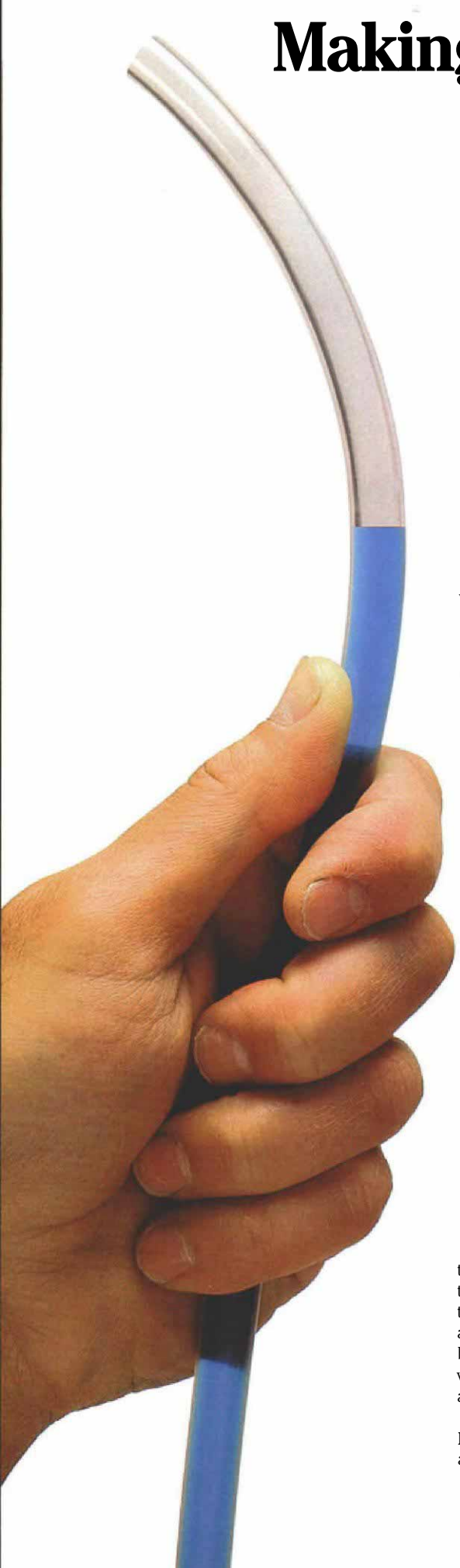
Making and Using Water Levels

Low cost and low tech, these highly versatile tools can't go out of whack

by Herrick Kimball



Everyone in the building trades knows the importance of achieving level in their work, but rare is the builder who can define level without retreating to the dictionary. There, in short, you will find that level is a line that coincides with a surface of still water. This explains why a simple, homemade water level can be so doggone accurate; it is the embodiment of levelness. I routinely use a water level to determine grade elevations, level footings and other formwork, level floors and ceilings in old buildings, hang cabinets, build decks and install suspended ceilings. A water level's applications are limited only by your imagination.

A water level is nothing more than a length of clear vinyl tubing, or hose, that is filled with water. The reason why water levels are so accurate is because they operate on the infallible natural law that a body of water seeks its own level. What this means is that the surface (or surfaces) of a volume of water will always be perfectly level: the water in a bowl; the surface of a pond; the two surfaces of water in a piece of plastic hose.

If you hold the two open ends of the water-filled hose upright and side by side, you'll notice the water in each end bob up and down and eventually settle to exactly the same level. And no matter how far apart the two open ends are taken, the level of water will remain the same. If, perchance, the two sides don't level out exactly, then something is interfering with the free flow of water. The problem usually can be traced to a kinked hose, trapped air bubbles or the fact that one or both of the hose's ends are obstructed.

Besides its incredible accuracy, another attraction of a water level is cost; the thing is cheap to make, costing about as much as a good 25-ft. tape. In this article I will show you how to make and use your own water level, and I'm willing to bet by the time you finish reading, you'll be convinced, as I am, that these tools are as versatile as a hammer and as reliable as a plumb bob.

More accurate than a builder's level—I will admit, for leveling lengths up to 8 ft., it's usually more convenient to use a spirit level, either by itself or in conjunction with a good straightedge. And for leveling very long distances (i. e., over 100 ft.), the water level will do the job effectively, but it could be cumbersome and impractical, so an optical builder's level mounted on a tripod may be better suited to the task. (A builder's level is similar to a transit but cannot be pivoted vertically.) However, unless you're a surveyor or a large-scale building contractor, a 100-ft. range will take care of most leveling needs.

A water level has numerous advantages over a builder's level. Aside from the fact that a water level will cost you peanuts compared with a builder's level, a water level is durable; you can drop it, step on it and toss it in the back of your truck without screwing up delicate and essential factory calibrations because there are none.

The water level levels with ease around corners and large obstructions where a builder's level would have to be moved and reset. A water level works in small rooms where a builder's level would have trouble focusing, and in many instances the water level can be used by one person. Try that with a builder's level. If those aren't enough reasons to consider the water level, how about this: It is consistently more accurate.

The accuracy of a water level lies in the fact that no matter how far apart the hose ends are taken (hose length notwithstanding), the water levels will remain exactly the same. On the other hand, if a builder's level is calibrated or set up even minutely out of whack (which isn't unusual), or if it's bumped after being set up, and the sight readings are off, let's say, 1/100th of an inch in 1 ft., then at a distance of 100 ft., the discrepancy compounds to an error of 1 in. Knowing this, if you own a builder's level and want to check its accuracy, use a water level.

Nothing but cheap hose—A water level can be used with the hose only, or with a hose and water reservoir. Regardless of which approach you take, you'll need a length of clear, flexible vinyl hose, which can be bought by the foot from most auto-supply or hardware stores. (I was quoted a price of 27¢ per ft. for 5/16-in. hose.) A practical length is 50 ft., but most of the time I use a 35-ft. hose. It is more manageable, and it is adequate for most of my general remodeling needs.

I've found that some hoses have a light oil coating on the inside that will collect tiny bubbles, which cling tenaciously to the hose wall and interfere with the level's accuracy. In time, the inside of the hose will become cloudy from the oil. But rinsing the inside of the hose with warm water and detergent usually will clean out the oil.

Small-diameter hoses are less bulky but are prone to developing bubbles, particularly when filling the hose. Also, small-diameter hoses are often difficult to read because of the pronounced U-shape of the water's surface inside the hose. This is called the meniscus, and it's caused by the surface tension of the water. A larger-diameter hose will render a flatter meniscus. I used a ¼-in. I. D. hose for years, and it worked well. But I recently made myself a new level for which I used 5⁄16-in. I. D. hose. I have found it easier to fill and read. Aside from bulk, there is no reason why an even larger-diameter hose couldn't be used.

Hose-only leveling—For hose-only leveling, the first step is to fill the hose by placing one end in a bucket of clean water. With the other end of the hose held lower than the bucket, suck on the hose until a siphon is created, and the water flows by itself. Let the water flow through for a few seconds to push through any air bubbles that commonly form in the beginning of the flow, then take both ends and hold them up together to make sure they align. Assuming they do, you're ready to level.

If the water levels are not the same, there are probably air bubbles trapped in the hose. To eliminate the bubbles, run more water through the hose, or hold the ends up and shake the bubbles to the top. And here's a helpful tip: The water level in the hose, as well as any air bubbles, will show up clearer if a few drops of food coloring are used in the water (photo this page).

Hose-only leveling is best done by two people. For example, let's say you and I have a room in which we want to install a suspended ceiling, and it is first necessary to establish a perfectly level ceiling-height line around the perimeter of the room. To do this we each take an end of the water level to a different corner of the room and hold it against the wall.

This can be done at any convenient height because the object for now is to establish level reference marks, not necessarily the final level. After waiting for the water to settle inside the hose, we mark the levels on the wall. If the wall is papered or finish painted, it's a good idea to stick some masking tape lightly on the wall and mark on that. If the hose diameter is small, and there is a pronounced meniscus, it's important that we both mark at either the top or the bottom of the U. This done, the two marks will be perfectly level with each other.

To transfer level marks to the other corners, stay at your mark, and I'll move to another corner of the room. I'll keep my thumb over the open end to keep the water in the hose and dull its movement. If water is lost from the hose while making a series of level marks, our accuracy goes with it, and the process must be started over. With our hose ends up against the wall corners again, you will more than likely note that the new water level does not align with the established mark. No problem. You just slide your end of the hose up or down; the water will move accordingly, and when it lines up with the established mark, you tell me to mark my level in the unmarked corner. We can then use the same procedure to get a mark in the last corner.

With the four level reference

The author made this water level from materials costing about as much as a 25-ft. tape (stepladder not included).

marks established, all that's left to do is pick a point in one corner where we want our ceiling height, measure to find how high the ceiling is above the reference mark, measure up the same distance in the other corners, and snap a chalkline to connect the dots. It is, of course, possible to make all reference marks exactly where you want ceiling height, but I find it more convenient to level while standing on the floor, then measure up.

By taping a wire loop on each end of the water-level hose, it can be hung on nails, enabling one person to mark a level line by himself. And between uses, the tool can be hung up out of the way. Also, I've found that if there is no danger of the water freezing, it's convenient to store and transport the water-filled hose behind my truck seat with the loops over the clothes hook.

With hose-only leveling, two people can leapfrog around the exterior of a house to establish a level reference for such things as installing lap siding or a row of windows. But for most situations, and especially when I work alone, it's much easier to use the hose in conjunction with a reservoir.

Water levels with reservoirs—I made my reservoir by installing a ⅜-in. tube thread by 5/16-in. hose-end brass fitting (photo p. 59) into the side of a sturdy 1-gal. plastic pail. (If you decide to go with a larger diameter or longer hose than I have, you may need a larger reservoir.) I first drilled a ½-in. dia. hole in the side of the pail down near the bottom. Then, to make a secure connection, I also drilled a ½-in. hole through two 1¼-in. thin rim fender washers (which are much thinner than regular nut-and-bolt washers) and threaded them onto the fitting so that there was one on each side of the pail wall. With some silicone caulk around the pieces to ensure watertightness, I cranked the fixture tight with a ⅜-in. brass cone end flare nut, and the reservoir was ready for action.

To fill the reservoir and the leveling hose, I first fill the bucket while holding my finger over the open hose connector. Then, with the bucket in an elevated position, I push the hose onto the connector, allow enough water through to clear out bubbles and pick up the unconnected hose end. The water in the reservoir and in the hose will adjust to level.

In my example of installing a suspended ceiling in a room, reservoir leveling could be done by placing the pail on a stepladder or a sawhorse somewhere in the center of the room and simply taking the hose to each corner to make the reference marks; no helper or adjusting between marks is needed.

The convenience of reservoir leveling can be further enhanced in many situations by taping the end section of the hose to a length of wood. With this arrangement I can level up the formwork for a concrete pad by first determining the level I want, setting the story pole with hose attached on the level point and marking the water level on the pole. The rest of the formwork is then leveled by setting the pole on different sections of the form, moving the form up or down to bring the meniscus in line with the reference mark, and nailing the form in place when it reads level.

This same story-pole technique can be used to determine grade from a benchmark. After marking the benchmark water level on the pole, any grade readings below the benchmark will be indicated as a higher water level in the hose, and conversely, higher readings will show a lower level of water. If you want to know exact grade variations, mark and measure the distances on the pole. Drainage pipes can also be sloped accurately by using the story pole.

Archaeologists believe the great pyramids of Egypt were leveled by using water. Now, centuries later, you and I can use a water level to apply the same effective principles in our more humble building projects. □

Herrick Kimball is a remodeling contractor in Moravia, N. Y. Photos by Susan Kahn except where noted.

Manufactured water levels

Before you buy all the parts to make a water level, you might be interested to know about a few ready-made water levels now on the market (photo below).

Invented in 1951, the Hydrolevel (P. O. Box 1378, Ocean Springs, Miss. 39564; 601-875-1821) is the granddaddy of modern water levels. The unit is a compact 7-in. dia. by 4-in. high plastic dish-type container that is divided into a center reservoir section surrounded by an outer-ring compartment. The compartment houses the tool's 50-ft. 3/16-in. I. D. hose. A container of dye for coloring the water and a lid to cover the dish are included. The Hydrolevel isn't fancy, but it does the job and is reasonably priced at $18.95.

The Versa-Level was developed by a couple of contractors who wanted a more versatile water level than the Hydrolevel they had been using. Their distinctive 1½-pint reservoir bottle has a molded-in hose connection and sports 15/16-in. dia. hollow cylinder side pockets (so that the unit can slide over a length of pipe or rebar driven in the ground), as well as a loop of chain for hanging it on a nail. The Versa-Level consists of a reservoir bottle, 50 ft. of ¼-in. I. D. hose and a plastic carrying case and sells for $50. Contact Price Brother's Tool Company, P. O. Box 1133, Novato, Calif. 94948; (800) 334-8270.

On the cutting edge of water-level technology are the Zircon electronic water levels (1580 Dell Ave., Campbell, Calif. 95008; 800-245-9265).

In lieu of a conventional reservoir, the Zircon units have a small plastic box that attaches to one end of the hose and houses an electronic water sensor that beeps when the water level in the hose reaches a point indicated on the side of the box. In use, the box can be mounted (ideally with a nail) and aligned to an exact point from which you wish to level. Or it can be attached to any convenient location and used to make a series of reference marks a la the reservoir method.

The Zircon Electra-Level has 25 ft. of 5/16-in. I. D. hose and sells for $25.99. The Electra-Level Pro model has 35 ft. of ¼-in. I. D. hose, an integral carrying handle and prongs for wrapping up the hose when it's not in use. The Electra-Level Pro sells for $39.99. Additional lengths of hose and couplings are available if needed.

Fi-Shock, Inc. (5360 National Dr., Knoxville, Tenn. 37914; 615-524-7380), manufactures two water levels. Both employ cylinders that act as water-hose extensions. The cylinders are calibrated so that the user can determine how far out of level one point may be from another. One model uses a reservoir and sells for $24. The other model, which has two cylinders and no reservoir, sells for $13.50. ***-H. K.***

Water levels are made by four companies. From the left are levels made by Fi-shock, Inc., Hydrolevel, Zircon and Versa-Level.

Photo this page: Jefferson Kolle