
CAST IRON SOIL PIPE INSTITUTE

CAST IRON PLUMBING SYSTEMS HAVE BEEN IN USE FOR CENTURIES –
from the fountains of Versailles in France, to the White House in Washington, D.C.
But cast iron is not just for kings and presidents.

CAST IRON IS AS RELIABLE AS IT IS ENDURING, AND IS THE BEST CHOICE FOR USE IN COMMERCIAL CONSTRUCTION.

What meets code and what represents the best solution for high performance commercial buildings are two very different questions. All too often, the perceived cost advantages of plastic over cast iron are not what they seem. Before allowing that next hotel or condo job to be converted to PVC or ABS, consider six areas that can add cost and complexity:

1

FIRE RESISTIVE CONSTRUCTION

2

CRUSH AND DEFLECTION UNDERGROUND

3

THERMAL EXPANSION, CONTRACTION, HANGERS AND SUPPORTS IN ABOVE GROUND INSTALLATIONS

4

SOUND ATTENUATION

5

GREEN BUILDING

6

THE IMPORTANCE OF MANUFACTURING STANDARDS

1 FIRE RESISTIVE CONSTRUCTION

Today's commercial buildings are constructed with fire-rated separations to contain the spread of flame and smoke. The critical juncture for plumbers is when fire separations are penetrated with piping systems. For combustible materials like plastic, these penetrations must be sealed back at significant expense to the original fire integrity of the compartment with a fire stopping system tested by a nationally recognized lab to ASTM E-814 Smoke and Flame Spread test.

BECAUSE CAST IRON PIPING WILL NOT MELT OR BURN AWAY, SEALING A CAST IRON PENETRATION IS **SIMPLER, FASTER AND MORE COST EFFECTIVE.**

Being a thermoplastic, plastic piping will combust at 700 degrees Fahrenheit, and will lose its structural integrity at just 250 degrees, leaving an opening that will allow the spread of smoke and flame. To counter this, fire stop materials are required to seal these penetrations. Installed in the annular space, these materials expand when exposed to high heat. A common fire stopping assembly for plastic piping through concrete floors consists of a ring of intumescent material held in place around the pipe with a metal collar. This assembly involves shooting masonry anchors into the concrete, clamping the collar in place and installing a smoke seal with a bead of fire-resistant caulking.

The expected service life of these intumescent materials vary significantly by manufacturer. Some fire stop manufacturers claim service life measured in decades, some make no claims of an expected service life. Although a test method for aging of intumescent materials has been developed, there is no established method for using the results of these to calculate service life. As with any potentially life-saving product, these fire stopping materials must be installed properly and tested and listed by an accredited third-party agency before use.

Un-ducted return air plenum areas are also critical. Model codes are very restrictive regarding the use of combustible materials in plenum areas. Plastic pipe tested to the ASTM E 84 test protocol and achieving values equal to or less than 25 (flame spread) / 50 (smoke developed) is generally considered the minimum for inclusion of a combustible material in a plenum area. It is important to note that neither PVC nor ABS meet the 25 / 50 rating. While plastic pipe has a flame spread rating of 10, its smoke developed rating is 975.

Cast iron piping will not melt or burn away in a fire, meaning designers and engineers can avoid the added cost and complexity of adding fire stopping materials to their piping assemblies for every penetration in a building. All that is required to seal a cast iron penetration is some mineral wool batting and fire-resistant caulking around the pipe. Simpler, faster and much more cost effective. And the more floors in the building, the greater the cost savings.

2 UNDERGROUND INSTALLATION

Proper underground piping installation is one of the most misunderstood piping applications. Proper installation of plastic pipe increases the installed cost of the product dramatically. Underground piping is expected

BECAUSE CAST IRON IS **UP TO 10 TIMES STRONGER** THAN ALL THERMOPLASTIC MATERIALS, IT DOES NOT NEED THE COMPACTION OF THE SIDEFILL TO SUPPORT THE PIPE WALL

to support not only the earth load, but the live (traffic) load above it as well, all while limiting deflections or obstructions that can cause joint leaks. Cast iron soil piping, defined as a rigid material, can handle these loads with no deflection. Defined as flexible systems, plastic piping is subject to deflection if not properly installed. The point of failure for plastic pipe is deflection in excess of just 5% of the inner diameter of the pipe, according to the ASTM D 2321 standard. This 5% limit means only a quarter inch in deflection in a 4 inch pipe is defined as a failure.

With plastic installations, the sidefill stiffness of the trench is critical to support the pipe. For thermoplastic pipe, the trench is required to be the width of the pipe O.D. plus 16 inches or pipe O.D. times 1.25 plus 12 inches. For example, a six-inch pipe would require a 20-inch wide trench – that's a lot of extra digging on the front end and extra compaction on the backfill. Compaction in six-inch maximum layers – done by hand – is required by ASTM D2321. Depending on the soil type, minimum compaction density can range from 85% to 95%. Because cast iron is up to 10 times stronger than thermoplastic materials, it does not need the compaction of the sidefill to support the pipe wall, so the trench can be as narrow as the installer wants.

Also, the plastic trench involves special bedding requirements – a minimum of four inches of material depending on the soil type to support the pipe. Cast iron requires no such bedding, only that the trench bottom be flat so that the pipe is uniformly supported. Again – a lot of extra work and materials when it comes to plastics, and a lot of extra cost. ■

CAST IRON SOIL PIPE

This rigid material does not depend on sidefill stiffness, so the trench can be as narrow as the installer needs to make joint connections.

THERMOPLASTIC PIPE

As a flexible material, it is dependent on sidefill stiffness to limit deflections. ASTM D2321 recommends a trench width of the pipe outside diameter plus 16 inches or pipe outside diameter times 1.25 plus 12 inches.

3 ABOVE GROUND INSTALLATION

Above ground plastic DWV applications introduce a different set of issues that can add cost and complexity to high rise commercial construction projects. For example, a lack of understanding of hanger requirements can lead to improper installations. Plastic must be supported by metal hangers every four feet in horizontal installations. Cast iron, on the other hand, needs only to be supported within 18 inches of each joint and every 10 feet. The cost of hangers, anchors, connectors and extra labor in a typical plastic installation can be up to 2½ times that of cast iron in horizontal applications.

And unlike cast iron, plastic expands and contracts between swings in heat and cold. The rate of thermal expansion for plastic is approximately .36 inches per 100 feet of pipe for every 10 degrees Fahrenheit. Installing plastic in high rise construction requires the use of expansion joints to accommodate these thermal effects. One method for compensating for thermal expansion is to use an expansion coupling, which is a pipe-within-a-pipe that telescopes in and out as the piping expands and contracts. The joint is sealed with rubber O-rings lubricated with a water-resistant material such as petroleum jelly. Expansion joints are required in vertical stacks at every other branch interval and on horizontal runs exceeding 20 feet – once again adding cost and complexity to the system. And expansion joints can create problems during water testing of the system because they can leak if not properly installed. ■

4 CREATING A QUIET SYSTEM

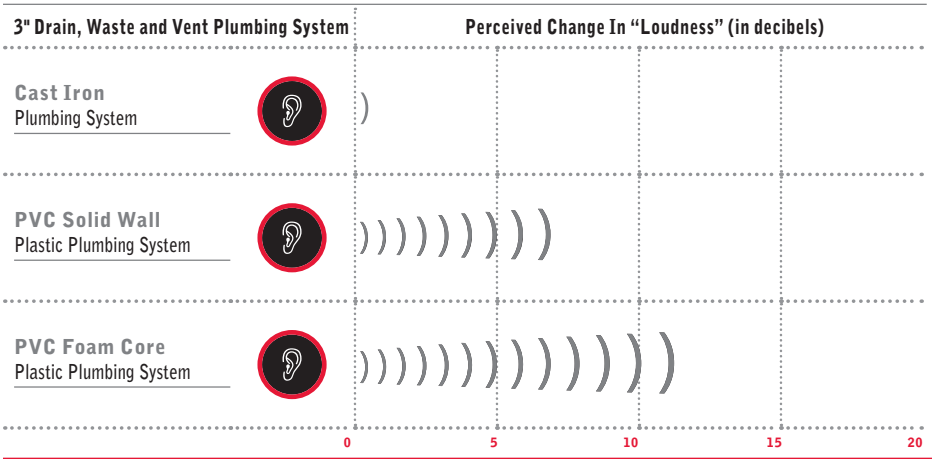
With fire resistive construction or underground installations, the differences between plastic and cast iron are hidden from view. But there's no hiding the differences in sound attenuation capabilities in above ground installations. Simply put – there is no piping system that is quieter than cast iron. No one wants to hear the gurgling and sloshing sounds of water from fixtures on floors above flowing down the walls, especially in high-rise condominiums, commercial office buildings or high-end hotels. Using cast iron for waste piping will result in a plumbing system that is twice as quiet compared to an all-plastic system.

Cast iron's microstructure is the primary factor in its sound-dampening quality. The graphite flakes in cast iron's microstructure act to dampen out any vibration applied to the iron, thereby reducing noise. But its microstructure isn't cast iron's only advantage when it comes to noise. The method of joining sections of pipe together also plays a key role. The neoprene rubber gaskets used in cast iron installations keep each section of pipe from touching, thus eliminating any contact-related sound. Plastic systems are solvent welded into rigid systems that can create noise as they expand and contract with heating and cooling.

Some "fixes" that plumbers attempt to solve plastics noise problems may not actually fix the problem, and they add expense. Wrapping plastic pipe in insulation to muffle the sound of water cascading through the pipe can create a solid barrier between the pipe and the wall that can end up being sound-enhancing rather than sound deadening. And, the time and materials involved in wrapping plastics in insulation adds cost to the installation. ■

The Quiet House® System Noise Comparison

Rule of Thumb: Most perceive a 10 dB increase in sound level as being twice as loud.



SPECIFICATIONS

ASTM Specifications:

(This specification is reviewed and revised every five years. The number following A 74 indicates the year of latest revision.)

ASTM A 74 Standard specification for cast iron soil pipe and fittings.

ASTM A 888 Standard specification for hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications.

CISPI Specifications

(This specification is reviewed and revised every five years. The number following 301 indicates the last year of revision.)

CISPI 301 Standard Specification for hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications.

CISPI 310 Specification for coupling for use in connection with hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications.

5 GREEN BUILDING

Just about every day, a new building or home arises somewhere in the country, boasting the latest in "green" design and technology. And every day, a greater number of new "green" products emerge that contribute to the sustainable building philosophy that is sweeping the nation. But while cast iron is not a new product, it does have a green pedigree. Most notably, all domestically produced cast iron pipes and fittings are made from at least 96% recycled material. Each year our members recycle hundreds of millions of pounds of scrap iron and steel, converting it into cast iron soil pipe and fittings. Additionally, at the end of the life of a building, the cast iron piping systems can be recovered and recycled again, to make new cast iron pipe and fittings. But that's not where recycling stops. Our members also recycle the foundry sand used in the production processes multiple times. And the inert sand that can no longer be used in the casting process is often beneficially reused in other applications such as highway construction and structural fill.

Our members also employ the most energy efficient processes when compared with off-shore foundries in developing nations. For example, castings imported to the U.S. from China are made using antiquated labor-intensive methods that are significantly less energy efficient and thus produce more greenhouse gas (GHG) emissions. Chinese foundries still use pig iron as the primary raw material for producing castings, resulting in GHG emissions that are an estimated 100%-200% higher per ton of good castings shipped, according to the American Foundry Society. In addition, castings made in off-shore facilities that are exported to the U.S. generate significantly more GHG emissions from transportation via cargo ships, as well as inland freight in China.

And it's not just greenhouse gases that matter. Our members also have spent tens of millions of dollars over the last several decades to voluntarily install new equipment or upgrade old equipment to improve

environmental control systems – and spend many millions more each year to operate and maintain these systems. Unfortunately, in many developing countries – particularly China – similar protections for the environment don't exist. By now it is well known how the speed and scale of China's rise as an economic power has produced a severe pollution problem with stark repercussions for the Chinese public. Linfen Province, home of several cast iron soil pipe and fitting foundries, has been identified as one of China's most polluted provinces. The World Bank notes that 16 out of 20 of the world's worst polluted cities are in China and China's own State Environmental Protection Administration (SEPA) has branded Linfen as having the worst air quality in the entire country – pollution levels that are taking a serious health toll on the inhabitants of Linfen.

EACH YEAR, OUR MEMBERS RECYCLE **HUNDREDS OF MILLIONS OF POUNDS** OF SCRAP IRON AND STEEL.

So if domestic castings are easier on the environment than foreign-made pipe and fittings, what about plastics? Unlike cast iron soil pipe, at the end of its useful life, a lot of plastic pipe simply ends up filling our landfills. Also, plastic pipe and fittings are joined using solvent cements that contain volatile organic compounds (VOCs). Installing cast iron is fast and easy. All one needs is a snap cutter and a torque wrench. There are no cleaning fluids or solvent cements required as there are with plastics, which is better for the environment. ■

6 THE IMPORTANCE OF MANUFACTURING STANDARDS

Not all cast iron soil pipe is created equally. But standards are in place to ensure just that – if they are followed.

Requiring products to conform to applicable manufacturing standards is essential in today's world of global outsourcing. Customers should have the peace of mind of knowing that overseas manufacturers have diligently followed all the necessary quality control requirements embedded in the standards. ASTM and the Cast Iron Soil Pipe Institute (CISPI) standards for pipe and fittings require consistent tensile strength, chemical and dimensional testing and radiation testing of raw materials. These tests must be done during the manufacturing process by the manufacturer to ensure consistent quality and to be in compliance with the standard.

CISPI's Quality Control Program ensures that domestic manufacturers are manufacturing in compliance with the standards. The quality control program was created in the early 1960s. CISPI technicians make three unannounced inspections of member company inventories per year to check dimensional accuracy, metallurgical data and record keeping requirements. NSF International recently approved CISPI's quality control program to validate the compliance of member products with the CISPI 301 and ASTM A 74 Standards. NSF also certifies that CISPI's member-company cast iron soil pipe and fitting products, inspected by the Institute and NSF, are compliant with these standards. The addition of NSF's certification adds an oversight to this on-going quality control program and provides an added assurance that products made by CISPI member companies are compliant with the product standards.

Some engineers and contractors may wonder why CISPI has such a rigorous quality control inspection program. If they see the ASTM A74 or A888 marked on a piece of pipe, they may automatically assume that someone other than the manufacturer had inspected the material and verified compliance with the standard. That is simply not true. Contrary to popular belief, cast iron soil pipe products are not inspected by ASTM and the ASTM numbers that are typically marked on the products are not even required by the standards. Some importers of foreign-made cast iron pipe and fittings claim that third-party inspections of their plants are required by the code. That is also not the case. In fact, the standard has no requirement for third-party inspections. It clearly states that certification is the manufacturer's responsibility – the entity that poured the iron – and cannot be delegated to a seller or a third-party after the fact. ■

CISPI requires a tensile strength test, as shown, to be conducted every four hours to ensure iron quality.

U.S. foundry shows pipe properly marked with country of origin, the name of the manufacturer, and the date it was produced.

The Mark of Quality Cast in Iron.

About CISPI

Founded in 1949, the Cast Iron Soil Pipe Institute (CISPI) is dedicated to aiding and improving the plumbing industry. Through the preparation and distribution of technical reports, we seek to advance interest in the manufacture, use and distribution of cast iron soil pipe and fittings, and through a program of research and the cooperative effort of soil pipe manufacturers, we strive to improve the industry's products, achieve standardization of cast iron soil pipe and fittings, and provide a continuous program of product testing, evaluation and development.

www.cispi.org