1. **What tolerances in manufacturer specification should I expect from bullets?**
   a) General
   b) Length, ogive and meplat
   c) Seating depth
   d) Diameter and concentricity
   e) Weight

a) General:
This is a very good question, and one that has to be placed within an application context to be relevant; with the most basic demarcation being *hunting* and *precision target.*

Some of the foundation stones for acceptable bullet accuracy are conformance to standard, consistency (tolerance) and form factor. There are others of course, but this is a great place to start.

First of all, a bullet must be within the SAAMI or CIP standard for dimension and tolerance for **safety reasons**, and these can vary from calibre to calibre, and cartridge to cartridge, although for most modern cartridges, if they exist, these variations are usually small. That said, it is extremely important to note that there are numerous standards for some calibres (mostly English/European vs US), and confusing them can cause trouble. This is particularly important when using bullets that do not obdurate (swage up or down to barrel dimension under the pressures of firing), such as brass and copper bullets. Most notable among the multiple calibre standards are the;

- 6.5 mm's (Swede – 0.265" / US – 0.264")
- 7 mm's (European – 0.285" / US – 0.284")
- 8 mm's (too many land and groove variations to list here!)
- 0.41" calibre big game bullets (0.408"/0.410"/0.411" and
- 50 calibre big game bullets (0.500"/0.505"/0.510")… but there are others

There are four main dimensions of a bullet, of which only three can be reasonably monitored by a shooter. Given that a bullet's form factor cannot generally be evaluated by most shooters, this subject will be left outside the scope of our response.

The three dimensions that can be monitored by most shooters are bullet;

- Length
- Diameter
- Weight

b) Length, ogive and meplat (the bullet tip):
All OEP precision turned CNC Copper Hunting and Target bullets hold 0.03 mm ES or better for length within a box, with ogive engagement tolerances considerably tighter again. This standard is among the very best in the industry. At least;

measuring the length of your bullets is no longer required and your seating depths (including jump to the lands) will be far more consistent! … more

The subject of bullet length, ogive and meplat conformity is often controversial and skirted around by many conventional bullet manufacturers who would prefer to talk about weight tolerance, for that is something swaged bullet manufacturers seem to find easier to produce consistently. A bullet's length, and more particularly the meplat/ogive consistency, is considerably harder for the swaging process to hold to tight tolerance (compared to the CNC process). Whilst a bullet's length can be easily measured by a shooter equipped with a quality micrometer of suitable size, (Vernier's are not adequate) few do, and meplat tolerance is even more difficult for a shooter to measure. The importance of these issues is contextual. Should a hunting bullet be used on the proverbial pig at close range in the lignum, small variations in bullet length and meplat conformity are pretty much irrelevant. It's a different story however at longer ranges around the 600 m mark and beyond. At these ranges, small variations in these form factors will influence a bullet's ballistic coefficient (BC) and therefore group size, increasing vertical dispersion at the very least as distance is extended. It is also important to note that whilst one tolerance or another may appear to be relatively small and hardly noteworthy, they are cumulative. Again, whether the cumulative tolerances, or lack thereof, are important will come back to application and need.

The issue of length and meplat tolerances however become very important to long range target shooters who measure and sort their bullets against a particular point on the ogive to gain an acceptable measure of consistency. It is also why some shooters trim and/or 'point' their bullets if the competition requires hollow point, or Open Tactical Match (OTM) bullets.
We at *OEP* have seen competitors (hollow point hunting) projectiles with a length tolerance ES of 0.22 mm within a single box. Whether or not this is important is again application dependent. So called long range target bullets with that much variation would have to be batched at least, if not culled. Fortunately for target shooters, target bullet length variation of this magnitude is most unusual, with bullet length tolerances closer to 0.013 mm ES nearer the norm. That said, many long range target shooters still use ogive collars and measure/batch both their bullets and cartridges to produce as consistently as possible, a specific jump or jam to the lands. Should a shooter believe this to be necessary, the use of a micrometer and ogive collar is essential for bullet appraisal, but for Cartridge Overall Length (COAL) this is generally impractical, and Vernier's are the only realistic option. Just keep in mind that Vernier's have the nickname of 'Very Nears', and for good reason. They are very good, but precision instruments they are not.

All OEP precision turned CNC Copper Hunting and Target bullets generally hold 0.03 mm ES for length within a box, with ogive engagement tolerances considerably tighter again. This equates to less than 1/4 the variance of premium match grade swaged target bullets and less than 1/7 the variance of common hunting bullets … At the very least; measuring the length of your bullets is no longer required and your seating depths (including jump to the lands) will be far more consistent!

c) How important is bullet seating and how sensitive are OEP bullets?
OEP bullets are not sensitive to jump to the lands provided the jump exceeds the minimum 0.035" or 0.9 mm. A jump of 1.27 mm is commonly used, with jumps of up to 2 mm showing no negative influence on accuracy!

Warning: Hunting application bullets of any type should ***never*** be jammed into the lands. Even target shooters must be extremely careful with this practice. An unnoticed bullet stuck in a chamber throat is a potentially dangerous situation. OEP bullets are so designed that seating the bullet with the base of the ogive flush with the case mouth will place your jump in 'the safe zone' of a standard chamber.

d) Diameter and concentricity:
Even though OEP bullets are equal to or superior to the highest standards for diameter and concentricity, it would be a long stretch to claim that bullets with an ES of 2 micron are likely to be substantially more accurate than product within a 6 micron ES range. However, it is reasonable to assume that product exceeding this standard would also have much wider tolerances in other areas, and the effects are cumulative … more

Put simply, it is much easier to consistently make a bullet to a very tight tolerance for diameter and concentricity, than it is a barrel. And the longer the barrel, the more difficult the task! That barrels are as good as they are these days is surely a miracle of modern production technology; but these tolerances are often twice those of the average bullet manufacturer. At *OEP*, we measured the products of five bullet manufacturers in 0.308 calibre. Three of the five manufacturers' products measured an ES of 0.006 mm, 0.003 mm and 0.003 mm respectively from their mean diameter. Although these diameters differed slightly from one another, they were all within the SAAMI specification and tolerance. Two suppliers product showed ES tolerances for diameter of 0.014 mm and 0.016 mm and were clearly outside expected tolerance standards.
The SAAMI standard for 0.308 barrel dimension is 7.62 mm and 7.82 mm for land and groove, with a tolerance + 0.013 mm. Notice that this is a positive figure only, there is no permitted negative tolerance, so the total tolerance for ES in these dimensions is 0.013 mm. That's it.

Even though OEP bullets are equal to or better than the highest standards from this sample group, it would be a long stretch to claim that bullets with an ES of 3 micron are likely to be substantially more accurate than product within a 6 micron ES range. However, it is reasonable to assume that product of 14 and 16 micron variance would also have much wider tolerances in other areas, and this was indeed found to be the case.

It was also particularly interesting to note that the retail prices paid for these products were not necessarily reflected in the tolerance standards. The most expensive product was the second worst for tolerance ES, and fell outside the accepted range. It seems that it always pays to check. For those wishing to do so, a calibrated and certified micrometer is essential, as is a temperature controlled environment.

Moderate changes in temperature can easily vary such measurements by 2 micron or more in a relatively short time.

e) Weight:
OEP Hunting Bullets consistently hold less than 0.5% in Extreme Spread (ES) for weight, and a Standard Deviation (SD) of less than 0.12%. They are outstanding performers for a very broad range of hunting applications. Accuracy is excellent and terminal performance is spectacular at ranges well beyond these benchmarks in suitable cartridges.

For the target bullet range, OEP has set the goal of achieving an ES of 0.16 % for weight, with an SD of 0.03% for all Precision Target Projectiles within any given batch.
These standards are among the very highest in the industry. In conjunction with our tolerances for length and concentricity, the ultimate in precision and consistency is in the box marked OEP Target.

Bullet sorting is now a thing of the past. We've already done it for you! *… more*
Bullet weight variation is generally the easiest for most shooters to assess, as all reloaders will have at least a balance scale measuring in 0.1 grain increments, with an instrument measurement tolerance around another + or - 0.1 grain or so, depending of course on quality.

For a hunter hunting over distances of less than 400 meters, bullet weight variations of 0.6% or less in extreme spread (ES) are more than adequate. Take the 150 grain 0.308 in a hunting style hollow or soft point for example. This means that if all the bullets in the batch weigh no less than 149.6 grains (conservatively rounded, as most scales are in 0.1 grain increments) or more than 150.4 grains, a suitable bullet should be consistent enough to hit a pig in the chest out to at least 400 meters. (Any shot placement outside this parameter is likely to be for reasons other than bullet weight!) Bullet product that fails to meet these basic standards or those with form factors designed for close range, heavy and dangerous game (such as round nosed or flat point bullets) could reasonably be expected to fall outside the category of medium to longer range hunting requirements.

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Target shooters of course require the most exacting tolerances possible if they are to meet the demands of modern bench rest, and more especially precision long range competition. In this game, competitors hover around the 40 – 50 mm group size at 908 m (the old 1,000 yd. mark) to be in it at the elite level. Bullet weight (and even more importantly, powder weight) must be measured in finer increments and to tighter tolerances. This can only be achieved using substantially higher quality equipment. Laboratory grade scales measuring in the 0.02 grain range, with + or –

0.01 grain tolerance are commonly used by elite competitive shooters seeking single digit ES and SD velocities. (0.01 grains is less than a milligram!)
To match the incredible form factor tolerances of length, and diameter, *OEP* individually weight sorts all *Target Projectiles*. This completes the trifecta for ultimate precision in length, diameter (including concentricity) and weight.

To this end, OEP has set the goal of achieving a target ES of 0.16 % for weight, with an SD of 0.03% for all Precision Target Projectiles within any given batch.

These standards are among the very highest in the industry. In conjunction with our tolerances for length and concentricity, the ultimate in precision and consistency is in the box marked OEP Target.