STRATEGY TO IMPROVE ENERGY EFFICIENCY OF INDUCTION MOTOR

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Overview

Induction motor is presently the most utilized machine for industrial motor worldwide. Its simplicity of use, self-starting, small in size, light in weight, high efficiency, less demanding maintenance, less prone to accidents and low cost per same power rating which usually met the required characteristics for industry as attract its application in industry. In Malaysia, about 48% of total energy is used to drive industrial motors. In many industrialized countries, more than 70% of the total energy is consumed by electric motors. It is available from fractional horse-power up to thousands of horse-power. Induction motor is employed in application such as centrifugal pumps, conveyors, compressor crushers, drilling machines, fans, blowers, escalators, refrigerator and electric vehicles. This work studies industrial low voltage three-phase induction motors with 4-pole, 0.5Hp, 50Hz and 415V. The improvement of the energy efficiency is investigated using copper for rotor bar slots and electrical steel sheet for rotor frame. Normally, the iron loss or core loss in rotor part of induction motor is contributing to the energy losses. This work proposed a new design for the rotor part, with modified rotor frame material, bar type, bar size and rotor bar design. A set of simulation showed that there is a significant improvement in the energy efficiency for the new design. This work has been investigated using two methods, namely, MotorSolve (IM) software and theoretically calculation. The theoretical calculation utilised MATLAB simulations. The comparison on efficiency between the NEMA design and the proposed new design was carried out using MotorSolve (IM) simulation. The finding showed that the proposed new design has batter energy efficiency of 76.92% as compared to NEMA design of 74%. The results was verified using MATLAB.

The paper is organised as follows: First section introduced to the energy efficiency of induction motor, than the second section gave a brief overview of the Induction motor as a special load, energy efficiency, MotorSolve (IM) software for design and Matlab simulation for comparing the results. The third section explained the rotor design and characteristics. Section four presented the results, discussions and analysis. The final section discussed the potential benefit of using the proposed new design motor and the challenges.

Methods

MotorSolve (IM) software and theoretically calculation MATLAB simulation.

Results

First, the comparison result for the NEMA design and the proposed new design with different rotor bar using the MotorSolve (IM) Software simulation were analyzed.

Second, the simulation results for the proposed new design was verified using MATLAB. The result shows that the error value between MotorSolve (IM) and MATLAB will be discussed.

Third, the potential benefits of using the new bar design for induction motor have been discussed for policy recommendations.

Conclusions

This work was intended to prove to estimate the amount of energy saving using high efficiency motors. The proposed new design was used as an example in the estimate. Futhermore the potential benefit and challenge in bringing the new design for industrial application was discussed.

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