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CFD evaluation of pressure drop across a 3-D filter housing for industrial gas turbine plants

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Abstract

This paper investigated the flow distribution and total pressure drop across a designed 3-D filter housing integrated with a 3-stage filtration system using computational fluid dynamics (CFD). The filter housing model was proposed for a heavy-duty industrial gas turbine plant

operating at an average ambient temperature of 20°C.The pressure drops across the classes of filters were 652.8 Pa, 2692.2 Pa, 887.8 Pa, 776.2 Pa and 2304.2 Pa for I-GB, GB-GA, GA-FA, FA-HA, and HA-O, respectively. The results obtained indicated an acceptable total pressure drop of 7.2% for the entire filter housing before filter clean-up. Although the CFD simulation result shows that small outlet flow velocity and transonic flows exist at the outlet of the filter housing, the designed filter housing was proved compatible with the studied GT, for inlet flow conditions between $600 \leqslant W_{air} \leqslant 610$ kg/s and $60 \leqslant v_{air} \leqslant 70$ m/s for the air flow rate and velocity, respectively. Furthermore, the designed filter housing could be adopted for the studied GT and locations of Usan and Maiduguri in Nigeria, and other locations with similar environmental conditions.

Keywords

computational fluid dynamics (CFD)pressure dropflow distributionfilter housinggas turbine

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