successful tips for buying and using pottery clay

how to select, process, and test clay bodies for better results
Successful Tips for Buying and Using Pottery Clay
How to select, process, and test clay bodies for better results

Buying or making the right pottery clay is one of the keys to success in your studio. There are many variables that determine the right pottery clay for your needs including color, temperature range, the type of pottery you make, and what kind of forming methods you use, just to name a few. Whether you end up using earthenware, stoneware, or porcelain (or perhaps all of these) depends on you understanding the properties, benefits, and drawbacks of each type of clay.

Most of the value in a piece of pottery is in the time and effort you invest, and the clay is one of the least expensive elements, but that does not mean it is the least important—quite the opposite. Becoming familiar with the types of pottery clay available will allow you to make smart design decisions and can open up new areas of creative exploration.

Selecting a Clay Body by Bill Jones
Most potters use commercially prepared pottery clays, and ceramic suppliers and clay manufacturers want to make sure you’re getting the clay you need. Here’s a checklist for selecting the right earthenware, stoneware, or porcelain.

Buying Porcelain by Antoinette Badenhorst
The lure of porcelain can be so irresistible! Working with a pottery clay that’s smooth, white, and translucent certainly has its appeal, but at what cost? Working with porcelain takes a bit of a change in how you work, what you make, and what your skill level is. Check out what it may take for you to switch; porcelain may be just the thing!

Recycling Pottery Clay in Your Studio by Jonathan Kaplan
We all end up with clay scraps when making pottery, and because this happens at various stages in the cycle, we need a way to bring all of that clay to an even level of moisture and consistency so it can be used again. Here is a simple way to recycle your pottery clay without a lot of equipment or hassle.

How Much Clay Do You Need? by Robin Hopper
For potters it’s hard to visualize just how much clay you need to last a month or three months or six months. But if you know that you can get 50 coffee mugs from a 50 lb box of clay, you at least have an idea of what you’ll need before you order again. If you make a chart like Robin Hopper’s, you’ll be able to judge your clay supply with no problem.

How to Wedge Pottery Clay by Michael Wendt
No potter really likes to wedge, but it’s a necessary step in getting clay uniform for throwing or handbuilding. While spiral wedging is widely practiced, over time it’s hard on the hands and wrists. With this stack and slam method of wedging, you can blend colors, textures, and moisture levels into a smooth blend in just minutes without pain.

Testing Pottery Clay by Paul A. Wandless
Pottery clay bodies have the potential to be really versatile. The more we know about a clay body, the more we can understand its limits; how high will it fire, how low can it go, what happens to the color? You may just find that you have a whole lot of choices with your particular clay body that you just didn’t know about.

How to Prevent Bloating by Dave Finkelnburg
Bloating in fired clay is always a puzzle. How is it possible for a fired object to have its surface distorted by an unsightly, unintended bulge that wasn’t present when the work was loaded into the kiln? The challenge with bloating is getting past that frustration to focus on preventing it from recurring.
Selecting a Clay
by Bill Jones

Most potters use commercially prepared clay, and ceramic suppliers have met their needs by offering a vast, though sometimes bewildering, selection of clay bodies to choose from. If you’re using the clay someone else just handed you, maybe it’s not the right one for the work you’re doing. Every clay body is formulated for a specific use, and finding the right one for your needs takes a bit of research and experimentation. There are several decisions to make when finding a clay body or bodies that meet your skill level, techniques, and aesthetic.

Choosing a Clay Supplier
Now why would you choose a supplier first? They work with amateurs, professionals, students, teachers, sculptors, tile makers, etc., and have solved a wide variety of problems. There are three types of suppliers: those that manufacture their own clay bodies, those that sell clay from other manufacturers, and those that do both. And, if you have problems a supplier can’t answer, either you or the supplier can contact the manufacturer.

Handbuilding or Throwing?
Clay bodies are formulated for different applications. Throwing tableware requires a clay body that is plastic (malleable) and smooth, while constructing a large sculpture may require “toothier” (coarse-grained) clay. In many cases, a clay body may be used for several applications, but some are highly specialized—raku or ovenware, for example. Make a list of the things you want to do, and you may end up with several bodies to achieve the best results.

Firing Stoneware, Earthenware, and Porcelain
Clay bodies are formulated to fire at specific temperatures within three general ranges: low-fire (cone 06–2), mid-range (cone 3–7) and high-fire (cone 8–10). Within a range, the higher you fire, the greater the shrinkage and the lower the absorbency of the fired clay. Low-fire clay bodies, such as earthenware, are easy to work with and fire, and there is a wide range of colorful glazes available. These clay bodies are also used for raku and pit firing. Mid-range clays are more durable and include stoneware and some porcelain bodies, but color is more limited. This situation improves each year as glaze companies improve and expand their offerings. High-fire clays are very durable and include stoneware and porcelain. Color palettes vary depending on firing atmosphere (oxidation or reduction).

Choosing a Clay Body Color
Color in basic studio clay bodies results mostly from naturally occurring iron and/or iron that has been added. Porcelain contains no iron, light buff bodies have some iron, and earthenware bodies may have over 10% iron. The body color (as well as the glazes) changes based on the type of firing atmosphere you have—reduction (from fuel firing) or oxidation. Reduction firing deepens or darkens an otherwise neutral-colored clay body. Some clay companies have duplicated this effect by adding more colorants to their formulas making it possible to achieve “reduction” colors from an electric kiln. Since the iron and other colorants in a body color affect glaze color, you’ll need to test your glazes with each body.

How Much Tooth?
Texture can range from smooth to rough. Smooth bodies contain very small particles of clay, which tend to shrink more. These are best suited for small, fine, and/or detailed work. Adding grog (ground-up fired clay) or sand gives the body “tooth,” and the larger the particle size, the less water the piece will need (hence less shrinkage). Manufacturers offer a range of bodies that incorporate finer particles of grog and sand to get a texture between smooth and rough.

Buy What You Need
Buying prepared clay requires a little judgment. First, try to find a supplier that is nearby because shipping costs can add up and sometimes equal or exceed the cost of the clay body itself. Next, test a sample before purchasing a large quantity. If you’re buying several types of clay bodies, suppliers will typically allow you to combine the weights for a better discount. Finally, buy only enough clay to last you a year maximum. Clay loses moisture in storage and becomes stiffer, possibly even unworkable. You can ask your supplier how long they have stored the clay. A good supplier will only stock what they can sell within a reasonable amount of time.

Mother Nature vs Clay
All commercially-prepared clay bodies are made from naturally occurring elements scooped from the earth for industrial users. Studio potters do not purchase enough materials to be a major user, so we have to make do with a small portion of what the industry uses (brick and tile manufacturers, china companies, steel industry, paper mills, pharmaceuticals, etc.). Mother Nature did not use any quality control when she created clay deposits, so veins of clay vary from one spot to another. And a mammoth front loader is not a delicate material-selection tool. The good news is that the industry often requires a degree of consistency in their raw materials, so that clay mines make every effort possible to provide them with the very best product out there for an intended application. To make sure your clay meets your every needs and your own quality standards, always test each batch everyday.
Buying Porcelain
by Antoinette Badenhorst

If you’ve only worked with red, brown or buff clay in the past and you’re looking for a change, maybe porcelain is the right clay for you. Planning, research, and evaluation are the best ways to assure any future success in making a switch from one clay body to another.

To determine if porcelain is what you’re looking for, you’ll need to evaluate where you want to go with your clay work, your skill level, and your vision as a potter. Decide if you’re happy with your current work, and if so, consider the effect that work will have if made with a white or porcelain clay body. Not all works in clay maximize the qualities that porcelain has to offer, so if you have to change your work in order to use porcelain, evaluate whether that’s something you want to do.

In my own experience, I had a vision of pots dancing like ballerinas—soft figurines moving around in bright colors against pure white backdrops. I also envisioned translucent light and instantly knew what to do, but it took some time to find the right porcelain and to develop a body of work.

Studio Setup and Working Methods
Do you have the right studio setup for porcelain and are you able to adjust your current workplace with ease? Can you work with precision and in a clean studio? Do you work with other clay bodies that might contaminate porcelain, or are there other potters working with you that might not respect a porcelain work station? Which techniques do you use most? For instance, if you work mostly with an extruder with a steel chamber and plunger, you’ll

Before making a large investment in porcelain, test several bodies to see which one best suits your needs.
need to replace it with a stainless steel or aluminum one to avoid possible rust contamination.

**Skill Level**

It’s important to know your own abilities and skill level. If you’re a beginner who wants to throw 20-inch pots, you’ll have a lot of difficulty achieving your goals and there will be a whole lot of frustration, time, and money wasted before you can reach them. In such a case, it’s better to use white stoneware clay and gradually work your way first through a semi-porcelain body and then eventually use pure porcelain as your skills improve.

**Different Porcelains**

If you want to become a porcelain production potter, you’ll look at a different clay body than someone who wants to make one-of-a-kind porcelain pieces, porcelain sculptures or strictly handbuilt forms. Your working methods will differ dramatically from theirs. Maybe you need a clay body that combines some or all of the above mentioned clay techniques.

Once you decide that you want to take on the challenges that porcelain offer, you’ll have to find the clay that suits your newly set goals. There are many different porcelain clay bodies available on the market.

I tested several commercially available cone 6 porcelain bodies and suggest you do the same before settling on one. Each clay had some special characteristic that I could use for my own work and could see used by anyone else. Commercial porcelain clay bodies meet almost all the needs of the potter, and there are some excellent throwing, handbuilding, and sculpture bodies available. The producers and suppliers know which one best suits each purpose, and they are an excellent resource when you are trying to figure out what you need.

They develop some bodies to be more plastic and stretchable, but less white and translucent. These bodies can go further in height and thinner in walls than some others that might be pure white and translucent, but may be a little harder to throw.

If you choose to work with pure white, translucent clay, you can always throw thicker and trim thin afterward. If you need an all translucent, white, and a non-warping clay body, it might cost a little more, but your ceramic supplier can recommend the right clay body for your purposes.

Amazingly, you will even find that some of the semi-porcelain clay bodies meet all the characteristics of porcelain and have the added green strength that is often missing in true porcelains. Add these qualities to the fact that you can save energy because many of the commercial clays are formulated for firing at cone 6 electric, and there are very few restrictions left that would limit you from working with this material.

Test several clay bodies for their ability to throw, trim, and to keep their shape when stretched beyond their limits. Also test them to see how they stand up to adjustments and attachments, then fire them to the proper cone in an electric kiln. Check them to see if shrinkage can cause problems. Compare the tests for shrinkage, color, and translucency.

**Transition Carefully**

It’s always best to start by buying one bag of clay and testing it thoroughly. Then, even when you think you’re satisfied with your choice, make the transition to your new style and clay body slowly and carefully. Porcelain is expensive but if you take a conservative approach, and do enough testing to make an informed decision, it will pay to make an investment in a large batch of clay.

I’ve seen porcelain clay bodies improve from one batch to another. Clay companies are constantly doing research to improve their clays. If you consult your clay company, they’ll know what to recommend to you only if you understand your own needs and what you want. To us, as potters, that’s good news, because it means that if we admire a specific clay body today, but it’s not working for our circumstances, it’s worth discussing that with our clay producer and retesting a body again to see if it has changed. Maybe your skills improve, perhaps the clay composition improves, or maybe you and that specific clay body simply get in sync with each other.

Read the literature available online, then talk to a sales representative and they’ll be able to recommend the right clay body for your needs.
The work we make generates discarded clay—scraps from trimming and slop from throwing or handbuilding. Whether you make your own or buy prepared clay, you need to decide what to do with used clay. For some, the solution is to throw the scraps in the dumpster and dump the slop down the drain, which isn’t really a solution. It’s economically and environmentally wasteful and can wreak havoc on your plumbing, sewer and septic systems.

All discarded clay—except that which comes in contact with plaster or other contaminants—is recyclable and reusable. Reclaiming it requires planning a system for your particular studio situation. Although there’s no one way that works for everyone, some basic guidelines can make this job easier.

The following solutions, submitted in a recent PMI reader’s online survey on clay reprocessing will give you a place to start.

Collecting and Storing

1. A trash container of some sort is the key to any system. Placed on wheels, it can be maneuvered anywhere in your studio. Remember that when filled with clay scrap, slop and trimmings, it will be very heavy, so buy a heavy-duty container, and use heavy-duty casters for the dollie. Pouring the scrap clay through a framed screen that sits on top of the container breaks up the scraps into smaller pieces and catches tools that got lost (figure 1).

2. When you’re done with a day’s work, dump your throwing slop and any scraps into the bucket. If you plan to recycle scraps that have fallen on the floor around your wheel, make sure there’s no non-clay debris on the floor first, otherwise you should simply throw these scraps away as the foreign matter could cause problems. Rather than using a broom, use a metal dustpan and your hands to collect the clay.

3. As the bucket approaches the top, decant the water. As long as there is water over the layer of clay in your recycle bucket, the clay scraps will all break down and become thoroughly saturated. If there are lumps or dry material in the slop, the resulting reclaim will have hard and soft spots. You don’t have to mix the clay in the bucket with a mixer. Let the water do its job.

Reclaiming

The resulting very wet scrap usually needs to be dried out before reprocessing can continue. Here’s a list of the more commonly mentioned and used methods.

1. Spread a thin layer (2-inches or so thick at most) of scrap onto an absorbent surface (figure 2). Plaster bats, wedging tables and large plaster slabs are good choices for this. A material called HardiBacker Board works very well. This is a heavy cement board that is...
not as effective as plaster, but is strong and will absorb moisture from the clay. Caution: do not use sheetrock. This is thin and porous, absorbs water very quickly, then the paper delaminates from the surface and the boards weaken. Flip the clay slab over periodically (it should pull away from the surface easily when it is ready to flip) and continue to do this until it is right for wedging.

2 Store drying bats on a vertical rack or ware cart to save space. **Note:** the HardiBacker boards need a board underneath for support. Some potters prefer to dry their reclaim outdoors. **Note:** cover the reclaim with a sheet or other breathable fabric if you live in a windy area to prevent foreign materials from getting into your clay. A fan can also help dry wet clay more quickly. This will accelerate the drying, so turn the clay frequently.

3 Another practical method involves a rudimentary filter press system made from cotton pillowcases. Simply fill the sacks with clay slop and hang them up, either over a bucket or outside. Excess water eventually drips out over time and evaporates from the surface.

### Reprocessing

1 When adding reclaim that has already been through one of the above processes to the clay mixer, make sure you mix the water and the dry clay first before adding the reclaim. Alternately, add the slaked-down reclaim straight from the bucket to the mixer (without drying it out first). This works best if you’re mixing a large batch of clay (over 100 pounds). Put the reclaim in first and add dry ingredients in small batches on top of the reclaim, adding water as needed to maintain the right consistency. A ratio of \( \frac{2}{3} \) dry materials to \( \frac{1}{3} \) reclaim usually works well.

2 Once your reclaimed clay has achieved the consistency you want, block it, bag it and leave it alone for a few days to let the moisture content even out. It can then be cut into small pieces or thin slices and re-wedged with your boxed clay or used as is.

3 A common misconception with a pug mill is that you can combine dry mix and wet mix successfully and get a decent extruded pug. Not true. Although the dry mix sets up the wet mix in the machine, the dry mix itself will not be suitably hydrated and, as a result, the clay will be exceedingly short. If you prepare your clay this way, do so well in advance of using it; bag the clay, let it age, and it will fully hydrate over time. The same is true if you are wedging dry clay into very wet wheel-thrown clay to make it workable again.

4 All plastic bags have a degree of porosity, and release moisture or let in air over time. Mix clay and reprocess scrap just a bit on the wet side to allow for a small degree of air infiltration through the plastic bag.

5 Finally, don’t let the volume of reclaim get out of control. If you keep up with it on a daily basis, you’ll always have reclaimed clay ready to go, and not have an overflowing bucket of scrap. And, if you’re just overwhelmed and don’t have the time, space or inclination to delve into clay recycling, consider donating your unwanted clay to a local school or art center.

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*Jonathan Kaplan is a frequent contributor to Pottery Making Illustrated. He has been actively involved in the ceramics field for 40 years. He lives in Denver, Colorado, where he curates Plinth Gallery, [www.plinthgallery.com](http://www.plinthgallery.com).*
How Much Clay Do You Need?

by Robin Hopper

If you’re doing repetitive throwing or production work, keep a chart of weights and measures showing the amount of clay needed and size of objects at the throwing stage. Here is a list of weights and measures of standard items produced in my studio. These are for an average throwing thickness of 3/16 in. for smaller objects, and 3/8 in. for larger objects. Adjust accordingly if throwing thinner or thicker.

Excerpted from Functional Pottery by Robin Hopper and published by The American Ceramic Society.

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<th>ITEM</th>
<th>WEIGHT</th>
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<tr>
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How to Wedge Pottery Clay

by Michael Wendt

Stack-and-slam wire wedging is a method for wedging that is quick, effective, versatile, and easier on the hands and wrists than any other type of manual wedging. This method allows you to uniformly wedge very large pieces of clay for large pots. You also can add water (or softer clay) to pieces of clay that have become too stiff, or even mix clays with different characteristics such as stoneware and porcelain. In addition, this method offers a superior way to get perfectly flat slabs for tile work or handbuilding.

To illustrate this method, I took two 3-pound balls of clay of different colors and spiral wedged them for two minutes. I sliced through the ball to see how uniform the mixing had become. After two minutes of spiral wedging, there were still pockets of red and white clay in the pink mixture that had not been completely dispersed. I repeated the exercise with two more balls of different colored clays using the stack-and-slam wire-wedging technique. The bottom photos show the remarkable change that took place.

Stack and Slam

Choose a comfortable amount of clay for the first attempt. I seldom wedge less than 3 pounds because it is too slow to wedge each piece one at a time. I prefer to wedge enough clay for several pots at one
time because, with this stack-and-slam wire-wedging technique, it is just as easy to wedge a large amount as it is to wedge a small amount.

First, block the clay into a rough rectangular shape (figure 1). Next, you will lift the piece by the sides and cut it roughly in half (figure 2) passing the left arm under the wire as you place the two pieces back onto the wedging table (figure 3). Make sure the cut is parallel to the front edge of the table.

Take the piece closest to the table edge and carefully place it on top of the other piece (figure 4). Be sure not to make any dimples in either of the mating surfaces.

Roll the joined pieces toward you, flipping them over so the bottom is now on top. Pick up the clay and slam it down with enough force that it ends up bring the original thickness you started with (figure 5).

Repeat steps 1–3 at least 30 times. This will give you over a billion layers of clay particles! It is very critical that you pay attention to the lamination pattern since the final goal is to layer the clay rather than cross the layers with each other.

Once you have completed the required number of cycles, place your left hand on the top of the piece and roll it to the left onto its side. Now your right hand can be placed on the area that was the bottom on the table surface. The goal is to keep track of these two surfaces while converting the block into a cylinder by repeatedly tapping it onto the table surface and finally rolling it round (figure 6).

Taking this extra step assures you can keep track of the laminated face. I have found that orienting the laminations parallel to the wheel head minimizes cracks on the bottom of all of my pieces, and that selecting the smoothest end for the top further reduces losses.

**Changing Softness of Clay**

Sometimes clay is too hard for our liking. Water can easily be added with wire wedging resulting
in the right feel every time. Slice the block first into thin sheets. Spread them onto the table surface and spray with water. Restack and wedge as previously explained or mix some softer clay with the harder clay. This lets you reclaim pots that have failed rather than drying them out and reusing them later. If some of your pugs are too hard and others are too soft, weigh out different proportions of stiff and soft clay. Record the amounts so that you can gauge how much needs to be added the next time.

**Conclusion**

If you’re already happy with the results from your current wedging or pugging, there’s no reason to change. But if you’re struggling with uneven clay and would like a method that gives you more control, try wire wedging. It can create some troubles if done improperly—most notably, the introduction of air pockets due to poor joining surface quality—but this is easy to diagnose and cure. I have used this method for over thirty years and have no wrist or hand problems.

**Constructing a Better Wedging Table**

**Wedging Table tips**

Tables suitable for stack-and-slam wire wedging must be solid with a fairly thick top to reduce noise. My table is made with two sheets of ¾-inch plywood featuring support legs directly under the area where the clay hits. It is bolted to the floor to prevent any kind of rebound or side movement. The height from your elbow to the top of the table should be no more than 4–6 inches when you are standing straight. Higher and you may bang your arms into the front edge of the table; lower and you have to reach down too far. Use heavy canvas for the top because clay barely sticks to it and replacement is easy. Periodically spraying the surface with water keeps the dust down and assures the layers will bond to each other better.

**Wire and Frame**

If your table is against a wall, it is easy to screw a hook into a stud or a concrete anchor to attach the top end of the wire. If the table is free standing, you’ll need to weld a steel frame out of 1×1-inch angle iron and screw it to the table. I added a counter to keep track of the number of times I cut and slam the clay. Guitar strings make good wires because they are very thin, strong, inexpensive and last a long time. Attach the wire to a turnbuckle, which will allow you to periodically tighten the wire as it loosens with use. Always keep spare wires on hand.
At some point we all change clay bodies for one reason or another. Whether you want a body that shrinks less, has more/less absorption, a lower/higher maturation point or just a different color, there are hundreds of commercial clays to choose from. While most clays have pretty good general catalog descriptions of what they are and what they can do, once we apply our specific working and firing processes other issues can arise. A combination of tests can give you plenty of information that makes choosing and learning about a clay body a little easier.

Why Test Clay?
Testing clay bodies provides you with information that you can observe, touch, and feel first hand in your own environment. While a catalog photo shows what a body may look like fired at one or several cones, it may not tell you what it will do at the cone you’re firing to. Basic clay bar tests give you information more specific to your needs, and a 25-pound sample is usually enough to complete all the tests you need.

What to Test
Tests should be done at multiple temperatures to yield the widest range of information on the body. You need to understand the same general characteristics at every temperature you fire to, and even at temperatures you may want to fire to in the future. I test at every potential cone I may fire to and keep records of all the results.

The three important general characteristics are shrinkage, absorption, and warping/slumping. Other important qualities to note are color, texture, plasticity, and hardness. Some results are determined with visual and touch tests while others require simple formulas. All require consistency of procedure so the results you achieve are created under the same conditions.

Firing Box and Stilts
When firing above a recommended temperature either on purpose or by mistake, clay bodies start to melt and fuse or stick to the shelves. To test clay bars, you’ll need a shallow firing box to protect your kiln shelves and make handling and transportation easier. You’ll also need clay stilts for the warping test.

Using a high-fire clay, make a simple clay box that’s 8–10 inches square with a 1-inch high wall. Make several boxes at the same time so you can test multiple bodies in the same firing or to have on hand for later (figure 1).

Make triangle stilts about the thickness of your pinky and long enough to span the width of the clay bar (figure 2). All stilts must be the same height.
Clay Bars

You’ll need three clay bars for each body you’re testing. For consistency and accuracy of results, use the same dimensions for all your clay bars. While some tests yield correct results regardless of the bar dimensions, if they are consistent, you can always rule out size and dimension as variables that could cause any irregularities. I make ¼-inch thick bars measuring 2 inches wide by 6 inches long. For thicker work, make bars to match, but don’t exceed a ½ inch in thickness. After cutting the bars to size, draw a 10-cm-long line on one of them with a hash mark at each end. This will be used for a shrinkage test later (figure 3).

For the tests here, I’ve selected four bodies to test: two white bodies from Standard (#257 Grolleg Porcelain cone 8–10 and #181 White Stoneware cone 6–10) and two from Amaco (#29 Brown Stone Earthenware cone 06–04 and #77 Terra Cotta Clay cone 5). All four bodies have different characteristics at the temperatures to which I’m interested in firing them, and testing several bodies at the same time takes better advantage of each firing. Write the clay number on the back of each tile.

Once all bars are cut and firing boxes are built, let them dry to bone dry. They can be stacked with newspaper layered in between and a board on top for a little weight to keep from warping. It’s important that the firing boxes and clay bars stay flat while drying to assure accurate test results (figure 4).

Pre-Bisque

At the bone dry stage, visually examine the bars for a color change if any. Use a ruler to measure the shrinkage line to see if it has changed from its original 10 cm length. Record the results.

For each firing, place the bars side by side in the firing box, and place one of them on the triangle stilts (figure 5). The stilts should be placed about ¼ to ½ inch in from the ends of the bar. If the stilts are too close, the bar may not warp or slump to its fullest potential. The shrinkage bar and the other regular bar are simply placed in the bottom of the box.

Firing Clay Samples

While the test firing can be done in any kiln, the results are most applicable if done in the same kiln used for your work. Indicate in your notebook or worksheet if it’s an electric or gas kiln, oxidation or reduction firing, salt, wood, soda, etc. For best results, start firings at the lowest cone temperature and then progressively refire the bars at higher cones until the highest desired cone is reached. A sample for progressive test firings for a cone 10 clay body would be cone 06, cone 01, cone 6 then finally cone 10.

Clay Bar Tests

The following traditional tests give a good range of basic information that helps you to better understand your clay body. Keep good records in your notebook or worksheet so you’ll have the results for future reference. If there are other specific qualities, such as glaze fit or color effect, test for these as well.
Warping/Slumping
Visually examine for any warping or sagging movement in the center. Remove the bar from the stilts, turn it over and place it on flat surface so the gap (if any) can be measured (figure 6). This test informs you at what temperature the walls may start to warp or deform or a plate may begin to slump. The information can be applied to the sculptural or structural applications of the clay body. An exact percentage for this is not as important as just knowing when the clay body starts to move.

Shrinkage Test
Measure the length of the line in centimeters on the shrinkage bar (figure 7), and subtract it from 10 (based on the original 10 cm line). For example, 10 cm – 8.5 cm = 1.5 cm. An easy way to convert this result to a percentage is to move the decimal to the right one place, so 1.5 cm means 15% shrinkage. Knowing the shrinkage rate helps in determining which glazes will fit the body and even which two bodies can be used together.

Absorption Test
There are two types of tests that can determine the absorption of a clay body. One is a simple visual test and the other is a weight calculation. For the visual test, place a few drops of a liquid (like ink) on the surface of the bar to create a stain. Let it soak in for an hour then wash off the surface with water. The darker the stain, the more absorbent the clay body. This is not an exact test, but it gives a quick and useful general result.

The weight calculation test is more specific. Weigh the fired bar on a gram scale and record the result (figure 8). Soak the bar in water for 24 hours, pat dry, then weigh again and record the result. Subtract the first weight (dry bar) from the second weight (water soaked bar) to get the weight of the absorbed water. Divide the weight of the absorbed water by the original dry weight and move the decimal two places to the right to find the absorption rate.

Example: Original bar weight of 4.2 grams is subtracted from soaked bar weight of 4.6 grams giving you an absorbed water weight of .4 grams. Divide .4 by 4.2 which equals .095 making absorption 9.5%.

Color Test
Visually examine a bar to see if there has been a color change (figure 9). The color change can sometimes be dramatic depending on the cone it was fired to and is important for aesthetic purposes. It can also help you determine the best glazes to work visually on the surface.

Surface/Texture
Visually examine the bar to determine if the surface has changed. Run your fingers across the bar to see if it’s the same, smoother or more coarse. This information is important aesthetically and helps you determine if it meets your visual and tactile needs.

Hardness
Using a metal nail or similar tool, see if you can scratch the surface to see how hard or soft it is at the fired temperature. This test helps determine the surface durability at different temperatures.
How to Prevent Bloating
by Dave Finkelnburg

There are three potential causes of bloating: over firing, “dirty” firing (reducing atmosphere in the early stages of firing), and poor clay mixing. Their cures are very different. Fortunately, they are easy to tell apart.

Defining the Terms

**Bloating:** Formation, in a clay body during firing, of a gas bubble large enough to distort the surface shape of the fired ceramic. In severe cases the gas bubble will burst through to the surface of the fired work.

**Oxidizing Atmosphere:** An excess of oxygen from air in a kiln firing.

**Reducing Atmosphere:** A shortage of oxygen from air in a kiln firing.

**Overfiring:** Firing a ceramic body so hot that it begins to distort from melting.

Fault: Over Firing

Overfiring is the easiest cause of bloating to recognize. Keep in mind that all ceramic bodies are intended to be formed at room temperature and then fired to durability while retaining that shape. However, if the firing is too hot, known as overfiring, the shape will be lost as the body just starts to melt.

Fault: Dirty Firing

Clays usually contain some organic materials which will burn in the presence of enough heat and oxygen. Some clays contain small to significant amounts of tiny crystals of pyrite, an iron sulfide. The sulfur in pyrite burns readily at moderate kiln temperatures and in a properly fired kiln has burned off by about 1300°F (700°C).

However, if the kiln is starved for air (unlikely in a well-ventilated electric kiln or a carefully tended fuel-fired kiln) the sulfur, as well as organic materials, can still be present. If oxygen gets into the kiln later in the firing, when the clay body is soft due to nearing its peak firing temperature, large volumes of gas will be generated by the combustion of the sulfur and organics and that will cause gas bloating in the ware.

Fault: Clay Mixing

When firing is clean and fully oxidizing until organics and sulfur are burned off, but bloating is observed, then the fault is not with the firing, but rather with inconsistencies in the clay body mixing. The fault is that flux in the clay body is concentrated in clusters, rather than being distributed uniformly throughout the body.

As any clay body approaches peak firing temperature, two features are always present in the work. There is a liquid glass phase formed from flux elements in the body melting the glass former present. There are also small bubbles of kiln gas left over as the body shrinks and becomes dense from the firing.

The glass phase, being a liquid, has almost no strength. At this point in the firing, the strength to keep the ceramic shape is supplied by the clay, quartz, and other more refractory materials in the body.

The gas bubbles naturally exert force to expand because the temperature everywhere in the kiln and ware is rising. The bubbles expand if they are not confined by the clay body.

In a well-mixed clay body, the liquid-glass phase is present in minute droplets too small to see with the naked eye. However, in the case of a poorly mixed body, or one contaminated with lumps of flux mineral, the glass phase forms pools just large enough that the clay-body structure is susceptible to being ruptured by expanding gas bubbles.

That’s what happens when a clay body bloats due to poor mixing of its ingredients. An excessively large glass pool weakens the clay and expanding gas forms a bubble at the site.

Note that while the body is overfired locally, the body does not look overfired in general. Certainly, bloats would not appear if the ware had been fired to a lower peak temperature, but firing temperature alone is not the root cause of bloating. The firing simply reveals the poorly mixed body’s susceptibility to this fault.

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Troubleshooting the Basics

It is critical that the first firing of all ceramic work be done in a fully oxidizing atmosphere until all organics and sulfur compounds are burned off. This is especially critical with work that is to be fired to full density—functional work intended to be impervious to water or other liquids.

A good rule of thumb is, regardless of the heat source of the kiln, fire such work in a fully oxidizing atmosphere up to ~1500°F (~816°C). Organics and sulfur will have burned cleanly off by that point and will not cause problems later in the firing.

When bloating due to poor clay mixing occurs, the culprit is almost always feldspar in the clay body recipe. Feldspar, when handled dry, tends to form small clumps due to electrostatic attraction. Feldspar clumps, if blended into the body, cause bloats.

Such clumps can easily be prevented by simply mixing the water for the clay body recipe with 5 to 10% of the clay to be used, and then mixing the feldspar into that dilute clay slurry. This process, best done with a high-speed mixer, coats the feldspar particles with just enough clay to prevent feldspar clumping.

It is also possible for crystals of flux oxides to precipitate from clay slip found in recycled clay (crystals formed from soluble salts in studio water or dissolved from the body itself), and for those crystals to cause bloats. Where ware is formed from extensively recycled clay, but not from new clay of the same recipe, the safest remedy is to throw out the reclaim. Crystals can be removed by slurrying and screening, but the result will be a body of somewhat altered, and unknown, chemical composition. Clay is just not valuable enough to risk forming effort on a suspect body.