

UniqueTek “Tips” File #2: “14 Tips for Electronic Powder Scale Accuracy”

Rev. 12; 05/2015

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Weighing powder charges requires as much care as throwing the charge. All your careful powder measure technique is useless if you can't weigh it accurately. I finally saved up and bought an electronic powder scale thinking it would solve all my frustrations with using a balance beam scale. Well, actually, it did solve most of them. It certainly is faster, but it also brought a few new problems to the table ... umm, make that reloading bench.

Tip #1: Stability & Vibration

The scale must be on a rock steady table. A table that wiggles just isn't going to cut it. If your bench doesn't have adjustable feet, place shims under the legs. Remember to protect your scale by taking it off the bench before hammering any shims into place.

Even if the table doesn't wiggle, vibrations through the table can affect measurements. If possible, move the scale to a separate table that is isolated from the press vibrations. If that is not possible, make sure that you aren't doing anything else while weighing.

The press may not be the only source of vibrations. I've seen more than one or two reloading benches sharing a room with the clothes washer and dryer. The wife doing laundry while you are dialing in a powder weight is not a good idea. Just how you go about getting her cooperation on this is a whole other can of worms!

Analytical labs place their scales on heavy marble or granite tables. The mass of the stone slab absorbs vibration. But these are too large and expensive for the average reloading bench. I've also seen anti-vibration foam pads that you place under your scale to absorb vibrations. Before you buy one, just try an old mouse pad and see if it helps. I took both concepts, combined them, and designed my own anti-vibration pad. I took a brick, set it on an old mouse pad and placed my scale on top. It works and cost practically nothing.

Tip #2: Leveling

I originally thought this would be the first and most critical step of this list. As it turns out, leveling is not as critical as I would have thought with modern electronic powder scales. Many don't even have adjustable leveling feet, just three or four fixed feet. If your bench is level enough that bullets aren't constantly rolling off the edge, it is probably okay. But if you needed to shim the feet to make the bench stop rocking in Tip #1, you may as well take the time to level it while you are there.

If you do want to check that your scale is level, buy a small bubble level that you can place directly on the weighing pan. Make sure it is the right size to rest flat on the pan and that it doesn't weigh more than your scale's capacity. I bought a lightweight, plastic bubble level at Home Depot for less than three dollars. Leave the scale turned off while leveling.

Tip #3: Batteries and AC Power

A weak battery can make an electronic powder scale give erroneous readings long before it ever goes dead or gives a low battery warning. I load a fresh battery in my scale every six months or so and use the old battery for some other less critical application. Buy a good quality battery. This is not the place to use a cheap battery.

Never substitute rechargeable NiCd, or NiMH batteries, or the new lithium batteries, if the recommended battery is an alkaline. This could actually damage the scale's electronics if not designed for it. Additionally, the low battery indicator circuit is calibrated for the specific battery type. It may not warn you when the battery is low if you use something other than the recommended type. Check the instruction manual for the recommended battery type. If nothing is mentioned, you should use the same type of battery that it came with. Of course, you can always call the manufacturer and ask them what battery type they recommend.

If your scale came with an AC Adapter, by all means use it. It will allow you to leave the scale on for extended periods without worrying about the battery going dead in the middle of a reloading session. However, you should be aware that the inexpensive “wall wart” powder adapters are not “regulated” and can pass on any line voltage fluctuations to your scale resulting in instability. If your scale is acting unstable and you are using the power adapter, try running off batteries (use fresh batteries please) and see if it improves.

Tip #4: Warm-up time

Warm-up time can affect the scale's measurement stability. Some scales can take as long as 30 minutes to warm up to a stable internal temperature, especially if the room is unusually cold. With an AC powered scale, you can just leave it on while you are making other preparations. If your scale has an Auto-Off feature, you may need to disable it or set it for a longer time if possible. Battery powered scales may not allow long warm-up periods especially if it is one that drains batteries quickly. In that case, allow 30 to 60 seconds warm up time, keep the room temperature as stable as possible before starting a reloading session and use the zero button before every weight measurement.

Tip #5: Calibration

Those check weights that come with most scales aren't just for looks. Use them! I check my scale calibration every time I set up for a reloading session. It is a good way to tell if your scale has warmed up and is ready to use. You should also check calibration if the scale has been moved (like to your shooting buddy's house), is being operating at a significantly different temperature than when it was last calibrated, and after you change the battery. If you just bought a new scale, checking the calibration is the first thing you should do before using the scale. Perform the calibration procedure as described in the owner's manual only if the calibration is off. But before deciding to perform calibration, make absolutely certain the scale has had a chance to warm up and the readings are stable. You may find that after sufficient warm up time, calibration will not be needed.

Always use the calibration weight(s) that came with your scale. Depending on the resolution of the scale, the “class” of calibration weight(s) that come with it will vary. Lower resolution scales (0.1 grain) may only come with ASTM Class 6 (equivalent to OIML class M2) calibration weights. A 50g Class 6 calibration weight can vary by as much as $\pm 7\text{mg}$ ($\pm 0.007\text{g}$ / $\pm 0.107\text{grain}$) and a 100g calibration weight can vary by as much as $\pm 10\text{mg}$ ($\pm 0.010\text{g}$ / $\pm 0.154\text{grain}$). That doesn't sound like much but if you use these weights to calibrate a scale with higher resolution, it can make a significant difference.

Scales with higher resolution require a calibration weight with tighter specifications. For instance, the UniqueTek High-Precision Electronic Powder Scale, which has a resolution of 0.02 grains (0.001g), comes with a 20g calibration weight rated Class F2 (OIML Class F2 fits in between ASTM Class 3 and Class 4). For a 20g calibration weight, the allowable tolerance is only 0.8mg (0.0008g) compared to a Class 6 tolerance of 3.0mg (0.003g). By substituting a 20g calibration weight from a lower resolution scale, the calibration could be off.

A balance should be calibrated using a weight with a class tolerance factor greater than the readability of the balance. For example, a milligram balance with readability of 0.001g should be calibrated with a weight having a known tolerance of at least 0.0009g. So why not just buy a calibration weight set made to tighter tolerances? In short, cost! I was given a set of calibration weights made by Ohaus. They are brass weights rated Class 6 and sold for about \$40.00. The cost of calibration weight sets with tighter tolerance is excessive, especially if you want, a set that comes with a certificate documenting the exact value of each calibration weight!

Here are some examples:

- Class 6 brass = \$40.00 / \$139.00 with Certificate
- Class 4 stainless steel = \$320.00 / \$815.00 with Certificate
- Class 1 stainless steel = \$600.00 / \$1225.00 with Certificate

In the United States, three classifications are used.

- ASTM E 617-97, Classes 0 through 7
- OIML R111, classes: E1, E2, F1, F2, M1, M2, M3.
- NIST Class F; (Only used for commercial weights & measures testing)

If you want to read a complete table comparing these weight classes see; [Calibration Weight Tolerances.pdf](#)

To make things even more difficult, some calibration weights are 2-piece assemblies. They are hollow and have either a plug in the bottom or a handle that is screwed on top. These are purposely manufactured a bit heavy and then metal is shaved off the handle or inside the bottom to calibrate it to the correct mass. If the plug falls out or the handle comes unscrewed, your calibration weight may be compromised. Fortunately, you can buy individual calibration weights on the Internet. I recommend that you contact your scale manufacturer and determine the correct size and tolerance classification of calibration weight for your scale. You can usually buy replacement calibration weights directly from the scale manufacturer.

Tip #6: Air Currents

Some electronic scales come with a cover. On some of these, the cover isn't just to keep dust off when not in use. Some covers are designed to be used during measurements and provide a valuable function by blocking air currents that can affect accuracy (the owner's manual will tell you if your cover is intended to be closed during measurements). You can sometimes identify covers that are designed to be closed during measurement as they may have a hole in the top. The hole allows you to add powder with the lid already down. As you can imagine, closing or opening the cover after placing a pan of powder on the scale will likely upset the measurement.

A few scales come with a "draft ring", which is usually a glass ring that fits around the weighing pan to protect it from air currents. Make certain it is in place for all measurements

Even if your scale has a draft ring or a cover designed for use during measurements, make sure it is located away from air currents in the room. Or, better yet, make a draft shield on three sides. I made one out of mat board (the stuff on which artists mount photographs). It is rigid, easy to cut with a utility or X-ACTO® knife, finished on both sides and available in lots of interesting colors. It is cheap and can be found at art & craft stores or office supply stores. Make it tall enough to extend at least 3 inches above the weighing pan.

Adding a draft shield may not be enough. I had an air conditioning vent that blew in the direction of the reloading bench and the draft shield just didn't help enough. I finally found an inexpensive plastic deflector at the local hardware store that attached to the face of the wall vent and deflected the airflow away from the reloading bench. Simple, elegant, cheap and it worked!

Tip #7: Static Electricity & Magnetic Fields

Static electricity near an electronic scale can affect measurement accuracy just as much as a stray air current. Always use a powder pan made from metal or from static dissipative plastic (e.g. the Lyman Powder Pal™ or RCBS Scale Pan/Powder Funnel). PACT recommends washing their powder pan occasionally with soapy water and allowing the soap film to dry on the pan. The soap film helps dissipate static electricity. Keep any plastic materials away from the scale, including plastic loading blocks, die storage boxes, ammunition storage boxes,

AkroBins and anything made of Styrofoam or vinyl. Keeping a clear space around the scale is generally a good practice anyway.

Don't forget the static on your body! Even though the days of the polyester leisure suit are (thankfully) long gone, you may have carpet under your reloading bench. I'm sure we've all scuffed our shoes across a carpet and then zapped some poor unsuspecting soul with a big arc of static electricity. A static spark to an electronic powder scale is not only bad for accuracy; it can destroy the scale's circuits! Even if you don't build enough charge to cause a spark, it can be enough charge to affect your powder scale's accuracy.

I talked on the phone with a customer, multiple times on several days, trying to help him diagnose the problem with his powder scale's instability. The scale was in a half-bath that was accessible from his reloading room. It had a Formica counter top and tile floor, so static charge was the last thing he thought of being the problem. But the reloading room floor was carpeted. Even with him standing bare foot on the tile, he was still carrying a static charge that he'd built up on his body from the carpet. The clue was that the scale would be perfectly stable when he stood back three feet away from the scale. But when he reached out toward the scale, it would begin drifting when his hand got within an inch or two. I then had him reach over and touch the metal faucet (to bleed off any static on his body) before touching the scale ... and the drift problem disappeared. The scale instability was simply due to static on his body. He never told me how many scales he had returned to the manufacturer before calling me.

Fortunately, a little anti-static laundry spray (Static Guard®) applied to carpet periodically is very effective. And touching a grounded metal object (the screw on the wall plate of a light switch or electrical outlet cover plate, a metal water pipe or metal faucet) occasionally will also remove any charge from your body. If you replace the plastic cover plate with a metal one, you don't have to aim for the tiny screw ... just touch anywhere on the metal plate.

Scales can also be strongly affected by magnetic fields and electrical interference generated by electronic devices. Don't use a scale near any electronic device such as a computer, monitor, radio, or cell phone. Fluorescent lights can also generate interference. If you are experiencing a problem with your scale, test it with nearby electronics and lights turned off.

Tip #8: Checking Zero

Use that zero (or "tare") button ... frequently! I always zero the scale immediately before every measurement. Some may feel this is overkill, but I feel it is worth the few extra seconds it takes to ensure the best measurement accuracy I can obtain from my scale.

While we are discussing the Tare button, let's look at just how handy this feature can be. The most basic use is to "tare" the weight of your powder pan so the scale reads 0.0 grains with the empty pan in place and the scale will display the weight just the powder charge. This same technique can also be used for sorting bullets, cartridge cases or even loaded cartridges.

Example 1: Lets say you want to sort a new batch of bullets by weight relative to a favorite bullet weight you know from previous test is ideal for your cartridge. If you were smart, you would keep a sample bullet from that earlier batch that is the ideal weight. Keep it wrapped in a piece of soft cloth and in a small bottle with a label on the outside noting the manufacture, type and weight and anything else you want to record.

1. Press Tare to zero the scale.
2. Place the example bullet on the scale and check that it weighs what you expect.
3. With the example bullet still on the scale, press tare to zero the scale then remove the example bullet.

4. Start weighing bullets from the new batch. Bullets that are an exact match will weigh 0.0 grains. Sort the bullets into weight groups depending on how close you need them to be to the example bullet weight.

Example 2: If you have a sneaking suspicion that you may have double charged or not charged a cartridge, just tare the weight of a known good cartridge and then start weighing the suspect cartridges. All the good cartridges should weigh 0.0 grains (or very close to it). So, all you need to do is look for one that weighs too much or too little by the weight of the powder charge. This greatly speeds up the inspection process!

Tip #9: Center the Load

Place the load (powder pan, bullet, calibration weight, etc.) at the center of the weighing platform. An off-center load may cause binding of the load cell resulting in error. Some powder scales have a cup shaped platform that automatically centers the powder pan. But if you are weighing a bullet, loaded cartridge or some other odd-shaped object, try to center it as best as possible. To keep round objects (e.g. a ball bearing) from rolling around, first place a simple gun cleaning patch on the scale, then place the object on the patch.

Tip #10: Cleanliness (Updated and Expanded)

Keep your scale clean. Dust and stray powder grains getting into the load cell can bind the mechanism. If your scale comes with a cover, keep it closed when you are not using the scale. If your scale came with a storage box, you should place it back in the box if it will not be used for an extended period of time.

I keep a can of compressed air at my reloading bench. It is handy for blowing powder grains off the powder scale, as well as off the press, and doesn't blow with enough force to damage anything. You may also want to consider one of those miniature keyboard vacuum cleaners. Since a keyboard vacuum sucks up the powder grains, it has the added advantage of reducing the risk of blowing powder grains into the powder scale interior.

If powder grains (or other particles) do get into the interior of the scale, they can cause all sorts of instability problems including: drifting off zero, drifting after displaying final weight, displaying wildly inaccurate weight, displaying a different weight each time, and inability to calibrate the scale. If you experience these symptoms with your scale, and you've already replaced the batteries, contamination in the load cell is the next most likely cause. Think of the load cell as a tuning fork. If dust or powder grains are clinging to it, it will change the tone.

The weighing platform can be removed on some scales, so you can easily clean underneath. A soft artist's paintbrush or a gentle puff of air is about all that should be needed to clean it. Just be certain to brush or blow in a direction that flushes particles off the scale and not down the hole under the weighting platform! You can turn your scale upside-down while cleaning, but do not shake it to dislodge dust and powder grains. Shaking could permanently damage the load cell!

Check with the scale manufacturer before attempting to open the scale up to clean out dust or powder grains that may have gotten inside. Messing around inside can cause permanent damage if you don't know what you are doing. After cleaning, recalibration will be needed. Indeed, you may need to calibrate it several times to get it back to normal.

Don't forget to clean your powder pan. Over time, a film of powder residue can build up on the powder pan. This can cause powder grains to stick to the pan, and not be transferred to the cartridge case. This is often misinterpreted as static cling and most frequently treated by rubbing the pan with an anti-static clothes drier sheet. Repeated use of drier sheets may also leave residue buildup. Residue buildup happens with both metal and plastic powder pans. The cure is simple. Just wash the powder pan with a drop of liquid dish soap, rinse thoroughly and let dry. Do not use abrasive soaps or scouring pads. The resulting scratches can cause powder grains to cling.

Tip #11: Powder Pans

The powder pan you use can make a difference too. If every grain of powder doesn't make it into the cartridge, then all your efforts to this point are in vain. My favorite powder pans are the metal pans that commonly come with balance beam type scales (e.g. Dillon Eliminator: Redding No.2 and RS-1; RCBS® Models 502, 505 and 1010; LEE Safety Scale™; Lyman® Pro 500 and Pro 1000; etc.). Metal powder pans have a few advantages over plastic pans.

1. They don't hold a static charge
2. They tend to need cleaning less frequently (see Tip #10)
3. Powder grains tend to slide off quite easily
4. They are usually a shiny gold or bare aluminum color, so you can easily see that all powder grains have been transferred to the cartridge case.

The gold or silver color also makes inspecting powder grain structure easy. Plastic pans are usually black and inspecting dull gray particles against a black background is difficult.

If you ever lose your metal powder pan ... well, let's say just don't ever lose it! They can be difficult to find and expensive. And it is highly recommended that you find the same pan that originally came with your balance beam scale. The hanger support is designed to fit the pan exactly, and a pan from another scale probably won't fit correctly. Your best bet is to call the manufacturer and get the pan that originally came with your scale. If that isn't possible, try to get the pan and hanger from another scale.

Most electronic powder scales come with plastic powder pans (Lyman is one exception). Most plastic pans that I've used leave much to be desired. Fortunately, there are alternatives. If you have an old balance beam scale packed away, just use the metal pan. If you don't happen to have a metal powder pan, the best plastic powder pans I've found are,

- Lyman® Powder Pal™
- RCBS® Scale Pan/Funnel

Both are made of anti-static plastic and have a unique feature of combining a scale pan with a powder funnel. I think that the RCBS product has a slight advantage because it also has a conventional pour spout. But either one will serve you well. The best part is that they cost around \$7 (versus \$16-\$20 for a metal pan). One caveat ... they are not recommended for use on a balance beam scale. Not sure just why that is, but it is most likely because the scale "zero" adjustment may not have enough range to adjust for the difference in weight between the metal and plastic pans. The plastic powder pan is also unlikely to fit the hanger.

If your scale has a cover that is to be closed during weighing, make sure that any pan you choose fits under the cover with plenty of clearance! The Lyman® and RCBS® pans have a much taller profile and may not fit. Likewise, if you have an electronic scale that has an integrated (or connects to) an auto-trickling mechanism, you must make certain that any replacement pan doesn't interfere with the trickling.

Tip #12: Working with Auto Powder Tricklers

Several automatic powder trickler scales are currently on the market. (e.g. Lyman® 1200 DPS 3, RCBS Chagemaster Combo, Hornady® Lock-N-Load™ Auto Charge™ Powder Dispenser). As good as they are, you may not want to trust them 100%. Crosschecking one is easy if you still have the scale you used before buying the auto trickling scale. And if you have a spare powder pan, you can start trickling the next charge while crosschecking the first charge using your old scale ... so you won't be losing time while doing the crosscheck. Of course, if your auto trickler is performing well, you won't need to do this every charge. But it is a good habit to

crosscheck periodically during a loading session to make sure nothing has drifted, and in particular when trickling gunpowders you haven't used before.

Tip #13: How NOT to break the Load Cell in your Powder Scale.

The "Load Cell" is the heart of every electronic scale. Lower priced scales usually use a strain gauge type load cell. Strain gauge load cells in particular, can be easily damaged if handled roughly.

- Never leave a load on a scale for an extended period of time as this can damage the load cell.
- Never place more weight on a scale than its uppermost limit. Overloading the scale can damage the load cell. Don't forget that the scale's weight limit includes any "tare" weight. For instance, if your scale has a 500 grain maximum capacity and you "tare" the scale (zero) with a powder pan that weighs 100 grains, the remaining capacity is now only 400 grains. Even though the scale reads zero, if you place a 500 grain weight on the scale, you will overload the scale.
- Never drop anything on the weighing pan. Always place the load or calibration weight gently onto the scale. Dropping weight on the scale can damage the load cell, even if the weight is well below the scale's uppermost limit.

If you ever do accidentally overload your scale, try recalibrating it. If the damage is slight, you may be able to save the scale. You may need to calibrate it several times to get it back to normal.

Tip #14: Read your Owner's Manual

The owner's manual for your scale is full of useful information specific to your scale. It may not be as exciting as a Tom Clancy techno-thriller, but it is worth reading.

A Final Word

These tips will get you a head start on accurate powder weighing and, hopefully, save you a few of the lessons I learned the hard way.

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