

PVC PIPE ASSOCIATION TECHNICAL BRIEF

IRON PIPE WALL THICKNESS – THINNER AND THINNER

TODAY'S IRON PIPE - MORE PRONE TO CORROSION THAN THE PIPE OF YESTERYEAR

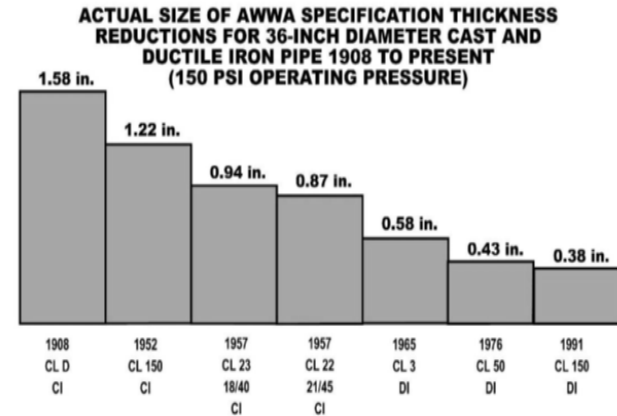
The Ductile Iron Pipe Research Association (DIPRA) likes to call attention to select cities in North America that have used iron pipe for at least 100 years. DIPRA equates the longevity of these pipes to 21st century pipes, but it is important to realize that today's iron pipe is not the same as the pipe being referenced:

1. Iron pipe wall thickness has been steadily reduced over the last century.
2. Corrosion becomes more of an issue as pipe wall thickness reduces.

FROM THICK TO THIN

The chart (from a paper by Spickelmire) shows the progression of wall thickness for 36-inch iron pipe over the last century.

The trend is unmistakable: the iron pipe industry has drastically reduced its wall thickness over time. In fact, the change from 1908 to 1991 represents a 76% reduction in thickness.



WHY THINNER?

Some of the thickness reduction can be partially explained by the change from cast to ductile. Ductile iron has a higher tensile strength than cast iron, which allows DI to have a thinner wall for the same pressure class. However, this does not explain the many instances of thickness reduction during the cast-iron era and the additional reductions during the 50+ years of ductile iron usage.

THINNER DI PIPE WALLS = GREATER SUSCEPTIBILITY TO CORROSION

From the same paper by Spickelmire: “The thinner wall of ductile iron pipe is one of the factors that contribute to its shorter useful life compared to cast iron. Historically, the extra thickness of the cast iron pipe provided more metal for corrosion to attack (corrosion allowance).” And furthermore: “If the wall thickness of ductile iron is only one fifth of the cast iron wall thickness and the corrosion rate is the same, then the expected life of ductile iron will be substantially less than for cast iron in similar corrosive environments.” Spickelmire goes on to state that reduced wall thickness must be taken into account during corrosion evaluations and during the selection of corrosion-control methods. He also points out that some utilities are specifying higher DI pressure classes to provide additional wall thickness to combat corrosion.

There are two logical conclusions:

- For the same installed conditions, ductile iron's thinner walls will corrode faster than cast iron's thicker ones.
- For the same installed conditions, today's thinnest-walled ductile iron (Pressure Class 350) will corrode faster than its commonly specified predecessor (Class 52).

DUCTILE IRON PIPE PENETRATED BY CORROSION EARLY IN PIPE LIFE

To underscore the magnitude of this issue, a recent report by AWWA's Water Research Foundation showed that ductile iron pipe can be compromised by corrosion very early in its lifetime. The paper, titled “Long-Term Performance of Ductile Iron Pipe,” reported that the “Time to full penetration of 6-inch diameter pipe in a moderately corrosive environment was estimated to be 11 to 14 years for pressure class 350.” This finding is especially significant because it is estimated in a paper by Folkman that 75 percent of all water utilities operate in corrosive soil conditions.

References: AWWA WRF “Long-Term Performance of Ductile Iron Pipe” (2011); Folkman, S. “Water Main Break Rates in the USA and Canada: A Comprehensive Study” (2012); Spickelmire, W. “Corrosion Control Considerations for Ductile Iron Pipe – a Consultant's Perspective” (2012)