

## Uponor Compares Material and Labor Costs of Five Pipe-System Types

Material and labor costs were determined for PEX, chlorinated polyvinyl chloride (CPVC), copper press, copper sweat, and polypropylene (PP-R).

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Uponor, provider of cross-linked polyethylene (PEX) plumbing, indoor-climate, and fire-safety systems for residential and commercial buildings, recently completed a study comparing the cost-effectiveness of five types of plumbing piping for a multifamily building.

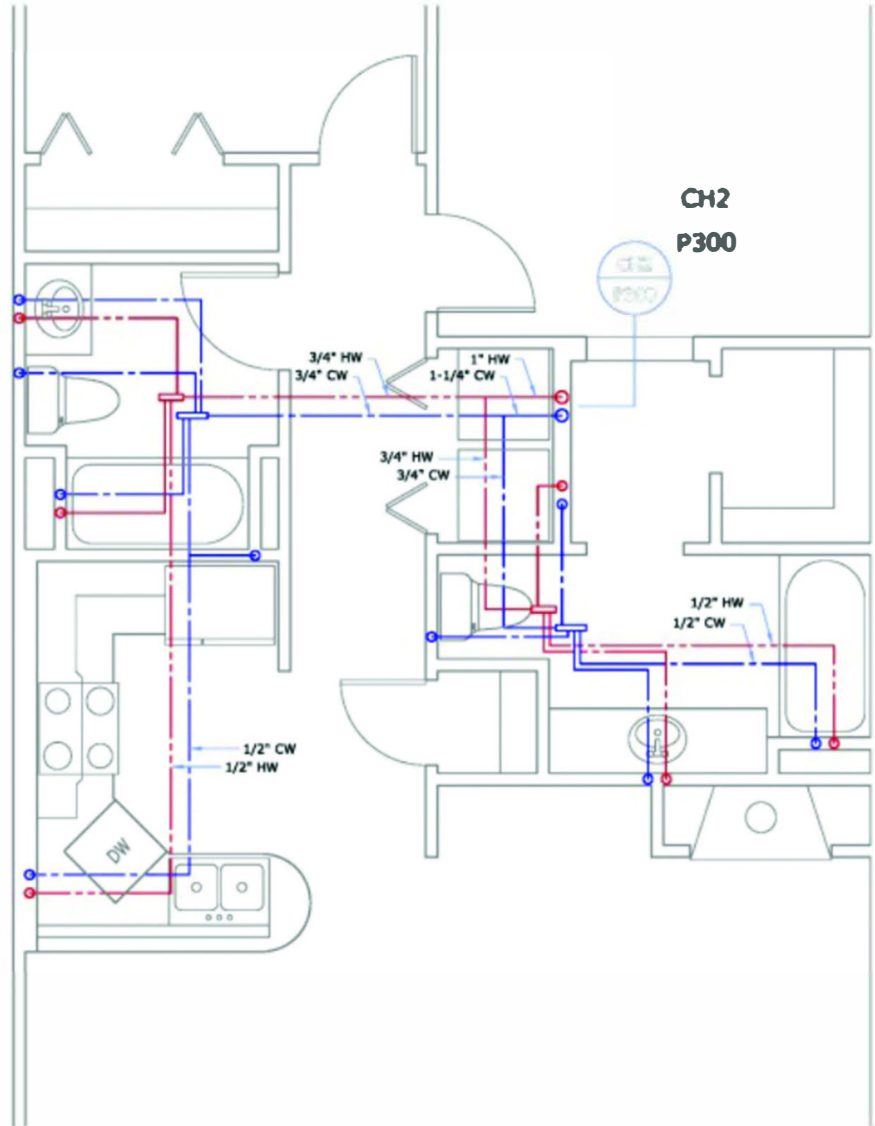
Material and labor costs were determined for the following system types:

- PEX.
- Chlorinated polyvinyl chloride (CPVC) trunk and branch.
- Copper press trunk and branch.
- Copper sweat trunk and branch.
- Polypropylene (PP-R) trunk and branch.

The building was a 517,550-sq-ft, 189-unit multifamily structure with three dwelling levels over a one-level parking garage.

The design had the main cold-water distribution routed in the parking garage and the main hot-water distribution routed in the third-floor ceiling, with risers transporting water up to the fourth floor and down to the second floor (figures 1 and 2).

FIGURE 1. Riser for PEX units.



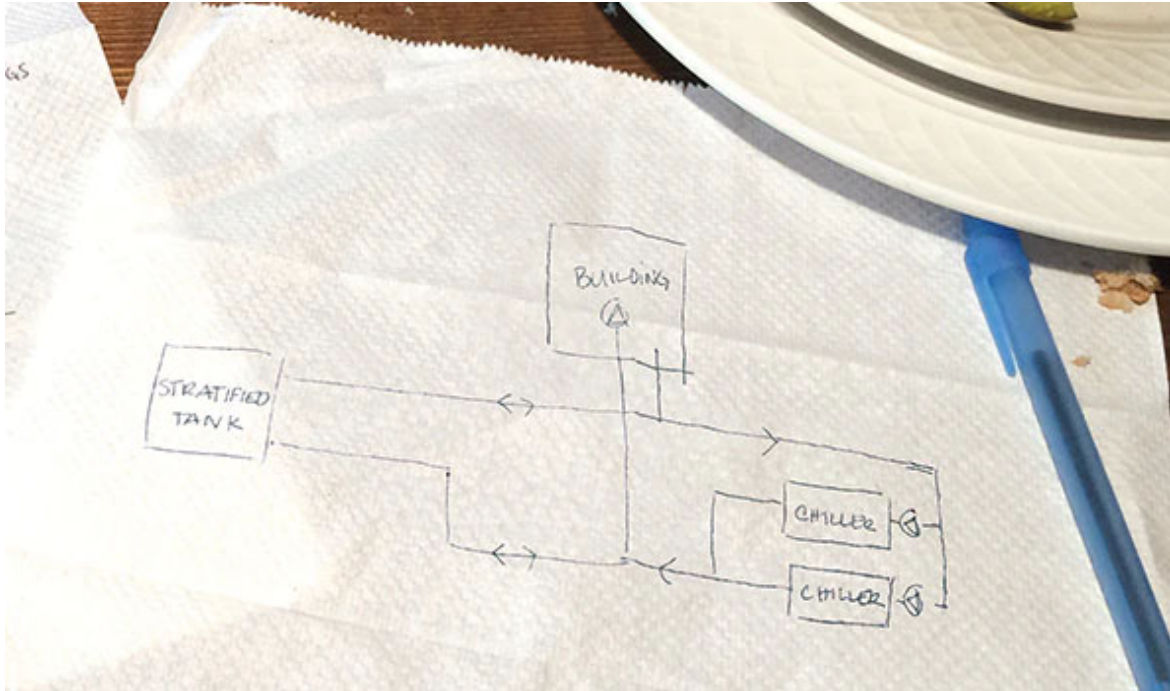


FIGURE 2. Riser for CPVC, copper, and PP-R trunk and branch units.

Although the project called for pipe and fittings larger than 2 in., the study looked only at costs for pipe, fittings, and valves 2 in. and smaller.

Material costs were calculated at 2014 trade pricing values from across the United States.

## Materials

For each system type, the following materials were included in the project costs:

### PEX

- 1/2- to 2-in. Engel- or peroxide-method (PEX-a) pipe and ASTM F1960, *Standard Specification for Cold Expansion Fittings With PEX Reinforcing Rings for Use With Cross-linked Polyethylene (PEX) Tubing*, fittings.
- 1- to 2-in. pipe support channel with cable ties (except in units).
- 1- to 2-in. ASTM F1960 elbows.
- 1/2- to 2-in. ASTM F1960 commercial ball valves.
- Sweat adapters to transition to larger-diameter copper pipe.
- Engineered polymer multiport tees.

- Plugs at fixture terminations for lavatories, water closets, and sinks.
- ASTM F1960 outlet boxes for ice makers and washing machines.

### *CPVC*

- 1/2- to 2-in. pipe and fittings (SDR-11 CTS).
- 1/2- to 2-in. elbows.
- Solvent-cement fittings.
- 1/2- to 2-in. commercial ball valves with threaded adapters.
- Caps at fixture terminations for lavatories, water closets, and sinks.
- Boxes for ice makers and washing machines.

### *Copper press*

- 1/2- to 2-in. Type L pipe and press fittings.
- 1/2- to 2-in. press elbows.
- 1/2- to 2-in. commercial press ball valves.
- Caps at fixture terminations for lavatories, water closets, and sinks.
- Boxes for ice makers and washing machines.

### *Copper sweat*

- 1/2- to 2-in. Type L pipe and fittings.
- 1/2- to 2-in. elbows.
- 1/2- to 2-in. commercial sweat ball valves.
- Caps at fixture terminations for lavatories, water closets, and sinks.
- Boxes for ice makers and washing machines.

### *PP-R*

- 1/2- to 2-in. pipe and fittings, with a standard dimension ratio (SDR) of 11 for cold-water pipe and a SDR of 7.4 multilayer (MF) for hot-water pipe.
- 1/2- to 2-in. elbows.
- Socket-type fittings.
- 1/2- to 2-in. commercial ball valves with threaded adapters.

- Caps at fixture terminations for lavatories, water closets, and sinks.
- Boxes for ice makers and washing machines.

## **Labor**

Labor was calculated using the [Mechanical Contractors Association of America \(MCAA\)](#) component-method approach. According to MCAA: “The component method is based on the use of labor units that represent all activities necessary for the installation of one component (such as a 90-degree elbow or a tee). For piping, the unit is in man-hours per foot, and for components such as fittings, the unit is represented by each. A labor unit is expressed in terms of man-hours to install a unit of material (such as a foot of pipe), an individual item (such as a fitting or valve), or perform a specific task (such as welding a joint).”

In developing the labor units, MCAA reviewed many aspects of installation, including:

- Receiving.
- Unloading.
- Stockpiling.
- Distribution.
- Handling and erection.
- Fitting and joining.
- Pressure testing.

Labor costs were calculated using a rate of \$75 per hour, based on extensive research of labor rates across the United States.

## **Study Results**

Material and labor costs were determined by building section:

- Main piping, which included all pipe and fittings 2 in. and smaller that were part of the horizontal cold-water distribution system on the garage level and the hot-water system on the third level.
- Unit piping, which included all pipe and fittings within units after the riser branch. Unit costs included hot- and cold-water isolation valves. Fixture terminations were plugged or capped for rough-in.

- Riser piping, which included all vertical piping and fittings. For cold-water risers, the piping started in the parking garage and rose roughly 30 ft to the fourth floor. For hot-water risers, the piping started in the third-floor ceiling space and was distributed 10 ft up to the fourth floor and 10 ft down to the second floor. Riser costs included isolation valves at the base.

Table 1 shows estimated labor hours for the individual building sections.

<b>Building section</b>	<b>PEX</b>	<b>CPVC</b>	<b>Copper press</b>	<b>Copper sweat</b>	<b>PP-R</b>
Main piping	216.51	224.80	227.73	298.95	299.66
Units	3,353.81	5,361.27	4,200.69	8,060.25	10,442.49
Risers	165.82	512.33	492.98	981.89	1,195.91
<b>Total</b>	<b>3,736.14</b>	<b>6,098.40</b>	<b>4,921.40</b>	<b>9,341.09</b>	<b>11,938.06</b>

TABLE 1. Labor hours by building section.

Table 2 shows the total project cost.

<b>Building section</b>	<b>PEX</b>	<b>CPVC</b>	<b>Copper press</b>	<b>Copper sweat</b>	<b>PP-R</b>
Main piping	\$23,492.12	\$12,610.06	\$35,358.90	\$34,255.30	\$16,245.63
Units	\$64,477.84	\$60,998.25	\$193,791.18	\$164,339.01	\$114,588.81
Risers	\$31,538.07	\$28,958.96	\$54,500.69	\$48,538.04	\$34,305.17
<b>Material cost</b>	<b>\$119,508.03</b>	<b>\$102,567.27</b>	<b>\$283,650.77</b>	<b>\$247,132.35</b>	<b>\$165,139.61</b>
Labor cost at \$75 per hour	\$280,210.30	\$457,380.00	\$369,105.00	\$700,581.75	\$895,354.50
<b>Project total</b>	<b>\$399,718.33</b>	<b>\$559,947.27</b>	<b>\$652,755.77</b>	<b>\$947,714.10</b>	<b>\$1,060,494.11</b>

TABLE 2. Total project cost (U.S. dollars) by building section.

### Individual-Unit Comparison

Material and labor costs were broken down at an individual-unit level. Figures 3 and 4 show unit piping. Table 3 shows the labor hours required to pipe a unit. Table 4 shows the total costs of piping a unit.

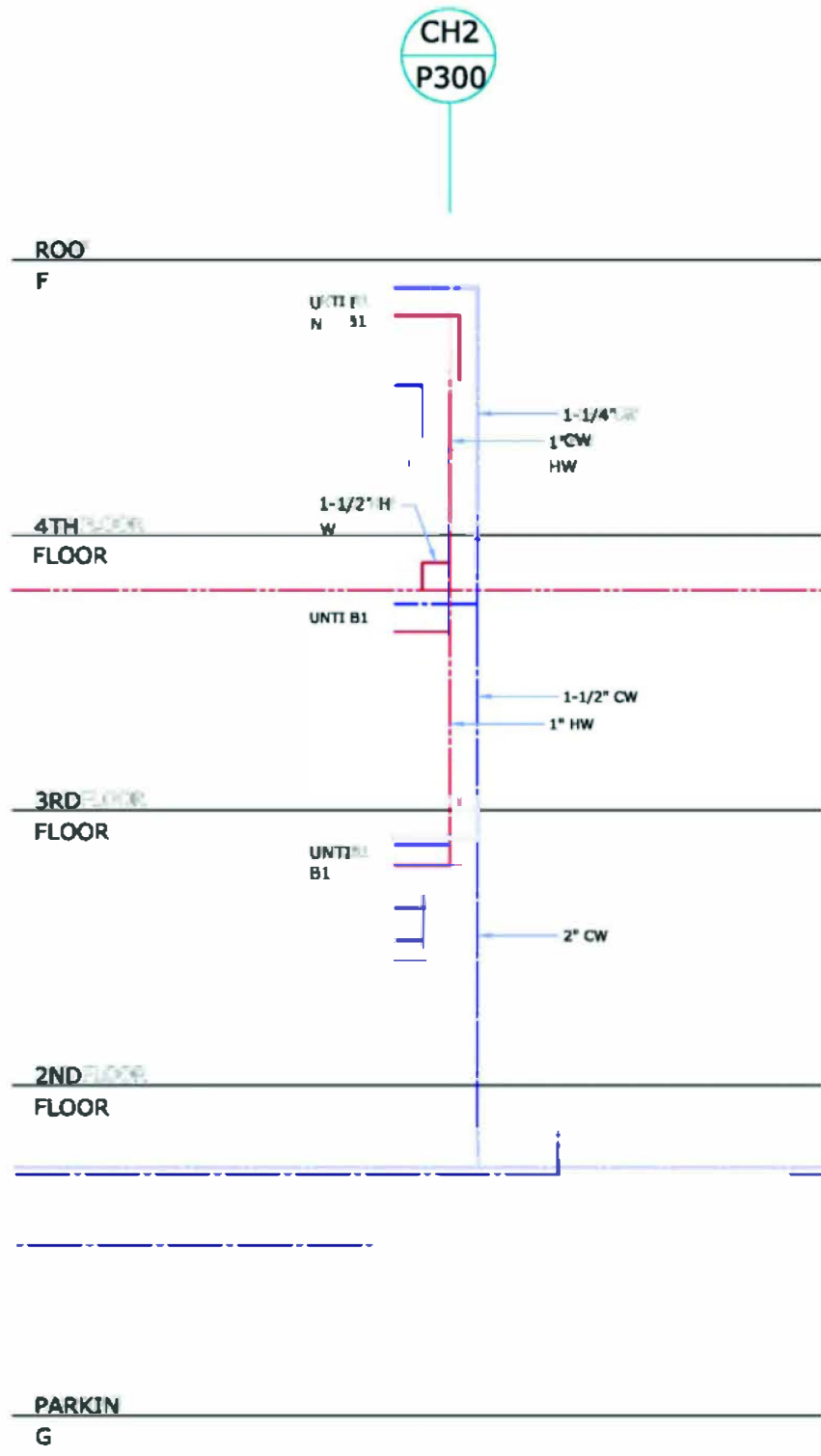


FIGURE 3. Individual-unit PEX design.

CH2  
P300

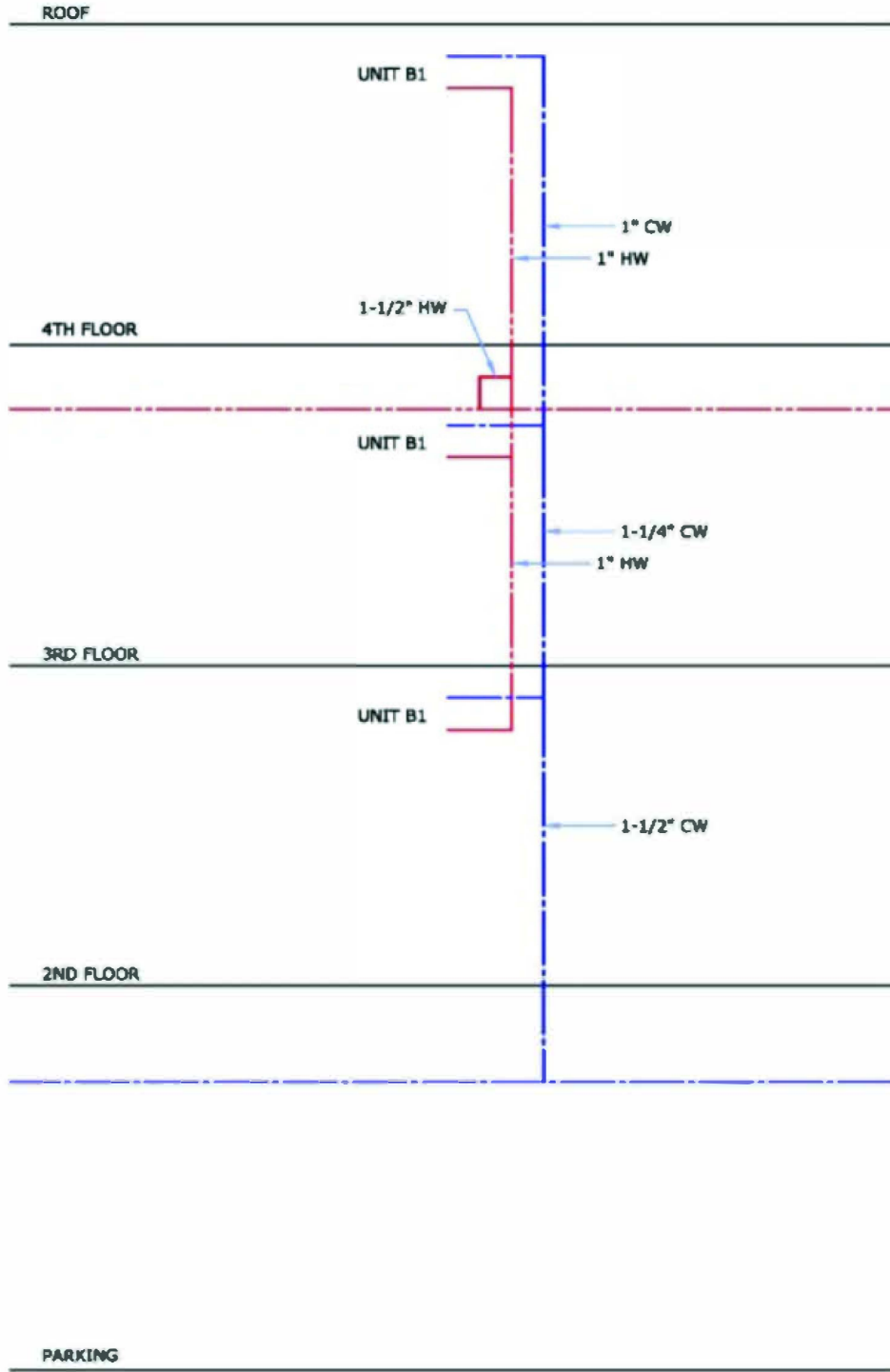




FIGURE 4. Individual-unit CPVC, copper, and PP-R trunk and branch design.

<b>PEX</b>	<b>CPVC</b>	<b>Copper press</b>	<b>Copper sweat</b>	<b>PP-R</b>
19.36	28.65	22.48	43.11	55.80

TABLE 3. Individual-unit labor hours.

	<b>PEX</b>	<b>CPVC</b>	<b>Copper press</b>	<b>Copper sweat</b>	<b>PP-R</b>
Material cost	\$365.20	\$326.31	\$1,029.21	\$870.11	\$614.59
Labor cost at \$75 per hour	\$1,452.00	\$2,148.75	\$1,686.00	\$3,233.25	\$4,185.00
<b>Project total</b>	<b>\$1,817.20</b>	<b>\$2,475.06</b>	<b>\$2,715.21</b>	<b>\$4,103.36</b>	<b>\$4,799.59</b>

TABLE 4. Total individual-unit cost.

### Individual-Riser Comparison

The labor required for an individual riser is shown in Table 5. Table 6 shows the total costs of piping a riser.

<b>PEX</b>	<b>CPVC</b>	<b>Copper press</b>	<b>Copper sweat</b>	<b>PP-R</b>
2.75	8.37	8.07	16.02	19.13

TABLE 5. Individual-riser labor hours.

	<b>PEX</b>	<b>CPVC</b>	<b>Copper press</b>	<b>Copper sweat</b>	<b>PP-R</b>
Material cost	533.39	\$478.40	\$911.47	\$811.80	\$574.12
Labor cost at \$75 per hour	\$206.25	\$627.75	\$605.25	\$1,201.50	\$1,434.75
<b>Project total</b>	<b>\$739.64</b>	<b>\$1,106.15</b>	<b>\$1,516.72</b>	<b>\$2,013.30</b>	<b>\$2,008.87</b>

TABLE 6. Total individual-riser cost.

*This report was prepared by Daniel Worm, plumbing-product specialist for Uponor. Worm has more than 14 years of plumbing-industry experience, with an emphasis on application and design. He is a licensed building contractor, a certified plumbing designer, and a member of the [American Society of Plumbing Engineers](#). He holds a degree in architectural design and drafting. He can be reached at [daniel.worm@uponor.com](mailto:daniel.worm@uponor.com).*