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Discover COPPER

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Illustration Courtesy of ECR Technologies

NEW HOME HEATING & COOLING SYSTEM IS EASIER ON THE WALLET – AND THE ENVIRONMENT

As fuel prices continue to rise, many homeowners are looking for new, more energy-efficient means of heating and cooling their homes. One system praised for being both highly efficient and environmentally friendly is geothermal heat pump (GHP) technology.

Unlike conventional heating systems, geothermal, also known as ground-source or Geoexchange systems, don't burn fossil fuels to produce heat. Instead, they use the supply of natural thermal energy located just below the earth's surface.

Compared to the air outside, which varies from hot to cold depending on the season, the temperature just a few feet underground remains at a relatively constant 50 to 60 degrees Fahrenheit year-round.

Many animals take advantage of this warmth by burrowing holes in the ground where they hibernate away from winter's cold. Similarly, geothermal heating systems employ buried pipes to access the earth's warmth for indoor heating.

Direct and efficient

There are several types of geothermal systems, but the most efficient is a technology called direct-exchange (DX) geothermal, which uses copper piping to harvest the earth's energy.

(Heating/Cooling continued on back)

A Fixture in American Homes

Most people don't spend a lot of time thinking about their home's plumbing. After all, it's not very exciting, and benefits like hot showers, clean drinking water on tap and indoor toilets are things we take for granted today.

However, it took awhile for bathrooms to progress to current standards. As late as 1940, almost half of the nation's homes still lacked complete indoor plumbing. It's only within living memory that a chain of inventions – from flexible copper tubing to flush toilets to home air-conditioning systems – started America on its road to better hygiene, not to mention more comfortable living conditions.

75 Years and Counting

Copper tubing, which helped make indoor plumbing accessible and affordable to all, was a technological advance of greater significance than most people realize. Before it came along, indoor water systems using jointed iron, steel, lead or brass pipe were difficult and expensive to install and maintain, and were found in only the most posh homes. Sometime around 1927 (the exact date is lost in history), metal manufacturers introduced a new type of lightweight yet durable drawn copper tube that could be quickly soldered together with inexpensive copper fittings. This revolutionized plumbing and created the type of indoor water systems virtually every home uses today.

In 2003, to commemorate the 75th anniversary of this historic milestone, the Copper Development Association (CDA) launched a nationwide search for the oldest surviving example of authentic indoor copper plumbing. Many candidates were identified and investigated, but a home with copper tubing dating to 1927 has yet to be found. Several early systems examined by CDA experts turned out to have "red brass" piping, a predecessor to copper tubing that contains zinc and can easily be mistaken for true "thinwall" copper systems.

However, recently a Fort Wayne, Indiana, residence was discovered with its original copper plumbing system still in good working order. Installed nearly 70 years ago, this home's copper pipes continue to function long after many of its other building materials have been replaced. The search for even older copper tubing systems continues.

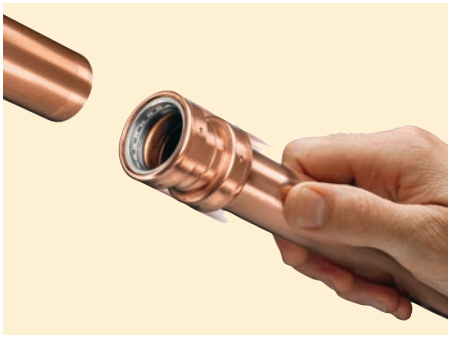


Photo Courtesy of NVent

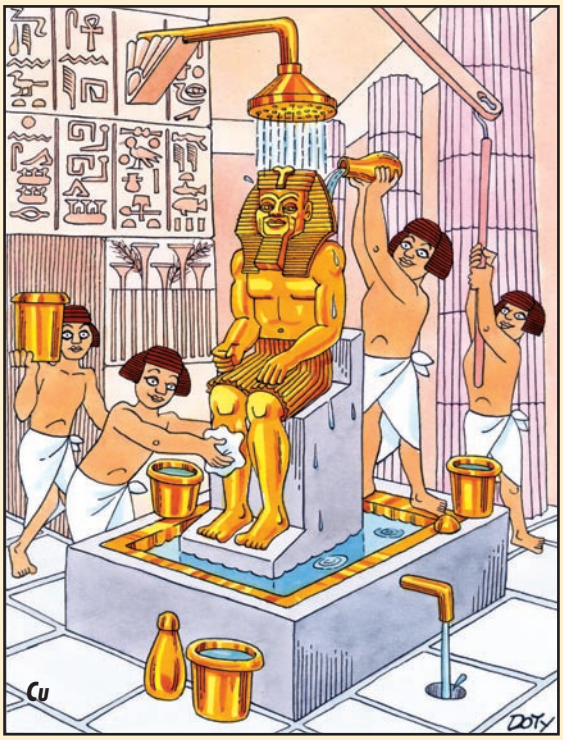
Flame-free copper joining technology like this PermaLynx system from NVent is an exciting new technology for the plumbing industry.

New Plumbing Technology

The advance of copper technology in home applications continues as well. One of the most exciting innovations is a flame-free method of permanently joining copper pipe. This new "Push-to-Connect" system uses specially designed fittings to mechanically connect the tube without the use of expensive, specialized tools.

Other copper piping applications today include residential fire sprinklers, snowmelt systems and energy-efficient home solar-heating systems. Another technology that is currently experiencing a resurgence in the home is radiant heating, which uses copper pipe embedded in or under the floor to heat a room.

The fastest growing area for copper tubing, however, is for fuel gas. More home builders are installing gas these days, says Rick Schaffer, a representative for Mobile Gas in Alabama, which is training its employees to install gas supply lines using copper tube. Copper tubing is the most economical choice for connecting appliances like gas ovens, water heaters, fireplaces and outdoor barbecues to a natural gas or propane supply. Cu



EGYPTIAN PHARAOH HAD COPPER PLUMBING

The ancient Egyptians were advanced in many fields including astronomy, construction and irrigation. They were also some of the earliest coppersmiths and made copper vessels, tools and the pipes used for their irrigation systems. It should come as no surprise that they were advanced in matters of indoor plumbing, as well.

In 1994, archeologists excavating the remains of a 4,500-year-old Egyptian funerary pyramid complex unearthed a sophisticated copper drainage system.

Located in Abusir in Northern Egypt, the pyramid is believed to be the oldest of many pyramids found in this region, which is just south of the Nile River. It served as the final resting place of King Sahure, the second King of Egypt's 5th Dynasty, who ruled from 2517 to 2505 B.C.

Ancient Egyptians believed the dead enjoyed the same earthly delights as the living, so they built elaborate temples alongside the pyramids where royalty were entombed after they died.

Copper pipe was found inside the temple closest to the pyramid — which is called the "mortuary" temple. Here priests assembled daily to present food and other objects as offerings to the dead king's spirit.

Only the finest materials were used to build the temple, which consisted of an elaborate entrance hall, courtyard and sanctuary made with white limestone ceilings, alabaster floors and red granite columns. Magnificent relief paintings of the king hunting, fishing and trampling his enemies covered the inside walls, while multiple statues of the king were displayed inside the sanctuary.

Experts speculate that the copper pipes, which extended some 330-yards along a causeway leading to another temple, were used to drain well water that was hand-carried into the temple to bathe the king's statues. These statues were anointed with oil as part of daily purification rituals.

Although the overall condition of the pyramid and temples today is poor, the copper piping has survived, attesting to the longevity of copper plumbing. *Cu*

(Heating/Cooling continued)

Here's how geothermal DX works:

- In the winter, a refrigerant is circulated through a closed-loop system made from copper tubing. Copper, an excellent heat conductor, transfers the warmth from the earth to the refrigerant.
- As the refrigerant is heated, it becomes a vapor and is sent to a compressor located inside the home.
- The compressor, which makes about as little noise as a refrigerator, raises the vapor's temperature to 130-160 degrees, then sends it to a copper coil located inside the home's air handler system.
- The air handler blows cool air over the hot coils (similar to the way air circulates through a typical oil- or gas-fired furnace) then distributes the heated air through the home's ductwork.

In the summer, the system is reversed:

- The air handler takes hot air from inside the home and blows it over indoor coils filled with refrigerant.
- The cooled air is then distributed throughout the house, while the refrigerant (now a vapor) is sent through the underground copper loop, where its heat is transferred to the earth.

For additional energy savings, DX systems are frequently designed with another heat exchanger connected to the hot water system that produces hot water using heat from the ground.

Geothermal DX is not only more energy-efficient than systems that burn fuel for energy, it also supplies more consistent heating, according to Don Creyts, president of Advanced Geothermal Technology, which has been installing geothermal DX systems since 1989.

While forced air furnaces are notorious for producing short blasts of intense heat that rob moisture from the air – leading to dry skin and other ailments – geothermal DX systems have longer operating cycles that produce a steady stream of 100-degree heat. This is only slightly higher than the body's own temperature, so it isn't as drying, says Creyts.

So, when system comfort is compared, DX geothermal wins again.

DX geothermal also outperforms water-based GHPs, which utilize plastic, not copper pipes underground. Plastics can't transfer heat as effectively as copper, says Creyts, nor can they carry refrigerant. Instead of refrigerant, a solution of water and antifreeze is circulated through the pipes. The liquid absorbs some of the adjacent ground heat, but must be pumped aboveground before it can transfer its heat to a refrigerant. This extra heat exchange, says Creyts, uses more energy, making plastic pipe systems less efficient than copper.

In comparison, the only energy costs associated with DX systems is the electricity needed to run the compressor unit and the fan inside the air handler, Creyts says.

Energy experts say that homeowners who purchase a DX geothermal system can recoup their initial investment in 3 to 5 years, depending on the local cost of electricity. However, many states and municipalities offer tax incentives, which can greatly speed the rate of return.

According to ECR Technologies, which began marketing DX geothermal systems in 1992, homeowners can easily retrofit their homes with a DX system by making minor modifications to their current air handler system and installing the copper earth loops and the compressor unit. *Cu*

RESOURCES:

This edition of Discover Copper is also available online at www.copper.org. For more information on the companies mentioned in this newsletter go to:

www.geoexchange.org — Geothermal Heat Pump Consortium

www.advgeo.com — Advanced Geothermal Technology

www.ecrtech.com — ECR Technologies

www.touregypt.net — Tour Egypt

www.nbm.org — National Building Museum