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Electrical Energy Efficiency Results of Die-Cast Copper Rotors

Six different sizes and types of rotors were die-cast using pure, high-conductivity, copper for motor companies worldwide. Electrical efficiency tests were performed on an assortment of motors using these copper rotors in accordance with IEEE Specification 112 test method B as required by the National Electrical Manufacturers Association (NEMA). The results from these tests exceeded our expectations.

Compared with an identical aluminum rotor, die-cast copper rotors reduced the electric motor's total energy losses by 15% to 23% (1.2% to 1.7% improvement in efficiency over aluminum) depending on the rotor design. Earlier modeling with die-cast copper rotors had indicated a potential range available of 15% to 20% reductions in losses, compared with current die-cast aluminum rotors. The improvement in efficiency was demonstrated consistent irrespective of the variables that were introduced into the die casting process such as pressure, shot speed and cooling rate. Consequently, from these data, it appears that the process of die casting copper rotors can be quite reliable and robust.

Further improvements in process and rotor design such as optimization of the steel laminations should extend copper's lead in efficiency over that for aluminum.

As a consequence in the improvement in efficiency, the copper rotors reduced the operating temperature of motors by as little as 5 degrees C to as much as 32 degrees C. As a general rule, for every 10 degree increase in the motor operating temperature, the insulation life of the motor is cut in half. These data indicate that the life of motors having copper rotors may be extended 50% or more with proper maintenance.