Conditioning Homes
A recipe for eliminating interior callbacks

BY MATT RISINGER

This is a story that began with hardwood flooring, but it affects all interior woodwork, including trim, panel doors, and cabinets. I started my building career in production housing where it was pretty standard to spend (at the time) around $1,500 per house on a warranty fund to cover the touch-up required after the house "settled." This typically occurred a year after the owners took occupancy. Of course, the defects we were touching up didn't have to do with settlement, at least not the settlement of soils or of the foundation, as we ordinarily think of the term. Most drywall cracks and nail pops, open miters in woodwork, warps and bows of doors and panels, or buckling and open joints between floorboards are due to moisture. Specifically, these problems are caused by the expansion and contraction that occurs as wood moisture content reaches equilibrium. The problems are most extreme (and expensive to fix) with wood flooring, but all of the issues can lead to some pretty negative perceptions by clients until the problems get resolved.

In the time that homeowners are waiting for the warranty touch-up, they may be stepping over ridges in the flooring or staring at open miters in woodwork and wondering what kind of a builder could be responsible for such shoddy workmanship. I remember clients calling and saying, "I know I'm supposed to wait 12 months,

Photos: Matt Risinger

but this looks really bad. Can we take care of it now?" That could happen at any time after the owners had moved in. And we'd have to say, "Yes, we can take care of that now, but we'll have to charge you if we come back later because only the first visit is free." That kind of discussion begins to set up an adversarial relationship. If I can eliminate that, I'll vastly improve my chances for getting the referrals that are essential to my business.

I am now building exclusively high-end custom, architect-designed homes. In this market, I can't afford to have many interior defects, and certainly no adversarial relationships. So instead of paying into a warranty fund to cover the cost of touch-up, I spend on average about $2,000 per house to dry and condition the interior. Since I've been doing this, I have never had to come back to fill cracks in woodwork or deal with drywall cracks, nail pops, or loose or buckled floorboards. No touch-up required.

The benefit of taking this approach has been huge for us, not only in eliminating callbacks but also in preventing negative client perceptions. In fact, when an architect or client walks the job and sees how we are using portable dehumidifiers and packaged AC units to control jobsite conditions, it confirms that we care about craftsmanship and are doing everything possible to deliver and maintain a well-crafted home.

STABILIZING WOOD ON SITE

In a previous article, I described the steps I take to monitor and control the moisture content of the framing before closing up the walls ("Drying Wet Framing," May/13). Not every house needs to have the frame dried out. There are plenty of times here in Austin, Texas, when it's barely raining or doesn't rain at all and we're able to frame and dry-in a house without worrying too much about high moisture levels in the frame. Also, our houses are often complex, and we might have six months or more from the time the house is framed until it's ready for drywall, and in that time the frame has plenty of time to dry, even if it did get rained on a bit during framing. As long as the frame doesn't get soaked, we're not typically dealing with dehumidification or conditioning until after drywall.

But every house needs to be conditioned once it's enclosed and the drywall is hung. All that curing drywall mud and paint and concrete and grout and tile adhesive dumps moisture into the indoor air. Add that to the high relative-humidity levels we typically

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see here in Austin, and the probability of problems demands that we dehumidify at the very least, beginning post-drywall until we bring the home's HVAC online.

Beyond dehumidification, we temporarily condition the indoor space with air conditioners and (when needed) heaters to keep the temperature at a moderate level. We do this largely to keep the house comfortable to work in. It makes a big difference with worker productivity. (Subcontractors love working on my jobs, too.) But most of the time we are cooling, which also helps dry the air.

To monitor climate conditions, we place a number of temperature and humidity meters around the house **(1)**. These have an outdoor sensor, which we can tape to the soffit or put outside a door or window, to keep track of temperature and relative humidity levels outside as well as inside the house. The Accu-Rite meter shown in the photo is reading 80% RH outdoors (top display) while we're keeping the indoors at 58% RH (lower display). Under these conditions, the woodwork is able to maintain near 10% moisture content (MC) (see Moisture & Interior Building Materials, page 53). These meters also have a trend indicator (small arrows on display), so you can tell if outdoor conditions are trending up or down, which helps you plan your dehumidification strategy—to know if you should be paying attention to keeping equipment running or whether you can relax a little and not focus so much on that part of the job.

During the day, the house is constantly opened when the trades are coming and going. It's not realistic for us to keep the house on lockdown all day. But as long as we can condition and dehumidify overnight, we can keep the indoor air stable. We'll also run cooling and dehumidification equipment over the weekend. That's enough to dry things out and allow the wood to reach equilibrium.

EQUIPMENT FOR CONTROLLING HUMIDITY

Here in the hot, humid South, the work of conditioning a job, starts with dehumidification, and that starts at the drying phase when finish materials are curing. For this we use a combination of big fans and industrial dehumidifiers.

Jobsite fans. Good commercial-grade fans start at about $300 each, or they can be rented for about $10 per day or $150 per month. I own several two-speed Quest C1000s, which draw 2.4/2.8 amps (low/high) to move up to 1,000 cfm (2,700 fpm). The Quest A3000 box fan operates in the same range, but its airflow is more diffuse **(2)**.


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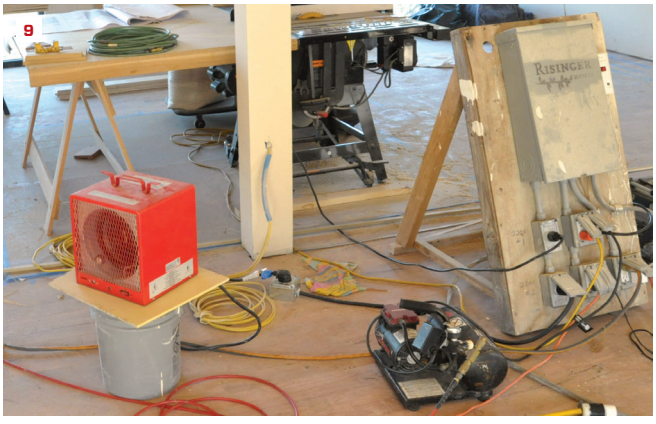
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Dehumidifiers. My first industrial dehumidifier was the Dri-Eaz DrizAir 1200 **(3)**. This manufacturer specializes in equipment to dry out structures after flooding. I've been using the DrizAir for about eight years and it's still running strong. My one complaint is that the filter clogs easily and needs to cleaned every day by blowing it off with compressed air.

We've since acquired a couple of Quest PowerDry 4000s **(4)**. These units can pull up to 22 gallons of water from the air per day, and treat up to 4,500 square feet of space. At the air intake, they have a pleated paper filter, which can handle a huge dust load without compromising the units' effectiveness at drawing water out of the air.

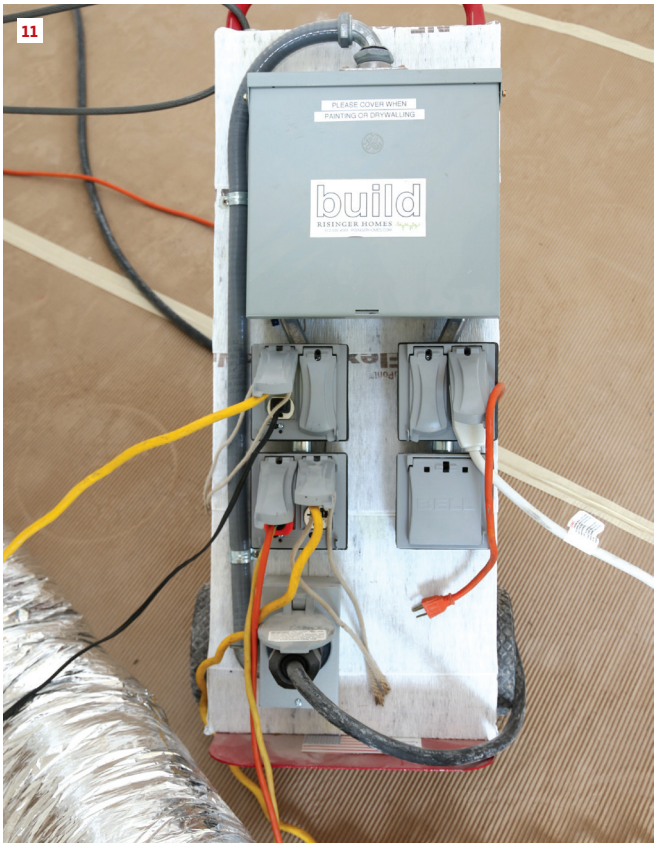
TEMPORARY CONDITIONING EQUIPMENT

To condition the air, we started out with portable AC units but have since switched to using a larger packaged unit. All of this equipment is temporary until the home's HVAC system goes online. As long as dust is being created on site, we don't want to bring the permanent equipment online—coating the evaporative cooler or lining the duct system with a thick layer of drywall dust and sawdust would lead to problems later on.

Portable cooling. The first unit we used was a Quest Cool ACS 12 1-ton portable air conditioner **(5)**, after which we acquired a portable 2-ton Movin Cool Classic Plus 26 unit **(6)**. These are small package units, meaning the evaporative coil and the condensing coil are in the same package, so we have to duct-in air to cool the condensing coil from outside and also duct-out the hot air coming off the condensing coil. To do this, we fill the opening of a sliding door with a sheet of OSB with holes cut in it for the two duct openings to the exterior—one that pulls cool air in and one that exhausts hot air out **(7)**. Or we may use a temporary swing door with cutouts for the ducts **(8)**.

The cool-air supply on the evaporative side blows either out the top of the 1-ton unit or through a couple of short ducts that can be angled in different directions on the 2-ton unit. We sometimes attach a long piece of flex duct to one of these short supply ducts to move the cool air to a different room. These units only cool.

Portable heating. In colder months, we use electric resistance units. We started out with a few 19,000 Btu, 220-volt units from Northern Tool & Equipment. While we paid more at the time, they now cost about $100. They're glorified hair dryers with a fan to push the air. The one shown here **(9)** is in a house that tested to about 1.7 ACH50—rea-



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sonably tight. It doesn't take much to make the interior comfortably warm. During the finish stage of construction, you don't need to bring the interior up to 72°F. You only need to heat it to 50°F or 60°F to make it relatively comfortable for working in. Of course, it doesn't get that cold in Austin (we never use more than one heater per jobsite).

We also have a Quest Power Electric Heat EHS 31 Pro **(10)**, a 30-amp, 31,000 Btu unit that pushes hot air out the top of the unit and warms a larger space than the little box units do. We plug it into one of several temporary power centers that I had my electricians wire up for me to roll around the jobsite as needed **(11)**.

When heating the jobsite in winter, it's particularly important to avoid the use of propane heaters. Water is a product of combustion. A salamander or a tank-top heater will add moisture to the house and can also produce carbon monoxide, creating a noxious work environment. Propane heaters are also a concern for fire. With electric-resistance heaters, we worry less about fire and will run them all day while the crew is on site, but we never leave them on overnight. But with the packaged heat-pump unit, we can leave it running overnight and over the weekend.

Packaged heating and cooling. We recently acquired a 5-ton heat-

MOISTURE & INTERIOR BUILDING MATERIALS

In the Austin climate, floorboards are usually delivered dry at 7% to 10% moisture content (MC), which is equilibrium moisture content (EMC) for wood in air at about 40% to 55% relative humidity (RH). But when wood acclimates to a higher RH, it takes on a higher MC and expands. We typically see the daily high RH averaging between 70% and 90% year-round—midsummer has the highest RH, and the lowest are in August and early September. If flooring is installed dry, as it is delivered, and then hangs out in these high-humidity conditions, it will absorb moisture from the air and expand. And when the floorboards expand, they have nowhere to go when they're installed tight, resulting in permanent ridges where the boards press together (known as "compression set"). Or worse, they expand so much that whole boards buckle out of place. Either is an expensive fix. In colder climates, the reverse is usually true: The hardwood is installed at a higher MC and becomes bone-dry in the first heating season, causing gaps to open up between floorboards. Our goal is to keep wood materials at their dry, delivered moisture content around 10% MC by keeping the interior air at 40% and 60% RH.

We begin conditioning the interior as soon as the house is dried-in and the insulation and drywall has been installed. Wood is not the only concern at this stage. While drywall is taped and finished, the curing mud adds moisture to the air, so we use industrial dehumidifiers to pull that moisture out of the air and industrial fans to move air around to promote drying. The fans and dehumidifiers also speed production of drywall taping; when outdoor air is 80% RH or better, a coat of drywall mud may not dry by the next day when a new coat needs to be applied. We also have to keep the dehumidifiers running while the interior's being painted, tile beds and grout are installed, or any interior masonry work is being completed, as all those curing materials add moisture to the interior air. This is a slow process of reducing the moisture load in the air; it's not going to compromise curing of cementitious materials that benefit from slow cure rates.


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pump package for cooling and heating, which we set up on staging outside the house **(12)**. The really nice thing about this unit is that you set it up once. There's nothing to move around on the jobsite. With the smaller units, you end up moving them around quite a bit during the course of a job, and you have to be more concerned about locking up the smaller units while they are on site to prevent them from being stolen. And, since the package unit sits outside, we don't need to dump the heat. It's set up as it would be if it were a permanent piece of equipment, with a supply side **(12)** and a return side **(13)**, which we duct to temporary window or door openings **(14, 15)**.

BUDGETING FOR HOUSE CONDITIONING

When I first got into this, I rented industrial dehumidifiers and was dissatisfied with the equipment. Sometimes we got a unit that was a dud—the pump was broken or it would leak. Out of frustration, I bought my first dehumidifier in 2009. Most of my jobs are cost-plus, and so I'd always put a temporary conditioning line under the utility line item in my construction budgets to cover the equipment rental.

Now that I own the equipment, I still add this line item—but now, in essence, I'm renting the equipment to myself. I bring this to the attention of my clients when we're discussing budget, and I explain that they are getting about a 10% discount over the cost from the rental yards. I also explain that this is a necessary cost to cover storage and maintenance of this equipment. I spell this out on the disclosure form that the clients sign, so they know there's nothing fishy going on. This is one way that I differentiate myself from my competitors. It really makes a difference when you take an architect or a client out to a jobsite and they see what we're doing to ensure perfect fit and finish of the interior.

Because I own it, I have great equipment that I ensure is well-maintained. Every six to 12 months, we'll pull the condensate pump out of each dehumidifier to clean it, making sure there's no drywall debris or other material that will clog it and cause a leak. We inspect the condensate line and clean the whole unit to make sure that everything is operating well. This gives me peace of mind, knowing that I can leave the unit going for a period of time without a leak that would spoil a finish floor or otherwise cause a mess. And I know it will do the job I need of pulling humidity out of the air and drying the interior.

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