Procedure One: Preparing test bars

1. Clay type and source: In all cases, note the batch number right away.
A. If testing clay from a mine or sampling from skids of clay, choose one of the top bags on each skid and take enough clay to make:
a. 6 bars of clay 6" long by 1" wide and 1/2" thick, if the clay is a high fire.
b. 2 bars if the clay is low fire or earthenware. B. If testing a manufactured clay body, choose a bag or box at random from the supplier's shelf or your supply and take enough clay to make 2 bars of clay for each temperature you will fire to.

2. Prepare the sample of clay for each temperature. A 5" ball is enough for each temperature. Do at least some wedging (25 times) and get it to the consistency you like to work with. If too hard or soft adjust the consistency but don't add any other clay.

3. Make a slab 1/2 " thick and cut TWO bars from it 1" wide by 6" long. Cut the bars from the center of the slab; discard the sides. Record the method you used to form the slab. (E.g., a slab cut with a harp may behave differently than a thrown or rolled slab.)

4. DO NOT bend the bar in any way when you move it. "Bent clay remembers." You will get unpredictable results unless you are careful.

5. Draw a shrinkage line on the bar. Mark the date, the name of the clay and batch number on the bar.

The shrinkage line:
Scribe a straight line in the plastic clay with cross bars at each end accurately 5" apart. Measure using an accurate scale divided into decimal parts of an inch. The triangular type with divisions at 20ths of an inch gives 100 divisions between the ends of the scribed line, which makes estimating shrinkage to the nearest per cent a simple matter of reading the scale. Such scales are available from drafting supply stores. You can use a metric scale as well. The line is a bit shorter. Make a line as above with 100mm (10cm) between the cross bars. Measure using a millimeter scale. As above, the per cent shrinkage is given by a simple reading of the scale value.

6. Let bars air dry in a normal way. It helps if they are on a rack which allows free circulation of air (like an old refrigerator rack or a cake rack) so they dry evenly. They should not be allowed to adhere to the drying shelf or rack, as that will stretch the clay and distort the shrinkage reading. If conditions are dry cover the bars with a piece of paper.

7. When dry note any warping and measure the line to get the wet to dry shrinkage. E.g.: If the line is 94 divisions long at that point (dry), the wet to dry shrinkage is 6% (100 - 94 = 6).

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Procedure Two: Firing the test bars

1. Clay type and source:
A. If testing raw mined clay:
a. For high fire clays, fire to cone 8, cone 10 oxidation (10ox) and cone 10 reduction (10r).
b. For earthenware, fire to cone 04.
B. If testing manufactured clay body:
a. Fire the bars as you would normally, or according to manufacturer's instructions.
b. If you can, fire cone 10 bodies to cone 8 and cone 10 oxidation (10ox) and cone 10 reduction (10r).
c. Record your choices and relevant reasons (e.g., my normal firing method, manufacturer recommendation).

2. Bisque the bars first to avoid blowing up raw clays in a glaze firing. You can once-fire them but there is a danger. (see Procedure II.3 below). Doing the same thing each time is the key. What you need is comparative data.

3. If you are once firing, you need to get the bars very dry (use some heat) or fire your kiln slowly, like a bisque firing, so they don't blow up. This means all water must be driven off before going over 100C or 212F. I recommend bisque firing them first. No need to measure the shrinkage after bisque: hardly any shrinkage will have taken place.

4. ALWAYS fire your bars near a cone and mark the cone bend on the bar as you unstack. Use an indelible marker or some mark that will not be removed in the boiling water (see Procedure III.3 below).

5. As soon as they come out of the kiln weigh them. Accuracy is essential. Zero your scale before you use it, don't move it after you zero it and make sure there is no air blowing on it. Always look at your scale from the same angle; the angle you zeroed it at.

6. If you can't weigh the samples while they are still warm, you have to wrap them very well (air tight) in plastic. What you don't want is for the fired clay bar to absorb any moisture from the air.

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Procedure Three: Fired measurements

1. Measure the shrinkage line again: if it's 88 long then call the fired shrinkage 12%.

2. When you are marking the shrinkage and dry weight on the tiles, do it with something that won't come off in hot water. Leave a space above where you mark the dry weight (for the wet weight) to make it easier to subtract.

3. Boil the bars for two hours. Keep the bars submerged at all times. If you over boil, redo the tests from the start or dry them on top of your kiln until the dry weight is the same as before. Keep any bars off the bottom of the pot - use a rack or something to keep the bottom bars from getting hotter than the rest.

4. Cool the bars by running cold water on them. You don't want the water evaporating as you are weighing.

5. Use a towel to pat any excess water off the bars and weigh them again. Mark the wet weight above the dry weight. You must do this step right away or water will evaporate and your data will not reflect what has happened.

6. Subtract the dry weight from the wet weight. If the wet weight is less than the dry weight you have made a mistake in weighing somewhere. If there is no difference the absorbency is zero, which can mean the sample is over fired. Porcelains are often 0. I try to keep the stonewares between 1 and 2, but many manufactured bodies may have higher absorption with manufacturer's recommended firing.

7. The formula for getting to % is: Divide the difference (wet minus dry) by the dry weight and multiply by 100.
Per cent absorption calculation:

Absorption(%) = 100 x (Wet mass - Dry mass) / Dry mass For: Dry mass = 150g, Wet mass = 153g
Absorption(%) = 100(153-150) / 150 = 100 x 3 / 150 = 100 x 0.02 = 2%

8. Mark the % absorption on the bar. Report the data from each bar. If you have air in the clay you may get a higher absorbency because the water may get in that cavity: in that case disregard the higher number (the wedging is to get any air pockets out.) Otherwise, calculate the average of the two measurements and report that as well.

9. Keep good records: dry and wet shrinkage, absorption, cone bend and remarks like "darker than average", warpage (what kind and up or sideways) any thing unusual like scumming, bloating, high or low absorbency or shrinkage.

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Hints

1. Always record and report the actual measurement you make before doing any calculations. Then if you have made a mistake it is easier to detect and recover.

2. Record your measurements on the sample itself (taking care not to alter the sample in any material way, e.g., by adding or subtracting significant mass). Then you will not lose them, or confuse samples.

3. Wherever possible, use the same instruments for all your measurements. Then even if they are in error owing to miscalibration, at least they will be comparable, and statistics will detect a systematic shift in your observations more easily.

4. When using a balance or scale, always check the zero before measuring, and also check some known mass of about the same value as the masses you will be measuring. Do the same with any caliper or micrometer. Report any discrepancies (e.g., your 200g test mass weighs 201g). Meticulous reporting

like this makes it much easier to assess the reliability of a measurement later on.

5. Whenever possible, establish a standard working method for yourself, as close as you can arrange to these procedures, and stick to it. Comparisons will be more valid if the methods do not change.

6. Keep the test tiles - for comparison to the next batches of the same clay - it is important because some differences can be explained by comparing.

7. If you have any questions, don't guess, ask me. Instructions can always be improved.