Why proper design and installation are so important—

To protect our water supply

Plumbing installation practices can impact drinking water quality. Copper is an acute contaminant that can cause gastrointestinal upset and other health problems. Installing copper pipe incorrectly can increase the copper concentration in drinking water above the national water quality standard. Metal shavings left in the pipe can also impact taste and odor.

To protect our environment

Like other heavy metals that accumulate in San Francisco Bay, excessive copper has a negative environmental impact. ***Of the copper discharged to the Bay from wastewater treatment plants, about 60% is believed to be from copper pipe corrosion.*** Copper is acutely toxic to plankton, and accumulates in shellfish, affecting their reproduction and growth. Impacts to these and other species can upset the natural balance of species.

STOCKBYTE/PHOTOS.COM SHERYL GRIFFIN/PHOTOS.COM

BAPPG BAY AREA POLLUTION PREVENTION GROUP

The **Bay Area Pollution Prevention Group (BAPPG)** is a committee of the Bay Area Clean Water Agencies (BACWA) that develops Bay Area-wide pollution prevention programs. (BACWA is a joint public powers authority whose members include public utilities that collect and treat municipal wastewater from the nine Bay Area counties.) To this end, BAPPG initiated a public education program focused on promoting pollution prevention through individual actions.

Visit **www.baywise.org** to learn more about how you can reduce water pollution and protect local creeks, the San Francisco Bay, and the Pacific Ocean. This website has information on a wide range of pollutants, such as pharmaceuticals, copper, mercury, used cooking oil, and household and gardening products.

Graphics Sources:

Copper Tube Handbook, Copper Development Association (CDA), 2002.

Edwards et al., "Lead and Copper Corrosion Control in New Construction," Water Research Foundation (WaterRF), 2011.

Lewis, Richard, "A White Paper Review: History of Use and Performance of Copper Tube for Potable Water Service," Washington Suburban Sanitary Commission, 1999.

Yeager, Thomas, "Copper Corrosion Reductions Associated with the Design and Construction Practices of Piping Systems, Heating Systems, Cooling Systems, and Hot Water Circulating Systems," Kennedy/Jenks, June 1995.

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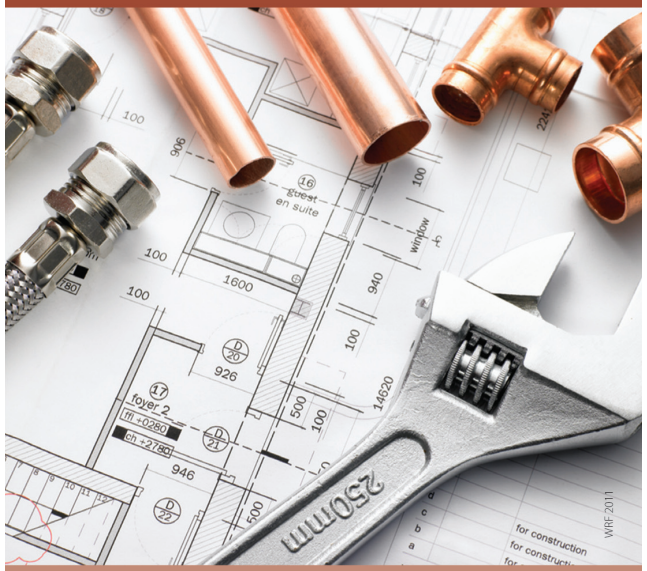
Proper Copper Pipe Installation



✔ protects drinking water

✔ protects the Bay

Proper Design and Installation Steps

☐ **System design**
- ✔ Minimize direction and size changes.
- ✔ Avoid stagnant sections.
- ✔ Minimize velocity (< 8 ft/s in cold lines, and <4-5 ft/s in hot lines).

☐ **Storage Protection**
- ✔ Protect pipe from weather and damage.

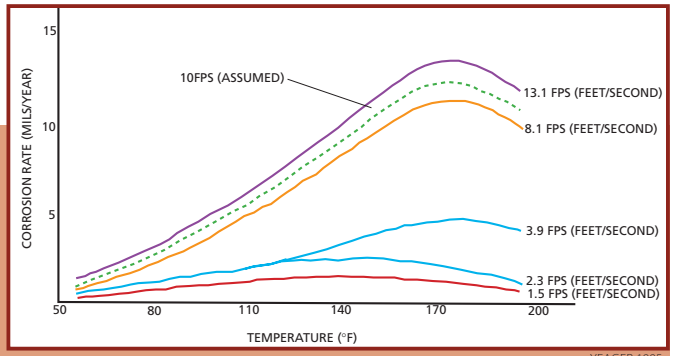
☐ **Careful reaming and cleaning**
- ✔ Eliminate small burrs created from pipe cutting. This prevents metal shavings from causing taste/odor issues and reduces turbulence, thereby decreasing corrosion.
- ✔ Remove all oxides, debris, and surface soil from tube ends.

☐ **Select the correct flux, and avoid excess**
- ✔ Select only flux with the "ASTM B813" standard to limit flux corrosivity.
- ✔ ***Avoid*** petroleum-based flux as it cannot be effectively flushed out of the pipe.
- ✔ ***Avoid*** ammonia-based flux as it attracts bacteria, which may impact taste and odor.
- ✔ ***Avoid*** zinc-based flux due to water quality impact.
- ✔ ***Avoid*** using excess flux; residue can increase pipe corrosion.

☐ **Immediately flush the system**
- ✔ Remove aerator and strainer screens.
- ✔ Flush system at a velocity of 3.6 feet/second for at least 30 minutes.

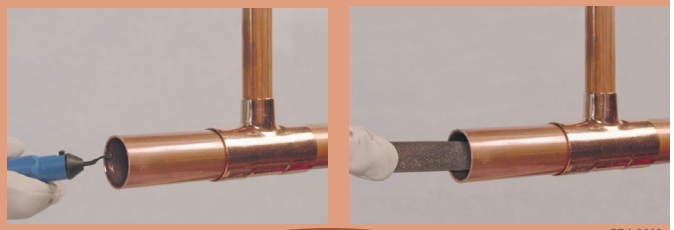
☐ **Building commissioning and operation**
- ✔ Avoid "shock chlorination" unless required by code.
- ✔ Minimize hot water temperature; a system temperature of 125°F is recommended.
- ✔ For inactive buildings, flush the system once a month. Stagnant water corrodes pipe.

Physical factors, such as flow velocity and water temperature, significantly affect pipe corrosion rate.

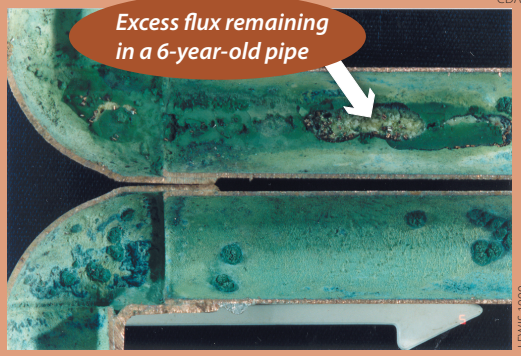


YEAGER 1995

Skilled reaming, prior to soldering, removes burrs and rough edges. This removes spots where turbulence can occur, thereby reducing corrosion. It also removes metal shavings that could affect taste and odor.


CDA 2002

Appropriate choice of flux and careful reaming and cleaning are key to avoiding pipe corrosion. Excess flux that has not been effectively flushed can create physical pitting in the pipe, increasing copper corrosion.



LEWIS 1999

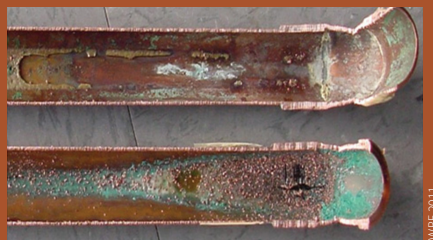
For line flushing, how much is 3.6 feet/second?

½ inch pipe	2.2 gal/min
¾ inch pipe	5 gal/min
1 inch pipe	8.8 gal/min
1½ inch pipe	20 gal/min
2 inch pipe	35 gal/min

WaterRF 2011

If flux is not flushed, a visible water quality impact occurs in water that is stagnant for three weeks.

The corroded pipe at right is from a 500-unit condominium complex. This corrosion was rapid, occurring prior to wallboard installation.


WRF 2011

What happened?
The installer used a flux that was not ASTM B813 compliant, and did not flush excess flux after installation.