Notes on Kiln Discussion and General Observations…

The kiln currently in use is a good design but I think several things can be done to make the kiln more efficient and/or have better recovery of the usable filters.

Physical changes to the kiln would include a bag wall being installed over each of the inlet flues. A bag wall is a very open, loosely stacked wall of bricks that can easily be modified to better direct the flame and gases through the kiln. The bag wall needs to be made of refractory brick so that the wall is able to take the stress of the excessive heat at the inlet flue. I would suggest a wall between one-half and one meter in height to begin. The point is to force the flame up to the roof of the kiln sooner so that it has to work to the front by producing a longer flame. The heat of the flame is at its tip, so it is very important to direct the flame’s travel in the kiln.

Over several firings, several cone packs of at least three cones should be placed in the back, middle and front of the kiln. You are firing to cone 010 so I would suggest a pack of 013, 010, and 08 or some combination close to that which would allow you to know where the kiln is firing too hot or too cold in a given area. Now, we know the kiln is firing hotter in the back so we need to place a bag wall that will force the flame up to the ceiling. If, after a few firings, the kiln is firing hotter in the center, we need to lengthen the flame by building the bag wall higher.

The second physical change would be to add doors to the stoking openings in the fireboxes. The doors can be open in the early, drying stage of the firing but once the kiln is dried out, the stoking should be done more carefully. The doors should be hinged to open easily for stoking and there should be holes though the base of the doors that can be plugged or opened at various times to improve and offer more control of the combustion of the fuel. The openings in the base of the doors will provide the primary air inlet for the burning of the fuel. The combination of stoking, controlling the amount of fuel and setting the damper at differing points is what produces the length and quality of the flame. A short, hot flame is produced by giving the firebox too much air for combustion. The result of which will be that of creating too much heat in the back of the kiln. By more carefully controlling the amount of air entering the firebox, the quality and length of the flame can be improved. It is possible to heat a specific area of the kiln more or less than others just by controlling the length of the flame. The bag wall should also help force the flame through the back more readily.

The third physical addition to the kiln would be more insulation both on the interior of the kiln and on the exterior. A coating of ITC material or kaowool blanket would greatly help. The ITC may be difficult to use because I don’t know whether or not it would adhere to the brick. Kaowool is not generally used in a wood-fired kiln because it does not do so well with fly ash building on its surface and it is very fragile. One should not disturb the surface. It can be coated with sodium silicate (water glass) to help protect the surface. The outside of the kiln should have more insulation added if nothing more than to make it more bearable to be around the kiln during firing. It would also help the kiln be more efficient with less heat being conducted to the exterior surface.

Other considerations…

Larger pieces of wood can be used in the early stages of firing but smaller, thinner pieces should be used when going for the final temperature and will allow greater control. Stoking patterns can be determined with the use of the pyrometer. When one stokes, there should be a slight drop in temperature because of the greater fuel to oxygen ratio. Then the temperature will rise slightly. Just after the rise, the next stoke should be done. Another stoking technique is to watch the chimney. Stoking should result in smoke. When the smoke dissipates, the next stoke should be done. I’ve seen potters use a peep-hole in the door to watch the smoke during stoking and use that as their gauge.

If, after several firings, it is still difficult to get the heat to move more easily toward the front, the stacking of the filters should be examined. Flame is like water and will seek the most direct and easiest path. The filter stack could be more open in an area that is too hot which would move the flame more quickly through that area on its way to the front of the kiln.

We might find that it simply isn’t possible to even the kiln satisfactorily. If we get to that point, then a product that can be fired hotter should be placed in that area. Perhaps the flower pot/planter idea could be put to use.

When quartz inversion occurs in the kiln, around 565 Centigrade, it is important to slow the temperature rise so that the free silica doesn’t crack the filters. I don’t think your kiln is cooling too quickly, but if a lot of cracks are being noted after the firing when they are not easily seen, that is an indication of too fast a cooling process. Cooling cracks would indicate a need for more insulation and/or ensuring that no air can enter the kiln after the firing is completed and the temperature is below 565 before cooling is forced.

The most critical thing is to have one lead person involved in the firing over a long period of time. It is extremely important that good recordkeeping be completed on each firing so that each one can be compared to the previous ones. The firing notes need to be assembled by one person only but there should be a team of reviewers. Firing notes should include not only temperature at a given time but also damper settings, primary air settings, atmospheric conditions (raining, sunny, etc.), fuel type and size, and any other items that the lead person might believe is affecting the firings. I am very impressed with the individual in the kiln area now who is in charge and I would really encourage Songhai to include the director of your foundry in reviewing firings. I think his English name would be Moses. He is extremely perceptive and very knowledgeable in the theory of firing and flame.