

Hydrometers Do Work

What Is Specific Gravity?

Specific gravity of any solid or liquid substance is its weight compared with the weight of an equal bulk of pure water at 62 degrees F at sea level. Gases use an equal volume of pure air at 32 degrees F. There are three methods of determining the specific gravity of liquids:

Hydrometer

In which the specific gravity of the liquid tested is read as the scale division marking the liquid level on the stem.

Bottle Method

In which the specific gravity is the weight of liquid (slip) in a full bottle divided by the weight of water in a full bottle.

Displacement Method

In which specific gravity is the weight of liquid displaced by a body divided by the weight of an equal volume of water displaced by the same body.

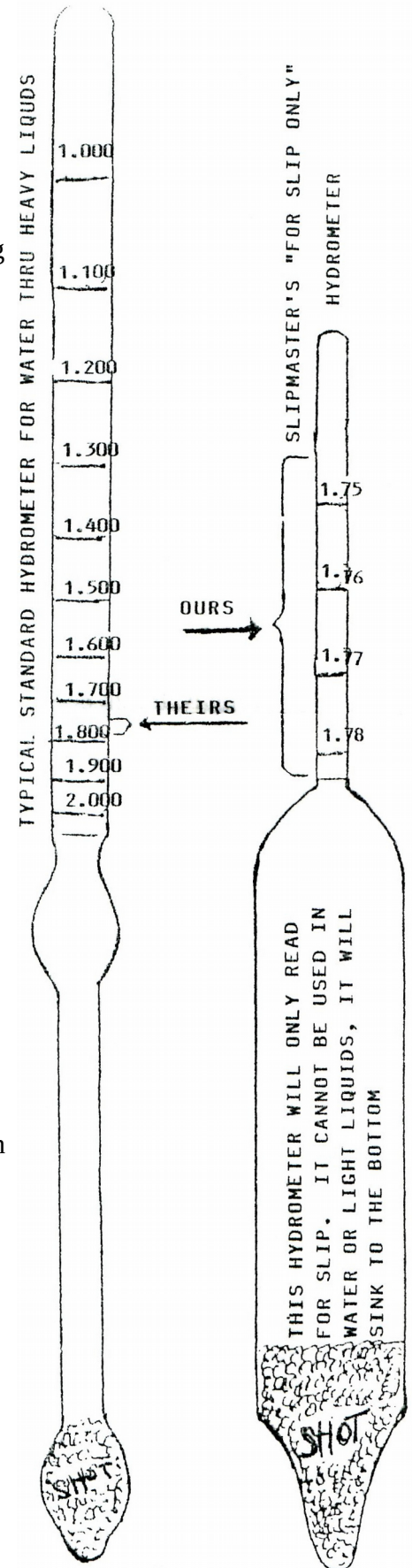
The first two methods are practical. The faster, easier method uses a hydrometer designed specifically for slip (see right). There are many different hydrometers.

Slip should range between 1.78 to 1.75, the latter being the maximum amount of water in the body and the former the lesser amount.

How To Get An Accurate Reading

1. Store hydrometer in water. This keeps slip from drying on the surface. A cut off two liter soft drink bottle is ideal. Remove and gently “squeegee” off excess water.
2. Immerse in freshly agitated slip to the stem readings.
3. Lift up, “squeegee” off excess slip. Hydrometer is now “wet coated” with slip, not with water, which would give a false reading.
4. Immerse bulb half way into slip before releasing.
5. Wait 1 to 2 seconds, lift up slightly and release.
6. Take reading. If it reads greater than 1.78 (down on the bulb) add some water, mix, and reread. If reading is less than 1.75 (up on the stem) add scrap or body, mix, and reread. Continue until correct.
7. When finished return hydrometer to water container. When specific gravity is correct, slip may be too viscous (thick). **Do not add water.**

After checking specific gravity check viscosity. Water should **not** be used to control fluidity. If slip is too thick (viscous) additional deflocculant (usually sodium silicate) must be added to make the slip more fluid. See **What Is Viscosity** on other side.



What Is Viscosity?

Viscosity is the internal friction of a fluid, caused by molecular attraction, which makes it resistant to flow. The tendency of clay bodies is to “flock” or ball together. It is necessary to break up these “flocks” yet keep the water at the barest minimum. This is accomplished by adding deflocculants, causing the particles to repel each other, floating separately rather than clinging together in groups. If there is not enough deflocculant, the slip is too viscous, will not fill small cavities, not drain well, leaving a thick gummy viscid slow drying wall. If over deflocculated, the particles repel each other so effectively they will be “grainy”.

Viscosity can be determined by use of a viscosity cup and timing a quantity rate flow in seconds.

How To Use Viscosity Cup

To take reading: Slip must have been just freshly mixed so it is in as fluid a condition as possible and must also be at least 60 degrees F in temperature. Slip below this temperature will not read properly. Excessively warm slip will give a more fluid reading. Consequently you may have a slightly different reading between summer and winter.

Immerse cup so it is just below the surface of the slip. Just as your timer indicates 60 or 30 seconds, lift up above surface. Watch flow from cup. It should be a smooth, steady, gradually diminishing flow as it reaches bottom. If flow stops or slows rapidly before cup is empty you have picked up some undissolved body. Dump out, rinse, and take a new reading.

If slip is too thick **do not** thin with water. Add small amounts of deflocculant (sodium silicate diluted 1 to 10 with water), remix, and take new readings until you get the correct result.

If slip is too thin **do not** add extra body or scrap. Add a small amount of flocculant (magnesium sulfate, which is epsom salts, in a saturated water solution). Remix and reread until you get the correct results.

Note: You may prefer some slip more fluid (less seconds) for tiny detailed molds, or less fluid for a large plain mold needing heavier sides.

You may have to experiment to get what you want. When you have slip that suits you, take both a hydrometer and viscosity reading and record both for future control.

Viscosity Chart For Slip

Water..... 11 seconds

Thin Slip..... 25 seconds

Normal Range..... 27-28 seconds

Thick Slip..... 30 seconds

Remember: always flush cup clean under running water immediately after use. Wet cup before use. Dip and dump out slip to coat cup and immediately put back into slip to coat cup and immediately take a reading. Slip must have just been mixed and preferable at room temperature. When you find the specific gravity and viscosity you like best, record for future use.

Slip Reclaim Instructions

There are two properties in slip:

1. Physical. Specific gravity, dry body-water ratio.
2. Chemical. Viscosity or fluidity controlled by additives (deflocculants) to the slip to make water “wetter” to do more work.

Reconstituting Wet Scrap

Additives are still active in wet scrap. Once dried, sodium silicate is not reusable.

1. This step needs to be done only once. Take a hydrometer reading. Most good slips will have a specific gravity between 1.78 and 1.75 on the scale. Write down your specific gravity.
2. Start with enough new slip in reclaimer to cover propeller blades.
3. Add wet scrap as trimmed from molds with an estimated amount of water, around 1 pint to a loosely packed gallon container.
4. To check for specific gravity (amount of water and body) see What Is Specific Gravity. If hydrometer reading is too light (less than 1.75) too much water was used. Add more scrap until right. If reading is too heavy (greater than 1.78) not enough water was used. Add small quantities. Recheck until reading is right. Ideal specific gravity is 1.78 to 1.75.

Reconstituting Dry Scrap

Do not use greenware that has any underglaze or glaze on it. Do not put any dry scrap in reclaimer. Break up in another container (pail, etc.), add water, and soak into a slurry. Stir occasionally. Let set a day or two to settle. Carefully pour off excess water, screen, and add to reclaimer and mix. Now proceed with steps 4 and 5.

5. Viscosity (or chemical control) can be checked by using a viscosity cup. See What Is Viscosity. Experienced slip makers often can tell by “feel” and watching slip movement in a container. If slip builds up around edges of tank, slip is too thick. **Do not** thin by adding water. Use a few drops of sodium silicate (waterglass) (in a 1 to 10 solution) per gallon of slip. Amount used will depend on volume of slip plus thickness. If reclaim is excessively thin (this will seldom ever happen in reclaiming) due to over deflocculation, re-thicken by using small quantities of magnesium sulfate (epsom salts, which have been mixed in water to make a saturated solution). Any deflocculant or flocculant should be added while mixer is running. This will either thin or thicken the slip without materially changing the specific gravity.

Use only 1 part of reclaim to 5 or more parts of new slip. Never withdraw so much slip from the reclaimer that the prop is exposed. This will be the starter for the next batch (see step 2).

These instructions are not for making slip but reconstituting scrap and trimmings.