Installation Time Study of Commercial Plumbing Systems | Home Innovation Research Labs #MR1106

Study Scope

REHAU commissioned Home Innovation Research Labs to conduct a side-by-side installation time study of a hot- and cold-water commercial plumbing system utilizing different piping and fitting systems. Using light gauge steel, Home Innovations built a mockup of part of a hotel in two identical sections. Each section included a hallway and four guest suites, each suite having 5 plumbing fixtures. The time study evaluated the installation of four systems: (1) REHAU RAUPEX® PEXa pipe and EVERLOC+™ fittings, (2) PEXa pipe with cold expansion fittings, (3) copper pipe with solder fittings, and (4) copper pipe with press fittings. A local plumbing contractor proficient in installation of commercial plumbing systems was hired for the study. Each of the four systems were installed on a section of the mockup by two different plumbers. The installations included 1/2, 3/4, 1, 1 1/4, and 2-inch piping, representing a mix reflective of a hotel.

Study Objective

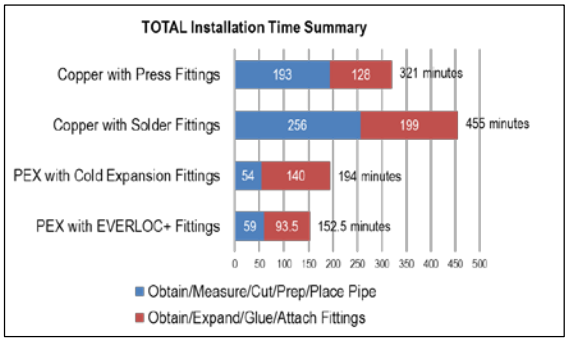
The primary objective of this research was to determine whether the use of the REHAU PEXa plumbing system (comprised of RAUPEX piping and EVERLOC+ compression-sleeve fittings) resulted in installation time savings in a typical commercial new construction setting compared to:

- PEXa piping with engineered polymer cold-expansion fittings
- Copper piping with solder fittings
- Copper piping with press fittings

Summary of Research Findings

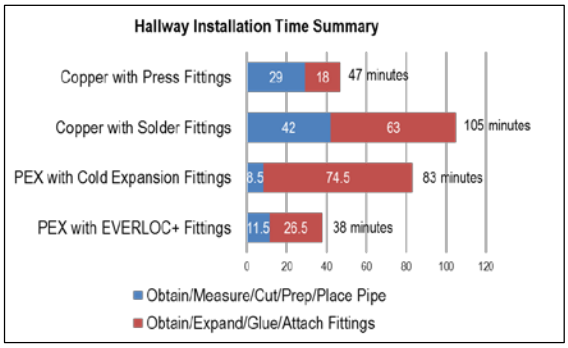
The study found that:

- EVERLOC+ system installed 21% faster than PEXa with cold expansion fittings
- EVERLOC+ system installed 52% faster than copper with press fittings
- EVERLOC+ system installed 66% faster than copper with solder fittings



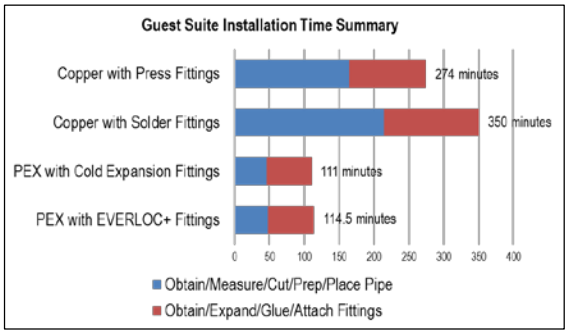
EVERLOC+ was fastest in the hallway using large diameter fittings (1 1/4 in. and above):

- EVERLOC+ system installed 54% faster than PEXa with cold expansion fittings
- EVERLOC+ system installed 19% faster than copper with press fittings
- EVERLOC+ system installed 64% faster than copper with solder fittings



EVERLOC+ was second fastest behind PEXa with cold-expansion fittings in the guest suites using small diameter fittings (1 in. and below):

- EVERLOC+ system installed 3% slower than PEXa with cold expansion fittings
- EVERLOC+ system installed 58% faster than copper with press fittings
- EVERLOC+ system installed 67% faster than copper with solder fittings



Pressure Testing

- PEXa with EVERLOC+ compression-sleeve fittings: Passed 60 psi (413 kPA) pressure test on first attempt
- PEXa with cold-expansion fittings: Passed 60-psi (413 kPA) pressure test on first attempt
- Copper with press fittings: Two un-pressed fittings were discovered during the pressure test, which were connected before passing
- Copper with solder fittings: Passed 60-psi (413 kPA) pressure test on first attempt

Cold-room Installation Time Comparison

An installation time comparison between EVERLOC+ compression-sleeve fittings and cold-expansion fittings was done in a cold room at slightly above freezing Twenty-five connections of large- and small-diameter fittings were made with both systems. Room, fittings and pre-cut plumbing piping was conditioned to 33°F (0.5°C). After completing the connections with each system, a pressure test was done.

The EVERLOC+ fitting system showed no variation between temperatures. In contrast, the installation time for cold-expansion fittings grew from 0.81 minutes per fitting to 1.08 minutes per fitting (+33%).

Average Fitting Attachment Time (1/2, 3/4, 1 and 2 in. Fittings)	Minutes per Fitting
EVERLOC+ at 70°F (21°C)	0.50
EVERLOC+ at 33°F (0.5°C)	0.50
Cold-expansion at 70°F (21°C)	0.81
Cold-expansion at 33°F (0.5°C)	1.08

This time difference, if extrapolated to the entire study mockup, would increase the cold-expansion fitting installation by 42 man-minutes. The additional 42 minutes would, in turn, increase EVERLOC+ labor savings for the total job from 21% to 35% compared to cold expansion fittings.

When the cold room installation of each system was completed, the researchers conducted a 60 psi (413 kPA) pressure test on the piping 1) immediately and 2) at 10-minute intervals for the first two hours with the following results:

- The EVERLOC+ compression-sleeve fitting system immediately passed the pressure test.
- The cold-expansion system failed the first test at several fittings. Over the next half an hour, the cold-expansion system still failed the pressure test, but with progressively fewer leaking fittings. After the fourth test, all but one fitting had sealed. Tests at the end of the first day and throughout the second day failed. On the morning of the third day, after failing a pressure test, the piping was removed from the cold room 70°F (21°C) room. Pressure tests failed from 6:30 am until noon, but passed after 1:00 pm. An inspection of the leaking fitting showed that the pipe was not seated completely—it was inserted about 3/16 in. short of the stops, which was an installer error.

Post-installation Discussions with Installers

On the third day of the study, after the installers had worked with all four fitting systems, they were asked to comment on aspects they liked and disliked about each of the systems.

PEXa with EVERLOC+ Compression-sleeve Fittings	PEXa with Cold-expansion Fittings	Copper with Press Fittings	Copper with Solder Fittings
▪ Least concerned about long-term health with PEX compared to other piping ▪ Liked PEX in general because it had fewer fittings, easier to keep them sorted and less measuring/cutting/attaching			
▪ Of the four plumbing systems, the plumbing installers stated they liked the REHAU PEXa with EVERLOC+ fittings best ▪ Believed this system would result in the fastest installation times and they trust the fitting system is reliable ▪ Expanding the pipe was easier with EVERLOC+ than the cold-expansion system ▪ They noted that pressing on the sleeve actually pulled the pipe and fitting together, making it more snug ▪ EVERLOC+ tool was easy to handle and of very good quality ▪ No issues with long-term health using this product	▪ Liked this system, especially for smaller diameter pipe ▪ Hard to expand large-diameter pipe and the battery capacity of the larger expansion tool was too small ▪ Didn't like the wait time for the material to shrink down onto the fitting after expanding ▪ Sometimes after expanding pipe, it shrinks too quickly and it is hard to press fitting completely against the stops ▪ During the cold-room exercise, they had to hold the fittings together longer to wait for expansion, which increased installation time	▪ Preferred over copper with solder fittings ▪ Cleaner, faster and no fire hazard ▪ Pressing tends to re-direct pipe a little, and the direction was not predictable ▪ Hard to see press on smaller pipe and know that connection has been made—as a result, they had two "blowouts" during the pressure test ▪ Hard to get the press tool into tighter areas ▪ Press tool is heavy, and it can be tiring to work with ▪ Any kind of copper piping is best done as two-man job—one to cut, prep and supply pipe and the other to join fittings	▪ Least favorite of the materials installed ▪ Doesn't look as neat as other systems ▪ Pipe gets hot to touch—need to cool it down with wet rag ▪ Hot solder drops on things below including installlers ▪ Flux gets on hands and makes pipe slippery ▪ Greater security of jobsite needed so people don't steal it

For more details on the study as well as installation set-up and study methods, go to http://www.everlocplus.com/timestudy