This study concerns the air side performance of a thermosyphon heat exchanger with and without the presence of electrohy-drodynamic (EHD) in the low Reynolds number region. For test results without EHD, the predictive ability of the well-known Zukauskas correlation significantly underestimates the present results. With the introduction of EHD, there is an insignificant increase of heat transfer coefficient when the supplied voltage is <15.5 kV. In the meantime, for a supplied voltage of 17.5 kV, the heat transfer coefficients can be improved by 15% at a Reynolds number of 58. However, the enhancement may drop to 10% when the Reynolds number is increased to 230. The power consumption relative to the heat transfer rate improvement is within 0.5-20%. The flow visualization experiment indicates that the corona wind is the major mechanism of heat transfer enhancement. However, the corona wind may be opposite to the air flow direction and reduce the benefits of EHD in the larger Reynolds number region.