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Electronics Thermal Management Driven Design of an IP65-Rated Motor Inverter

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Abstract : Thermal management of electronic components packaged inside an IP65 rated enclosure is of prime importance in industrial applications. Electrical enclosure protects the multiple board configurations such as inverter, power, controller board components, busbars, and various power dissipating components from harsh environments. Industrial environments often experience relatively warm ambient conditions, and the electronic components housed in the enclosure dissipate heat, due to which the enclosures and the components require thermal management as well as reduction of internal ambient temperatures. Design of Experiments based thermal simulation approach with MOSFET arrangement, Heat sink design, Enclosure Volume, Copper and Aluminum Spreader, Power density, and Printed Circuit Board (PCB) type were considered to optimize air temperature inside the IP65 enclosure to ensure conducive operating temperature for controller board and electronic components through the different modes of heat transfer viz. conduction, natural convection and radiation using Ansys ICEPAK. MOSFET’s with the parallel arrangement, IP65 enclosure molded heat sink with rectangular fins on both enclosures, specific enclosure volume to satisfy the power density, Copper spreader to conduct heat to the enclosure, optimized power density value and selecting Aluminum clad PCB which improves the heat transfer were the contributors towards achieving a conducive operating temperature inside the IP-65 rated Motor Inverter enclosure. A reduction of 52 ℃ was achieved in internal ambient temperature inside the IP65 enclosure between baseline and final design parameters, which met the operative temperature requirements of the electronic components inside the IP-65 rated Motor Inverter.

Keywords : Ansys ICEPAK, aluminium clad PCB, IP 65 enclosure, motor inverter, thermal simulation
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