

# Pipe Comparisons



## Prestressed Concrete Cylinder Pipe (PCCP) vs Ductile Iron Pipe (DIP)

First used in the early 1940's, Prestressed Concrete Cylinder Pipe (PCCP) combines a water tight steel cylinder with structural concrete and high tensile steel wire to produce a high-performance pipe suitable for a wide range of water conveyance applications, such as transmission mains, force mains, reclaimed water, industrial, intake and discharge pipelines. PCCP is used in buried applications, as well as above ground and subaqueous lines. It's cement-rich mortar coating electrochemically protects the steel components from corrosion. Being a rigid pipe, PCCP has a high load carrying capability and can generally be installed without special bedding or backfill procedures.

This document is a comparison between PCCP and ductile iron pipe utilizing information available from industry standards and resources. It is intended to differentiate key performance attributes of the materials to assist specifiers in product selection for water and wastewater pipelines.



ITEM	Prestressed Concrete Cylinder Pipe (PCCP)	Ductile Iron (DIP)
Pipe Standards	<ul style="list-style-type: none"> <li>• AWWA C301 – Prestressed Concrete Cylinder Pipe, Steel Cylinder Type</li> <li>• AWWA C304 – Design of Prestressed Concrete Cylinder Pipe</li> <li>• AWWA M9 – Concrete Pressure Pipe</li> </ul>	<ul style="list-style-type: none"> <li>• AWWA C151 – Wall thickness has been continually reduced, resulting in premature corrosion and reduced durability</li> <li>• AWWA M41 – Ductile Iron Pipe and Fittings</li> </ul>
Service Life	<ul style="list-style-type: none"> <li>• Estimated service life of 75 to 105 years. <sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Today's Ductile Iron Pipe thickness are designed for 50-year service life, but studies have shown corrosive environments can significantly reduce the actual service life.</li> <li>• AWWA WRF study – "Long-term Performance of DI Pipe" – 8-inch PC350 life expectancy in moderately corrosive soils = 11 - 14 years. <sup>2</sup></li> <li>• Ductile Iron wall thickness today may have up to 76% wall thickness reduction than original Cast Iron Pipe designed for the same diameter and pressure class. <sup>2</sup></li> </ul>
Pressure and Diameter Ranges	<ul style="list-style-type: none"> <li>• Typical diameters range from 16" (400mm) through 144" (3600mm) but 156" (3900mm) has been produced.</li> <li>• Prestressed concrete cylinder pipe has been designed for operating pressures greater than 400 psi. <sup>3</sup></li> </ul>	<ul style="list-style-type: none"> <li>• 3" (75mm) though 64" (1600mm) up to 350 psi pressure class.</li> </ul>
Pipe Strength/Stiffness	<ul style="list-style-type: none"> <li>• Designed as a rigid pipe which allows the use of native materials for embedment providing significant installation savings.</li> </ul>	<ul style="list-style-type: none"> <li>• Flexible pipe design with deflection limitations based on type of interior lining.</li> <li>• Pipe stiffness declines as size increases.</li> <li>• Requires select material with regimented compaction for embedment.</li> </ul>
Restrained Joints	<ul style="list-style-type: none"> <li>• Mechanical restraint option utilizing Snap-Ring, Harness Clamp and Holdfast Joints for most pressure and diameter ranges.</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanical restraint options based on manufacturer.</li> <li>• Pressure and diameter range limitation based on type of restraint.</li> <li>• Bolt type restraints are expensive and difficult to install correctly.</li> </ul>
Corrosion Performance	<ul style="list-style-type: none"> <li>• Integrated cement mortar coating and concrete lining provides protection for pipe and fittings.</li> <li>• Supplemental corrosion protection available for adverse environments.</li> </ul>	<ul style="list-style-type: none"> <li>• Ductile Iron Pipe requires additional external protection from corrosion which may include cathodic protection.</li> </ul>
Bedding and Backfill Requirements	<ul style="list-style-type: none"> <li>• Rigid pipe with no limitations on burial depth.</li> <li>• Pipe is designed to handle burial depth.</li> <li>• Minimal bedding is required, and native soils can be used as bedding material.</li> </ul>	<ul style="list-style-type: none"> <li>• Requires select material with regimented compaction for embedment.</li> </ul>

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Fittings	<ul style="list-style-type: none"><li>• Custom Fittings configuration and geometry to match customer needs.</li><li>• Adaptability to all pipe types.</li><li>• Produced domestically by pipe manufactures.</li></ul>	<ul style="list-style-type: none"><li>• Typically imported.</li><li>• Limited configuration options.</li><li>• Long lead times.</li><li>• Availability of larger diameter fittings is limited.</li></ul>

REFERENCES  
1 AMERICAN WATER WORKS ASSOCIATION (AWWA) (2015). "BURIED NO LONGER: CONFRONTING AMERICA'S WATER INFRASTRUCTURE CHALLENGE."  
2 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)  
3 CONCRETE PRESSURE PIPE AWWA MANUAL M9 – 3RD EDITION, AMERICAN WATER WORKS ASSOCIATION.



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