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# Analyzing the factors effect on wear of brushes and optimizing the brush life of AC universal motors

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Among many types of motors available, the single-phase AC or universal motor stands out for its compact size, lightweight design, high-speed performance, and strong starting power. However, a significant challenge lies beneath their seemingly flawless operation: the limited lifespan of the brushes and commutators within these motors. The research focuses on minimizing brush wear, a critical issue affecting motor efficiency.

By investigating brush wear intensity concerning applied force, the research establishes a mathematical model linking brush wear to brush pressure. Laboratory experiments on a BSM 550E universal motor reveal a direct correlation between force on brushes and sparking energy, with brush wear dependent on applied force. The optimal spring pressure for brushes is determined to be around 3 N, resulting in minimal wear intensity (0.0186 mm/hour). The study concludes that maintaining constant brush pressure is crucial for increasing motor lifespan. To address this, a mechanism is developed to automatically reduce brush force by shortening the brush length proportional to wear, offering a practical solution to enhance motor longevity.

**Keywords:** Universal motor, Commutation, Spark energy, Brush wear, Spring pressure

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