Water Level Know-How

by Dale Williams

Many old-timers are familiar with the water level, though it has grown out of favor of late. It has gained an undeserved reputation for being slow and prone to inaccuracies. However, a water level has some distinct advantages that have served me well in my 24 years in the trade. Namely, a water level can be used around a corner and is highly affordable. I use it when building decks, shoring up sagging sills and floors, leveling ceilings, building handrails and steps, leveling drains, and sloping grades. A water level is accurate and easy to operate, but getting consistent results requires understanding how it works.

Simple Systems

There are two types of water levels. One I call a "simple system," the other a "reservoir system."

A simple system is just a clear hose filled with water. The water inside will always seek the same level at both ends of the tube. By holding one end stationary (for example, tied off to a nail) you can move the other end around the building to mark out a level plane. To get an accurate reading, however, you want to be sure to mark from the same spot on the tube at every elevation point. I typically make a mark on the tube 6 to 9 inches from the end.

There are some problems that can arise with simple systems. If any water is lost when you move the tube to a different location, you will need to start all over again. Just stepping on the hose can cause the water to "jump" out. Also, it can be difficult to avoid spilling when one end is secured at a specific elevation (the "stationary" end) while you move the other end around the job (the "working" end). The only remedy is to move slowly and carefully, but this can be frustrating to someone who wants to get the job done *now*!

Reservoir systems. I prefer to use a reservoir system, which has a bucket, coffee can, or any other container to hold a quantity of water on the stationary end of the tube. This allows you to move the working end of the tube around without any loss of water. And if a small amount is lost, it won't change the level in the tube significantly.

I usually hang the reservoir in some central location and move the working end around to establish a level plane. This plane then becomes a common reference to measure from.

A water level, such as this Zircon Pro Series, quickly establishes a level plane. Here it is used to mark the top cut on some deck posts.

Accuracy

Reservoir systems are much more accurate than simple systems. With a simple system, the working end only has to move 2 inches up or down to create a 1-inch change in the water level. By contrast, a 4-inch-diameter reservoir with 1/4-inch ID tubing needs to move 8 inches up or down to change the water level 1/32 inch. This greatly reduces the chances for a mistake. If at one elevation point, for example, the water is 9 inches from the working end of the tube, the water level would have to be either 1 inch or 17 inches from that end at the next elevation to create a 1/32-inch error. Chances are good that you'd be able to avoid this error.

The larger the reservoir's surface area in relation to the tubing's cross-section, the more forgiving the water level will be. If you use a 5-gallon mud bucket, which has a 10-inch diameter, with a 1/4-inch ID hose, you'd have to have a 25-inch difference in the marking points at the working end of the hose to create a 1/64-inch error.

Meniscus. The surface tension of water causes it to cling to the inside walls of the tubing. This attraction creates a *meniscus* — a belly on the water inside the tube. When making your level mark, you want to aim for the low point of this belly. The smaller the tube, the more pronounced the belly will be, and it will be harder to see the exact level.

Also, the meniscus will be more pronounced in cold weather (temperature affects the viscosity of water). One way to reduce the meniscus is to add a drop of dishwashing detergent, which won't foam and will lower the viscosity of the water in the tube. While the meniscus can be difficult to read at first, it can actually be a help once you understand it. Due to the way air pressure exerts itself on the column of water inside the tube, the meniscus will become more pronounced when the column moves toward the reservoir, and will flatten out when the column moves away from the reservoir. By finding precisely where the meniscus will either start to flatten or move in the other direction, you can pinpoint exact level. This is easier to read with 3/8-inch ID tubing.

Available Models

There are several commercially avail-

able models of water levels. Mayes Brothers (P.O. Box 1018, Johnson City, TN 37601; 615/926-6171) and Aqua-Level (P.O. Box 689, Concrete, WA 98237; 206/853-8933) both make reservoir-type systems. The Mayes *Hydrolevel* has a reservoir in the center of a kind of plastic bowl, around which you can coil the 50 feet of 3/16-inch ID clear plastic tubing. The Aqua-Level is designed more like a hose reel that hangs on a nail, and has a reservoir at the center of the reel. Both retail for around $30.

Zircon makes a couple of simple systems. The *Electralevel* emits a 95-db beep when the water reach a specific level. It's fairly accurate because the water must always reach the same level before the electrical sensor will activate. This sells for about $26. A fancier model — the *Pro Series* — includes a wraparound storage bracket for the 50 feet of 3/8-inch ID tubing (see photo). This one sells for about $42.

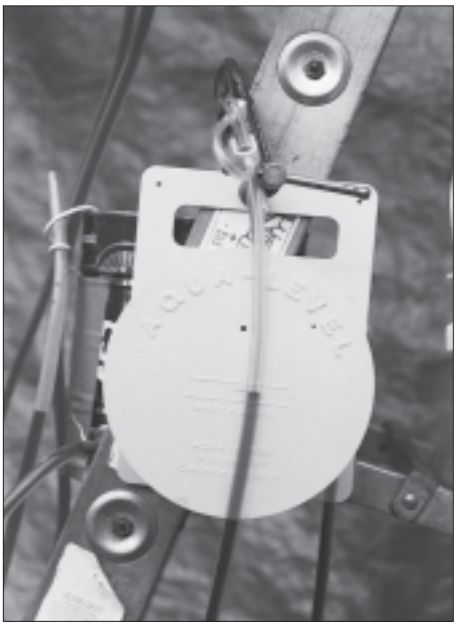
It isn't necessary to buy a prebuilt system, however. You can make your own water level, and it will be just as accurate. For many years I have used a reservoir system made with a coffee can. I soldered a 2-inch piece of 1/4-inch OD copper tubing at the bottom of the can, and clamped on 20 feet of 1/4-inch ID clear vinyl tubing. I also made a large reservoir system that uses a 5-gallon mud bucket, a swamp cooler drain hose fitting, and 150 feet or more of nonkinkable garden hose with a short piece of clear tubing secured to the working end. I use this larger model for larger jobs, such as jacking and leveling whole houses.

Do's and Don'ts of Water Leveling

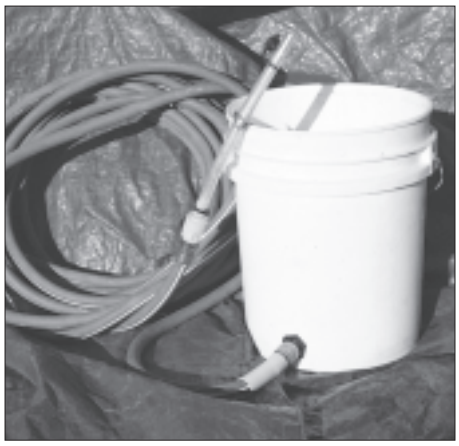
Here are some guidelines that will make using a water level easier:

- Add a non-oilbased food coloring to the water to make it easier to read.
- Beware of bubbles. If there are bubbles in the line, the readings will not be consistent. Drain the water back to the reservoir, then allow the line to refill slowly and smoothly. You want the column of water to push the air ahead of it without "gulping" air.
- Keep lines from kinking.
- Don't stand on the line when making marks.
- Be sure both ends are free to the air. Air pressure must exert a constant force on both ends. That's what makes the water level work.
- Keep the working end above the reservoir when moving around the site. The middle length of the tubing line can go over objects higher than the ends without spilling the water. The air pressure will still exert a constant force on each end to keep the water level.
- If a considerable length of time passes and the temperature changes, it's a good idea to check against previous marks. ■

Dale Williams is a remodeling contractor in Kirkland, Wash.



The author clamps this Aqua-Level to a ladder, then takes the "working end" (shown on clamp handle) to mark out a level line.



For longer leveling jobs, the author uses a model made from a mud bucket and 150 feet of nonkinkable garden hose. This version has a built-in fitting, but it works just as well to siphon water into the hose.