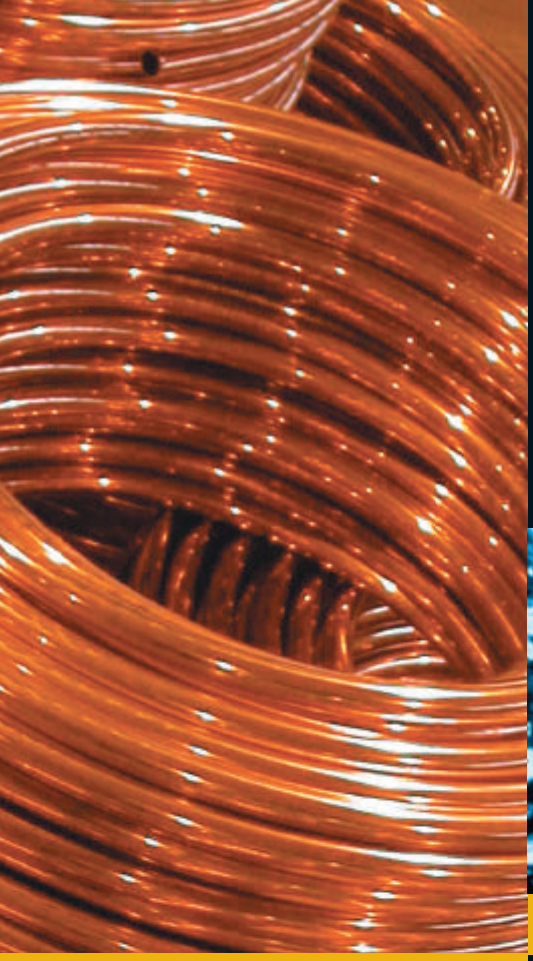
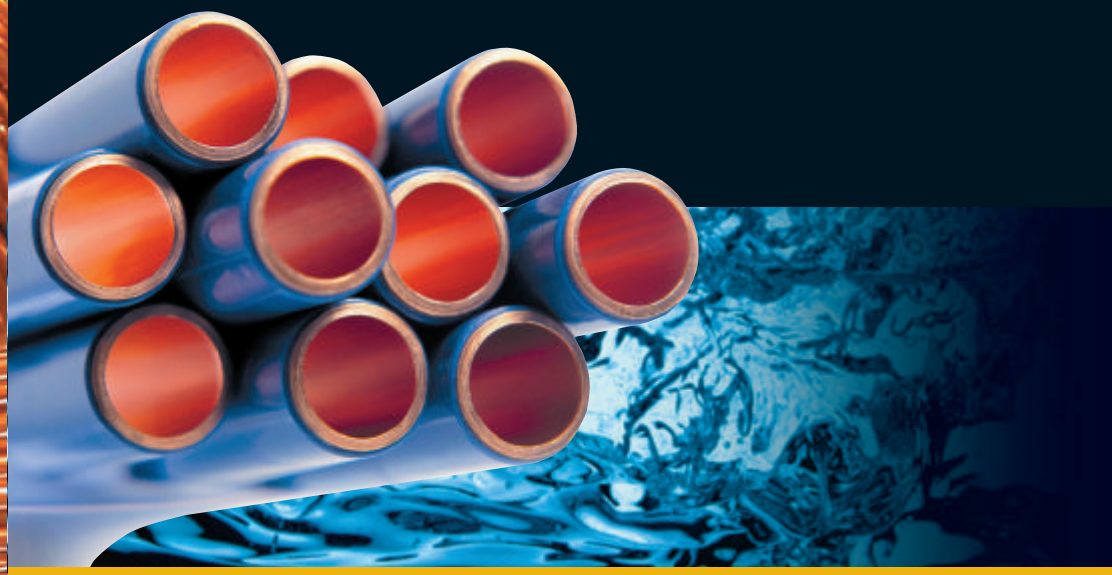


UNDERGROUND COPPER WATER SERVICES

COPPER THE COLOUR OF TRUST

CANADIAN COPPER & BRASS DEVELOPMENT ASSOCIATION

UNDERGROUND COPPER WATER SERVICES



COPPER THE COLOUR OF TRUST

The importance of a reliable supply of safe potable water is clear to all Canadians today. Copper tube and fittings have played a vital role in the water supply infrastructure for decades and will continue to do so in the future. Now new copper and copper-alloy products are being introduced to meet the latest needs of water consumers and the industry.

Replacement of old lead water services has become a topic of significant attention in many localities in Canada. A section is included on this subject as well as the trend to lead-free alloys.

What about the alternatives?

"We've already pulled out some plastic ones that we installed a few years ago", reported one municipal waterworks employee in the CCBDA's most recent survey on underground water services. He was not the only one with this type of comment. There were others who expressed disenchantment and concerns with plastic lines.

"Well what's so great about copper? It's been around for ages." Exactly! Copper water services are renowned for providing trouble-free service for decade after decade after decade after... When you bury water lines below the frost line you have to be able to rely on the performance of the materials over the long term. The following sums up the situation very well[1].

When you are burying water lines as deep as we are in this area, you have to be confident that they will stand up to some pretty harsh conditions. That's why we use copper for services. It's no fun digging around here in January, and it gets pretty expensive with the special equipment needed. We know that copper will give us a dependable, cost-effective system, and see no reason to change to something that may be less reliable.

Installation specifications

Two authorities are usually involved when considering underground water services. (Figure 1) Both should be consulted when determining which Type of copper tube is to be used for a specific installation.

TUBE FOR WATER SERVICES

Types K & L tube

Type K or Type L soft temper copper tube is used for underground water services in sizes up to and including 2-in. For larger sizes, hard temper copper tube can be used, with brazed joints.

Long coils of soft temper tube allow underground water services to be installed without intermediate joints. Types K and L tube are available in lengths up to 100 feet (30 m). Longer lengths are available on request. Soft tube can also be bent around any obstructions or unevenness in a trench, and it adjusts readily to ground settlement.

Types K and L copper tube are manufactured in accordance with the requirements of ASTM Standard Specification B88, Seamless Copper Water Tube, and they are third-party certified to be in compliance with the Standard.

Polyethylene-coated copper tube

The corrosion resistance of bare copper tube buried in a wide-range of soils is well known. It has been documented in a number of papers by Cohen and others,[2] [3] and this attribute is clearly a major reason for the extraordinary performance of copper water services over the decades.

At the same time, changes in materials used for water mains and installation practices, as well as the increased occurrence of "hot" soils, have placed additional stress on copper services in certain areas.

Manufacturers have responded by producing polyethylene-coated copper tube for use where conditions warrant this additional protection[4]. These products are typically Type K copper tube with a polyethylene coating.

A related application for coated Type L copper tube is for underground lines under a concrete slab. Slab-on-grade construction is common in some localities in Canada, and the polyethylene jacket provides additional protection.

The first is the municipal waterworks which has control over the section of the water service from the water main to the property line of a house or building. Their specifications determine which Type of copper tube is used for their portion of the service, and may vary from what is allowed by the plumbing code. Industry data indicates that Type K copper tube is the material preferred by Canadian water suppliers, but some use Type L tube.

Plumbing codes also contain requirements for water services from the property line to the inside of the house or building. In 1970, there was a move to allow copper plumbing tube with slightly reduced wall thicknesses. As a result codes were revised to allow both Types K and L tube underground.

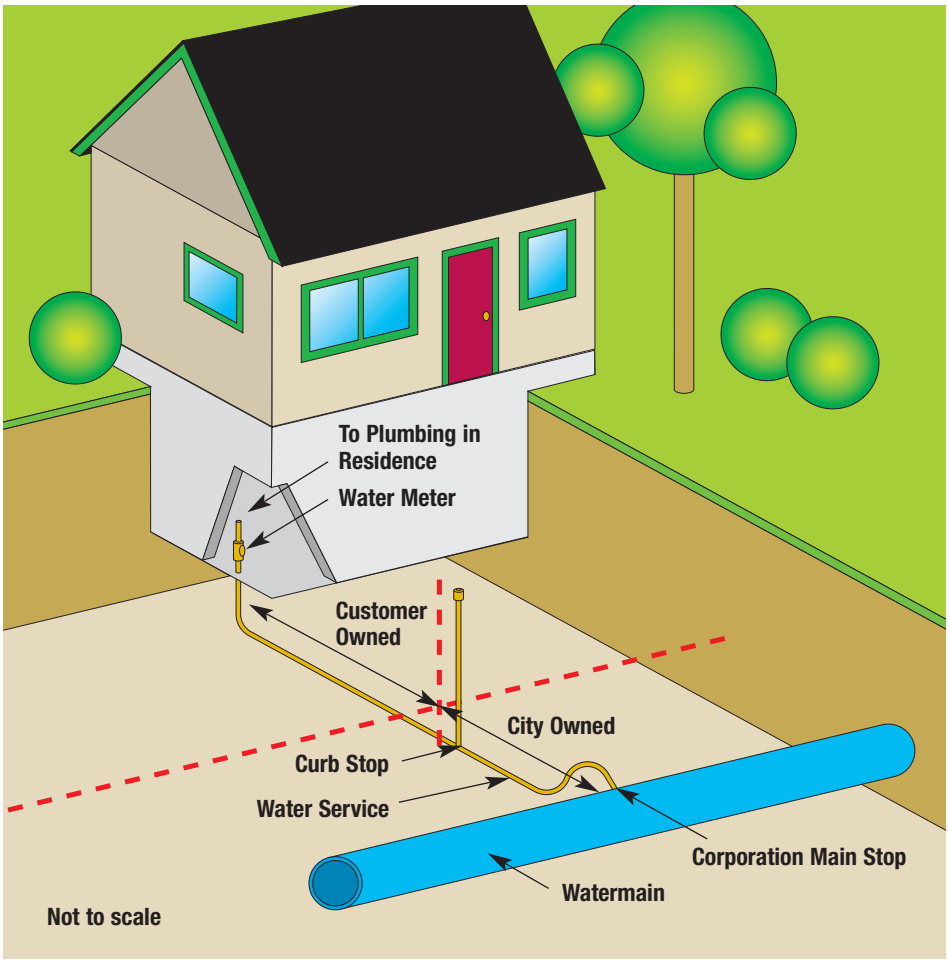
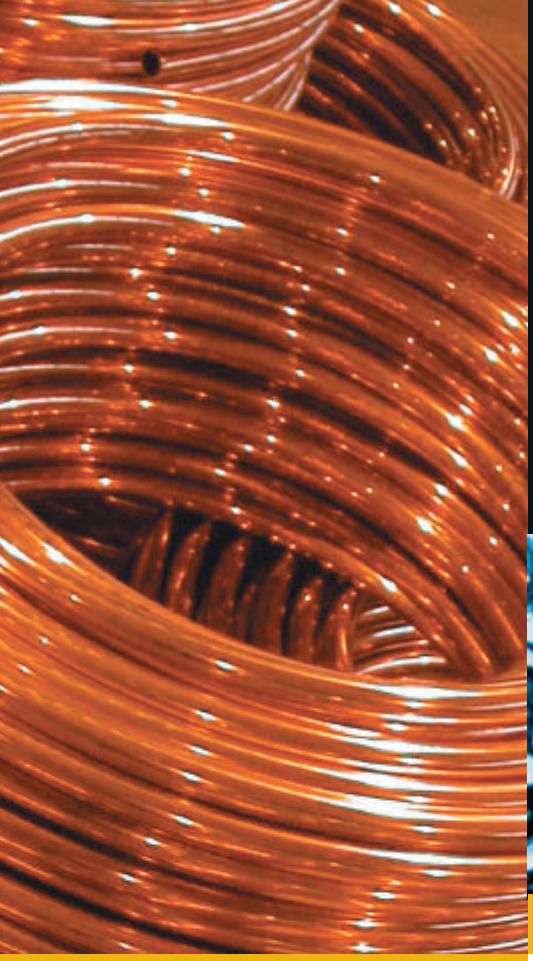


Figure 1: Schematic of underground water system.



WHAT'S NEW?

COPPER THE COLOUR OF TRUST

Lead-free fittings

In recent years, lead-free copper alloys that can be machined, forged and/or cast have been developed to replace lead-containing alloys. They are commonly known by such trade names as *ECO BRASS*®, *Federalloy*®, and *EnviroBrass*™ (Table 1). The lead-free alloys are used primarily for components that are in contact with potable water, while leaded alloys, such as C83600 and C84400, are used for components like top caps and nuts that are not in contact with water.

Waterworks products now available incorporating lead-free materials include corporation (main) stops, curb stops, meter valves, meter couplings, and accessories. They are designed and manufactured to meet the appropriate standards of the American Water Works Association (AWWA). Also they are evaluated and certified to the NSF/ANSI 61 Standard, Section 8. These waterworks products are being manufactured in Canada for customers throughout North America.

The City of Los Angeles began installing lead-free fittings and components in their municipal water distribution system in 1998. In Canada, Welland and Newmarket (Ontario) and Oliver (B.C.) now specify lead-free waterworks products. Cincinnati and New York City have also switched, and the trend is expected to accelerate in the next few years.

Replacement of lead services

In many Canadian cities where older neighbourhoods still have lead or galvanized steel water services, programs are in place to systematically remove and upgrade these services. Some of the service replacement programs are tied in with water efficiency or conservation initiatives, such as the installation of water meters.

Early in 2007, the City of Montreal announced the start of a multi-year program to replace approximately 75,000 lead services supplying water to residences of less than 8 units built before 1970. Toronto is in the midst of a program to replace about 140,000 lead or galvanized steel services, with an additional 180,000 old small-diameter services

Table 1: Lead-Free Casting Alloys

Copper Alloy UNS No.	Trade Name	Nominal Composition (%)[A]						
		Copper	Tin	Lead	Zinc	Silicon	Bismuth	Selenium
C87850	*ECO BRASS*[B]	76	-	-	20.9	3	-	-
C89833	-	89	5	-	3	-	2.2	-
C89833	*Federalloy*[C]	89	5	-	3	-	2.2	-
C89836	-	89.5	5.5	-	3	-	2	-
C89510	*EnviroBrass*	87	5	-	5	-	1.0	0.5
C89520	*EnviroBrass*	86	5.5	-	5	-	1.9	0.9

[A]ASTM Standard B584 for Sand Castings [B]Phosphorus 0.12% [C]With mischmetal

ECO BRASS® ingots for producing lead-free castings.

Cast waterworks fitting.

Compression coupling.

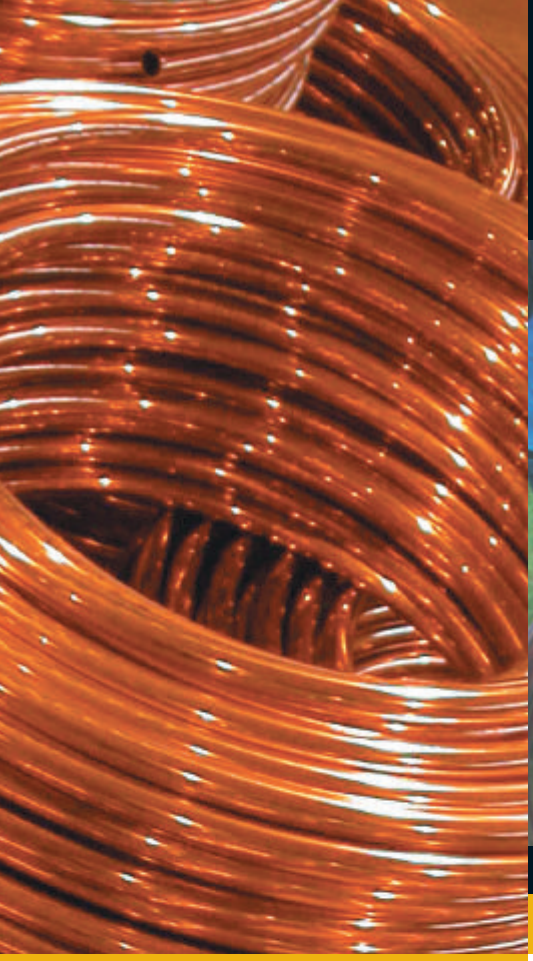
that need upgrading to either 3/4-in. or 1-in. Many other municipalities have lead water service replacement programs, including Ottawa, London, Winnipeg, and elsewhere.

The importance of the property line is illustrated in Figure 1. Municipal service replacement programs generally involve replacing the portion of the service from the main to the property line. The owners of the house or building are required to cover the cost of the section from the property line to the building. As a result, partial replacement of only the municipal portion often occurs.

Studies have revealed that there are problems with partial replacement for a number of reasons[5]. Lead levels can be extremely high after partial replacement, for example. Documenting locations where half-lead services remain becomes difficult, and there is an increase in future risk of exposure.

Full replacement of a lead service with copper should be mandatory. In some localities, financial assistance may be available for homeowners to change their portion of the service.

Backfilling of an underground water installation, showing the main, service, anode and curb stop.



INSTALLATION

Pneumatic (impact) moling is used by the City of Toronto*.

COPPER THE COLOUR OF TRUST

Installation methods

There are several methods of installing underground copper water services[6]. The open-trench method is the most obvious, but trenchless technology is particularly important when replacing services in established neighbourhoods while minimizing disruptions and property damage.

In the past, replacement of an existing water service involved excavating a trench from the curb stop at the water main along the length of the old service up to the entrance to the building. In a move to decrease costs, property damage and disruption to occupants, utility personnel are now working with a combination of excavation and pneumatic (impact) moling techniques.

In the impact moling method, the old service is simply disconnected and left in the ground and a new tube is installed along a parallel route. Access pits are dug at the ends of the route and an air-driven tool, commonly known as a torpedo, is allowed to work its way underground from one pit to the other creating a cylindrical passage. The torpedo is disconnected from the compressed air hose, a replacement coil of copper tube is attached and is pulled back through the bored passage.

Joining annealed tube

Workmanship is very important in making a joint that will perform without problems for decades. Soft temper copper tube is usually supplied in coils. The coiling process causes a slight ovality to form in the cross-section of the tube. A dull tube cutter can cause the same condition. Because of this, installers should always size and round the end of a tube before making a compression or flare joint. Joints made with a slightly out-of-round tube may suffer water leaks which may subsequently result in erosion of the tube.

Vacuum excavation is used in some locations for water works installations. A Vactor® HXX™ HydroExcavator is shown. Photos: Vactor Manufacturing, a subsidiary of Federal Signal Corporation.

Traceability

When non-metallic pipe is used for a water service, it is normally required that a solid copper tracer wire be attached to the pipe, which increases the cost of the installation.

Permeability

Copper tube is non-porous and non-permeable, meaning that contaminants like gasoline can not pass through the wall of an underground service tube into the drinking water supply.

Thawing

In the event that an underground water service freezes, thawing is much easier when copper tube is involved compared to plastic pipe.

Water efficiency & conservation

The copper industry supports water conservation practices in Canada. Despite an abundance of water in many areas, supplying potable water has become a significant challenge for many communities. Demand for potable water can be reduced through the use of water-efficient fixtures, including low-flow water closets, shower-heads, faucets and related fittings. Water supply can be augmented by introducing non-potable water systems which harvest rainwater and recycle greywater for flushing water closets, irrigating lawns and gardens, washing vehicles, and other purposes.

Copper... The Green Choice

Copper is an exceptional material when it comes to green qualities and recycling. About 80% of the copper ever mined during the past 10,000 years is still in use today in some form somewhere. In fact, it has probably been used in several forms over the centuries and will continue to be recovered and reused in the future.

Tube and fittings are outstanding examples of copper's green attributes. When tube is manufactured today, over 70% of the feed material for the mill is copper recovered from recycled materials. For fittings, it is even more remarkable, with the copper alloys used being generated from an even higher proportion of recycled metals.

For the full story on the green qualities of copper and copper alloys, contact the CCBDA and ask for Publication No. 43E, *Copper... The Green Choice*. It will be supplied along with a series of case studies on green projects in Canada and the United States. The case studies include details on the LEED™ credits assigned to the copper applications in the projects.

This information is also available on the www.coppercanada.ca web site.

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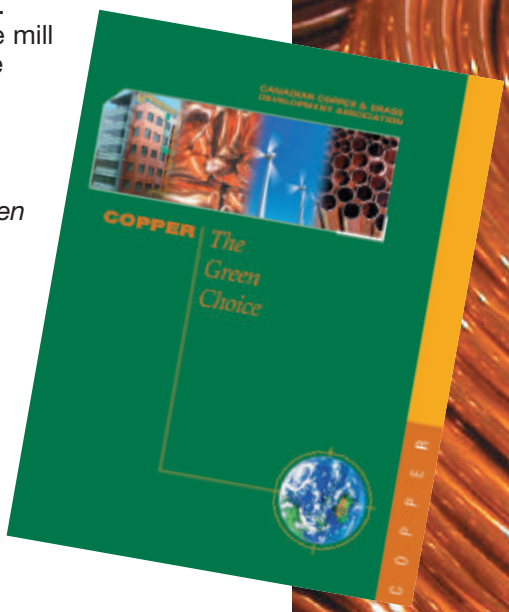

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