



Electric Brushless DC Motors Operating Manual



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1. Initial Warnings / Recommendations



Electric motors have energized circuits, exposed rotating parts and hot surfaces that may cause serious injury to people during normal operation. Therefore, it is recommended that transportation, storage, installation, operation and maintenance services are always performed by qualified personnel. Also the applicable procedures and relevant standards of the country where the machine will be installed must be considered. Noncompliance with the recommended procedures in this manual and other references on the Scorpion website may cause severe personal injuries and/or substantial property damage and may void the product warranty.



For practical reasons, it is not possible to include in this Manual detailed information that covers all construction variables nor covering all possible assembly, operation or maintenance alternatives. This Manual contains only the required information that allows qualified and trained personnel to carry out their services. The product images are shown for illustrative purpose only.

The user is responsible for the correct definition of the installation environment and application characteristics.

During the warranty period, all repair (with the exception of general maintenance), overhaul and reclamation services must be carried out by Scorpion authorized Service Centers to maintain validity of the warranty.

Warning Symbol



Warning about safety and warranty.

Neither Scorpion Power System nor its agents have any control over the assembly, maintenance and use of this product. Therefore, no responsibility can be traced back to the manufacturer. You hereby agree to release Scorpion Power System from any responsibility or liability arising from the use of this product.

2. Damage Limits

SCORPION POWER SYSTEM SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCT, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY. Further, in no event shall the liability of Scorpion Power System exceed the individual price of the product on which liability is asserted. As Scorpion Power System has no control over use, setup, final assembly, modification or misuse, no liability shall be assumed nor accepted for any resulting damage or injury. By the act of use, setup or assembly the user accepts all resulting liability. If you as the Purchaser or user are not prepared to accept the liability associated with the use of this Product, you are advised to return this Product immediately in new and unused condition to the place of purchase.



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3. Limited Warranty

All Scorpion Motor products come with a 1 year manufacture defect warranty from the original date of purchase. The warranty does not cover General Maintenance. General maintenance is classified by changing of motor shafts and bearings. Scorpion Power System reserves the right to change or modify this warranty without notice and disclaims all other warranties, express or implied.

- (a) This warranty is limited to the original Purchaser ("Purchaser") and is not transferable. REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. This warranty covers only those Products purchased from an authorized Scorpion Power System dealer. Third party transactions are not covered by this warranty. Proof of purchase is required for warranty claims.
- (b) Limitations - SCORPION POWER SYSTEM MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NONINFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCT. THE PURCHASER ACKNOWLEDGES THAT THEY ALONE HAVE DETERMINED THAT THE PRODUCT WILL SUITABLY MEET THE REQUIREMENTS OF THE PURCHASER'S INTENDED USE.
- (c) Purchaser Remedy - Scorpion Power System's sole obligation hereunder shall be that Scorpion Power System will, at its option, replace any product determined by Scorpion Power System to have a manufacture defect. In the event of a manufacture defect, this is the Purchaser's exclusive remedy. Replacement decisions are at the sole discretion of Scorpion Power System. This warranty does not cover cosmetic damage or damage due to acts of God, accident, misuse, abuse, negligence, commercial use, or modification of or to any part of the Product. This warranty does not cover damage due to improper installation, operation, maintenance or attempted repair by anyone.

4. Receiving Inspection

- All motors are tested during the manufacturing process. The motor must be checked when received for any damage that may have occurred during the transportation.
- All damages must be reported either to the reseller you have purchased the product from, or directly via email to support@spihk.com
- Check that the packaging is not excessively damaged.
- Check that the motor type, size, kv, and shaft type matched your purchase order.
- Spin the motor by hand and ensure no abnormal noises occur.

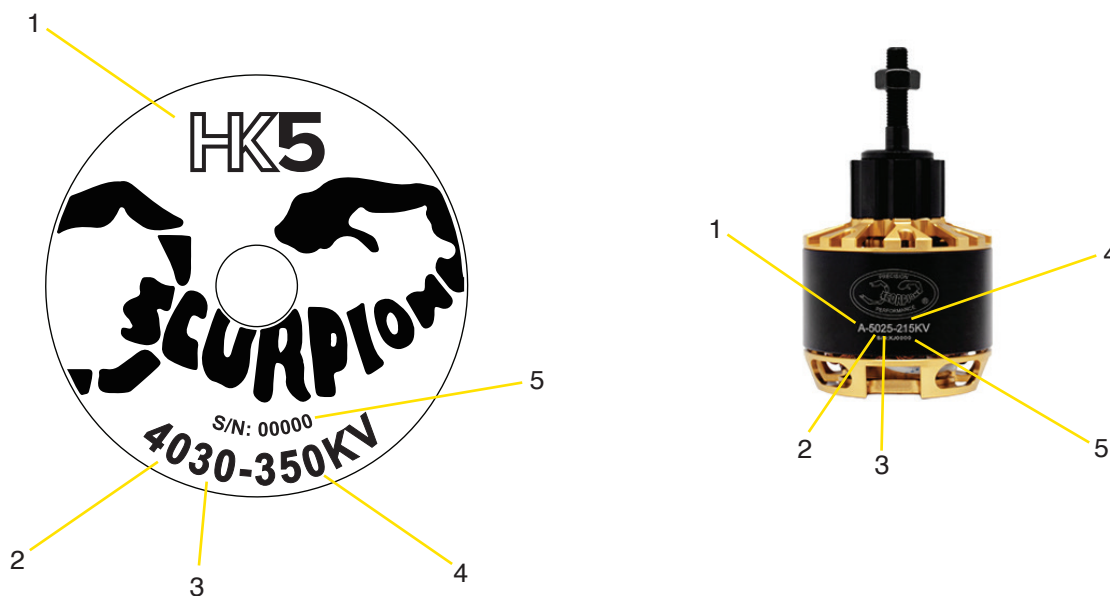


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5. Motor Laser Engraving

The Laser Engraving on the motor contains information that describes the motor type, size, and KV.



- 1 ————— Motor Series Type
- 2 ————— Motor Stator Diameter
- 3 ————— Motor Stator Height
- 4 ————— Motor KV
- 5 ————— Production Date Code / Serial Number

! The Laser engraving shows the identification, and the most important size / speed data. The name plate also defines manufacturing year of the motors. The first two letter in the serial number, shows the manufacturing date code. The remaining numbers show the serial number of the specific production lot. Please contact us at support@spihk.com for date code information.



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6. Safety Instructions



The motor and related electronics must be disconnected from the power supply and be completely stopped before conducting any installation or maintenance procedures. Additional measures should be taken to avoid accidental motor starting.



Professionals working with installations, either in the assembly, operation or maintenance, should use proper tools and be instructed on the application of standards and safety requirements, including the use of Personal Protective Equipment (PPE) that must be carefully observed in order to reduce risk of personal injury during these services.



Electric motors have energized circuits, exposed rotating parts and hot surfaces that may cause serious injury to people during normal operation. It is recommended that transportation, storage, installation, operation and maintenance services are always performed by qualified personnel.

Always follow the safety, installation, maintenance and inspection instructions in accordance with the applicable standards in each country.



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7. Installation Safety Considerations



- The motor is intended for installation and use by personnel familiar with general knowledge of electric BLDC motors and the respective use case application.
- The temperature of the outer casing of the motor may be too hot to touch during normal operation and especially after shut-down.
- Be aware of rotating parts of the motor and attached accessories.
- Do not touch the motor phase connectors while energized.

8. Mechanical Installation Procedure

- Before installation, check motor specifications from Scorpion Power Systems website, and ensure they fit the requirement of the load, voltage, and application you intend to use.
- The motor shall in most cases, be mounted with the included hardware. Be sure to properly tighten all bolts and it is recommended to use thread locking glue.
- Ensure that when mounting the motor with either the 4 x included mounting bolts, and / or other hardware, that the mounting screws do not protrude excessively through the motor base and contact the motor winding.
- This motor is designed to work only with a suitable Brushless ESC, and you should connect the 3 motor phase wires to the ESC properly and ensure they can not touch to each other.
- Ensure your pinion, propeller, drive train is properly mounted.

Before start-up, please check that

- The motor is in good working order, and the bearings and shaft are properly maintained, and all wires and connectors are well insulated and properly installed
- The ESC which the motor is connected to is adequately sized for the power rating of the motor, and is properly programmed for your intended application.
- The propeller / gear train / or other mechanism which is connected to the motor are free and clear from any obstructions, and away from body parts.

9. Rated Temperature and Conditions

- Scorpion motors with Multi strand winding have winding rated to at least 180C.
- Scorpion motors with single strand winding have winding rated to at least 250C.
- Scorpion Magnets are rated to at least 180C.
- In general operation the measured temperature of the motor should not exceed 100C at any measured point.
- If safety margin is required, the motor temperature should not exceed 60C – 80C during normal use.



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10. Rated Power / Current Capabilities and Motor Cooling

- It should be noted that the rated power / current capabilities of the motor as found on Scorpion Powers Systems website are only approximate values, based on standard use case scenarios, in specified conditions*.
- Exact power / current capability will depend on your exact installation and the user should take extreme precaution and measurements to ensure the motor is not over loaded causing over temperature.
- If you have restricted cooling ability, high ambient temperatures, or extended Duty Cycle, the Power / Current Rating should be reduce.
- The rated Power / Current capability is with little to no safety margin. User should accommodate for adequate safety margin depending on their exact application.
- Over temperature due to improper usage will damage the motor and void your warranty.

**Duty Cycle is specified as 60 seconds at 100% throttle for continuous rating, and 5 – 60 seconds at 100% throttle for peak rating, with forced airflow cooling of at least 30m/s with ~30C ambient Air Temperature.*

Rated Power Changes According To Ambient Temperature*							
Ambient Temperature	< 30°C	35°C	40°C	45°C	50°C	55°C	60°C
% Power Ratio	100	97	95	93	87	82	78

Approximate % Power Ratio for reference only. Exact % Power Ratio depends on your exact application accounting for all parameters*

Rated Power Changes According To Airflow Cooling Speed*							
Airflow Cooling Speed	> 30m/s	25m/s	20m/s	15m/s	10m/s	5m/s	0m/s
% Power Ratio	100	95	93	87	80	70	50

Approximate % Power Ratio for reference only. Exact % Power Ratio depends on your exact application accounting for all parameters*

Rated Power Changes According To Duty Cycle*							
Duty Cycle	< 1 min	2 mins	5 mins	10 mins	30 mins	60 mins	> 60 mins
% Power Ratio	100	87	80	75	73	70	60

Approximate % Power Ratio for reference only. Exact % Power Ratio depends on your exact application accounting for all parameters*



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11. Motor Efficiency

- Each Scorpion Motor will have a peak efficiency point, and an efficiency power band. This varies depending on the exact motor type, size, voltage, torque load, and rpm.
- Using the motor outside of its efficient power band will result in poor performance and may lead to damage which may void your warranty.
- As general rule, the Continuous and Peak power / current should only be achieved at 100% throttle (max rpm).
- As a general rule, operating the motor at either too high torque load @ too low rpm, or too little torque load @ too high rpm, will put the motor outside of its efficiency power band.
- Reference Scorpion Power System website for data charts and tables about our products or email support@spihk.com for power system optimization assistance.

12. Motor Maintenance

Cleaning

- Cleaning is not mandatory, but user should ensure there is no excessive dust build up, or foreign debris in the motor as it may wedge between the stator and rotor or effect the bearings.

Bearing / Shaft Oiling

- Oiling of the bearings and shaft is not “required” for general applications, but, oiling the shaft and bearings will extend the life span of the bearings and shaft.
- If user chooses to oil bearings / shaft they may use the Scorpion Motor Bearing Lubrication Kit to apply a few drops of oil to the shaft every 1 – 50 hours of operation.

Bearing Lifespan / Maintenance

- Bearing lifespan depends on your exact application. As there is varying rpm, temperature, and load, the exact lifespan can not be predicted.
- As a general rule, in standard use and with proper care the bearings should last between 300 – 1000 hours of operation, but in demanding situations with high temperature and loading, the life span may be drastically reduced and the bearings may need to be change even every 10 – 30 hours of operation.
- User should monitor the health of the bearings and change them when needed.
- Special care should be taken when removing the bearings. They should be removed using special bearing removing tool kits, and fitted by heating or using special tools for the purpose.
- Bearing wear is not covered under the warranty, and user maintenance of the bearings is permissible, common and does not void the warranty.

Shaft Lifespan / Maintenance

- Shaft lifespan depends on your exact application as there is varying rpm, temperature, and load, the exact lifespan can not be predicted.
- As a general rule, in standard use and with proper care the shaft should last between 300 – 1000 hours, but in demanding situations with high temperature and loading, the life span may be drastically reduced and the shaft may need to be change even every 10 – 30 hours.
- User should monitor the health of the shaft and change them when needed.
- Special care should be taken when removing the shaft. It should be removed and fitted by using special tools for the purpose.
- Shaft wear is not covered under the warranty, and user maintenance of the shaft is permissible, common and does not void the warranty.



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13. Motor Lifespan / Storage

- The stator and magnets of Scorpion Motors come with a surface treatment which protects against standard environmental conditions. But it does not protect against significant environmental conditions, especially salt spray.
- The surface treatment is officially rated for 8 years from the manufacturing date. Using of the motor over this time is possible, but may lead to increased chance of failure.
- Standard bearings like the ones used in Scorpion Motors are officially rated for 3 years shelf life. Bearings should be maintained by the user and changed when required.
- If storing the motor for extended period of time, it should be stored in a sealed container in a cool dry place. When re-using the motor again, be sure to check the health and age of the bearings, and check the stator and magnets to ensure there is not rust.

14. Faults During Operation

- Deviations from conditions during normal operation, such as an increase in power consumption, temperatures or vibrations, unusual noises or odors, etc., indicate that the motor is not functioning properly. This can cause faults which can result in eventual or immediate fault, severe injury, or material damage.
- If you are in doubt, immediately switch off the motor.
- Immediately check the motor for maintenance issues and make the necessary repairs.
- If you are in doubt, contact an authorized Scorpion Re-seller or email support@spihk.com

15. Disposal

Environmentally friendly design, technical safety, and health protection are always main target for us even at the product development stage.

Recommendations for the environmentally friendly disposal of the motor and its components are given in the following section.

Be sure to comply with local disposal regulations.

Dismantle the motor using the general procedures commonly used in mechanical engineering.

Disposal of Components

- The motors mainly consist of steel, copper, and aluminum. Metals are generally considered to be unlimitedly recyclable.

Sort the components and process materials for recycling according to what they are:

- Iron and steel
- Aluminum
- Winding (enameled copper wire); the winding insulation is incinerated during copper recycling
- Insulating materials
- Cables and wires



SCORPION POWER SYSTEM LTD

📍 16th Floor, Excelsior Industrial Building,
68-76 Sha Tsui Road,
Tsuen Wan, New Territories, Hong Kong.

☎️ (852) 2851 3513 📠 (852) 2581 4199

✉️ support@spihk.com

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