manifold Size (in inches) |
|---|---|---|---|---|---|
| | | | Designation | Face Width (in inches) | |
| 1-1/2" | 2 | 50,000 | 2 - 13 | 31.62 | 2 x 2 |
| | 3 | 75,000 | 3 - 13 | 47.46 | |
| | 4 | 100,000 | 4 - 13 | 63.31 | |
| | 5 | 125,000 | 5 - 13 | 79.15 | |
| | 6 | 150,000 | 6 - 13 | 94.99 | |
| | 7 | 175,000 | 7 - 13 | 110.84 | |
| | 8 | 200,000 | 8 - 13 | 126.68 | |
| 2" | 9 | 225,000 | 9 - 13 | 142.53 | 2 x 3 |
| | 10 | 250,000 | 10 - 13 | 158.37 | |

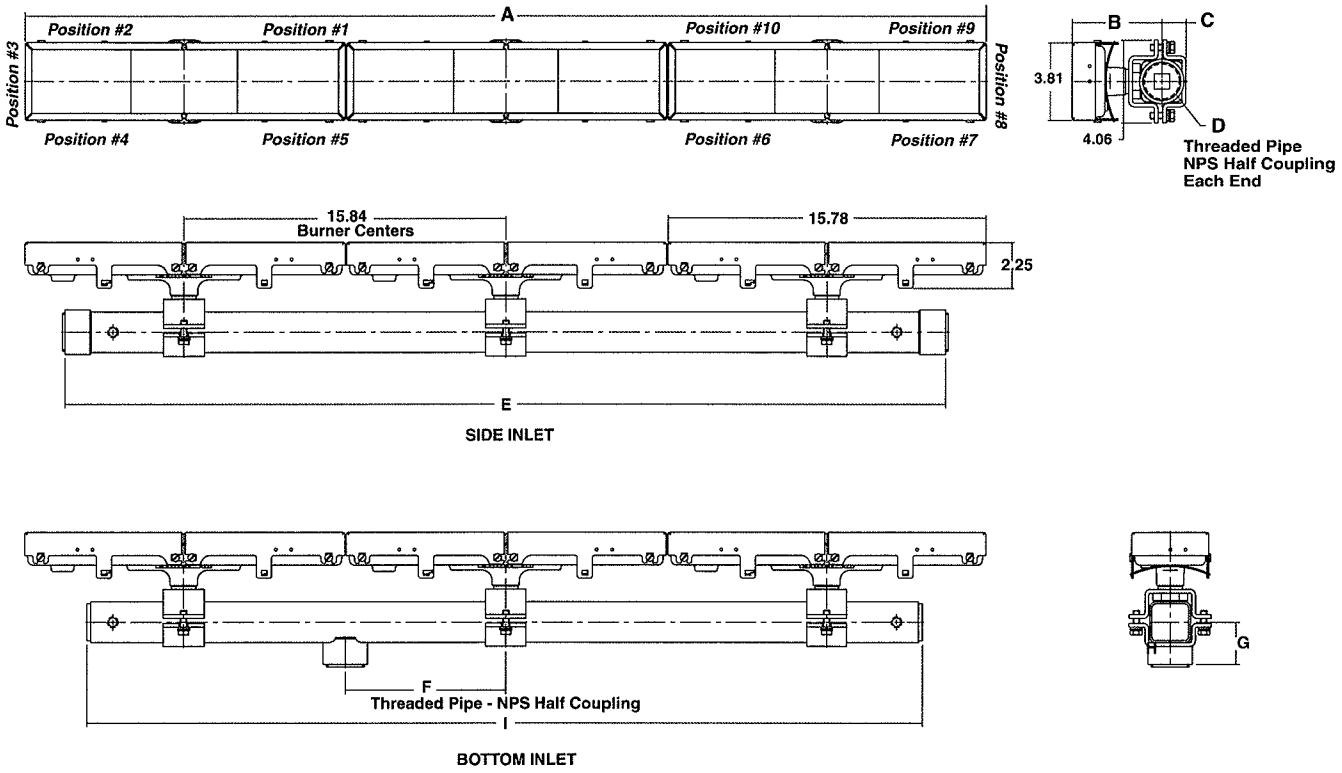
## Type 25 and Type 50 RadMax™ Burners

| Inlet Size | Number of Burner Heads | Nominal Capacity (Btu/hr) | Type 25 (end-to-end) Assembly | | Type 50 (side-to-side) Assembly | | Manifold Size (in inches) |
|---|---|---|---|---|---|---|---|
| | | | Designation | Face Width (in inches) | Designation | Face Width (in inches) | |
| 1-1/2" | 3 | 75,000 | 3 - 25 | 33.57 | 3 - 50 | 16.45 | 2 x 2 |
| | 4 | 100,000 | 4 - 25 | 44.82 | 4 - 50 | 21.98 | |
| | 5 | 125,000 | 5 - 25 | 56.07 | 5 - 50 | 27.52 | |
| | 6 | 150,000 | 6 - 25 | 67.32 | 6 - 50 | 33.05 | |
| | 7 | 175,000 | 7 - 25 | 78.57 | 7 - 50 | 38.58 | |
| | 8 | 200,000 | 8 - 25 | 89.82 | 8 - 50 | 44.11 | |
| 2" | 9 | 225,000 | 9 - 25 | 101.07 | 9 - 50 | 49.64 | 2 x 3 |
| | 10 | 250,000 | 10 - 25 | 112.32 | 10 - 50 | 55.17 | |
| | 11 | 275,000 | 11 - 25 | 123.57 | 11 - 50 | 60.70 | |
| | 12 | 300,000 | 12 - 25 | 134.82 | 12 - 50 | 66.23 | |
| | 13 | 325,000 | 13 - 25 | 146.07 | 13 - 50 | 71.77 | |
| 2-1/2" | 14 | 350,000 | 14 - 25 | 157.32 | 14 - 50 | 77.30 | 2 x 4 |
| | 15 | 375,000 | 15 - 25 | 168.57 | 15 - 50 | 82.83 | |
| | 16 | 400,000 | --- | --- | 16 - 50 | 88.36 | |
| | 17 | 425,000 | --- | --- | 17 - 50 | 93.89 | |
| | 18 | 450,000 | --- | --- | 18 - 50 | 99.42 | |
| 3" * | 19 | 475,000 | --- | --- | 19 - 50 | 104.95 | 2 x 5 |
| | 20 | 500,000 | --- | --- | 20 - 50 | 110.48 | |
| | 21 | 525,000 | --- | --- | 21 - 50 | 116.02 | |
| | 22 | 550,000 | --- | --- | 22 - 50 | 121.55 | |
| | 23 | 575,000 | --- | --- | 23 - 50 | 127.08 | |
| | 24 | 600,000 | --- | --- | 24 - 50 | 132.61 | |
| | 25 | 625,000 | --- | --- | 25 - 50 | 138.14 | |
| | 26 | 650,000 | --- | --- | 26 - 50 | 143.67 | |

* Maximum inlet size for bottom inlet is 2-1/2" NPT

# Dimensions *(in inches)*

## Type 13 RadMax™ Burner

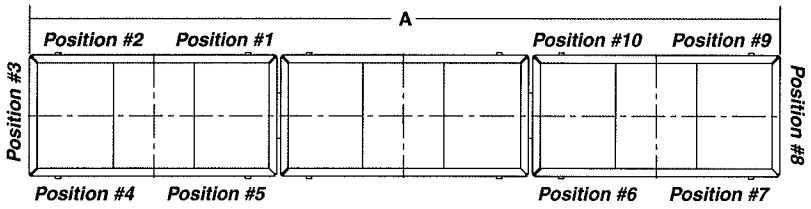


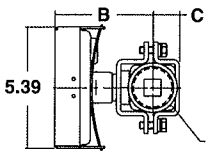

## Type 13 RadMax™ Burner

| Burner Size | A | B | | C | D | E | F Bottom Inlet Only | G Bottom Inlet Only | H # of Inlets (Bottom Inlet) | I |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Standard | Extended Length | | | | | | | |
| 2-13 | 31.62 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 27.63 | 0.00 | 2.06 | 1 | 25.38 |
| 3-13 | 47.46 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 43.47 | 7.92 | 2.06 | 1 | 41.22 |
| 4-13 | 63.31 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 59.31 | 0.00 | 2.06 | 1 | 57.06 |
| 5-13 | 79.15 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 75.16 | 7.92 | 2.06 | 1 | 72.91 |
| 6-13 | 94.99 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 91.00 | 15.84 | 2.06 | 2 | 88.75 |
| 7-13 | 110.84 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 106.84 | 23.77 | 2.06 | 2 | 104.59 |
| 8-13 | 126.68 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 122.69 | 31.69 | 2.06 | 2 | 120.44 |
| 9-13 | 142.53 | 4.92 | 5.92 | 1.69 | 2" NPT | 138.66 | 39.61 | 2.62 | 2 | 136.28 |
| 10-13 | 158.37 | 4.92 | 5.92 | 1.69 | 2" NPT | 154.50 | 47.53 | 2.62 | 2 | 152.13 |

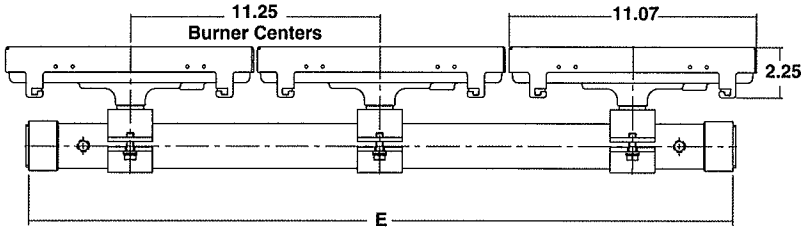
# Dimensions *(in inches)*

## Type 25 RadMax™ Burner

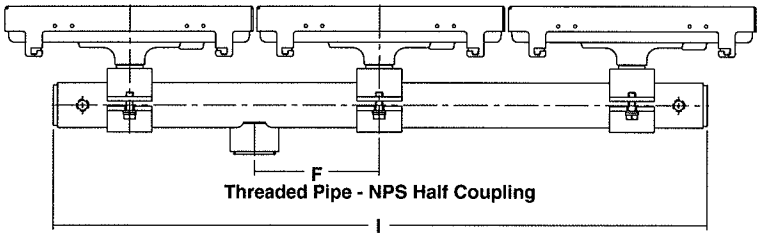


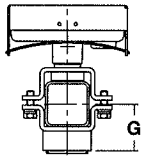

Threaded Pipe
NPS Half Coupling
Each End




SIDE INLET




BOTTOM INLET

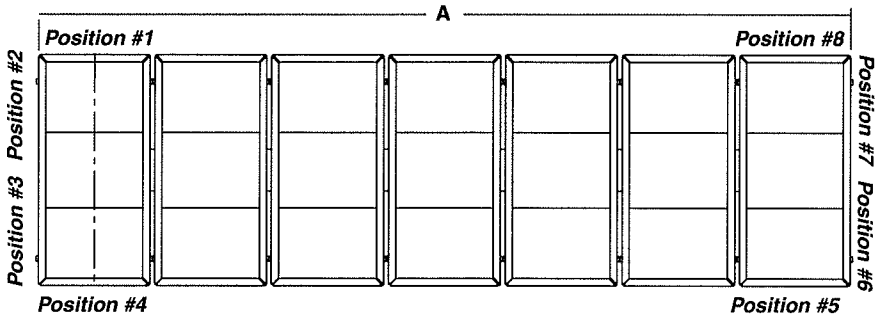


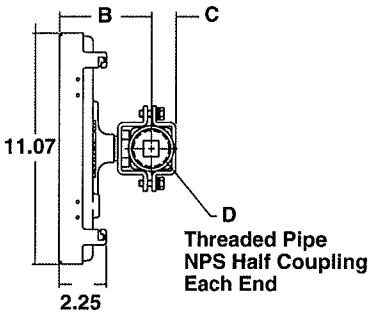

## Type 25 RadMax™ Burner

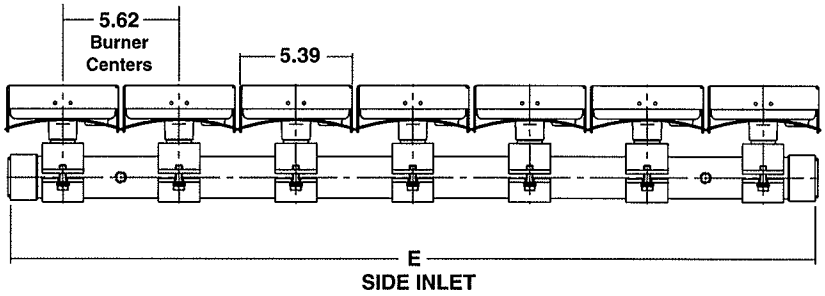
| Burner Size | A | B | | C | D | E | F Bottom Inlet Only | G Bottom Inlet Only | H # of Inlets (Bottom Inlet) | I |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Standard | Extended Length | | | | | | | |
| 3-25 | 33.57 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 31.50 | 5.63 | 2.06 | 1 | 29.25 |
| 4-25 | 44.82 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 42.75 | 0.00 | 2.06 | 1 | 40.50 |
| 5-25 | 56.07 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 54.00 | 5.63 | 2.06 | 1 | 51.75 |
| 6-25 | 67.32 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 65.25 | 0.00 | 2.06 | 1 | 63.00 |
| 7-25 | 78.57 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 76.50 | 16.88 | 2.06 | 2 | 74.25 |
| 8-25 | 89.82 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 87.75 | 22.50 | 2.06 | 2 | 85.50 |
| 9-25 | 101.07 | 4.92 | 5.92 | 1.69 | 2" NPT | 99.13 | 28.13 | 2.62 | 2 | 96.75 |
| 10-25 | 112.32 | 4.92 | 5.92 | 1.69 | 2" NPT | 110.38 | 22.50 | 2.62 | 2 | 108.00 |
| 11-25 | 123.57 | 4.92 | 5.92 | 1.69 | 2" NPT | 121.63 | 28.13 | 2.62 | 2 | 119.25 |
| 12-25 | 134.82 | 4.92 | 5.92 | 1.69 | 2" NPT | 132.88 | 33.75 | 2.62 | 2 | 130.50 |
| 13-25 | 146.07 | 4.92 | 5.92 | 1.69 | 2" NPT | 144.13 | 39.38 | 2.62 | 2 | 141.75 |
| 14-25 | 157.32 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 158.63 | 33.75 | 3.75 | 2 | 153.00 |
| 15-25 | 168.57 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 169.88 | 39.38 | 3.75 | 2 | 164.25 |

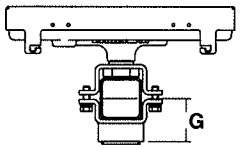
# Dimensions *(in inches)*

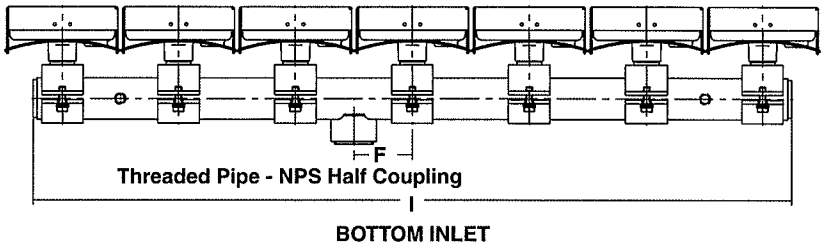
## Type 50 RadMax™ Burner




*See Page 1413 for additional dimensions*

# Dimensions *(in inches)*

## Type 50 RadMax™ Burner

| Burner Size | A | B | | C | D | E | F Bottom Inlet Only | G Bottom Inlet Only | H # of Inlets (Bottom Inlet) | I |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Standard | Extended Length | | | | | | | |
| 3-50 | 16.45 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 16.13 | 2.77 | 2.06 | 1 | 13.88 |
| 4-50 | 21.98 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 21.66 | 0.00 | 2.06 | 1 | 19.41 |
| 5-50 | 27.52 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 27.19 | 2.77 | 2.06 | 1 | 24.94 |
| 6-50 | 33.05 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 32.72 | 0.00 | 2.06 | 1 | 30.47 |
| 7-50 | 38.58 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 38.25 | 2.77 | 2.06 | 1 | 36.00 |
| 8-50 | 44.11 | 4.42 | 5.42 | 1.19 | 1-1/2" NPT | 43.78 | 0.00 | 2.06 | 1 | 41.53 |
| 9-50 | 49.64 | 4.92 | 5.92 | 1.69 | 2" NPT | 49.44 | 2.77 | 2.62 | 1 | 47.06 |
| 10-50 | 55.17 | 4.92 | 5.92 | 1.69 | 2" NPT | 54.97 | 0.00 | 2.62 | 1 | 52.59 |
| 11-50 | 60.70 | 4.92 | 5.92 | 1.69 | 2" NPT | 60.50 | 2.77 | 2.62 | 1 | 58.13 |
| 12-50 | 66.23 | 4.92 | 5.92 | 1.69 | 2" NPT | 66.03 | 16.59 | 2.62 | 2 | 63.66 |
| 13-50 | 71.77 | 4.92 | 5.92 | 1.69 | 2" NPT | 71.56 | 19.36 | 2.62 | 2 | 69.19 |
| 14-50 | 77.30 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 80.34 | 16.59 | 3.75 | 2 | 74.72 |
| 15-50 | 82.83 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 85.88 | 19.36 | 3.75 | 2 | 80.25 |
| 16-50 | 88.36 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 91.41 | 22.12 | 3.75 | 2 | 85.78 |
| 17-50 | 93.89 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 96.94 | 24.89 | 3.75 | 2 | 91.31 |
| 18-50 | 99.42 | 5.42 | 6.42 | 2.19 | 2-1/2" NPT | 102.47 | 27.66 | 3.75 | 2 | 96.84 |
| 19-50 | 104.95 | 5.92 | 6.92 | 2.69 | 3" NPT* | 110.13 | 24.89 | 3.75 | 2 | 106.38 |
| 20-50 | 110.48 | 5.92 | 6.92 | 2.69 | 3" NPT* | 115.66 | 27.66 | 3.75 | 2 | 111.91 |
| 21-50 | 116.02 | 5.92 | 6.92 | 2.69 | 3" NPT* | 121.19 | 30.42 | 3.75 | 2 | 117.44 |
| 22-50 | 121.55 | 5.92 | 6.92 | 2.69 | 3" NPT* | 126.72 | 33.19 | 3.75 | 2 | 122.97 |
| 23-50 | 127.08 | 5.92 | 6.92 | 2.69 | 3" NPT* | 132.25 | 30.42 | 3.75 | 2 | 128.50 |
| 24-50 | 132.61 | 5.92 | 6.92 | 2.69 | 3" NPT* | 137.78 | 33.19 | 3.75 | 2 | 134.03 |
| 25-50 | 138.14 | 5.92 | 6.92 | 2.69 | 3" NPT* | 143.31 | 35.95 | 3.75 | 2 | 139.56 |
| 26-50 | 143.67 | 5.92 | 6.92 | 2.69 | 3" NPT* | 148.84 | 33.19 | 3.75 | 2 | 145.09 |

*Maximum inlet size for bottom inlet is 2-1/2" NPT

# Notes

# Start-up Instructions

Read complete instructions before proceeding and familiarize yourself with all the system's equipment and components. Verify that all 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/flame safeguard circuitry and with knowledge of the overall installation. Equipment installation and operating procedures should comply with all applicable international, federal, state, local codes and standards.

## Initial RadMax™ Burner start-up:

1. **Close all burner fuel valves and gas cocks.** Make preliminary adjustment to fuel gas regulator(s) to establish adequate fuel pressure.
2. **Check all electric circuitry.** Verify that all control devices, flame safeguard, and interlocks are operable and functioning within their respective settings/ranges.
3. **Check that all duct and chambers are clear** and that their dampers operate freely. Adjust all dampers to their proper start-up positions. Open the manual pet-cock valves on all burner Direct-Spark/Flame-Sensing Ports.
4. **Start process fan(s) and combustion blower(s) and purge** the entire unit in accordance with the appropriate codes and standards.
5. **Adjust combustion air pressure** to establish the proper burner manifold pressure per the "Capacities and Specifications" table on page 1400-S-2. A test connection is provided on the burner manifold for set-up adjustment purposes. Required manifold pressures are differential pressures relative to the firing chamber. **For on/off (single firing rate) operation**, adjust air to establish the proper manifold differential pressure required for the desired firing rate. **For variable firing rate operation**, refer to the following procedure:
   A. **Set low fire combustion air flow.** Position combustion air flow control device to establish burner manifold pressure required for the desired minimum firing rate (per table on Page 1400-S-2). Manifold differential pressure should never be less than 2.0" w.c.
   B. **Set high fire combustion air flow.** Position combustion air flow control device to establish burner manifold pressure required for the desired maximum firing rate (per the table on Page 1400-S-2.) Manifold differential pressure should not exceed 6.0" w.c.
   C. **Return air flow control device to minimum.**
6. **Adjust fuel/air mixing device** to the recommended initial settings. Refer to the appropriate start-up instructions provided by the manufacturer for this equipment.
7. **Ignite the burner.** (Direct spark applications only; refer to appropriate manufacturers instructions for piloted systems.)
   A. Verify combustion air blower is running.
   B. Set air flow control device to minimum.
   C. Open main gas shut-off valve(s).
   D. Initiate trial for ignition sequence and verify spark ignitor is arcing properly.
   E. If burner does not ignite, close main gas shut-off valve(s) and re-purge unit before attempting to ignite the burner again.
8. **Adjust burner minimum firing rate.** Allow burners to come up to stable operating temperature. With the air flow control device at minimum, adjust the fuel flow to establish the desire operating temperature within the range stated in the "Capacities and Specifications" table on Page 1400-S-2. If a slight blue haze is present on the face of the burner, this is an indication that the mixture is too lean. To correct, increase fuel flow until the blue haze is no longer present. If you notice a yellow blanket of flame on the burner surface, this is an indication the mixture is too rich. To correct, decrease fuel flow until the yellow haze is no longer present.
9. **Adjust burner maximum firing rate.** Slowly increase combustion air flow and fuel flow in small increments as allowed by the fuel/air ratio controller. Hold at each step and allow the burner to come up to a stable operating temperature. Make adjustments to fuel flow as necessary to establish the desired operating temperature within the range stated in the "Capacities and Specifications" table. Continue to increase the fuel/air ratio controller in small increments and make adjustments at each step until the desired high firing rate is established.
10. **Verify settings.** After establishing high and low fire settings, cycle the burner from high to low fire several times to confirm the repeatability of fuel/air settings. Shut down the burner and re-ignite to confirm reliability of ignition system and light-off settings. Check all safety interlocks and limits and confirm proper settings and operation.
11. **Verify temperatures.** Confirm desired face temperature is achieved. Also, confirm oven/chamber temperature does not exceed 500°F. Verify that sufficient process circulation exists to prevent localized hot spots in excess of 500°F on burner bodies.

# Start-up Instructions

## Capacities and Specifications

### RadMax™ Type 13/25/50 Burner Head

| Manifold Pressure | "w.c. | 2 | 3 | 4 | 4.5 (nominal) | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Combustion Air Flow | SCFH | 205 | 252 | 291 | 308 | 326 | 357 |
| Maximum Capacity | Btu/hr | 17,800 | 20,700 | 23,500 | 24,925 | 26,200 | 28,500 |
| Fuel Flow at Maximum | SCFH | 17.8 | 20.7 | 23.5 | 24.9 | 26.2 | 28.5 |
| Minimum Capacity | Btu/hr | 10,800 | 14,100 | 16,600 | 18,000 | 19,300 | 21,700 |
| Fuel Flow at Minimum | SCFH | 10.8 | 14.1 | 16.6 | 18.0 | 19.3 | 21.7 |
| Face Temperature Range | °F | 1050-1483 | 1110-1537 | 1130-1569 | 1150-1590 | 1173-1611 | 1200-1659 |

### Direct Spark/Flame Sensor Port

| Manifold Pressure | "w.c. | 2 | 3 | 4 | 4.5 (nominal) | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Combustion Air Flow | SCFH | 66 | 77 | 87 | 93 | 97 | 106 |
| Maximum Capacity | Btu/hr | 5,340 | 6,210 | 7,050 | 7,478 | 7,860 | 8,550 |
| Fuel Flow at Maximum | SCFH | 5.3 | 6.2 | 7.1 | 7.5 | 7.9 | 8.6 |

### RadMax™ Type 13/25/50 Burner Head (metric data)

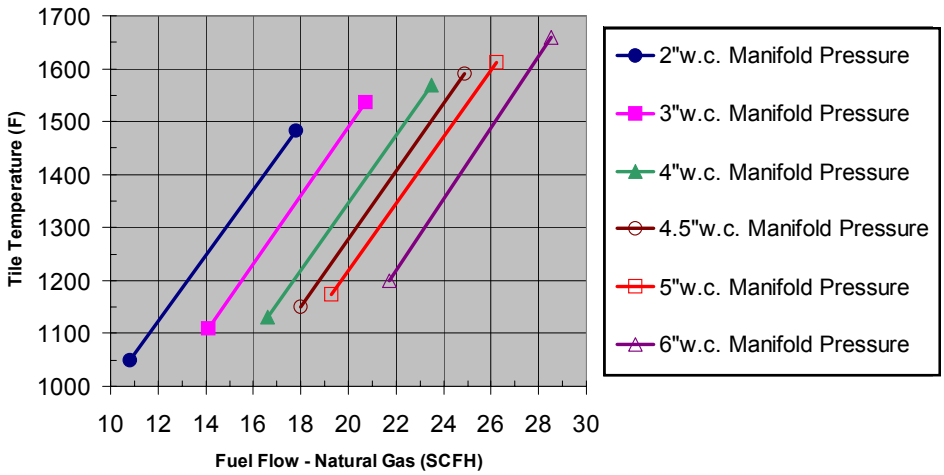
| Manifold Pressure | mbar | 5.0 | 7.5 | 10.0 | 11.2 (nominal) | 12.4 | 14.9 |
|---|---|---|---|---|---|---|---|
| Combustion Air Flow | (n)m³/hr | 5.80 | 7.15 | 8.25 | 8.72 | 9.23 | 10.12 |
| Maximum Capacity | kW | 5.2 | 6.1 | 6.9 | 7.3 | 7.7 | 8.4 |
| Fuel Flow at Maximum | (n)m³/hr | 0.50 | 0.59 | 0.67 | 0.71 | 0.74 | 0.81 |
| Minimum Capacity | kW | 3.2 | 4.1 | 4.9 | 5.3 | 5.7 | 6.4 |
| Fuel Flow at Minimum | (n)m³/hr | 0.31 | 0.40 | 0.47 | 0.51 | 0.55 | 0.61 |
| Face Temperature Range | °C | 566-806 | 599-836 | 610-854 | 621-866 | 634-877 | 649-904 |

### Direct Spark/Flame Sensor Port

| Manifold Pressure | mbar | 5.0 | 7.5 | 10.0 | 11.2 (nominal) | 12.4 | 14.9 |
|---|---|---|---|---|---|---|---|
| Combustion Air Flow | (n)m³/hr | 1.88 | 2.18 | 2.48 | 2.63 | 2.76 | 3.00 |
| Maximum Capacity | kW | 1.6 | 1.8 | 2.1 | 2.2 | 2.3 | 2.5 |
| Fuel Flow at Maximum | (n)m³/hr | 0.15 | 0.18 | 0.20 | 0.21 | 0.22 | 0.24 |

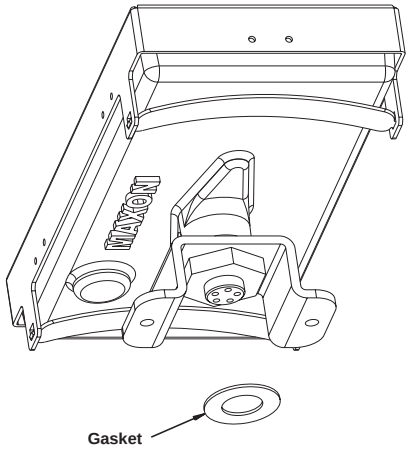
**NOTE:** Most systems are designed to nominal capacities. Reduced or extended capacities are possible. RadMax™ should not be installed in ovens/chambers above 500°F. Contact Maxon for more information.

**Face Temperature Range for Various Firing Rates**



# Assembly Instructions

Upon receipt of your Maxon RadMax™ Burner, it may be necessary to install the burner heads to the burner manifold. The burner heads are shipped completely assembled and only require two fasteners per head to attach them to the burner manifold.




**Detail of Gasket Installation**

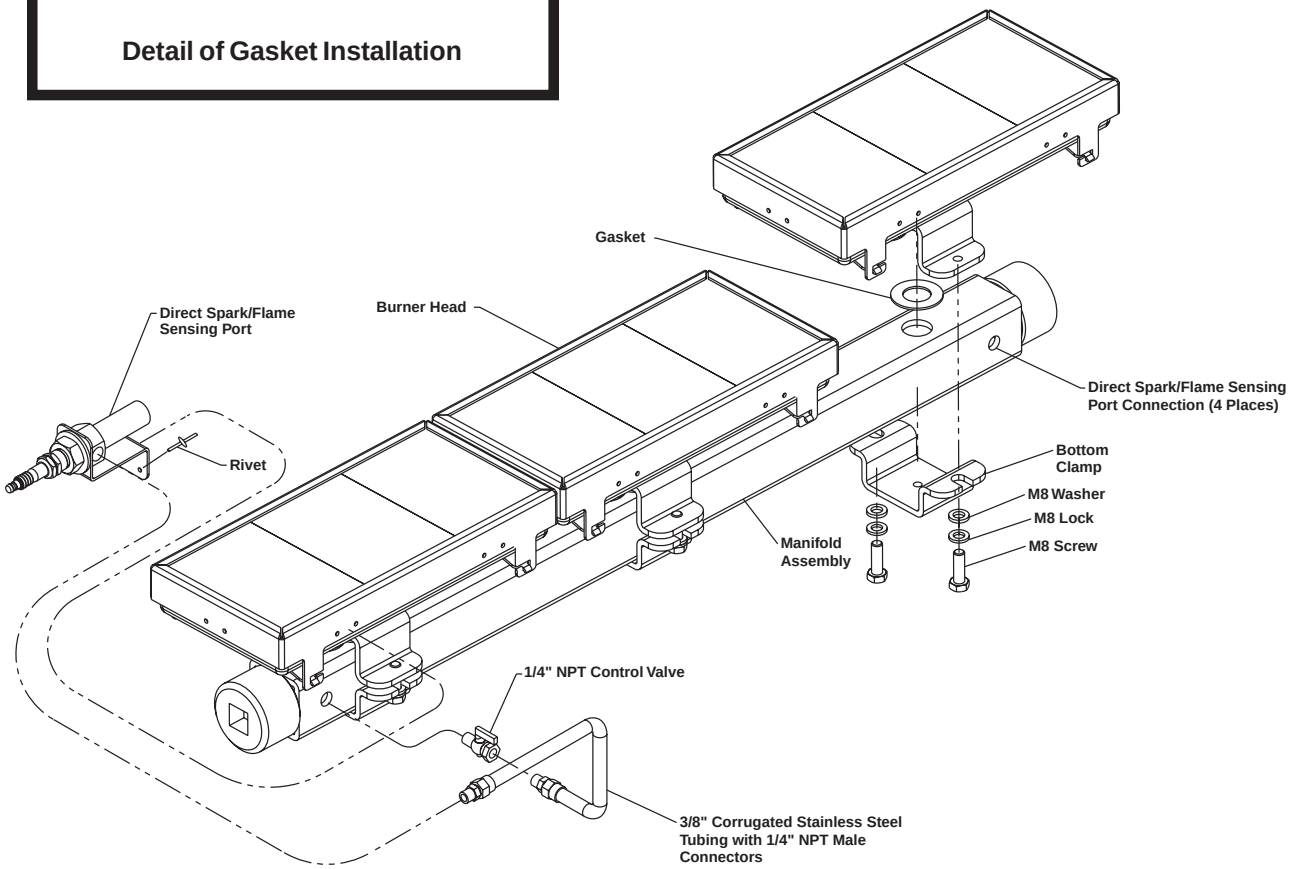
Following the illustrations below, mount the burner head to the manifold:

1. Place the gasket on the air/gas inlet on the underside of the burner head. This gasket is used to help provide a gas tight seal and must be installed.

2. Place the head on the manifold such that the plug mates up with the hole in the manifold.

3. Use two M8 screws and two M8 washers (provided) to attach the bottom clamp against the manifold and securely fasten the head. Alternate the tightening of the bolts to ensure an even clamping force.

4. Repeat for the remainder of the burner heads. Make sure the “face” or tile sides of the heads are relatively flush with each other before final tightening of the fasteners to 3-5 foot-lbs.



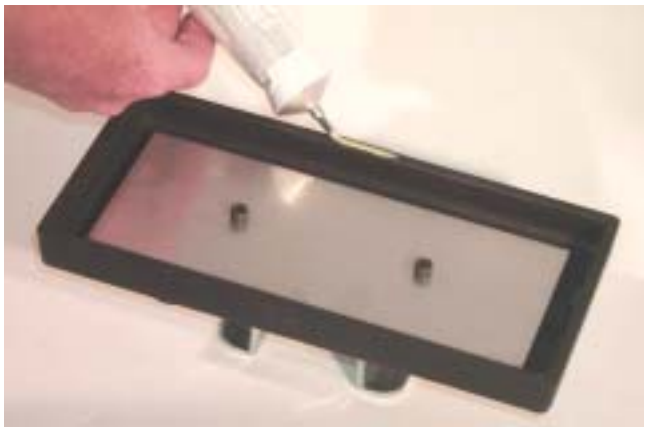
# Maintenance Instructions

## Installing Replacement Burner Tiles

### – Step 1

Coat the tile support face of the body casting with a thin film of gasket adhesive.

*Figure 1*



### – Step 2

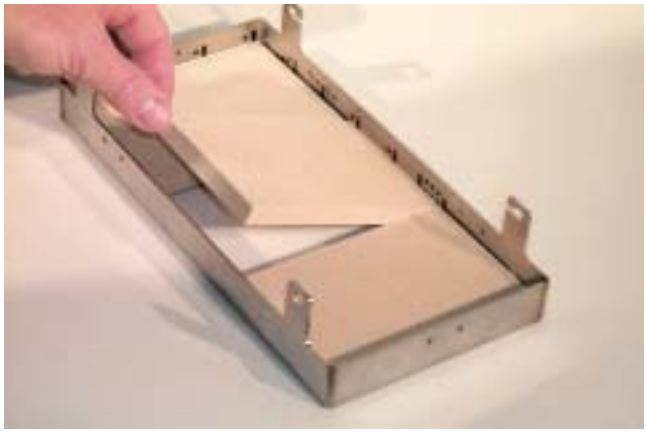
Install the burner body gasket. Be careful to ensure gasket is installed squarely and use care to avoid tearing gasket material. Allow gasket to set for 5-10 minutes before installing tiles.

*Figure 2*

### – Step 3

Place tile retainer frame face down on a flat surface. Install 3 burner tiles into tile retainer, making sure that no gaps exist between tiles and that tiles are properly centered in tile retainer.

*Figure 3*



# Maintenance Instructions

### – *Step 4*

Place burner body casting face down into tile retainer frame, with burner body gasket resting on top of burner tiles (along inside edge of tile retainer frame).

***Figure 4***

### – *Step 5*

Install spring clips to secure the tile retainer frame.

***Figure 5***

# Notes