



An Allied Motion company

ThinGap Motor Life Expectancy Statement

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General Position

ThinGap’s brushless DC electric motor kits are high quality, high performance motion components designed for deep system integration. This exceptional motor performance includes a consistent expected functional life for the product under typical operating conditions.

The life expectancy of ThinGap’s off-the-shelf motor kits, by design, is calculated to be in excess of 45,000 hours of continuous duty at the maximum continuous temperature. Various materials, architecture, and process choices impact life expectancy and a motor kit’s design can be adjusted to meet up to 150,000 hours of continuous duty operation for custom applications.

An analysis of the motor design, and the key components and materials used to build the product, is one basis for calculating life expectancy. A second data point is an accelerated run test intended to extrapolate the expected life of a motor. Both these approaches are described herein. Further industry data is widely available on the expected life of brushless DC motor kits and validates the calculated expected life of ThinGap’s architecture.

Analysis by Design and Components

ThinGap’s slotless motor kits are designed to be robust for their intended uses in aerospace, medical, and precision industrial applications. The design of both stator and rotor assemblies use materials, techniques, and processes that are deemed adequate to represent the expected life of 45,000 hours within the specified operating conditions, which includes a maximum stator temperature of 130C, and maximum rotor temperature of 80C. Depending on application requirements, ThinGap can modify components and design practices to accommodate even harsher environments upon request.

Key Components, Base Materials, and Process Steps

Presented are the expected lives for each major component, material or process steps used in the making of a ThinGap motor kit.

| Component/Material/Process | Relevance to Motor Assembly | Life Expectancy |
|----------------------------|--|-------------------------------------|
| Insulated Copper Wire | Used in the stator coils | 45,000 hrs. @ Max Cont. Temperature |
| Printed Circuit Boards | For the interconnect of the stator coil’s wave windings | >45,000 hrs. |
| Potting Resin | To pot or encapsulate the stator coil and to create a rigid structure | >45,000 hrs. |
| Steel Lamination Stacks | Flux carrier for the stator | >45,000 hrs. |
| Neodymium (Nd) Magnets | Epoxy-coated Nd permanent magnet segments used for the rotor assembly | >45,000 hrs. |
| Bonding Adhesive | Used to bond magnet segments to the rotor assembly | >45,000 hrs. |
| Solder Joints | To create the interconnect between the coil windings and to connect the terminal leads | >45,000 hrs. |

Accelerated Run Test

Between 2018 and 2023, a continuous run test of a ThinGap motor (model LSI 105-33) was conducted as an empirical demonstration of the expected lifespan of a typical unit. The motor was loaded with current, and the stator temperature raised to near the maximum continuous operation temperature of 130C. This test ran for >38,000 hrs. without noticeable signs of degradation in performance. Using assumed operating conditions and duty cycle, this test is the equivalent to a typical application operating without noticeable signs of degradation for greater than 18.8 years.

Conclusion

ThinGap considers its run test evidence, design approach, material and component analysis, and well-established industry data on brushless DC motors as sufficient justification for estimating the expected life of its slotless motor kits to be in excess of 45,000 hours of continuous duty at the maximum continuous temperature limits.

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