

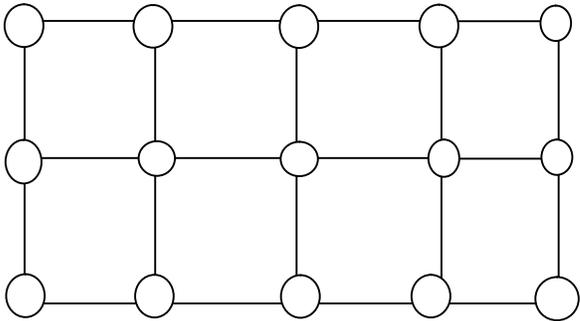
Modifying Kiln Cars for Efficient Use of Heat (Low Thermal Mass)





The heavier the material on kiln car more will be the gas consumption of the kiln. The heavier the furniture material, more the heat is utilized to heat up the car, which is of no use. The only useful heat is what absorbed by the product loaded on the car.

Furniture of the car consists of the shelves for loading the moulded pieces, supports to withstand the shelves and refractory bricks platform to withstand the whole assembly. This kind of arrangement makes the kiln car very heavy, aiding to heat absorption and increase the gas consumption.

Case Study – 1	Modification in kiln car furniture by replacing ' <u>Solid Cordierite Kiln Car Shelves (Saggers)</u> ' with ' <u>Extruded Batts</u> ', thereby reducing the weight of kiln car (Low Thermal Mass Kiln)								
Implementing the technology	<p>The diagrammatic representation of kiln car before modification at a porcelain ware industry is shown here.</p>  <table border="1" data-bbox="456 1535 1409 1745"> <tr> <td>The size of the kiln</td> <td>104' (31.69 meters) approx.</td> </tr> <tr> <td>Car capacity of kiln</td> <td>27 Cars</td> </tr> <tr> <td>Dimensions of the kiln car</td> <td>(46" * 20" * 30") (L * W * H)</td> </tr> <tr> <td>Cycle time</td> <td>40 Min</td> </tr> </table>	The size of the kiln	104' (31.69 meters) approx.	Car capacity of kiln	27 Cars	Dimensions of the kiln car	(46" * 20" * 30") (L * W * H)	Cycle time	40 Min
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Material of car furniture	The shelves are made of Pressed Cordierite and the platform is made up of heavy refractory bricks with ceramic fibre as filling
Dimension of cordierite plates	11" * 10" * 1" (280mm * 254 mm * 25mm)
Loaded product per kiln car	150 Kg
No. of layers of sagger per car	4 to 6 (depending upon size of product)
Gas consumption	287.35 SCM/Ton of product



A typical cordierite plate is shown here (For Symbolic reference only)

Recommendations:

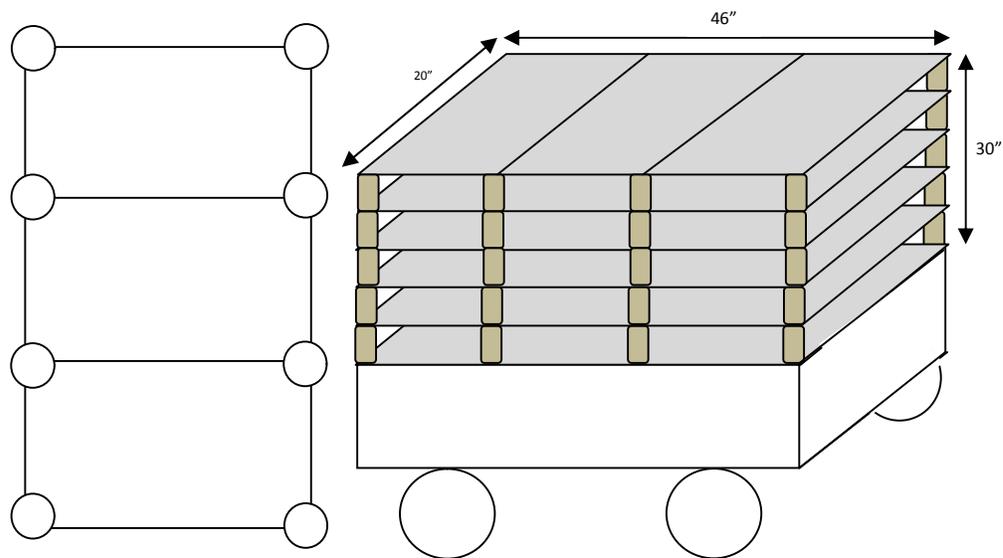
As per the thumb rule, the gas consumption will be reduced dramatically by reducing the weight of the kiln car. The option to reduce the kiln car weight is by changing the design of shelves in the kiln car

It is highly recommended to replace the Solid Cordierite Shelves with light weight 'Extruded Cordierite Batts'. The structure can be visualized in the picture given below.



The specific gravity of the extruded cordierite batts is 2.57 – 2.66 with better thermal efficiency and thermal shock resistance and proven to reduce the gas consumption than the solid cordierite plates.

The only drawback associated with using such plates is that the thickness required for carrying heavy load is around 25 mm. However, it is still the better condition, because after deducting the internal hollow portion, the solid portion thickness still reduces to 12 mm.



After CP

- Size of one shelf: 20" * 15" * 1" (0.508 * 0.381 * 0.025 meter)
- Volume of one shelf: 0.0048 m³
- Density of one extruded batt: 2100 Kg/m³ * 60% (as 40% space is hollow)
- Weight of one extruded batt: (0.0048 * 2100 * 0.6) = 6.048 Kg
- Each layer of car will contain 3 shelves of extruded batt
- Each car may contain 5 layers of such batts
- Total no. of batts per car: (5 * 3) = 15 (405 batts for 27 Cars)
- Total weight of 15 batts: (15 * 6.05) = 90.72 Kg
- Total weight of batts for 27 cars = 2450 Kg
- Current weight of shelves on 27 cars 4082.4 Kg + Weight of product 3500 Kg = Total 7582 Kg
- After modification, weight of shelves on 27 cars 2450 Kg + Weight

	<p>of product 3500 Kg = Total 5950 Kg</p> <ul style="list-style-type: none"> • Reduction in weight of cars: $(7582 - 5950) = 1632 \text{ Kg}$ • % Reduction in weight: 22% • % Reduction in Gas Consumption: 22% approx. • Savings in Gas Consumption per annum: 1,20,860 SCM
Benefit	
Environmental	<ul style="list-style-type: none"> • Per Day reduction in the gas consumption: 335.72 SCM. Per Year reduction in gas consumption: 1,20,860 SCM. • Per Day reduction in Greenhouse Gas (CO₂) emission: 0.63 MT Per Year Reduction in Greenhouse Gas (CO₂) emission: 226 MT
Economic	<p>Investment: Rs. 4,90,000/- (for 405 batts @ Rs. 200/Kg of batt)</p> <p>Expected Savings: Rs. 22,80,000/- per annum</p> <p>Simple Payback Period: 3 Month</p>