FAQs About Flashlight Performance

Q: Is there any written standard that actually specifies uniform ways to measure and report a flashlight's performance?

A: Yes, there is a written standard. It was published in 2009 and is called the ANSI/NEMA FL 1-2009, the Flashlight Basic Performance Standard – the "FL1 Standard" for short. The FL1 Standard defines four categories of flashlight performance, prescribes test equipment and procedures, and prescribes a set of logos for use in reporting the numbers on product packaging and elsewhere. The categories are as follows

Category	ANSI FL-1 Logo	Short Explanation
Beam Distance (Unit: 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 (Unit: 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 (Unit: 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 (Unit: 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*

Q: Which of the FL1 Standard's four performance categories is the most important?

A: That's like asking, "Which are more important – apples or oranges?" The answer depends on what you are looking for in a flashlight. For example, if you mainly use your flashlight to read by, then you probably don't need it to be particularly bright but you would prefer that it not drain its batteries too quickly. So the "Run Time" would be the most important FL1 Standard category for your needs.

Q: What FL1 Standard performance category should matter most to me if what I want is the flashlight that's most effective at lighting up an object at a distance?

A: If that's what you want most, then "Beam Distance" is the FL1 Standard category that's most important for your needs. That's the category that tells you how good the flashlight is at lighting up an object at a distance.

Q: What does "Beam Distance" mean exactly?

A: According to the committee that developed the FL1 Standard, a flashlight's "Beam Distance" is the maximum distance (in meters) at which it will produce "0.25 lux of light." That, as the Standard explains, is "approximately the equivalent of the light emitted from the full moon 'on a clear night in an open field'." Nobody would say that's as bright as day, but everybody can agree that the light of the full moon in a clear sky is a useful level of light. You can see by it well enough to find your way around, and you could even read by it if you had to.

Q: Why doesn't "Light Output" tell you just as much as the "Beam Distance" number?

A: The FL1 Standard "Light Output," measured in lumens, tells you how much light energy is being emitted from the lamp or LED that is in the flashlight – regardless of how the beam is focused, and regardless of whether the flashlight even has any kind of beam-forming optics in it at all. The "Light Output" rating tells you how powerful a light-generator the flashlight's lamp is, but it does not tell you how good an optical device the flashlight is – i.e., how good

the flashlight is at projecting light onto a distant target. “Light Output” ignores optics; “Beam Distance” is mainly about optics.

Q: Is there any correlation between Light Output and Beam Distance?

A: A flashlight having a higher Light Output does not mean that it will have a longer Beam Distance. You’ll find numerous flashlights on the market that boast a pretty high Light Output (lumens) number but have a disappointingly short beam distance. (That may be why, on many flashlights’ packaging, the “Lumens” number is prominently touted but no “Beam Distance” number is mentioned at all.) For example, comparing the venerable Mag-Lite® 2D incandescent flashlight against a “modern” LED flashlight tells an interesting story. According to independent testing, this older – but still optically superb – Mag Instrument flashlight achieves a Beam Distance of 229 meters from a 19-lumen incandescent lamp; whereas a well-known competitor’s focusing-beam flashlight is advertised to have a Light Output of 200 lumens, and yet it achieves a Beam Distance of only 225 meters –that’s a shorter Beam Distance despite ten times more advertised lumen output – even though they are both focusing-beam flashlights. (This calculates to over 12 meters of Beam Distance per lumen of Light Output for the Mag Instrument flashlight vs. only about 1.1 meters per lumen of Light Output for the rival product, if you want to put it in those terms.) For another example, independent testing of our current (as of mid-November) Mag-Lite® 2D-cell LED flashlight revealed that it achieved a Beam Distance of 298 meters from a Light Output of 114 lumens. Compared to the same competitor product, the Mag Instrument flashlight achieved almost 25% more Beam Distance from 43% less lumen output. (Or about 2.6 meters per lumen for the Mag Instrument product but only about 1.1 meters per lumen for the competitor product.) Both of these examples make the same point: When it comes to Beam Distance, a flashlight’s optical properties can matter tremendously; but the Light Output (lumens) number just doesn’t tell you anything about the flashlight’s optics.

Q: Is Light Output (Lumens) totally irrelevant to Beam Distance?

A: No. If your goal is to develop a flashlight that throws a useful beam of light a long distance, having a lamp with a decent Light Output (lumens) is a good start; but it does not get you all the way to the goal, by any means. A flashlight with superior beam-forming optics can have a significantly greater Beam Distance than a flashlight that has much more Light Output but inferior beam-forming optics. So you can’t count on the flashlight that has the more powerful lamp (i.e., the higher-Light-Output flashlight) to have the longer Beam Distance unless the two flashlights are identical in every way that matters optically – but in a real-world comparison between two flashlights from different manufacturers, that’s rarely, and probably never, going to be the case. The two flashlights’ optics likely will be different; that difference will affect Beam Distance; and the effect can be very large. Some flashlights can achieve a very long Beam Distance without having to produce a lot of lumens.

Q: Do all sellers and advertisers of flashlights follow the FL1 standard?

A: No. Compliance with the FL1 Standard is voluntary. There’s no legal requirement that flashlight packaging, labeling and advertising follow the Standard. So not everybody who makes, packages, advertises and sells flashlights chooses to follow the FL1 Standard.

Q: How about Mag Instrument?

A: Mag Instrument has chosen to follow the ANSI FL1 Standard. When it packages and advertises its flashlights, it uses the FL1 Standard logos and relies on the Standard’s definitions and test procedures in reporting performance in the Standard’s four defined performance categories.

Q: Does the FL1 Standard require that the tests be conducted by an independent testing laboratory?

A: No, it doesn't. But that's how Mag Instrument chooses to handle it, nevertheless. We feel that having the tests run by an independent lab helps assure that they are done by well-trained professionals using state-of-the-art, accurately-calibrated equipment; and it helps assure that the results are unbiased and objective.

Q: I've seen claims to the effect that "you can see this flashlight's beam from more than a mile away." Does that mean that the flashlight has an FL1 Standard Beam Distance of over a mile?

A: We sure wouldn't bet on it. If an advertising claim like that were based on the FL1 Standard's definition of "Beam Distance," the ad typically would indicate that by referencing the Standard – for example, by using the Standard's prescribed logo for "Beam Distance" – and according to the Standard, it should be speaking in meters, not miles. If the advertising claim does not reference the FL1 Standard, then you just can't tell what testing – if any – the advertiser is claiming to have done in support of the claim. In fact, you can't even tell what these "see-it-over-a-mile-away" advertisers really are trying to say. If all they mean is that the flashlight can be made out as a dot of light on a distant hilltop at night, that's probably true of most flashlights, not just theirs. And it certainly doesn't mean the flashlight's "Beam Distance" (as defined in the FL1 Standard) is over a mile. The FL1 Standard definition isn't talking about the farthest distance at which the flashlight's beam itself can be seen when it is turned on at night; instead, it's talking about the farthest distance at which the flashlight can light up an object in the beam to a useful level of illumination – specifically, the "full-moon-on-a-clear-night" level of illumination. So the claim that a flashlight "can be seen for over a mile" doesn't really tell you its Beam Distance. In fact, if such a claim is not further explained – if it doesn't make clear what standard and what test (if any) was used and what measurement (if any) is being reported -- then it's just not a technically meaningful claim to make.