

# Pipe Comparisons

## Prestressed Concrete Cylinder Pipe (PCCP) vs HDPE Pipe

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 HDPE 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)	HDPE Pipe
Pipe Standards	<ul style="list-style-type: none"> <li>• AWWA C301 – Prestressed Concrete Pressure 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 C906 – Polyethylene Pressure Pipe Fittings 4” – 65” Waterworks</li> <li>• AWWA M55 – PE Design and Installation</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>• Estimated service life of 50-100 years. <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”(3600mm) has been produced.</li> <li>• Prestressed concrete cylinder pipe has been designed for operating pressures greater than 400 psi. <sup>3</sup></li> </ul>	<p>Maximum pressure class (PC) vary by diameter</p> <ul style="list-style-type: none"> <li>• SDR21 = 14” (350mm) to 60” (1500mm) = 100psi</li> <li>• SDR17 = 14” (350mm) to 60” (1500mm) = 125psi</li> <li>• SDR13.5 = 14” (350mm) to 48” (1200mm) = 160psi</li> <li>• SDR11 = 14” (350mm) to 36” (900mm) = 200psi</li> <li>• SDR9 = 14” (350mm) to 30” (750mm) = 250psi</li> <li>• SDR7 = 14” (350mm) to 24” (600mm) = 335psi</li> </ul> <ul style="list-style-type: none"> <li>• Actual internal diameters significantly smaller than nominal pipe diameters. Large pipe may be required.</li> <li>• SDR = Standard Dimension Ratio</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.</li> </ul>
Restrained Joints	<ul style="list-style-type: none"> <li>• Mechanical restraint options utilizing Snap-Ring, Holdfast and Harness Clamp restraints.</li> <li>• Restrained joints require very little time for installation and can unassembled if necessary.</li> <li>• Joints can be welded if required.</li> </ul>	<ul style="list-style-type: none"> <li>• Fused joints require extended periods of time for the fusion welding process.</li> <li>• Long sections of open trench for extended of time are needed for installation.</li> <li>• Specialized equipment required for fused joints.</li> <li>• Expansion and contraction of pipe prior to and during installation must be considered.</li> </ul>
Contaminated Soils (Hydrocarbons)	<ul style="list-style-type: none"> <li>• Product is not permeable.</li> <li>• Only gasketed sections of pipeline need to be addressed for performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Product is permeable to gasoline contaminated soils <sup>4</sup></li> <li>• Not suitable for potable water applications in the presence of hydrocarbons <sup>4</sup></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>
Negative Pressures	<ul style="list-style-type: none"> <li>• No special design considerations required for full vacuum or external pressure.</li> </ul>	<ul style="list-style-type: none"> <li>• Susceptible to collapsing from any vacuum.</li> </ul>

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Buoyancy	<ul style="list-style-type: none"> <li>More suitable for saturated ground conditions due to inherent weight of pipe.</li> </ul>	<ul style="list-style-type: none"> <li>Susceptible to floatation in saturated ground conditions.</li> </ul>
Pressure Tapping	<ul style="list-style-type: none"> <li>Procedure has more predictable behavior.</li> </ul>	<ul style="list-style-type: none"> <li>Flexibility of pipe requires significant care when tapping.</li> </ul>
Product Support	<ul style="list-style-type: none"> <li>Pipe supplied direct from manufacturer along with OEM engineering and field service support.</li> </ul>	<ul style="list-style-type: none"> <li>Pipe typically supplied through distribution chain with limited engineering and field service support.</li> </ul>
Special Circumstances	<ul style="list-style-type: none"> <li>Pipes capable of being installed on piers.</li> <li>Heat/Flame resistant.</li> <li>Hydrocarbon resistant gaskets available (Nitrile).</li> </ul>	<ul style="list-style-type: none"> <li>Cannot be installed on piers.</li> <li>Not flame resistant, susceptible to damage from flames/excess heat.</li> <li>Pressure derating at 80° F</li> </ul>
Expansion / Contraction	<ul style="list-style-type: none"> <li>4.1 to 7.3 x 10<sup>-6</sup> in/in/°F</li> <li>Joint extensibility allows for expansion and contraction.</li> </ul>	<ul style="list-style-type: none"> <li>4.1 to 7.3 x 10<sup>-6</sup> in/in/°F<sup>5</sup></li> <li>Thermal expansion is 1 inch per 10<sup>0</sup>F for 100 feet of pipe.</li> <li>Longitudinal contraction needs to be carefully considered for flanged connections.<sup>5</sup></li> </ul>

### REFERENCES

1 AMERICAN WATER WORKS ASSOCIATION (AWWA) (2015). "BURIED NO LONGER: CONFRONTING AMERICA'S WATER INFRASTRUCTURE CHALLENGE."

2 "KEY FACTORS THAT INFLUENCE THE SERVICE LIFE PE PIPE: PEAK PIPES." PEAK PIPES | MANUFACTURERS OF POLYETHYLENE PIPE, 1 SEPT. 2021, <https://www.peakpipesystems.com/key-factors-that-influence-the-service-life-pe-pipe/#:~:text=TYPICALLY%20POLYETHYLENE%20PIPE%20CAN%20LAST,DESIGNED%2C%20MAINTAINED%20AND%20INSTALLED%20CORRECTLY>. ACCESSED SEPT-01-2022

3 CONCRETE PRESSURE PIPE AWWA MANUAL M9 – 3RD EDITION, AMERICAN WATER WORKS ASSOCIATION.

4 AMERICAN WATER WORKS ASSOCIATION RESEARCH FOUNDATION (AWWARF) (2007). "IMPACT OF HYDROCARBONS ON PVC/PE PIPES AND PIPE GASKETS" (ONG, ET AL).

5 PLASTIC PIPE INSTITUTE (PPI) <https://www.plasticpipe.org/common/uploaded%20files/technical/TN-27.pdf> - ACCESSED JUNE-02-2022



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