

Electric Kiln Power (Kilowatts) Requirement

The required power for power (in kilowatts) of the electric kiln is a function the kiln's volume temperature and the time required to reach the temperature (Olsen, 2001). Kiln voltage depends on the local power voltage. The voltage supply is 240V in Ado-Ekiti State, Nigeria. 1.8KW is the recommended electric kiln power for kiln capacity below 0.028m³ (1 ft.³). The rate of the resistance element used is 2KW.

Thus:

$$P = IV \text{ Eq. 4}$$

Where: P = Power, I = current, V = voltage
 Voltage is = 240V and Power is 2000 watts

$$\text{Current} = \frac{2000}{240} = 8.33 \text{ amps}$$

Resistance of the Electric Kiln Element (R)

Resistance is given according to ohms as:

$$R = \frac{V}{I} \text{ Eq. 5}$$

Where V= voltage and I = current

Therefore;

$$R = \frac{240}{8.33} = 28.8\Omega$$

2.3 Description of Components

Kiln Cover

The cover of the kiln is a movable flat roof construction. It is made up of insulating bricks, fibre glass lining, a stand and a metallic cover. Row of bricks were arranged on the stand and held tie together by bolts. The kiln cover was fabricated from mild steel sheet, of 610mm x 610mm, bent 90mm from each end to seal up the kiln jacket. A 2.5 mm diameter drilled hole near the centre of the kiln's floor serves as the chimney.

Kiln Wall

The kiln jacket was fabricated from a 1.5mm mild steel to produce a cuboid of 430mm x430mm x23mm as the dimension of the length, the width and height respectively. The jacket serves as a protective wall that seal up the kiln lagging.

Kiln Stand

The kiln stand was made up of 25 x 25 mm mild steel angle bar. The angle bars were cut and welded together to form a support for the base of the kiln with 430 x 430 x75 mm as the length, width and length. Insulating bricks are arranged on the stand.

Resistance Heating Element

The heating element used for the construction of the kiln is manufactured by Kenton incorporated with capacity of 2000watts, eight elements pieces were installed in the size grooves and connected to an electric power source.

Refractory Linings

A layer of insulating bricks with dimension of 250mm x 120mm x 60 mm followed by 10mm layer of fibre glass were used for lining the electric kiln.

Mortar Paste

Mortar paste was composed from admixture of ball clay, grog, kaolin sodium silicate and water. It was used to bind the bricks together while constructing kiln's wall, base and cover. The composition of the constituents of the mortar is shown in Table 1.

Table 1: Composition of the Mortar

Ball Clay	Grog	Kaolin	Sodium Silicate	Water
15kg	30kg	40kg	50cm ³	2000cm ³

2.4 Material Selections

Table 2 shows the materials selected for the design and fabrication of the electric kiln. The materials selections for this research work were mild steel and insulating brick. The reason for choice of mild steel is its corrosion resistant property, strength durability and cost effectiveness. The bill of engineering measurement and evaluation including the cost analysis of fabricating the electric kiln and the cost of imported kiln with similar heating capacities were shown in table 3 and table 4 respectively.

Table 2: Kiln part names, materials selection and quantity

S/N	Part Names	Materials	Quantity
1	Top Cover	Mild Steel	1
2	Kiln Door	Mild Steel	1
3	Kiln Stand	Angle Bar	4
4	Kiln Wall	Mild steel and fibre glass	
5	Kiln door	Mild steel and insulating brick	1
6	Insulating materials	Insulating brick and fibre glass	
7	Thermostat	Bi-metal	1
8	Electrical wire	Cable	4
9	Connector	Ceramic connector	8
10	Heating elements	Nickel-chrome alloy	8
11	Nuts	Iron	16

Table 3: Bill of engineering measurement and evaluation (BEME)

S/N	Items	Unit Price (N)	Quantity	Amount (N)	Amount (\$)
1	Angle bar iron	1000		1000	5.1
2	Mild steel flat sheet	4500		4500	22.9
3	Mortar (Kaolin, Grog, Sodium silicate etc)	1000		1000	5.1
4	Sodium Silicate	150	2 litres	300	1.6
5	2KW Heating element resistance	250	8	2000	10.2
6	Thermostat	1000	2	2000	10.2
7	Ceramic connector	300	8	1800	9.2
8	AutoCAD drawing charges	3000		2400	12.2
9	Fabrication and electrical installation fees	5000		5000	25.5
10	Transport, typing expenses and Miscellaneous	5000		5000	25.5
	Total			25,000	127.5

1US Dollar equals 196.5 Nigerian Naira.(Central Bank of Nigeria, 2015)

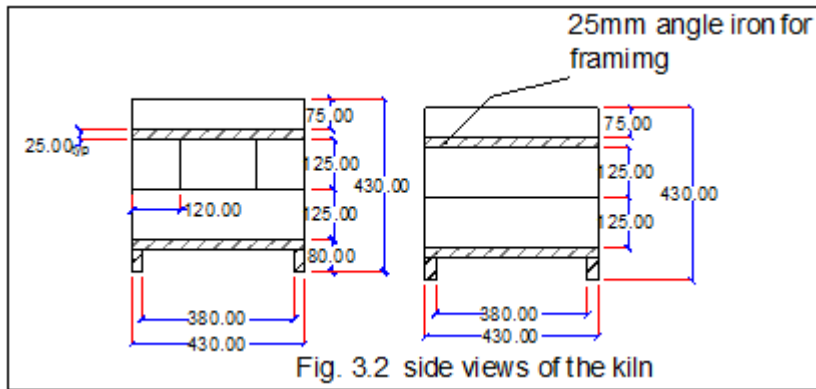


Figure 2: Orthographic view of electric kiln

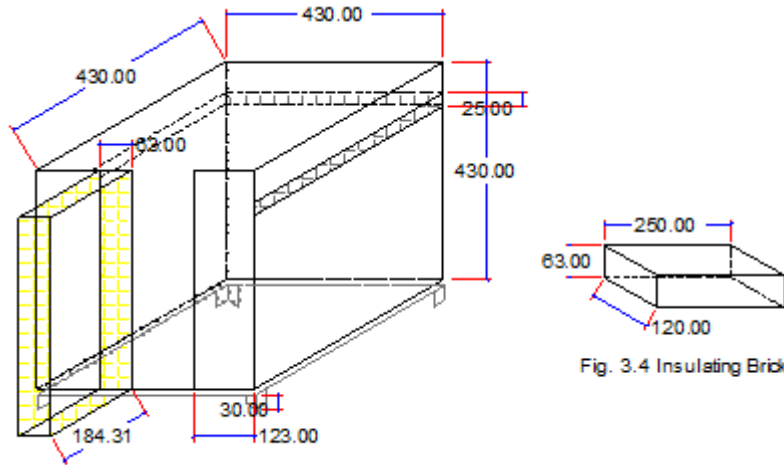


fig. 3.5 kiln

Figure 3: Isometric view of the Electric kiln without the kiln roof