General FAQs

You recommend alkaline batteries for use in all of Mag's AAA, AA, C and D-cell flashlights. But I would prefer to use rechargeable batteries (NiMH) if I can. Is there any reason why NiMH rechargeable batteries can't be used in these lights?

With the exception of the MAG-TAC® flashlight that runs on lithium CR123 batteries, all of Mag's non-rechargeable LED flashlights operate on AAA, AA, C or D-cell batteries. All of our published ANSI-standard performance data (Light Output, Beam Distance, Peak Beam Candlepower and Run Time) are based on testing with alkaline batteries; and when we ship these flashlights with batteries, the batteries we include with them are alkaline. We do this because the designs of these flashlights are optimized for use with (non-rechargeable) alkaline batteries.

Alkaline AAA, AA, C and D batteries standardly have a nominal output of 1.5 volts. NiMH rechargeable batteries in these sizes typically have a somewhat lower nominal output (1.2 volts). Also, the discharge curves of NiMH batteries typically differ from those of alkaline batteries – so the two battery types may behave differently under load.

That said, the flashlights will operate with NiMH rechargeables, and use of NiMH rechargeables will not harm the circuitry nor otherwise damage the flashlights in any way. You should not, however, expect the flashlights' performance to be consistent with our published ANSI data if they are operated with rechargeable batteries. (For example, ANSI Light Output may be lower, and/or ANSI Run Time may be shorter with rechargeable batteries.) The degree of difference is hard to predict. We have noted variation in the quality of NiMH rechargeable batteries on the market, and if you choose the best-quality NiMH batteries you might find that any performance shortfall is, for your purposes, not meaningful.

Bottom line, if you are willing to tolerate a possibly significant decline in flashlight performance, there is no reason you can't substitute rechargeable NiMH batteries for (non-rechargeable) alkalines.

How long should an LED last? What is its "life expectancy"?

A MAGLITE® flashlight's LED light engine is a permanent component, not a "perishable" or "consumable" item like a battery or an incandescent lamp. In normal use, the LED should last for the life of the owner and should never need to be replaced.

The explanation for these statements is a little complicated. It starts with answering a preliminary question, which is, "How do you define when the useful life of an LED is at an end?" With an incandescent (filament) lamp, this question is so easy that nobody even asks it: The life of an incandescent lamp is over when it burns out. The "burning out" of an incandescent lamp is a sudden, catastrophic, complete failure; there's no mistaking it when it happens. "Burnout" occurs when the lamp's filament (typically made of tungsten, a very high-melting but brittle metal), grows so thin and weak that it can't support its own weight, especially if it is jarred. So the filament breaks. When it does, the flashlight can't complete the electrical circuit that ordinarily would flow through the filament, so if you turn on the flashlight, it does not give any light. When we say that an incandescent lamp is "dead," what we actually mean is that its filament has suddenly and catastrophically failed.

But if we ask the same question about an LED – "How do you define when the useful life of an LED is at an end?" – the answer is not nearly that simple because an LED typically does not fail suddenly and catastrophically: There's no filament to "burn out," nor is there any other clear, distinct event

you can point to and say that the LED is dead. Instead, what typically happens to an LED is that its light output extremely slowly, and extremely gradually, declines with use.

Much of the literature states that in a typical installation, an LED should perform for 50,000 to 100,000 hours before its light output falls to 50% of its initial output. So if we define 50% as the end-of-useful-life point, and if a flashlight is used for 1 hour a week (and even that might be a lot for a typical homeowner, who would use the flashlight sporadically, occasionally and in short episodes), the LED's "useful life" (as defined above) should be 50,000 to 100,000 weeks – that is, between one and two thousand years. Even if the user is a night watchman whose flashlight is actually on for 4 hours a night, 5 nights a week – which would be a lot — the LED's "useful life" (as defined above) should be between 1,666 and 3,333 weeks (i.e., between 48 and 96 years).

Also to keep in mind is that the "50%-of-initial-light-output" definition of the "endpoint of an LED's useful life" is an arbitrary definition, and one can argue that it is much too short: 50% of the initial light output of a high-powered LED flashlight is still a lot of light, and it seems doubtful that a typical user would discard the flashlight at that point (even if he lived long enough to reach that point). For comparison, the widely-followed ANSI/NEMA FL-1 *Flashlight Basic Performance Standard* (2009), in prescribing how to rate a flashlight's "Run Time" on a fresh set of batteries, defines the endpoint of the "useful life" of batteries to be the point where light output declines to 10% — not 50% — of initial output. So in the view of the committee that drafted the ANSI Standard, 10%, not 50%, of initial light output is the reasonable point at which to say that the user would likely regard the batteries as no longer fit for use and in need of replacement. If we were to define the end-point for an LED's "useful life" as 10% rather than 50% of initial light output, then we might need to speak in terms of a "useful life" of centuries rather than years.

Nobody would claim, however, that an LED is completely bulletproof under all conditions. It should go without saying that one who uses his LED flashlight as an impact tool or a fire-poker is looking for trouble. And, for example, if an LED were driven grossly in excess of its design-rated voltage and/or current, it could fail quickly. Even if an LED were driven somewhat (but not grossly) in excess of its rated voltage and/or current over a long period of time, that could accelerate the rate at which its light output would decline. Excessive operating temperatures could also threaten the longevity of an LED. MAGLITE® flashlights, however, are carefully engineered to keep voltage and current within rated specifications when used with batteries of the correct voltage; and means including good, efficient heat-sinking are built in to keep operating temperature within rated bounds.

In view of all this, the statement with which we started this discussion is quite reasonable: A MAGLITE® flashlight's LED light engine should be seen as a permanent component, not a "perishable" or "consumable" item like a battery or an incandescent lamp; and the user should expect the LED, in normal use, to remain serviceable for his or her entire lifetime, never needing to be replaced.

Every time I put a new replacement lamp in my Mag-Lite® flashlight, it burns out. Why?

It sounds like you may be using the incorrect replacement lamp for your flashlight. D & C Cell Mag-Lite® flashlights have different numbers of batteries or cells and therefore operate at different voltages, so each size Maglite® flashlight needs its own unique lamp size. For instance, if you have a 4-Cell Mag-Lite® flashlight and you put a 2-Cell or 3-Cell lamp inside, it will burn out very rapidly because the 4-Cell flashlight runs at a higher voltage than the lamp of a 2 or 3-Cell flashlight was designed to handle. For our personal size flashlights and your information, we manufacture a 2-Cell AA Mini Maglite® flashlight, a 2-Cell AAA Mini Maglite® flashlight and a Single Cell AAA Maglite® Solitaire® flashlight each of which require its own unique lamp.. If you use the single cell Solitaire®

lamp in a 2 Cell AA or 2Cell AAA, the lamp will burn out immediately. Make sure to buy the correct lamp for your flashlight. It's marked on the packages of our replacement lamps.

I can't remove the tailcap from my flashlight. I have even put pliers on it and tried to twist it off, but it's absolutely stuck. Is this problem covered by my warranty?

When you cannot remove the tailcap to change the batteries, it is probably that the batteries leaked and caused corrosion inside. Mag Instrument does not warrant against battery leakage. If the flashlight has been damaged by leakage of batteries, do not return the flashlight to Mag Instrument but determine what brand of battery caused the damage and follow the battery manufacturer's instructions about how to make a damage claim. For details, see the above FAQ entitled "**If my flashlight is damaged by a battery leak, what should I do?"**

Are Mag flashlights waterproof?

We consider our flashlights to be extremely water resistant but we don't advertise them to be waterproof.

I can't get the batteries out of my flashlight. They're stuck inside. How do I change them? Is this covered by my warranty?

When this happens, it probably means that the batteries have leaked and are stuck inside the barrel. Oftentimes, batteries will swell before leaking, causing them to get stuck inside the barrel. Mag Instrument does not warrant against battery leakage. If the flashlight has been damaged by leakage of batteries, do not return the flashlight to Mag Instrument but determine what brand of battery caused the damage and follow the battery manufacturer's instructions about how to make a damage claim. For details, see the above FAQ entitled "**If my flashlight is damaged by a battery leak, what should I do?"**

Are Mag's flashlights "explosion-proof" or "intrinsically safe"?

Mag Instrument's flashlights are general-purpose flashlights. We have not had them tested or certified as safe for special-purpose uses under any "intrinsically safe" standard or under any of the various "explosion-proof" standards that exist. We do not label our flashlights "explosion proof" or "intrinsically safe" and we do not warrant that they would be safe if put to such a special-purpose use.

Can alkaline batteries leak and damage my flashlight?

Yes, unfortunately, they can.

All alkaline batteries are filled with a caustic material that can damage (corrode) any device, including a flashlight, if it escapes from the battery cell. Given the limitations of alkaline battery technology, there is always some risk that a battery might leak under some conditions. There are a number of specific reasons why this might happen. One is a defect in the battery, or physical damage to it. Another reason has to do with the fact that all alkaline batteries have a self-discharge rate, causing them to gradually weaken and die even if they are in a package on a shelf, or in a device that is not used. Leaving dead batteries inside a device can cause battery leakage and resulting corrosion damage. Putting new batteries together with old batteries, and/or with batteries of a different type, can also cause rapid discharge, pressure buildup, and leakage. And misuse of the batteries (e.g., by attempting to recharge batteries not designed to be recharged) can also cause leakage that can damage or destroy the flashlight.

Besides staying with reputable brands of alkaline batteries, is there anything else I can do to minimize the battery-leak-damage risk?

Yes, just follow these simple rules:

- Never leave dead or weak batteries in a flashlight, as they are the ones most likely to leak.
- It is good practice to replace your entire set of batteries at least once a year, even if the batteries still seem to be functioning normally.
- When your batteries get low (which you can generally tell by noticing that your flashlight is less bright than it used to be, or goes from bright to dim shortly after it is turned on), replace the batteries – and be sure to replace the entire set at the same time, with freshly-dated batteries that are all of the same brand and the same type.
- Stick to premium brands of alkaline batteries
- Never mix old and new batteries together.
- Never mix different brands or types of batteries together (e.g., don't mix alkaline batteries with carbon-zinc or lithium batteries)
- Never try to recharge batteries that are not designed to be recharged.
- Carefully inspect your batteries before inserting them into your flashlight, and make sure all batteries are inserted correctly (with the + and – terminals oriented as indicated for the device). Inspect your batteries at least once a month while they are in service.
- Inspect your batteries immediately after the flashlight has been dropped or otherwise has suffered a hard impact.
- Immediately remove from service any battery that is found to be leaking or swelling, or that shows signs of damage to its casing or terminals – e.g., denting, crushing or puncture.
- Remove from service any battery found to be past its marked expiration date.
- When removing and replacing a damaged or date-expired battery, replace all other batteries in the same set at the same time, even if they appear undamaged and are not date-expired. (Again, the idea is to never mix old and new batteries together.)
- Importantly, when your flashlight is to be stored for a month or longer, or when you otherwise expect to use it less than once a month, you should remove the batteries and store them separately – not inside the flashlight.

Given the limits of alkaline-battery technology, the unfortunate fact is that there's no completely foolproof way to prevent corrosion damage from alkaline battery leakage. But if you follow the simple rules above, you can minimize the possibility that batteries will leak inside your flashlight.

How can I tell if my alkaline batteries have leaked and damaged my flashlight?

Visual signs of battery leakage and crusty deposits (corrosion) inside your flashlight are a sign of leakage and damage, and if the flashlight is non-functional, this corrosion damage is likely the cause.

It sometimes happens that batteries become stuck inside the barrel and are hard to remove. If this happens, it likely means that the batteries have leaked and have swelled up, and if the flashlight is non-functional, corrosion damage from the leaking batteries is almost certainly the cause.

It also sometimes happens that the tailcap becomes stuck on the flashlight and is difficult to unscrew. When this happens (and there is no evidence of barrel crushing or denting), the cause likely is that a battery leaked and produced corrosion that involved the tailcap threads, seizing of the tailcap onto the flashlight's barrel.

In any of these situations, the likely cause is alkaline battery leak damage.

Is battery-leak damage covered by my warranty?

No. Battery exhaustion, battery leakage, and flashlight damage caused by battery leakage are all specifically excluded from your warranty. You may, however, be able to get help from the battery manufacturer if a battery leak damages your flashlight. See the next FAQ below for details.

If my flashlight is damaged by a battery leak, what should I do?

Because our warranty excludes battery-leak damage, you should NOT take or send the flashlight to Mag Instrument's Warranty Service Department.

What you CAN do is contact the battery manufacturer to see if it has a program to repair or replace your leak-damaged flashlight.

Every reputable alkaline battery manufacturer has some form of device damage policy under which you may be eligible to have your flashlight repaired or replaced if it has been damaged by leakage of alkaline batteries that came from that manufacturer.

(NOTE: It is good practice to write down and remember the brand name of any batteries you put in the flashlight. If leak damage does occur, it is sometimes difficult or impossible to get the batteries out of the barrel to see what brand they are.)

Different battery makers may call their device damage policies by different names, and the exact terms may differ from one maker to another and may change over time. Some of the policies may have special requirements, so it may be important to contact the battery manufacturer without delay if you discover battery leak damage. And do not discard the flashlight or the batteries before finding out whether the battery manufacturer requires you to submit them as proof of claim.

You should communicate with the battery manufacturer before you send them the damaged flashlight, and should confirm exactly what their device damage claim eligibility requirements and procedures are.

Information can typically be found on the battery manufacturer's website, and/or on its retail packaging for batteries, and/or via a customer-service phone number appearing on its website or retail package.

For your convenience we provide the following website links and contact numbers through which you can get more information concerning battery-leak-damage policies and procedures of various battery manufacturers.

What Is ANSI?

Flashlight Performance Testing – The ANSI Standard

In 2009, the American National Standards Institute,

in cooperation with the National Electrical Manufacturers

Association, published a standard called the ANSI/NEMA FL 1-2009

Flashlight Basic Performance Standard. The ANSI Standard has

become widely accepted in the portable lighting industry because

it affords a practical way to make "apples-to-apples" comparisons

among different flashlights.

Although the ANSI Standard is not mandatory, Mag Instrument has chosen to follow it. That is why, on our product packaging, in our product literature, and on the website, we display certain flashlight performance data in the form of an “ANSI Strip,” so called because it uses the officially-designated ANSI logos and reports data taken in the ANSI-prescribed way.

The ANSI Standard defines four basic performance categories, and prescribes official logos for displaying results. The following table lists the categories, and for each one indicates the unit of measure, the official logo, and the basic meaning of the category:

CATEGORY	UNIT	ANSI-FL LOGO
BEAM DISTANCE	METERS	
A measure of how far away the flashlight will usefully light up an object when its beam is optimally focused (sometimes called "Throw")		
PEAK BEAM INTENSITY	CANDELA	
Tells how intense the light is in the brightest part of the flashlight's beam when optimally focused (sometimes called "Beam Candlepower")		
RUN TIME	HOURS/ MINUTES	
A test of how long the flashlight will continuously operate before an "end point" (roughly 10% of initial light output) is reached		
LIGHT OUTPUT	LUMENS	
Indicates how much total light ("luminous flux") the lamp or LED generates, without regard to direction or the flashlight's beam quality or configuration		

Light Output versus Beam Distance

Judging from questions and comments we receive, the distinction between Light Output and Beam Distance is a source of some confusion. It is important to understand that these two concepts – Light Output and Beam Distance –deal with quite

distinct characteristic which, surprisingly to many people, don't necessarily go hand in hand. A flashlight can have a very high Light Output (measured in lumens), and yet have a very short Beam Distance (measured in meters). And the opposite can also be true: A flashlight can have a very modest output in lumens and yet can be remarkably effective in lighting up an object very far away. Why is this possible? Because Light Output is simply a raw measure of the rate at which a light source generates light –

i.e., how many photons, how much "luminous flux," the source

generates per second. It tells nothing about how well or poorly that light is gathered and directed. Beam Distance, on the other hand, is a measure of the maximum distance from which an optimally focused flashlight will cast a useful amount of light on a target. The ANSI Standard effectively defines a "useful level of light" by prescribing that the Beam Distance is the maximum distance at which the flashlight will produce ¼ lux of light. A quarter of a lux can roughly be described as the light level provided by a full moon in an open field on a clear night. That's not as bright as day, but it is bright enough to see by – a good, standard, working definition of a "useful level of light." So while a flashlight's Light Output – its "lumen rating" – tells you nothing at all about how good or bad a job the flashlight does at forming a useful beam of light, the flashlight's "Beam Distance" rating is all about its ability to form light into a useful beam and send it in a useful direction. "Beam Distance" thus strongly correlates to a flashlight's optical quality; whereas Light Output has nothing whatsoever to do with beam-forming optics. In fact, to get a high Light Output score, a flashlight would not even need to have a reflector or lens, at all!

Optic Master

Since the beginning, Mag Instrument has prided itself on its beam-forming optics — the quality of its precision-designed and precision-crafted reflectors, and the versatility of its spot-to-flood beam focusing mechanism. High-quality optics help a flashlight to direct light in a useful way without excessive power consumption

– something that the "brute force" approach of maximizing lumen

output cannot do.

Optics and Run Time

High-quality optics can also play a role in slowing battery consumption and prolonging Run Time. As LED technology continues to advance, the number of watts of power consumed per lumen of light generated goes down; but it is still true to say that the more lumens you want, the faster you will consume battery power. So it is still true, and probably always will be true, that excellent beam-forming optics will enhance a flashlight's ability to deliver useful light while avoiding the need for enormous lumen output and correspondingly fast battery drain.

If I wanted to know the current draw and the wattage of a particular Mag® incandescent lamp (say, the LMXA301 Xenon lamp for the 3-cell Maglite® flashlight), how would I find that information?

Each of our incandescent lamps was designed and developed with only one purpose in mind – to operate optimally in the particular flashlight for which the particular lamp is designated. We publish data describing how each lamp performs in its flashlight – for example, our website, catalog and package literature supply light output, peak beam intensity, beam distance and run time numbers for the 3-D-cell Maglite® flashlight running the lamp you mention. All such data are based on testing according to the ANSI/NEMA FL-1 Flashlight Basic Performance Standard (2009). We do not, however, test for or publish current-draw or wattage figures for the lamp itself, as these are not ANSI performance categories.

Just as we do not publish any claim, we also do not guarantee any rating, as to the current draw or the wattage of the lamp you reference.

You may get at least an approximate idea of how much current your particular specimen of the lamp draws when operating in its intended application, and an idea of the wattage and voltage drop, by putting it in the flashlight for which it was designed (a 3-Cell Maglite® flashlight, in the case of the LMXA301 Xenon lamp) with fresh batteries, illuminating the lamp, and using an ammeter to measure

the current flow across the lamp terminals, and a voltmeter to measure the voltage, and then doing a wattage calculation according to the formula

Voltage (in volts) times Current (in amperes) equals Power (in watts)

Thus, if the voltage drop is 4.2 volts and the current flow is 720 milliamperes , the power output is 4.2 volts X 0.72 amps = 3.024 watts. You would, however, need to look to the accuracy of your own equipment and the correctness of your own technique. Mag Instrument is not in a position to warrant the accuracy or the typicality of whatever current-draw, voltage-drop or wattage numbers you might obtain.

What if I wanted to know one of your lamps' wattage, voltage or current-draw ratings for purposes of designing a product that would use that lamp?

It is against Mag Instrument policy to provide engineering advice to persons seeking to use Mag Instrument parts or components to build non-Mag devices. And of course we do not warrant, endorse or recommend any such use or any such non-Mag device.

You can, however, obtain approximate wattage, current-draw and voltage-drop numbers for the lamp in its intended operating environment by following the procedure described in the answer next above.