

# Feasibility Assessment of IEC 61800-9-2-2023 Standard in Switched Reluctance Motors



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## INTRODUCTION

Electric motor systems account for more than 53% of the world's electricity consumption, with a predominance of the industrial sector [1]. Despite the widespread use of three-phase induction motors, limitations such as reduced performance under partial loads, absence of direct speed control, high starting currents, and construction constraints have encouraged the search for technological alternatives. Regulatory requirements for energy efficiency, namely IEC 61800-9-2:2023, reinforce this need. In this context, Switched Reluctance Motors (SRMs) stand out as a promising solution, offering high power density and less dependence on critical materials [2]. Thus, this work aims to analyze the energy performance of a switched reluctance motor and evaluate the applicability of the methods defined in IEC 61800-9-2:2023 [3].

## METHODS

- Two testing procedures: IEC 61800-9-2:2023 and thermal stabilization
- Evaluation at 7 operating points.

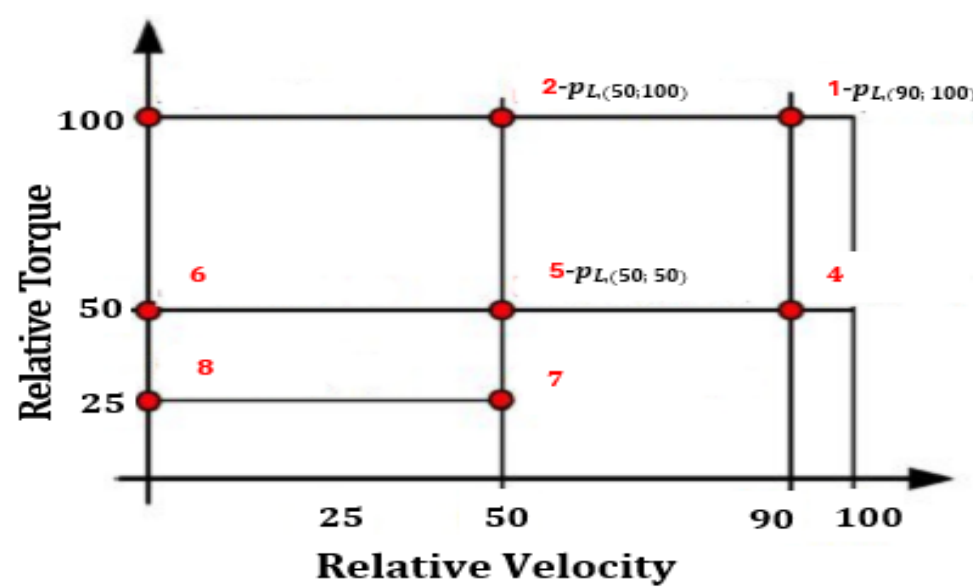


Figure 1 – Operating points considered in the tests.

## EXPERIMENTAL RESULTS

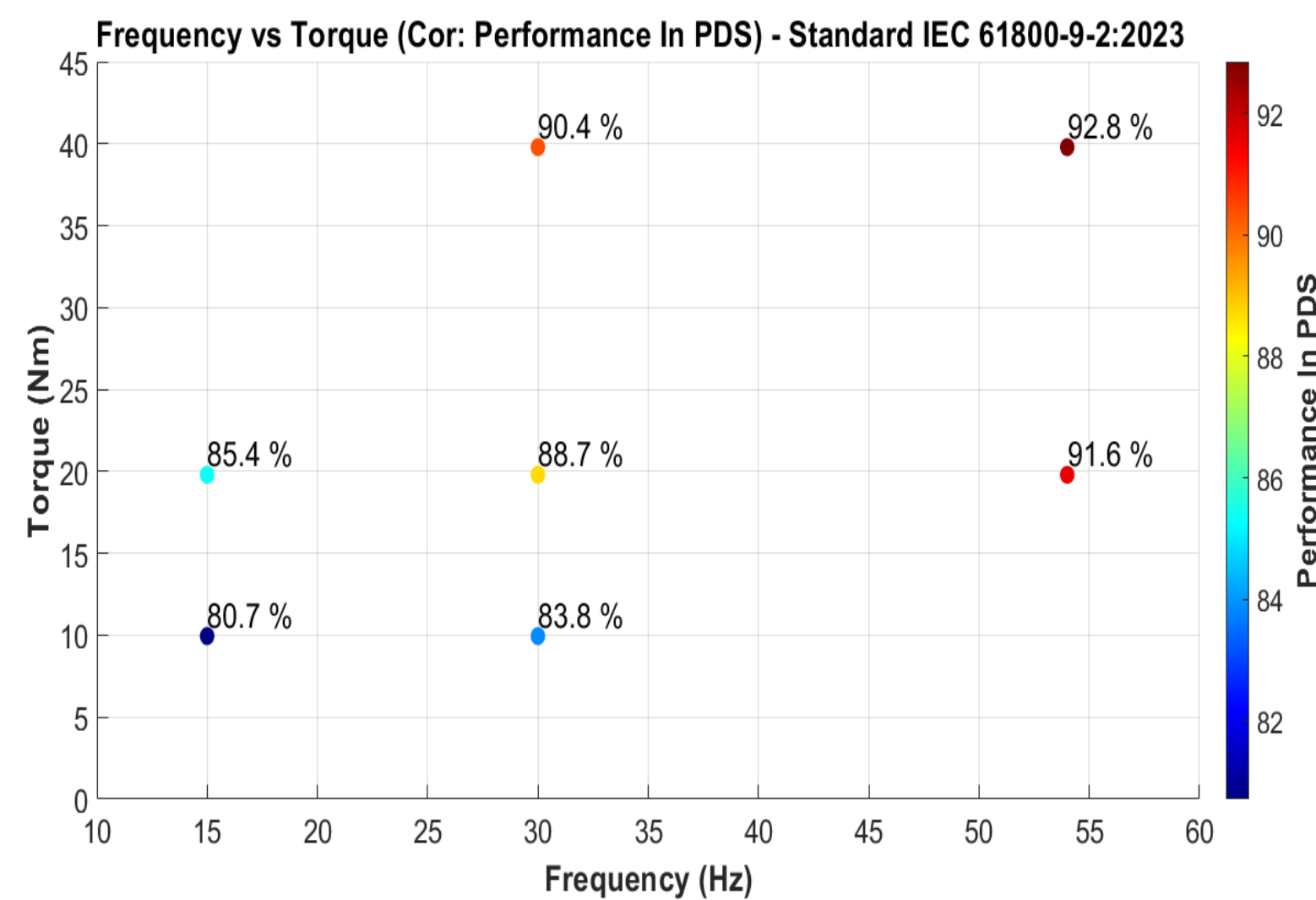


Figure 3 – Power Drive system (PDS) performance for the seven test points, following the standard.

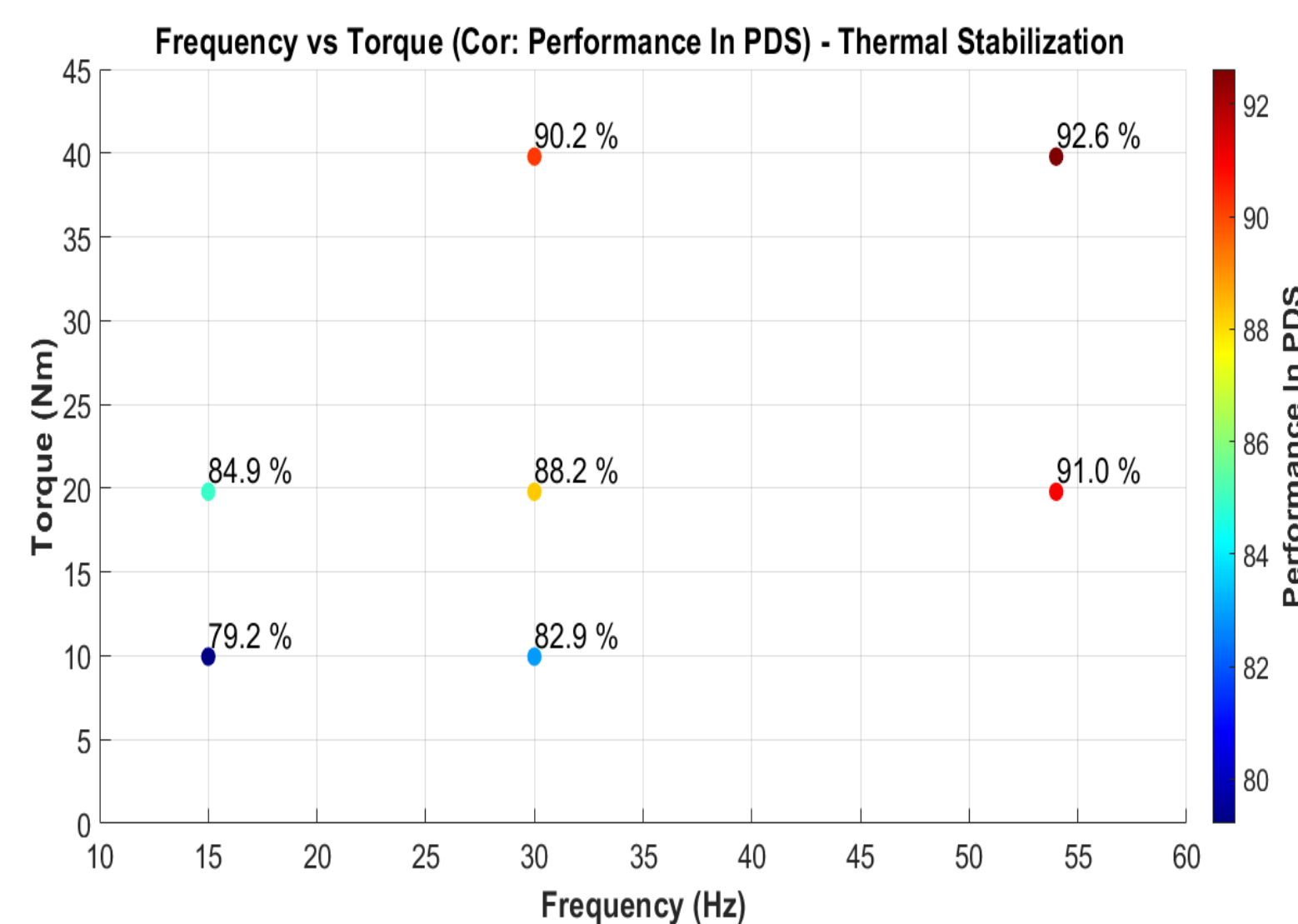


Figure 4 – PDS performance for the seven test points, following thermal stabilization.

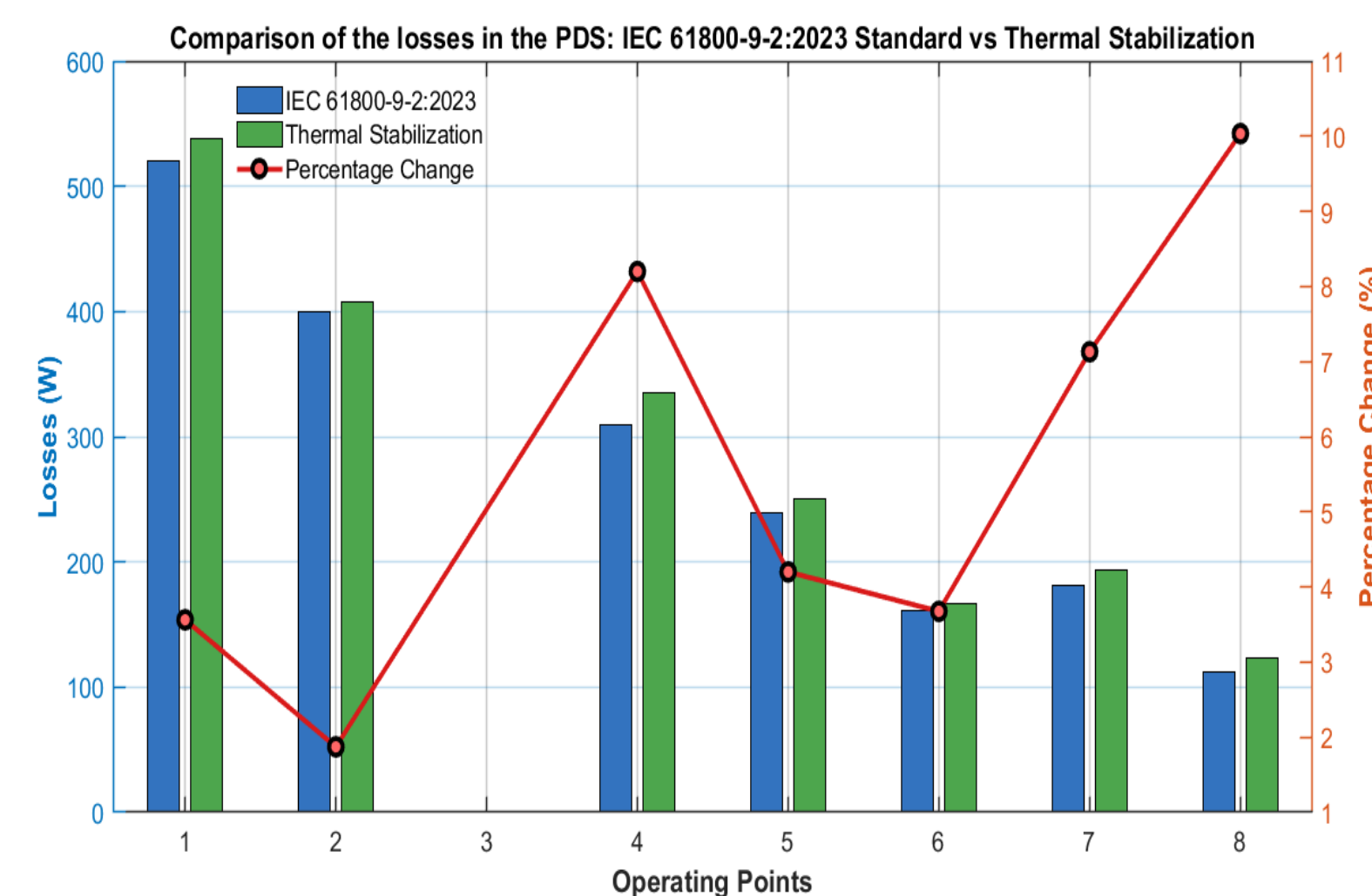


Figure 5 – Comparison of the measured PDS losses: IEC 61800-9-2:2023 standard vs thermal stabilization.

## DISCUSSION

The efficiency of the PDS increases with frequency and torque, exceeding 92% at high loads and decreasing to around 80% at low speeds, demonstrating a strong dependence on operating conditions and motor losses, according to the analysis of the results based on IEC 61800-9-2:2023 (Figure 3).

Similarly, Figure 4 reveals that the efficiency of the PDS increases with torque and frequency, exceeding 92% at high loads and decreasing at low speed and torque regimes, due to the greater relevance of motor losses, showing that the system's behavior is dominated by this, according to the analysis.

The results provided in Figure 5 indicate that the highest percentual variations occur in conditions far from the nominal regime, especially at low load torque and low speed, while the agreement between the testing methods is high at the operating points close to the nominal load.

## CONCLUSIONS

The results indicate that the test method defined in IEC 61800-9-2:2023 provides consistent losses estimations under nominal operation, but has limitations under partial load conditions. It is recommended to:

- integrate thermal stabilization at the standardized points;
- adapt the standard to the specificities of switched reluctance motor drives.

## REFERENCES

- [1] A. De Almeida, J. Fong, C. U. Brunner, R. Werle, e M. Van Werkhoven, «New technology trends and policy needs in energy efficient motor systems - A major opportunity for energy and carbon savings», *Renew. Sustain. Energy Rev.*, vol. 115, p. 109384, nov. 2019, doi: 10.1016/j.rser.2019.109384.
- [2] T. J. E. Miller, *Switched Reluctance Motors and Their Control*. in Monographs in Electrical and Electronic Engineering. Oxford, New York: Oxford University Press, 1993.
- [3] IEC 61800-9-2, Adjustable Speed Electrical Power Drive Systems – Part 9-2: Energy Efficiency Indicators for Power Drive Systems and Motor Starters, *International Electrotechnical Commission*, 2023.

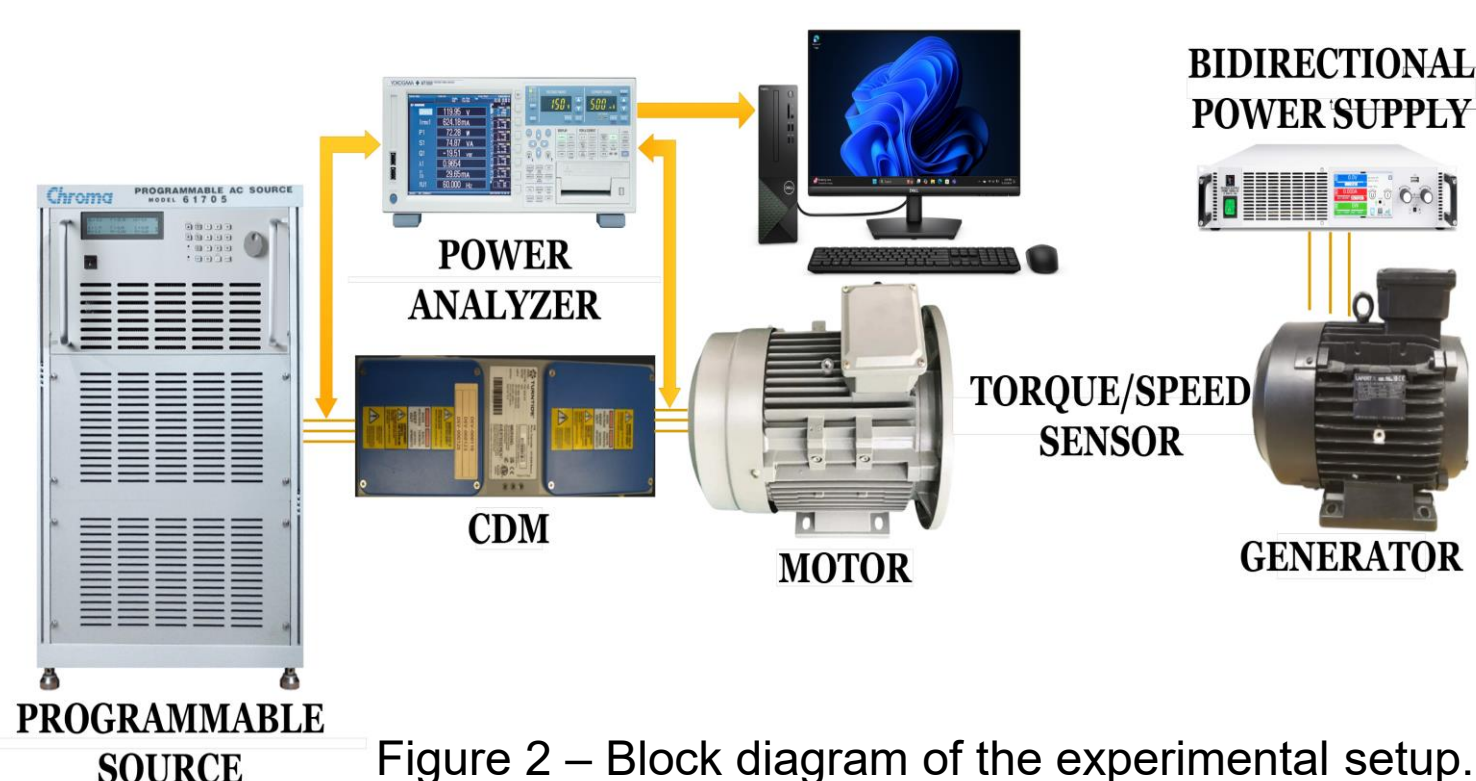


Figure 2 – Block diagram of the experimental setup.