

SAFETY HAZARD WARNINGS FOR LITHIUM ION BATTERIES

Rechargeable Lithium Ion batteries are potentially hazardous and can present a serious **FIRE HAZARD** if damaged, defective or improperly used.

A FIRE IS MOST LIKELY TO OCCUR DURING THE CHARGING PROCESS UNDER THE FOLLOWING CIRCUMSTANCES:

- **THE BATTERY HAS BEEN FULLY DISCHARGED AND IS NOT RECHARGED SHORTLY AFTERWARD.** This potential is aggravated if batteries are damaged, contain an undetected factory defect, are used or stored at temperature extremes, **or are approaching the end of their useful life.** Ideally, batteries should be recharged within 24 hours of a full discharge.
- **CHARGING IS ATTEMPTED AT TEMPERATURES BELOW 40°F (4°C).** Charging below 40°F (4°C), causes a chemical reaction in the battery cells that can cause permanent damage and the possibility of fire or explosion during charging.
- **THE BATTERY HAS BEEN EXPOSED TO LIQUIDS, ESPECIALLY SALTWATER.** Exposure to liquids can cause internal corrosion or damage to the cells or to the Battery Management System (BMS). The BMS protects the battery from overcharging, high self- discharge or imbalanced charging of the cells, any of which can present the possibility of fire during recharging.
- **OPERATING OR CHARGING A BATTERY THAT HAS BEEN DAMAGED FROM DROPPING OR FROM SHIPPING DAMAGE.**
- **USING A CHARGER OTHER THAN SPECIFICALLY DESIGNATED FOR THE PARTICULAR BATTERY.** Lithium Ion battery chargers provide a specific charging voltage and microprocessor current and voltage control.

CHARGING RECOMMENDATIONS

The following recommendations, **in addition to those precautions above**, should be followed when charging Lithium Ion batteries to ensure the avoidance of potentially catastrophic fire or explosion.

- **Charging should be performed in a fire-safe area, away from children or pets. For maximum safety, a metal trashcan with lid placed on a non-flammable surface is suggested.** Never charge batteries unattended, or where objects such as carpet, furniture, wood or vinyl floors, curtains or other flammable objects are present.
- **Charging should be performed at a temperature between 40°F and 110°F (4°C and 43°C). Never charge below 40°F (4°C).**
- **Do not attempt to charge a battery that is swollen or bulging. Use only supplied charging cables and connections.** Make sure connections are in good condition. Do not allow the charging polarity to be reversed or short-circuited. If equipment is connected during charging, equipment should be switched off. As a delayed chemical reaction can occur if a fault is present, observe the battery in a safe place for at least 15 minutes after charging is complete.
- **A healthy battery should only get slightly warm during charging. If the battery becomes hot, smokes, swells, or gives off an odor during charging, terminate charging immediately and contact the manufacturer.** Note – the charger itself may get quite warm to the touch when charging a deeply discharged battery.

OPERATING AND STORAGE CONSIDERATIONS

- **Batteries may be safely discharged at temperatures between 4°F and 140°F (-20°C and 60°C).** Note this is the safe battery temperature rather than ambient temperature. Heavy use (frequent flashing) will cause the battery to develop internal heat beyond the ambient temperature. **It is recommended that the discharge duty cycle be limited to 50% or less for long-term continuous use (more than 5-10 minutes).** Example: If recycle time is, say 4 seconds, allow 8 seconds between shots. If shooting is in ambient temperatures above **105°F (41°C)**, lower duty cycles are recommended.
- **Batteries should be stored at temperatures between 40°F and 80°F (4°C and 27°C) for maximum life and safety.** Higher storage temperatures increase the self-discharge rate from the nominal 1-2% per month to as high as 35% per month, and can reduce battery life and increase the possibility of catastrophic failure with long term high temperature storage. **Never store batteries at temperatures higher than 170°F (76°C) as this can potentially result in self-combustion, particularly in LiNiMnCoO₂ (NMC) batteries.** LiFePO₄ batteries are intrinsically safer, more tolerant and robust than LiNiMnCoO₂ (NMC) batteries.
- **Batteries may be stored at 100% charge if used frequently. However, for maximum life, batteries infrequently used should be stored at 40% to 70% charge.**

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