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Augmentation of convective heat transfer in the cooling zone of brick tunnel kiln using guide vanes: An experimental study

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One of the most important priorities in brick industry is to reduce energy consumption. Therefore, the present work aims to enhance the average Nusselt number that provides an indication of the production time of the tunnel kiln. A test rig simulating the cooling section of tunnel kiln, by scale 1:4 has been designed and fabricated. Augmentation technique using guide vanes with attack angles (q ¼ 120_, 135_, and 150_) in flow direction are attached to the side walls to direct the flow toward the confined zone between the heated columns. This technique is applied on ten different settings within Reynolds number range of 11,867 _ Re _ 25,821. The results demonstrate that the heat transfer and pressure drop depends on the brick setting. Furthermore, using guide vanes increases the heat transfer rates with all settings. The maximum enhancement of about 94.5% is obtained for longitudinal brick at middle column (compared with that nearest to the wall) in setting 2 at q ¼ 135_ and Re ¼ 22,407. Finally, the present study aimed to extend kiln designers with Nusselt number correlations within 11,867 _ Re _ 25,821, 0.33 _(S/a) _ 1.0, 0.79 _ (εS=b) _ 3.0, and 120_ _ q _ 180_.

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