

Repiping With PEX

Where I work in southern California, “aggressive” water is a major problem. This catch-all term refers to high alkalinity or high mineral or gas content in the water that causes the premature corrosion of copper and galvanized piping (see Figure 1, next page). There are two main

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types of corrosion related to aggressive water: pitting, which affects an entire system, and thermal-galvanic corrosion, which first affects hot water pipes. Pitting accounts for about 75% of all the repipes my company does, with the

other 25% stemming from thermal-galvanic corrosion. Depending on the severity of the problem, new copper supply lines can fail within one to ten years. In some cases, entire developments plagued by aggressive water have had their piping systems fail.

The upshot of all this is that my business focuses almost entirely on residential repiping. If pitting is present in a system, then it must be entirely repiped. Thermal-galvanic corrosion, on the other hand, may only require new pipes on the hot water supply lines. I almost always insist on using plastic piping because the plastic isn't affected by aggressive

water and won't doom residents to additional future whole-house repiping.

In most areas of California, state code doesn't allow anything but copper for residential potable water distribution — even though most water travels through PVC right up to home service entrances. Fortunately, though, some municipalities are beginning to allow for CPVC or PEX

For replacing corroded copper supply lines, PEX installs easily and can stand up to aggressive water



pipng in new construction, based on local conditions. And most jurisdictions will allow a home to be repiped with CPVC or PEX instead of copper if the presence of aggressive water can be proven.

PEX: The Pipe of Choice

Although I've successfully worked with CPVC, I've recently started using PEX (short for cross-linked polyethylene) because it's easier to install and holds up in almost all conditions. PEX is flexible and can be repeatedly bent as it is pushed and pulled during installation. PEX requires no solder or glue, so there's no danger of igniting a fire and the installation is free of noxious

because the material is easier to snake through finished walls and ceilings.

Estimating

Over the years, I've found that estimating repiping jobs is as easy as counting the number of fixture drops and accurately assessing the degree of difficulty for each one. I use a straightforward estimating scheme, charging between \$250 and \$500 per drop depending on how hard it will be to get from the primary run to the fixture (Figure 2). A straight shot through easily accessible wall and ceiling bays goes for \$250 a drop, while a time-consuming run through an inaccessible attic area or a long detour to avoid damaging fancy wallpaper costs \$500 a drop.

Route Planning

Because my quick estimating system works so well, I don't have to plan the exact repiping routes until after I get the job. When the time comes, however, route planning is the most important aspect of the work. On repipes, I find that branch routing works much better than home-run routing because there are fewer lines to run. I carefully consider several different route options, then choose the one that minimizes damage to finish walls, ceilings, and floors.

In southern California, where the original plumbing is usually installed in the slabs of homes without basements, repiping generally involves leaving the old pipes in the slabs and running the new pipes in the ceilings. In a one-story house, this can mean that most of the work takes place in the attic and very little damage is done to drywall.

One drawback to running pipes in an attic is that cold water lines are often heated up during hot weather, resulting in tap waits for cold water. Most times, however, homeowners will choose this over other more expensive and disruptive options. Of course, plumbers in cold areas of the country will have to worry about the opposite problem — pipes freezing if they are installed outside of heated spaces. Many houses in those areas, however, have the advantage of a full basement or insulated crawlspace.



Figure 1. Water with low pH levels or high CO₂ content, often referred to as aggressive water, can prematurely wear out copper piping (left). Thermal-galvanic corrosion, caused by a variety of factors, usually damages hot water pipes first (right).



fumes. If a PEX line gets a kink in it during installation, heating it up with a heat gun returns the material to its original shape.

PEX also saves money — especially on new construction, where it goes in very quickly. But even on more labor-intensive repiping jobs, where cutout and drilling costs are the same no matter what material is used, there are still modest savings compared with copper because there are fewer connections and

Repipe Estimating Worksheet

Job # _____

Address _____

Owner's Name _____

No. of Units and Plan Mix _____

Fixtures in House or Building

Number of Kitchen Sinks _____

Number of Tubs _____

Number of Ice makers _____

Number of Toilets _____

Number of Dishwashers _____

Number of Lavs _____

Number of Showers _____

Number of Bar Sinks _____

Number of Water Heaters _____

Return lines if applicable

Single line _____

Hot _____ Cold _____ Complete Repipe _____

PEX, CPVC, or copper (what type of copper?) _____

Ice makers _____

Angle stops _____

Replace? Yes _____ No _____

Flex lines, what type? _____

Pressure Regulator _____

Number of hose bibbs & antisiphons _____

Locations of hose bibbs & antisiphons _____

Any stucco knockout? _____

Drywall or plaster _____

Approximate age of system _____

How many feet of pipe and size of pipe? _____

Faucets needing replacement _____

Shower head replacement _____

New cartridges _____

Rough materials cost _____

Finish materials cost _____

Rough labor cost _____

Finish labor cost _____

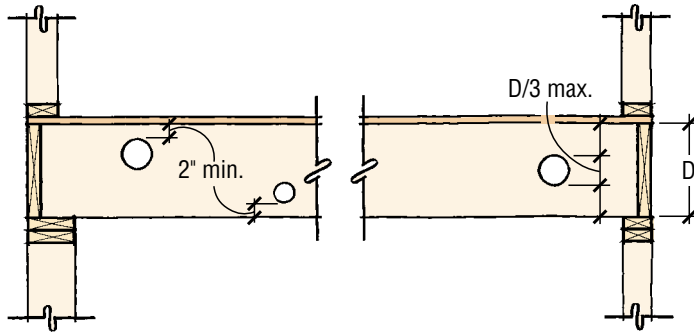
Total Materials	_____	_____	%
Total Labor	_____	_____	%
Permits	_____		
Amount of Contract	_____		
Gross Profit & Overhead	_____	_____	%

Comments _____

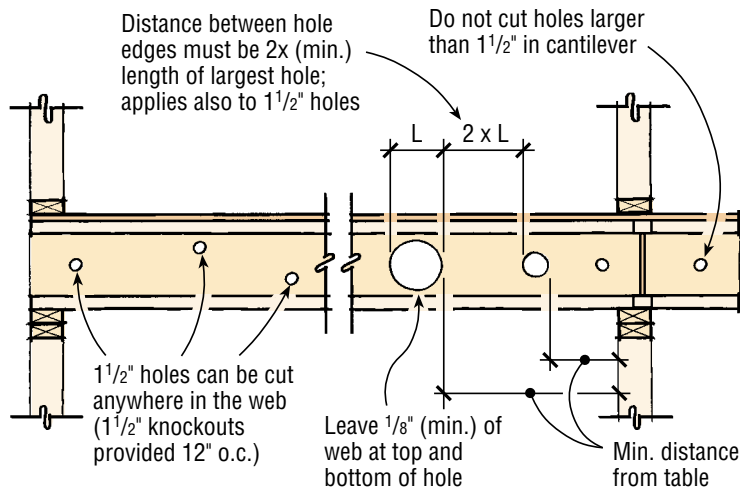
Figure 2. The author uses this simple worksheet to count fixtures and fittings and estimate the total cost of the job.

Hole-Cutting Rules

Solid-Sawn Lumber



Wood I-Joists



Min. Distance from Inside Face of Support to Near Edge of Hole

Depth	TJM/Pro	2"	3"	4"	5"	6"
9 1/2"	150	1'-0"	1'-6"	3'-0"	5'-0"	6'-6"
	250	1'-0"	2'-6"	4'-0"	5'-6"	7'-6"
11 7/8"	150	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"
	250	1'-0"	1'-0"	2'-0"	3'-0"	4'-6"
	350	1'-0"	2'-0"	3'-0"	4'-6"	5'-6"
	550	1'-0"	1'-6"	3'-0"	4'-6"	6'-0"
14"	250	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"
	350	1'-0"	1'-0"	1'-0"	1'-6"	3'-0"
	550	1'-0"	1'-0"	1'-0"	2'-6"	4'-0"
16"	250	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	350	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"
	550	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"

General Notes:

*Distances in the charts above are based on uniformly loaded joists using the maximum loads shown [in TJM's brochure. For other load conditions or hole configurations, contact TJM representative.

*For simple span (5-foot minimum) uniformly loaded joists, one maximum-size hole may be located at the center of the joist span provided no other holes occur in the joist. DO NOT cut into joist flanges when cutting out web.

Figure 3. The plumbers in the author's company follow basic code rules for drilling holes in floor joists (top). With wood I-joists (middle) and other types of engineered lumber, it's best to consult the manufacturer's literature. The example provided above is courtesy of Trus Joist MacMillan.

In general, routing water supply lines on a repipe job involves a few rules of thumb and a healthy dose of common sense. On most jobs, work starts at the front service. Often, I leave the existing pressure regulator and ball valve, and run a new main line to the water heater. From there, most houses require two primary runs, one heading toward any full bathrooms and another heading toward the kitchen. Secondary branch lines can usually pick up half-baths, hose bibbs, mop sinks, washing machines, dishwashers, and ice makers.

Running primary lines through ceiling joist bays usually works best for long runs. Drywall cutouts need to be spaced to accommodate PEX hangers, which should be installed every 2 to 3 feet on horizontal runs and every 4 to 5 feet on vertical runs. When running secondary lines beyond ceiling bays or attic space, the best route is the one with the fewest cutouts and drillouts. For example, choosing a ceiling bay that delivers a primary run as close as possible to a bathroom branch can reduce the number of joists that have to be drilled.

I've seen lots of jobs where the plumbers spend too much time going over alternatives or where lots of second-guessing goes on after work has actually begun. The fact is that there's almost always more than one good way to route the many runs on a job. What's more important is making sure nothing critical is overlooked, such as structural limitations that are strictly defined in the code. Sometimes, it's necessary to make a few exploratory cuts early on to verify that particular beams can be drilled through. What material a beam is made from, as well as manufacturer specs, can determine routing decisions by forbidding certain drillouts. For most cases, code rules for drilling holes are clearly defined (Figure 3).

Once a route is planned, it's easy to size piping. After determining the incoming water pressure, a chart in the plumbing code specifically defines how many fixtures can be run off of each size of piping. If I haven't had to replace the pressure regulators, I always check them to make sure they're working

properly. Typically, water pressure on a water supply system should be regulated at around 65 psi.

Preconstruction Walk-Through

At this point, before any actual work begins, I always take the time to walk through the job with the customers, to let them know exactly what's going to happen, and where. By understanding where cutouts and drilling will occur, the clients can get all their furniture and valuables out of harm's way. This saves me from having to do it later and prevents property damage that would cost me money and drive up my insurance rates. I also stress at this point that children and pets need to be kept out of the way. I back up my walk-through policy with a contract that makes it completely clear to the customers that they bear the responsibility for preparing the job site for the work.

Cutouts and Drilling

Repiping happens in distinct stages. With my routes planned, I make all necessary cutouts and drillouts. Chalking lines and carefully cutting out drywall often makes it possible to reuse drywall pieces in their original locations. This saves time later, because the drywall cutout fits the hole exactly. Avoiding cutouts in corners, which are harder to patch, can also save time later (Figure 4).

When drilling, it's important to have the right tools on hand and to think twice beforehand to avoid costly mistakes (Figure 5). For example, drilling holes for hose bibbs from the outside instead of the inside eliminates the danger of blowing out the exterior cladding or stucco.

I stop to clean each room after drillouts are complete and before moving on to the next room or starting to install new piping. This protects flooring surfaces from being damaged by boots grinding in the debris, and it goes a long way towards generating a good reputation with customers.

Snaking Pipe

With cutting and drilling complete, it's time to push some pipe (Figure 6,

next page). Installing PEX in new construction is straightforward (see "Plastic Plumbing Comes of Age," 3/97). In repiping, however, pipes have to be pushed and pulled from one strategically placed cutout to the next. Although still challenging, snaking PEX is much easier than repiping with copper or CPVC because there are fewer connections and the material is more flexible. Much like pulling electrical wires during remodeling work, PEX piping is fished through difficult junctures using all the usual tools and tricks. On



Figure 4. Marking precise cuts in drywall and saving the cutouts for reuse later help keep the cost of a job down.



Figure 5. A heavy-duty right-angle drill is a necessity for boring joists and studs.

the repipe job shown in this article, we were able to fish PEX through a wall-ceiling juncture and into the master bath, thereby eliminating extra holes and connections that would have been necessary with rigid copper or CPVC. This saved fittings and time.

While most piping can be installed by one person, problem areas often require two people — one pushing and the other pulling. An example is the tight space found where intersecting roofs converge. Attic space under a valley rafter is usually tight and fishing drops into nearby walls is tough, even with two people.

Connections and Manifold Distribution

Each PEX manufacturer uses slightly different types of connections. The product that I use, Wirsbo's Aquapex, works by slipping a reinforcing collar over cut ends and then expanding pipe openings with a special tool. After the opening is expanded, the tool is disengaged and a fitting can be quickly slipped in before the PEX material naturally contracts back to its original diameter (Figure 7). A wide variety of transition pieces are available for special connections, such as where the service entrance connects to PEX.

Manifolds are often used to distribute the various primary supply lines just after the point where the main entrance line splits at the water heater. Stock manifolds are available or installers can assemble their own using common plumbing materials. Manifolds, however, are not required. They tend to be common on new construction where a separate line or home run is piped to every wet room in a house. On repipes, however, the idea is to limit the number of runs to minimize damage to finished surfaces. With just a few primary runs, it's usually possible to use common tee or wye fittings where secondary lines branch off or 90-degree elbows for getting around tight turns.

Because PEX is vulnerable to UV light, it can't be used outdoors. And because it lacks rigidity, it also shouldn't be used



Figure 6. Hot and cold PEX water lines are strapped together for feeding into cutouts.



Figure 7. Wirsbo's PEX connects to brass fittings using a proprietary expansion tool bit (left). The cut end of the PEX is expanded, the fitting slides into place (right), and within seconds, the PEX contracts back to its original diameter. Rings placed outside the cut end ensure strong, leak-free connections.

for hose bibbs or shower risers. I use copper in these situations. Shower risers are not usually affected by aggressive water because they air out when they're not in use. And the hose bibbs are relatively easy to repair if they wear out prematurely.



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