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# North American Historic Landmarks Rely on Copper

*Beyond its beauty, copper offers durability, versatility and longevity – properties with which other building materials can't compete*

Each year, the Copper Development Association awards a handful of new and recently restored buildings in the U.S. and Canada that utilize architectural copper and copper alloys in their design. Award recipients include a variety of government buildings, academic facilities, houses of worship, upscale residences and many more—most of which are now considered historic landmarks. But why is it that we see so many landmarks using copper?

Known as mankind's oldest metal, copper delivers an unparalleled beauty while providing durability, longevity and malleability, making it a preferred building construction material, time and time again. For centuries, copper elements have contributed to a project's architectural significance and have been prominently showcased in the landscape of building design.

"Copper's natural patina has a very attractive appearance as it ages, and also when it has aged," said Nick Lardas, owner of Niko Contracting, located in Pittsburgh, PA. "What makes it most attractive though, is that it's a life-long material—a copper roof can last for more than 100 years if it's built right."

While copper adds a sense of grandeur to any building, it is also widely known for its durability.

Outdoors, copper and its alloys like brasses and bronzes can withstand harsh exposure to the elements and wear from constant use better than any other material. It will not rust, yet, gradually, copper attains an attractive, stable patina that enhances the appearance of statues, roofs and other decorative and architectural applications.

CDA recently honored the Old Courthouse in St. Louis, MO with a North American Copper in Architecture Award (NACIA) for the restoration of its age-old copper roof. Constructed in 1828, the Old Courthouse is considered one of the country's most prominent architectural landmarks, as it has been the site for several important legal cases, including the first two trials leading up to the Dred Scott decision. Originally, the courthouse roof was designed using a tin and timber roof structure; however, the National Park Service (NPS) replaced the original roof with copper when it took the building over as part of the Jefferson National Expansion Memorial in 1941. In order to preserve this important landmark, the NPS sought to design a replacement roof with the intention of staying true to the building's historic design. Because of its durability and longevity, copper was selected as the appropriate replacement material.

The Old Courthouse in St. Louis. Photo Credit: Quinn Evans Architects - Ann K Dilcher

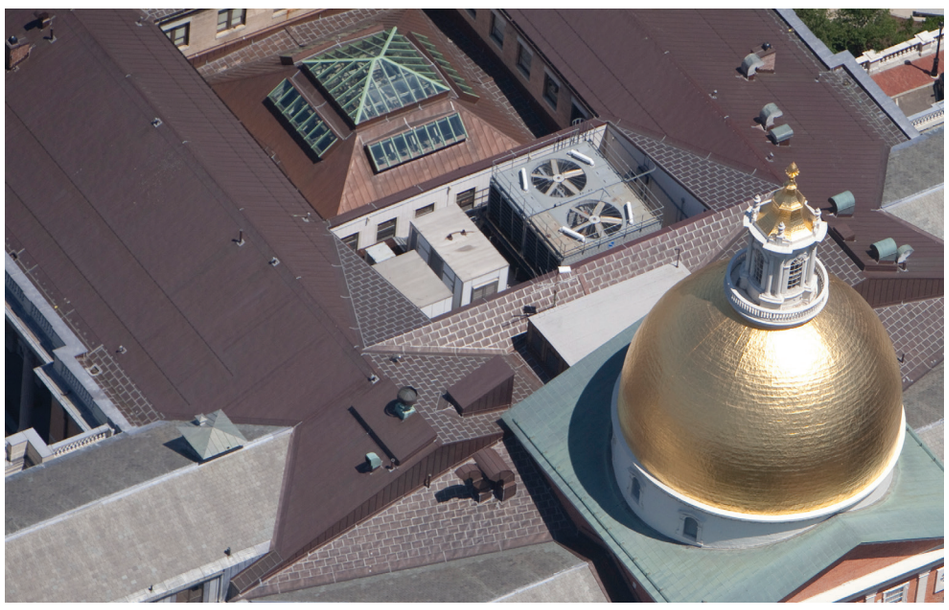
Longevity? Yes. While all structures experience wear-and-tear over time, architects and contractors can trust copper will not deteriorate or corrode with age. As a result, this metal is often used on buildings designed to last a lifetime, or longer.

"Copper has been chosen throughout history because it's a very long-life product, and also because it's one of the easier sheet metals to work with in terms of forming, joining and soldering," said Lardas, who has worked with the metal for more than 40 years.

In 2008, the Library of Parliament in Ottawa, Ontario underwent a major restoration on one of the most prominent features of its structure—its magnificent copper roof. First opened in 1877 after 18 years of construction, the main objective was to give the library an extended life span of 50 additional years. Since a properly designed and installed copper roof should last upwards of 100 years or more, the newly installed copper roof should still be performing as intended for years to come. Eventually, the roof will feature a beautiful natural patina, typically associated with buildings on Parliament Hill.

Copper is also often used because it is extremely malleable and formable—it can be formed, bent and stretched into complex and intricate surfaces without breaking. This makes it possible to easily create spires, steeples, domes, non-linear roofs and walls, as well as complicated dormers, fascia and the like.

In 2012, the Massachusetts State House—known as the 'Hub of the Universe' in the Massachusetts political system—completed a brand new roof restoration. Erected in Boston in 1795, the dome was originally covered by wood shingles and, later, gold leaf. However, in 1801, it became the first building in North America to ever apply cold-roller copper. The roof system on the State House is truly one-of-a-kind in design and functionality. Twenty and thirty-two ounce copper adorns the majority of the State House because of its workability, aesthetic appearance and historical significance to the building itself. The design creates a fully-functional masterpiece that protects the contents below and preserves the historic nature of this monument to American history.



The Massachusetts State House Building. Photo Credit: The Commonwealth of Massachusetts Division of Capital Asset Management & Sky High Enterprises

"Iconic buildings that played notable roles in establishment of the United States—from Ellis Island to the U.S. Capitol—are continuously looking to copper to protect and adorn them, even today," said Andy Kireta Jr., vice president of CDA. "While many historic landmarks turn to copper during restoration, we also see copper used in new and innovative ways—like for intricate wall-cladding systems, for example—in an effort to increase the lifespan and beauty of buildings that could very likely become landmarks in the future."

For more information about copper in architecture visit www.copper.org. **Cu**

A plumber prepares the copper piping on racks at the warehouse. Photo Credit: Angela Richardson Photography

# Copper Proves to be the Superior Piping System for Hospital Expansion Project

*Unique building design, versatility and reliability make copper pipe the better choice over black steel for plumbing and mechanical systems*

When it came time to install the plumbing and mechanical system at the Nemours/A.I. DuPont Children's Hospital in Wilmington, Delaware, the shape of the new building created some unforeseen challenges for the contractor.

The semi-circular design of the new $215 million, five-story hospital building required a large-diameter piping system that was lightweight, malleable and easy to work with. Black steel pipe — the material originally specified for the project — did not meet the criteria and was proving to be difficult for the job. As a result, Binsky/Snyder Mechanical Contractors, SkanskaUSA and AEI Engineers, as a group, decided to contact the Copper Development Association (CDA) for assistance.

On the advice and recommendation of CDA, the hospital opted to go with a copper piping system instead of black steel pipe. Copper tube, of various sizes, is now being installed for domestic hot and cold water service, HVAC systems as well as for medical gas distribution. Copper's superior performance, durability, versatility, reliability, resistance to corrosion – as well as its ease for bending and fabrication – ultimately made it the better option for this project.

"We got a call from the engineer on the project asking about bending copper tube in sizes up to 2 1/2 and 3 inch so that they could have it wrap around two football-shaped additions," said Dale Powell, project manager and piping application specialist for CDA. "Following discussions with the engineer and installing mechanical contractor, it was determined that the amount of bend required would be well within the limits for copper tube and could easily be accomplished by several local pipe bending companies."

Using modular construction techniques — including mechanically formed extruded outlets which effectively reduce the number of tee fittings and soldered or brazed joints needed — CDA was able to assist the engineering team in creating curved copper tube assemblies to meet the project's design and ensure its functionality. As a result, the entire large-diameter piping work was done using copper.

According to Michael Duffy, project manager for Binsky & Snyder, by applying this type of joining technique, they were able to work faster and more efficiently, providing a much better installation at a lower system cost, despite material prices being higher.

"Given the radius of the building, the bending required and the weight of the piping, it was much easier for us to work with copper than steel pipe," added Duffy.

The project design team was also able to pre-fabricate the plumbing modules for the bathrooms and medical gas system offsite in a warehouse just 10 miles away. This aided in expediting the project. Using a series of rack systems, the piping was transported to the site, once it was ready to be installed. Powell noted that the piping project should be completed this spring.

When complete, the hospital expansion will consist of a 144-bed unit with underground parking. The parking garage will also connect to the existing building by means of a three-story connecting link. The building's first floor will contain a new emergency department, atrium, retail and dining facility.

In addition to this project, CDA has also worked with SkanskaUSA on the piping systems for the $1.2B University Medical Center Project in New Orleans, Louisiana. It is estimated that the new University Medical Center will use more than 12-1/2 miles of copper tube when it is completed.

To learn more about copper piping systems or making mechanically formed extruded joints, visit www.copper.org. **Cu**

# Copper Industry Advises Plumbing Professionals in Soldering New, No-Lead Copper Alloys

*New Legislation Prompts the Copper Development Association to Revisit Soldering Techniques for Making Proper Joints*

New federal legislation enacted earlier this year lowered the acceptable levels of lead that can be found in plumbing components used for potable water applications. The Reduction of Lead in Drinking Water Act (RLDWA) was designed to keep the general public safer by reducing exposure to lead that can potentially contaminate tap water and is typically leached from pipes, faucets and other plumbing fittings and components.

The Act not only affects the consumer, but also the manufacturers, retailers, plumbers, contractors and technicians who make, sell and install these plumbing components and fittings for use in homes, schools, hospitals, offices and commercial buildings throughout the United States.

Copper tube and fittings have always been lead-free, however many copper alloys like some brasses and bronzes have included small amounts of lead in their composition to provide beneficial machining properties, allowing the production of complex parts. Across the industry, copper-based alloys like brass and bronze are the most commonly used materials for valves, backflow preventers, faucets and other plumbing fittings. The significant reduction in allowable lead content – from 8 percent of the total volume of the component, to a weighted average of 0.25 percent of the total surface area of the component in contact with the water (wetted surface area) – affects the chemical composition of copper alloys that can be used for potable water applications, as well as the design of components made from these alloys.

Concerns related to the cleaning methods, types of fluxes, size of the torch tips and solderability between copper tube and these new no-lead copper alloys began to surface as manufacturers began to comply with the RLDWA. To address these concerns, the Copper Development Association (CDA) conducted laboratory research and testing out in the field. They found that, in many cases, those working with the new no-lead copper alloys — which use bismuth, silicon, sulfur, selenium or other elements in place of lead — were using the incorrect soldering procedure, particularly when it came to the heating techniques used while making a joint.

"Perfectly good joints can be made using no-lead, brass and bronze copper alloys as long as the joint is heated correctly," said Andy Kireta, Jr., vice president of CDA. CDA has been recognized as the industry expert on the use, application and soldering of copper and copper alloys for over a half a century.

CDA discovered that the most common mistakes when making a soldered joint with the new alloys occurred during both preheating and the actual heating process. Because some of the newer alloys have different thermal conductivity properties than the older ones, the proper amount of heat and the location where it is applied play a pivotal role.

"During preheating, we found that many installers began heating the joint by applying the torch directly to the fitting or component cup, ignoring the tube while attempting to bring the entire joint assembly up to soldering temperature," said Kireta. "During the soldering process, once the joint is at soldering temperature, installers tend to focus all of the heat at one point at the base of the fitting or component cup while applying solder at either one point or around the entire joint. Both of these habits are incorrect, and can lead directly to poor soldered joints."

Andy Kireta Jr. demonstrates proper soldering. Photo Credit: Copper Development Association

The improper application of heat during the soldering process can result in faulty joints, causing it to leak or fail. To aid those in the plumbing industry, CDA has developed a new do-it-yourself video that demonstrates how to properly solder copper tube and fittings to the newer, no-lead, brass and bronze copper alloys. The video, *Soldering of No-Lead Copper Alloy Fittings, Valves and Components,* is now available on the CDA YouTube Channel and the copper.org website.

Additionally, CDA has written a white paper on the topic titled, "Recommended Practices for Soldering No-Lead Copper Alloys," which can be downloaded at www.copper.org. For detailed instructions on soldering, plumbing professionals can also refer to the ASTM B828 standard or the CDA Copper Tube Handbook, now available as a downloadable app for both Apple and Android users. **Cu**



For more information on the technical uses of copper in building construction, please contact the Copper Development Association at 212-251-7200 or visit the website at www.copper.org.