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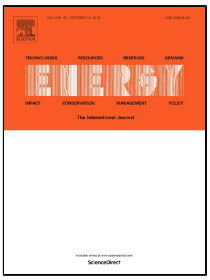

Deformation of receiver in solar parabolic trough collector due to non uniform temperature and solar flux distribution and use of bimetallic absorber tube with multiple supports

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Deformation of receiver in solar parabolic trough collector due to non uniform temperature and solar flux distribution and use of bimetallic absorber tube with multiple supports

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Abstract

A group of researchers have observed bending in receiver during experiments. In literature, different types of receivers to enhance the heat transfer are proposed. However, bending that leads to practical issues and energy loss (due to defocusing) have not been modelled. Current authors have dealt with the issue of bending in previous work. Present study aims at minimising the risk of bending using double-layered-absorber held at pillars. Mathematical equations are formulated for bending and energy loss. Tube is modelled for practical scenarios supported by pillars made up of movable structure that can slide to help absorber expand when heated. Ball-joints at contact points enable tube to rotate. Equations are validated against the experimental-measurements. Effects of placement of conductive-material, focal-length, PTC-width, geometrical-imperfections and HTF-flow-rate on bending/energy losses are studied. It is found that (i) conventional single-layered-absorber leads to bending and energy loss of -15.1mm and 2.3%. Double-layered-absorber with high-conductivity-material as inside-layer reduces bending/energy loss to -10.0mm/1.0%. However, use of high-conductivity as outside-layer further reduces bending/energy loss to -6.1mm/0.4%, (ii) change in HTF-flow-rate from 0.4kg/s to 1.4kg/s reduces bending/energy loss from -15.1mm/2.3% to -10.2mm/1.0% for single-layered-absorber and -6.1mm/0.4% to -4.5mm/0.2% for double-layered and (iii)focal-length near to 0.7m reduces bending/energy loss to 0mm/0%.

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