

Boxmoor Kiln Design Check

Using Fred Olsen's "The Kiln Book" design principles, as set out in pages 74 to 81.

Principle 1 – The cube is the best all purpose shape for a kiln. Increasing the height versus the width leads to inefficiencies and a drop in temperature at the top of the kiln. - It is not completely clear if this refers to the overall chamber or just the packing space. He does seem to refer to the packing space, so if we take that as correct, then -

Boxmoor kiln has 110cm length x 95cm width x 138cm high packing space and this unequal height over width ratio could account for a 1 to ½ cone difference in temperature between top and bottom. There is probably no easy way to correct this, short of tearing the kiln down and rebuilding. This could be solved by using glazes with different maturing temperatures, but this would be very complex to control and probably unworkable in the Guild multiple user scenario.

NB Paul Rowbotham recalls that Joe Finch said he had made the arch taller than he did normally, when he built the kiln.

Principle 2 – Chamber shape – flames should follow the flow of the arch, not be at right angles to it.

Boxmoor is perfectly OK

Principle 3 – A specific amount of grate area is needed for natural draft. For wood, the ratio of 10 to 1, grate to chimney cross section at base of chimney, is given by Olsen. However, he admits this is a very complex issue, and in some cases he has found kilns with lower ratios, fire just as well.

Boxmoor Kiln – grate area $2 \times 110\text{cm} \times 20\text{cm} = 4400\text{sqcm}$
Chimney $35\text{cm} \times 25\text{cm} = 875\text{sqcm}$
Ratio 5 to 1

Check exit flue size $(40\text{cm} \times 10\text{cm}) + (43\text{cm} \times 10\text{cm}) = 830\text{sqcm}$.
This should equal the chimney cross section and it does so it's OK.

However it is not clear if there is sufficient gaps/space through the bottom shelf for flames to exit, of the same size as the flue. Apparently there should be, as the kiln shelves are 20cm x 50cm. So $3 \times 20\text{cm} = 60\text{cm}$. The space is $110\text{cm} - 60\text{cm} = 40\text{cm} \times 30\text{cm} = 1200\text{sqcm}$, greater than 830sqcm flue, so should be OK. However this needs to be checked, and when packing the kiln, ensure the gaps between the shelves are not blocked.

Generally, though the ratio is only 5 to 1, this should be OK and all the other flue areas check out OK.

Principle 4 – The taper of chimney affects the draft and increases the speed of draft. Tapering the chimney allows the height of the chimney to be reduced.

Boxmoor chimney has no taper. See also Principle 5 below.

Principle 5 – For downdraft kilns, need 90cm of chimney for every 30cm of downward pull plus 30cm chimney for every 90cm horizontal pull.

Boxmoor kiln $(135\text{cm chamber height} \times 90\text{cm chimney} / 30\text{cm downward pull}) + (200\text{cm horizontal distance} \times 30\text{cm chimney} / 90\text{cm horizontal pull}) = 470\text{cm required}$

Actual chimney height is 255cm, almost half the requirement. Also there is no taper, so we can take no benefit from that. This is of course, exacerbated by the fact the chamber is taller than it should be, see Principle 1 above.

It is probable that we need to increase the height of the chimney and taper it if possible.

Principle 6 – Applies to circular kilns

Principle 7 – Notes the chimney height is critical, if too high it can pull heat out of kiln and too short leads to too slow combustion. See Principle 5 above.

Principle 8 – Applies to chamber kilns

Principle 9 – Critical kiln areas should be planned and built to be altered easily including chimney height. Good advice.

Conclusion – Joe Finch has done us no favours building the chamber that much taller. I would suggest the chimney is increased to the height suggested above, as this is pretty easy to do compared with altering the kiln structure.