

Case Study

Time and Materials Comparison — Hangers and Supports

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Executive Summary

With advancements in plumbing materials technology, the importance of remaining price-competitive is ever increasing. However, material costs are only one part of a larger puzzle. Many of the materials offered today also claim to reduce labor times for installation, resulting in reduced installation costs for the installing contractor.

The purpose of this case study is to examine the costs, both material and labor based, for hangers and supports used in a piping system. Because different pipe materials require different types of hangers and spacings, this study will examine the differences in labor and material costs for additional hangers.

Project Information

Basic assumptions

The scope of this project is to compare project costs, both material and labor based, of five system types:

- PEX-a with ASTM F1960 Fittings
- CPVC with Solvent Welded Socket Fittings
- Copper Sweat with 95/5 Solder Fittings
- Copper Press
- Polypropylene (PP-R) with Heat-fusion Socket Fittings

Material costs are calculated at 2014 trade pricing information received from various parts of the United States. It is to the best of our knowledge accurate and current.

Labor has been 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° elbow or a tee). For piping, the unit is in manhours per foot and for components such as fittings, the unit is represented by each."*

From MCAA:

"A labor unit is expressed in terms of manhours 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 set forth on this website, MCAA reviewed the many elements that make up installation labor."

They are:

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

Piping System Comparison

Pipe lengths for each product will be:

- 10'-0" for copper
- 10'-0" for CPVC
- 13'-0" for PP-R
- 20'-0" for PEX
- 10'-0" for PEX¹

Notes:

1. Although only currently available in 20'-0" straight lengths, a second PEX system using 10'-0" lengths will also be shown for a more-direct comparison.

Fittings for each system will be:

- Copper will be connected with either a sweat x sweat or a press x press coupling
- CPVC will be connected with a socket x socket coupling
- PP-R will be connected with a socket x socket coupling
- PEX will be connected with an ASTM F1960 coupling

Hangers for all systems will be:

- Trapeze type using 1 $\frac{5}{8}$ " steel strut (12-ga.)
- Strut is 4'-0" in length, with (2) $\frac{3}{8}$ " rods that are 3'-0" in length
- Standard strut clamps

Example:

A piping run consisting of three pipes (1" domestic hot-water return, a 2" domestic cold-water supply, and a 2" domestic hot-water supply) runs 100 feet down the length of a corridor. Using the IPC guidelines for hanger spacing shown in **Table 1**, the system layouts are shown below in **Details 1 through 5**.

| Piping Material | Maximum Horizontal Spacing (feet) |
|-------------------------------------|-----------------------------------|
| Copper, 1 1/4" diameter and smaller | 6 |
| Copper, 1 1/2" diameter and larger | 10 |
| Cross-linked Polyethylene (PEX) | 2.67 (32 inches) ¹ |
| CPVC, 1" and smaller | 3 |
| CPVC, 1 1/4" and larger | 4 |
| Polypropylene, 1" and smaller | 2.67 (32 inches) |
| Polypropylene, 1 1/4" and larger | 4 |

Table 1: Hanger Spacing for Pipe Materials per Table 308.5 of the 2012 IPC

Notes:

1. PEX pipe that is continuously supported can utilize a maximum hanger spacing of 6'-0" for pipe $\frac{3}{4}$ " and smaller, and 8'-0" for piping 1" and larger. Refer to PMG-1006 for more information.

Detail 1: Copper System Hanger Layout



Detail 2: CPVC System Hanger Layout²



Detail 3: PEX System 1 Hanger Layout¹



Detail 4: PEX System 2 Hanger Layout¹



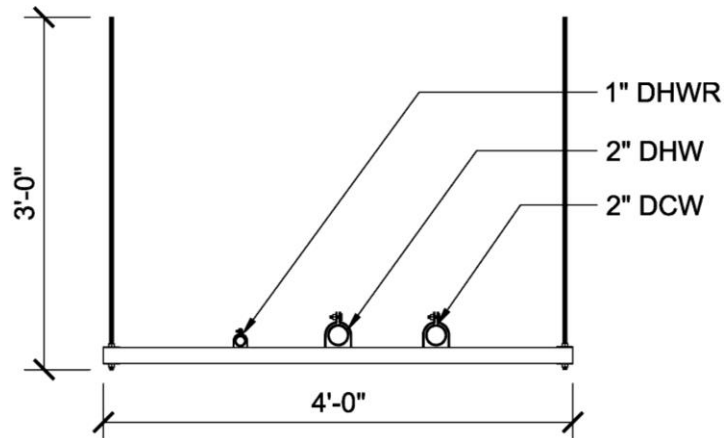
Detail 5: PP-R System Hanger Layout²



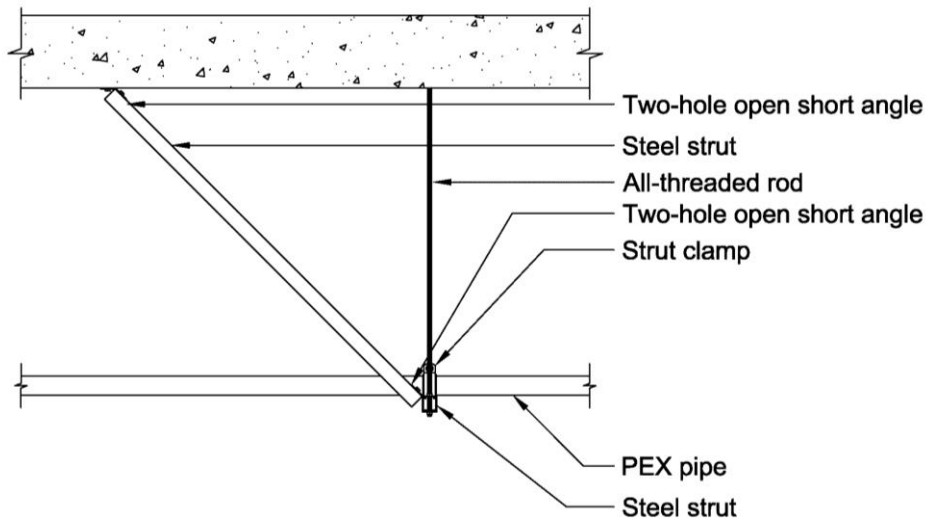
Note:

1. The PEX hanger layouts include PEX-a Pipe Support, as well as two fixed-points located at 65'-0" O.C. See **Detail 7** for Fixed Points.
2. Due to variations in manufacturer's data, fixed points were not included for CPVC and PP-R systems. Please refer to manufacturer's installation instructions for each application.

Detail 6: Hanger Assembly, Front View



Detail 7: Fixed-point, Section View



Labor Hours for Piping Systems

Given the criteria above, the labor and material costs were calculated for the piping systems. Note that the PEX system costs include the use of two fixed-points and PEX Pipe Support to compensate for movement due to thermal expansion.

Because of varying data from CPVC and PP-R manufacturers, thermal expansion compensating devices were not included for these systems. However in practice, it is up to the installing contractor to refer to the manufacturer's installation instructions for thermal expansion compensating devices. Listed in alphabetical order, the total system costs are shown in **Tables 2 through 7**.

| Total System Cost- Copper Press | | |
|--|-----------|--------------------|
| Piping System | Qty | Total Labor |
| 1" Copper Pipe, Type L | 100-ft | - |
| 2" Copper Pipe, Type L | 200-ft | - |
| 1" coupling, sweat x sweat | 10 | - |
| 2" coupling, sweat x sweat | 20 | - |
| Labor Hours for Pipe System | | 32.10 |
| Hanger assembly | Qty | Total Labor |
| 1 5/8" Steel Strut | 68-ft | - |
| 3/8" Threaded Rod | 102-ft | - |
| Strut Washer | 68 | - |
| 3/8" Nut | 68 | - |
| 1" Strut Clamp | 17 | - |
| 2" Strut Clamp | 34 | - |
| Total No. of Hanger Assemblies | 17 | 39.61 |
| Labor Hours for Hangers | | 39.61 |
| Total Materials Cost (USD) | | \$5,763.99 |
| Labor Cost @ \$75/hr (USD) | | \$5,378.25 |
| Total Cost for System (USD) | | \$11,142.24 |

Table 2: Copper Press System Costs

| Total System Cost- Copper Sweat | | |
|--|-----------|--------------------|
| Piping System | Qty | Total Labor |
| 1" Copper Pipe, Type L | 100-ft | - |
| 2" Copper Pipe, Type L | 200-ft | - |
| 1" coupling, sweat x sweat | 10 | - |
| 2" coupling, sweat x sweat | 20 | - |
| Labor Hours for Pipe System | | 48.30 |
| Hanger assembly | Qty | Total Labor |
| 1 5/8" Steel Strut | 68-ft | - |
| 3/8" Threaded Rod | 102-ft | - |
| Strut Washer | 68 | - |
| 3/8" Nut | 68 | - |
| 1" Strut Clamp | 17 | - |
| 2" Strut Clamp | 34 | - |
| Total No. of Hanger Assemblies | 17 | 39.61 |
| Labor Hours for Hangers | | 39.61 |
| Total Materials Cost (USD) | | \$5,583.38 |
| Labor Cost @ \$75/hr (USD) | | \$6,593.25 |
| Total Cost for System (USD) | | \$12,176.63 |

Table 3: Copper Sweat System Costs

| Total System Cost- CPVC | | |
|---------------------------------------|-----------|--------------------|
| Item Description | Qty | Total Labor |
| 1" CPVC, SDR 11 | 100-ft | - |
| 2" CPVC, SDR 11 | 200-ft | - |
| 1" coupling, socket x socket | 10 | - |
| 2" coupling, socket x socket | 20 | - |
| Labor Hours for Pipe System | | 27.30 |
| Hanger assembly | Qty | Total Labor |
| 1 5/8" Steel Strut | 96-ft | - |
| 3/8" Threaded Rod | 204-ft | - |
| Strut Washer | 136 | - |
| 3/8" Nut | 136 | - |
| 1" Strut Clamp | 34 | - |
| 2" Strut Clamp | 68 | - |
| Total No. of Hanger Assemblies | 34 | 79.22 |
| Labor Hours for Hangers | | 79.22 |
| Total Materials Cost (USD) | | \$3,913.92 |
| Labor Cost @ \$75/hr (USD) | | \$7,989.00 |
| Total Cost for System (USD) | | \$11,902.92 |

Table 4: CPVC System Costs

| Total System Cost- PEX 1 | | |
|---|-----------|-------------------|
| Item Description | Qty | Total Labor |
| 1" PEX | 100-ft | - |
| 2" PEX | 200-ft | - |
| 1" PEX Pipe Support, 9-ft | 11 | - |
| 2" PEX Pipe Support, 9-ft | 22 | - |
| 1" coupling, F1960 x F1960 | 5 | - |
| 2" coupling, F1960 x F1960 | 10 | - |
| 1" ProPEX Ring | 10 | - |
| 2" ProPEX Ring | 20 | - |
| Labor Hours for Pipe System | | 30.75 |
| Hanger assembly | Qty | Total Labor |
| 1 5/8" Steel Strut | 60-ft | - |
| 3/8" Threaded Rod | 90-ft | - |
| Strut Washer | 60 | - |
| 3/8" Nut | 60 | - |
| 1" Strut Clamp | 15 | - |
| 2" Strut Clamp | 30 | - |
| Total No. of Hanger Assemblies | 15 | 34.95 |
| Fixed Points | Qty | Total Labor |
| 1 5/8" Steel Strut | 12 | - |
| 45 Degree Open Angle | 8 | - |
| Bolt, 1/2"-13 x 1 1/2" | 12 | - |
| Nut, 1/2" | 12 | - |
| Strut Washer | 12 | - |
| Blue Banger, 1/2"-13 | 4 | - |
| Total No. of Fixed Points | 2 | 4.66 |
| Labor Hours for Hangers & Fixed Points | | 39.61 |
| Total Materials Cost (USD) | | \$1,942.01 |
| Labor Cost @ \$75/hr (USD) | | \$5,277.00 |
| Total Cost for System (USD) | | \$7,219.01 |

Table 5: PEX 1 with ASTM F1960 Fitting System Costs (20'-0" straight lengths)

Note:

1. The PEX system includes the time and materials costs for PEX-a Pipe Support, as well as two fixed-points, which help compensate for thermal expansion.

| Total System Cost- PEX 2 | | |
|---|-----------|-------------------|
| Item Description | Qty | Total Labor |
| 1" PEX | 100-ft | - |
| 2" PEX | 200-ft | - |
| 1" PEX Pipe Support, 9-ft | 10 | - |
| 2" PEX Pipe Support, 9-ft | 20 | - |
| 1" coupling, F1960 x F1960 | 10 | - |
| 2" coupling, F1960 x F1960 | 20 | - |
| 1" ProPEX Ring | 20 | - |
| 2" ProPEX Ring | 40 | - |
| Labor Hours for Pipe System | | 31.50 |
| Hanger assembly | Qty | Total Labor |
| 1 5/8" Steel Strut | 80-ft | - |
| 3/8" Threaded Rod | 120-ft | - |
| Strut Washer | 80 | - |
| 3/8" Nut | 80 | - |
| 1" Strut Clamp | 20 | - |
| 2" Strut Clamp | 40 | - |
| Total No. of Hanger Assemblies | 20 | 46.6 |
| Fixed Points | Qty | Total Labor |
| 1 5/8" Steel Strut | 12 | - |
| 45 Degree Open Angle | 8 | - |
| Bolt, 1/2"-13 x 1 1/2" | 12 | - |
| Nut, 1/2" | 12 | - |
| Strut Washer | 12 | - |
| Blue Banger, 1/2"-13 | 4 | - |
| Total No. of Fixed Points | 2 | 4.66 |
| Labor Hours for Hangers & Fixed Points | | 51.26 |
| Total Materials Cost (USD) | | \$2,418.40 |
| Labor Cost @ \$75/hr (USD) | | \$6,207.00 |
| Total Cost for System (USD) | | \$8,625.40 |

Table 6: PEX 2 with ASTM F1960 Fittings System Costs (10'-0" straight lengths)

Note:

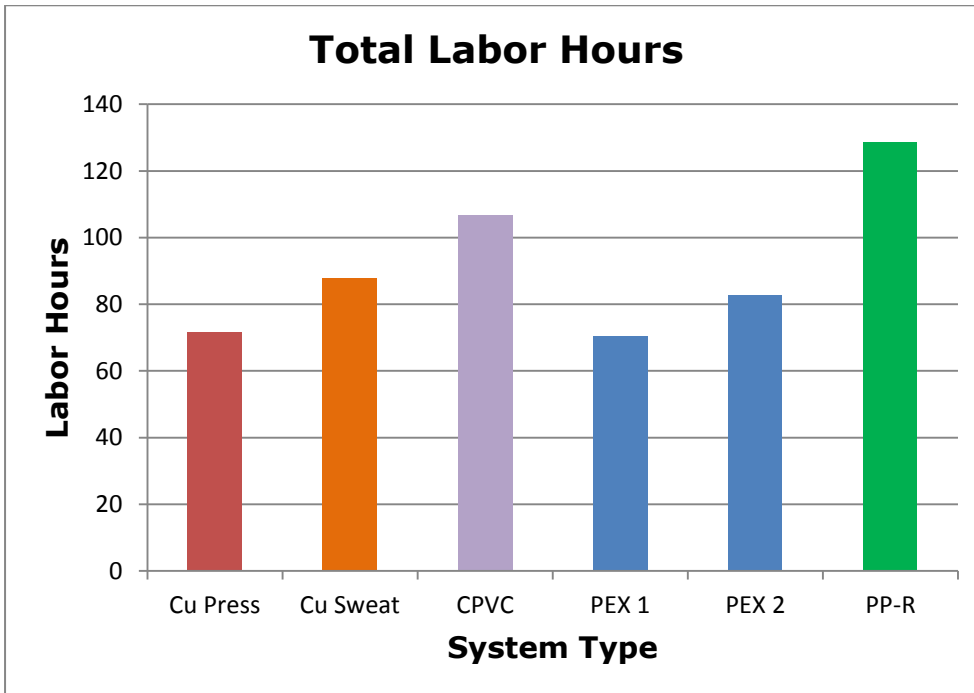
1. The PEX system includes the time and materials costs for PEX-a Pipe Support, as well as two fixed-points, which help compensate for thermal expansion.

| Total System Cost- PP-R | | |
|---------------------------------------|-----------|--------------------|
| Item Description | Qty | Total Labor |
| 1" PP-R, SDR 7.4 | 100 | - |
| 2" PP-R, SDR 7.4 | 100 | - |
| 2" PP-R, SDR 11 | 100 | - |
| 1" coupling, socket x socket | 7 | - |
| 2" coupling, socket x socket | 14 | - |
| Labor Hours for Pipe System | | 40.12 |
| Hanger assembly | Qty | Total Labor |
| 1 5/8" Steel Strut | 152-ft | - |
| 3/8" Threaded Rod | 228-ft | - |
| Strut Washer | 152 | - |
| 3/8" Nut | 152 | - |
| 1" Strut Clamp | 38 | - |
| 2" Strut Clamp | 76 | - |
| Total No. of Hanger Assemblies | 38 | 88.54 |
| Labor Hours for Hangers | | 88.54 |
| Total Materials Cost (USD) | | \$4,772.97 |
| Labor Cost @ \$75/hr (USD) | | \$9,649.50 |
| Total Cost for System (USD) | | \$14,422.47 |

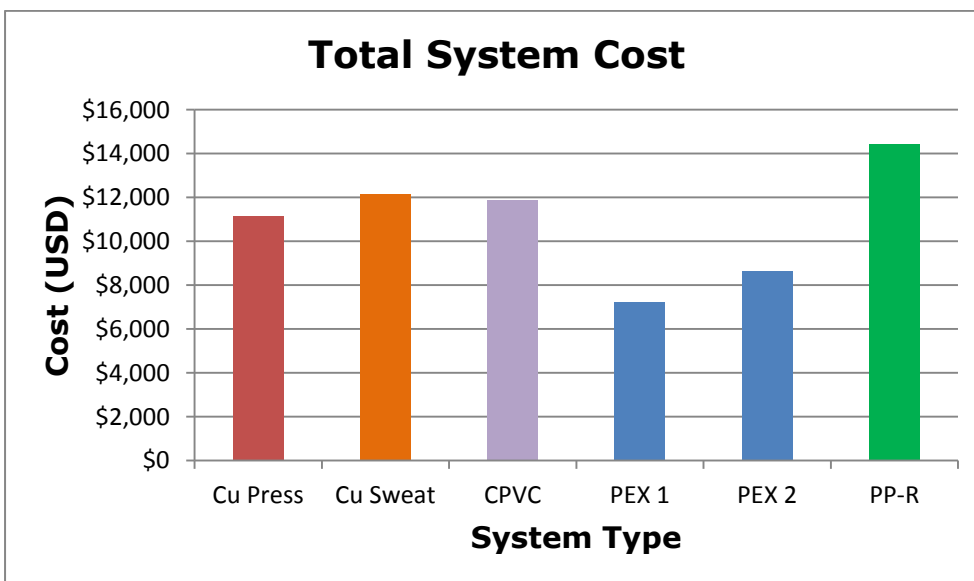
Table 7: PP-R System Costs

| System Type | Labor Hours | | Cost (USD) | | |
|--------------------------|-------------|---------|------------|------------|-------------|
| | Piping | Hangers | Materials | Labor | Total |
| Copper Press | 32.10 | 39.61 | \$5,763.99 | \$5,378.25 | \$11,142.24 |
| Copper Sweat | 48.30 | 39.61 | \$5,583.38 | \$6,593.25 | \$12,176.63 |
| CPVC | 27.30 | 79.22 | \$3,913.92 | \$7,989.00 | \$11,902.92 |
| PEX 1 (20'-0" straights) | 30.75 | 34.95 | \$1,942.01 | \$5,277.00 | \$7,219.01 |
| PEX 2 (10'-0" straights) | 31.50 | 51.26 | \$2,418.40 | \$6,207.00 | \$8,625.40 |
| PP-R | 40.12 | 88.54 | \$4,772.97 | \$9,649.50 | \$14,422.47 |

Table 8: Overall System Comparison



Graph 1: Overall Labor Hours Comparison



Graph 2: Overall Project Cost Comparison

Pipe Weight

The weight of the piping materials is important to consider for both installation labor time and structural requirements. Added weight not only puts more stress on the structure itself, but on the laborers who have to install the product. **Table 9** shows the weights of the various piping materials.

| Nominal Pipe Size (inches) | System Type | | | |
|----------------------------|------------------------|-------------------|---------------------|-------------------|
| | PEX ¹ | CPVC ² | Copper ³ | PP-R ⁴ |
| | Weight of Pipe (lb/ft) | | | |
| 1/2 | 0.06 | 0.09 | 0.29 | 0.10 |
| 3/4 | 0.10 | 0.14 | 0.46 | 0.16 |
| 1 | 0.20 | 0.22 | 0.66 | 0.18 |
| 1 1/4 | 0.34 | 0.33 | 0.88 | 0.28 |
| 1 1/2 | 0.44 | 0.46 | 1.14 | 0.43 |
| 2 | 0.68 | 0.79 | 1.75 | 0.68 |

Table 9: Weight of Piping (lbs.)

Notes:

1. PEX is SDR-9 type, with copper tube size (CTS) controlled O.D.
2. CPVC is SDR-11 type, with CTS controlled O.D.
3. Copper is Type "L".
4. PP-R is SDR-11 type.

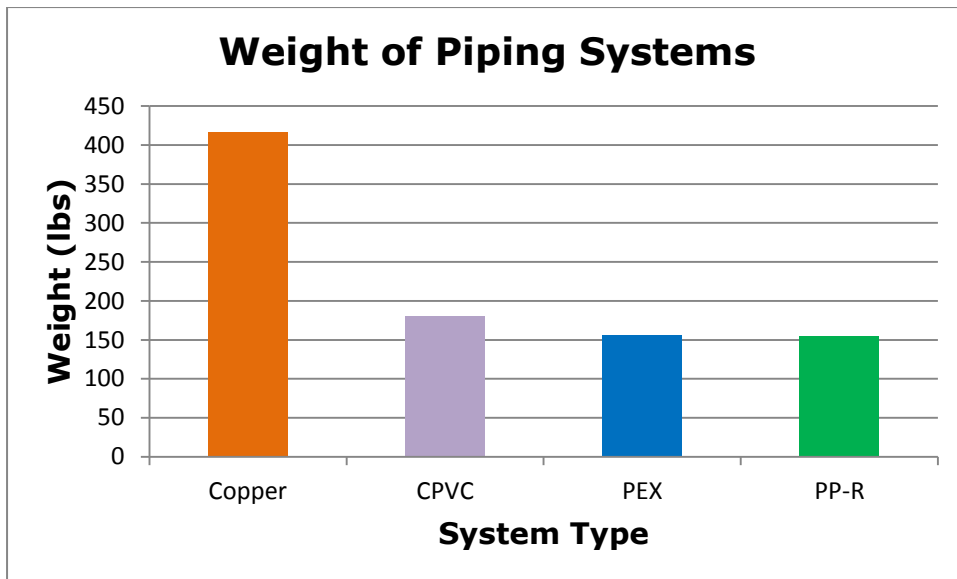
Using the pipe weights in **Table 9**, the total system weights were then calculated for the 100-foot pipe run used in the example above. Taking into account the weight of the pipe only (no water), the piping systems would weigh:

| Nominal Pipe Size (inches) | Pipe Length (feet) | System Type | | | |
|----------------------------------|--------------------|----------------------|-------------------|---------------------|-------------------|
| | | PEX ^{1,5} | CPVC ² | Copper ³ | PP-R ⁴ |
| | | Weight of Pipe (lbs) | | | |
| 1 | 100 | 20 | 22 | 66 | 18 |
| 2 | 200 | 136 | 158 | 350 | 136 |
| Total System Weight (lbs) | | 156 | 180 | 416 | 154 |

Table 10: Weight of Piping Systems from Example (lbs.)

Notes:

1. PEX is SDR-9 type, with copper tube size (CTS) controlled O.D.
2. CPVC is SDR-11 type, with CTS controlled O.D.
3. Copper is Type "L".
4. PP-R is SDR-11 type.
5. Although not included, the PEX-a Pipe Support would add roughly 90 lbs. to the system weight.



Graph 3: Weight of Piping Systems from Example (lbs.)

In comparison, the CPVC system weighs almost 13% more than the PEX system, and the copper system weighs 63% more than the PEX system.

As noted above, the weights listed are for the pipe only due to variations in fitting weights between manufacturers.

Also, because the PEX system utilizes PEX-a Pipe Support to achieve a greater hanger spacing, it is important to consider the added weight of that product. In the example above, the PEX-a Pipe Support would add roughly 90 lbs. to the weight of the system, bringing the total to 246 lbs. respectively. This is still 40% less than the copper system.

Conclusion

Overall System Costs (lowest to highest)

% Increase

| | |
|------------------------------|--------|
| 1. PEX 1: \$7,219.01 | |
| 2. PEX 2: \$8,625.40 | (+16%) |
| 3. Copper Press: \$11,142.24 | (+35%) |
| 4. CPVC: \$11,902.92 | (+39%) |
| 5. Copper Sweat: \$12,176.63 | (+40%) |
| 6. PP-R: \$14,422.47 | (+49%) |

Total Labor Hours Required (lowest to highest)

| | |
|------------------------|---------|
| 1. PEX 1: 70.36 | |
| 2. Copper Press: 71.71 | (+.01%) |
| 3. PEX 2: 82.76 | (+14%) |
| 4. Copper Sweat: 87.91 | (+19%) |
| 5. CPVC: 106.52 | (+33%) |
| 6. PP-R: 128.66 | (+45%) |

Number of Hanger Assemblies Required (lowest to highest)

1. PEX 1: 15¹
2. Copper: 17¹²
3. PEX 2: 20¹
4. CPVC: 34¹
5. PP-R: 38¹

Note:

1. Length of run in example is 100'-0".
2. Since the example included a 1" nominal pipe, the copper system required hangers at 6'-0" O.C.

Overall System Weights (pipe only)

| | |
|---------------------|---------|
| 1. PP-R: 154 lbs. | |
| 2. PEX: 156 lbs. | (+.01%) |
| 3. CPVC: 180 lbs. | (+14%) |
| 4. Copper: 416 lbs. | (+62%) |