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10 cubic Ft. of air per thousand BTU
For every 10 Cu. Ft. of Kiln you should have 15,000 BTU's or 15,000 Cu.Ft. of Natural Gas

Sample Calculations & Burner Options

Flat Top Kiln☹not logical to build unless you were born or lived in Minnesota
45" H • 45" W • 45" L. Constructed of 9" insulating brick.

45 x 45 x 45 = 91,125 cu/in. divided by 1728 = 53 cu/ft (aprox.)
For cone 10 firing of 6-8 hours - 53 x 16,000 = 848,000 Btu/HR

For 2 Burners - 848,000 ÷ 2 = 424,000 per burner

For 4 Burners - 848,000 ÷ 4 = 212,000 per burner

For 6 Burners - 848,000 ÷ 6 = 141,333 per burner

Sprung Arch Kiln: (30"H + 5" RISE) • 30" W • 30" Hard Brick construction

(30 + [.66 x 5]) = 33.3 x 30 x 30 = 29,970 cu/in divided by 1728 = 17.5 cu/ft
For cone 10 firing of 6-8 hours - 17.5 x 20,000 = 350,000 Btu/HR

For 2 Burners - 350,000 ÷ 2 = 175,000 Btu per burner

For 4 Burners - 350,000 ÷ 4 = 87,500 Btu per burner

For 6 Burners - Not necessary

Catenary Arch Kiln: 40" W • 48" H • 60" L Insulating brick w/2" ceramic fiber

([4/3 x 48]=64) x ([1/2 x 40]=20) x 60 = 76,800 cu/in divided by 1728 = 44.5 cu/ft
For cone 10 firing of 6-8 hours - 44.5 x 12,500 = 556,250 Btu/HR

For 2 Burners - 556,250 ÷ 2 = 278,125 Btu per burner

For 4 Burners - 556,250 ÷ 4 = 139,062 Btu per burner

For 6 Burners - 556,250 ÷ 6 = 92,608 Btu per burner

Calculating Kiln Volume

Kiln volume is usually expressed in Cubic Feet (CF). In a flat top kiln this figure is arrived at by multiplying the interior height (H) by the interior width (W) by the depth or length (L).

Sprung or Roman arch: CF = W x L x (Side wall + 2/3 of the arch rise)
Catenary arch: CF = L x Arch area (4/3 H x 1/2 Base Width)
Barrel kiln: CF = H x Pi x R^2 (R^2 - Radius is 1/2 the diameter x itself) (Pi = 3.14)

If you have used inches in the above equations, divide the total by 1728 to convert to Cubic Feet.

Wall Construction & Temperature

The type of material and its' insulating values determines how many Btu's per Cubic Feet per Hour (Btu/Cf/Hr), you will need to reach a desired temperature. Below is a simplified chart showing materials, desired temp., and the corresponding Btu/Cf/Hr. There are a host of variables that can affect kiln efficiency. This is a basic guide only.

High Temp Kiln Construction	Cone 06 Btu / Hr.	Cone 6 Btu / Hr.	Cone 10 Btu / Hr.
9" Hard Brick	12,000-17,000	14,000-18,500	16,000-20,000
9" Insulating Brick	6,000-10,000	8,000-13,000	10,000-16,000
6" Ceramic Fiber	4,000-6,000	6,000-9,000	7,000-11,000

This simple table gives you an idea of how many BTU's per Cubic Feet per Hour you will need. Multiplying this figure by the total Cubic Feet will give you BTU/Hr. Now divide BTU/Hr by the number of burners you plan to use to determine what Btu/Hr rating each burner should have. The numbers above show a range of BTU figures. The highest figure in each range produces a 6-7 hour firing. The lowest figure will produce firings in the 14-18 hour range.
Raku kilns have much higher BTU input rates than stoneware kilns. This is because Raku is traditionally done very quickly. For this reason, it is very difficult to bisque fire in a Raku kiln. The chart below gives the basic BTU input for Raku kilns of various materials. These input values are for a fast firing rate of around 20-30 minutes for the first load. Subsequent loads would be slightly faster

RAKU KILN Construction	Btu / Hr
4 1/2" Hard Brick	70,000
2 1/2" Insulating Brick	40,000
4 1/2" Insulating Brick	30,000
1" Ceramic Fiber	25,000
2" Ceramic Fiber	20,000

The chart below gives estimates of the cubic ft. of flow per hour @ 5" to 7in. Water Column.
One cubic Ft. of Natural Gas = 1,000 Example : **1" pipe with a 10 foot run -**
387 cu. ft. x 1,000 = 387,000 BTU

Schedule 40 Metallic Pipe

Natural Gas Pipe Sizing Chart

Length of Pipe In Feet	Size of Pipe in Inches								
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
10	108	230	387	793	1237	2259	3640	6434	
20	75	160	280	569	877	1610	2613	5236	9521
30	61	129	224	471	719	1335	2165	4107	7859
40	52	110	196	401	635	1143	1867	3258	6795
50	46	98	177	364	560	1041	1680	2936	6142
60	42	89	159	336	513	957	1559	2684	5647
70	38	82	149	317	476	896	1447	2492	5250
80	36	76	140	239	443	840	1353	2315	4900
90	33	71	133	275	420	793	1288	2203	4667
100	32	68	126	266	411	775	1246	2128	4518
125	28	60	117	243	369	700	1143	1904	4065
150	25	54	105	215	327	625	1008	1689	3645
175	23	50	93	196	303	583	993	1554	3370
200	22	47	84	182	280	541	877	1437	3160
300	17	37	70	145	224	439	686	1139	2539

Plastic Vs. Metal in Piping Systems

Frist let me state that plastic piping system (Orange or Yellow) should be run below ground and run it with a copper tracer wire using a steel riser at each end.

Plastic Vs. Metal in Piping Systems A basic guide to selection and use.
In many applications plastic pipe, valves and filters can be a viable replacement for metal. Recent estimates show that about 25% of the expenditures for metal pipe, valves and filters could be spent on plastic ones. And, in a lot of those systems, plastic would not just do the job, it would be better.

We can summarize some of the things that support the fact that in many applications where metal valves are specified, plastic ones would do a better, more cost effective job.

First and foremost is the corrosion resistance advantage of plastics over metal. This results in some obvious, and not so obvious, benefits. More than just being a low maintenance valve, a plastic one will never jam, stick, or fail because of rust or corrosion.

Another often overlooked benefit of corrosion resistance is that plastic filter vessels never have to be painted to withstand corrosive environments or harsh climatic conditions. They can be installed and used right out of the box in places where a metal valve would have to be epoxy coated just to survive.

Another benefit is cost. Not only the cost of the individual filter vessel but the total cost of the installed system. When all costs are considered, including freight, installation and service life, a metal system will in most cases be more expensive.

The differences can be significant. Exotic metal alloy systems can cost up to 13 times that of a plastic system . Even carbon steel can be almost twice the cost of PVC - depending on the size and complexity of the piping system involved.

Flow rates are another area where plastic pipe has an advantage. The interior of plastic pipe is smooth and clean and it will stay that way year after year. Metal pipe can rust, corrode and scale - resulting in reduced flow rates and higher pressure drops over time.

Often, users are not aware of the engineering advances that have been made with regard to plastic piping materials over the last several years. Users of metal pipe, valves, and fittings are often concerned with what they believe to be the mechanical strength limitations of plastics. While it is true that there is no commonly available plastic system that can match the temperature/pressure service levels of metals, significant advances have been made. And plastic piping systems are now commonly available that provide adequate tensile strength or operation up to 200F. Plastic pipe is also available that maintains its pressure bearing capabilities for over 50 years.