

## History of Porcelain Enamel Coated Liquid Storage Tanks

We bathe in it. We build buildings with it. We even write on it in our schools. Porcelain enamel has been used through the ages by artists, inventors and scientists who wanted a material that is both beautiful and enduring.

As far back as 2000 BC, the Egyptians inlaid glass in metal frames. Then Greek craftsmen advanced the art form by applying sufficient heat to fuse the metal and glass. With the expansion of the Roman Empire, the technology spread throughout Europe.

**Their art** - fashioned centuries ago - is testimony to the timeless beauty and permanence of Porcelain Enamel.

Everyone in the modern world uses porcelain enamel products everyday. Bathtubs, sinks, lavatories, stoves, ovens, washing machines, grills, dryers, water heaters; each has a beautiful, glassy finish we trust. We walk through buildings sheathed in porcelain enamel and read signs of the same material. The operating rooms of many hospitals are porcelain enamel. Our children write on porcelain enamel boards at school. Look around and you'll see that it's used in an amazing number of places.

**In the Home:** Porcelain enamel is the reason your stovetop clean so easily. Porcelain enamel keeps the basket of the clothes washer from rusting away due to the constant exposure to water and bleach. And porcelain enamel is why you can clean the oven with caustic chemicals without damaging the surface. These benefits are a result of the protective, lustrous, and non porous nature of the chemically fused mixture (enamel) which protects the supportive metal to prevent chemical corrosion and rust formation, to aid in durability, and to add a shiny smooth beauty to the product

**In Industry:** The protective metal-coating property of enamel offers a multitude of industrial and municipal applications. Porcelain enamel creates a durable barrier on a structure's substrate making it safe for storing corrosive, rust forming, caustic and chemically altering liquids, gases and solids. These porcelain enamel coated tanks play a fundamental role in the storage of the essential and sometimes dangerous components of products for manufacturing, food production, petrochemical products, agricultural uses, vaporous gases, municipal waste water, dry bulk solids, etc.

Outdoors, porcelain enamel is used to protect storage structures and their supporting framework from the unending erosion and damage caused by weather. Stored material is protected because the enamel coated tank permanently seals off the water, heat and other damaging effects that would eventually destroy a metallic container. Because of this, tanks of all shapes and sizes are used to safely store materials outside, with out any additional protection.

How does it protect? Porcelain enamel is a form of glass bonded to metal on a molecular level at high temperature. It begins as a blend of minerals smelted in much the same manner as common glass. During this process (known as "fritting"), the red-hot, molten mixture is poured from a smelter and quenched between water-cooled rollers. This quick-cooled ribbon of glass is then shattered forming a particulate known as "frit". Frit is applied to metal using either a wet or dry method and fired at very high temperatures - generally ranging from 1100 to 1600 degrees Fahrenheit. While in the furnace, the frit melts, bonding with the metal to create more than a coating. It forms an

inseparable compound that merges the chemical makeup of the frit and metal; resulting in a new, chemically unique, finish. Porcelain enamel is quite simply the highest quality, most durable and sanitary finish available for metallic surfaces.

A.O. Smith Corporation chose to utilize the benefits of porcelain enamel on a series of breakthrough developments: a coating for the first large, single-piece brewery tank in 1933; the porcelain enamel-lined water heater in 1936, and agricultural dry storage in 1949. The agricultural steel tank applications include storage of rice, flour, wheat, other grains and dry bulk solids. Later, in the 70's the A.O. Smith Corporation again used the concept of protective storage of liquids for both industrial and municipal applications. These included potable water tanks, waste water tanks, leachate tanks, anaerobic digesters, clarifiers, and tanks for the renewable fuel industry.

A.O. Smith Harvestore Products Inc. is now part of CST-Industries. Today this manufacturer is located in DeKalb, Illinois and is still producing dry storage tanks, but sales are now dominated by liquid storage tanks. They are the only manufacturer of porcelain enamel (also called glass-fused-to-steel) tanks operating in the United States. CST distributes their porcelain enamel Aquastore® tanks through a dealership network spread out through North America.

Aquastore tanks feature low life-cycle costs and versatility for potable water and wastewater treatment tanks. Applications in wastewater range from E.Q. tanks, aeration tanks, anaerobic digestion tanks, clarifier tanks, trickle filters, and sludge storage/mixing tanks. Water applications include clear wells, ground storage tanks, standpipes, and composite elevated tanks.

The history of porcelain enamel coatings is a long trial and error story written by many inventors. A very fitting history for a product that over a long extended period of time has proven itself as one of the lowest lifecycle cost products available for municipalities and industry for their liquid storage needs.