

# DUCTILE IRON PIPE VERSUS PVC PIPE COMPARISON



IRON STRONG

COMPARISON	DUCTILE IRON PIPE	C 900 PVC	C905 PVC	C909 PVCO
<b>SIZES</b>	<b>3" — 64"</b>	<b>4" — 48"</b>	<b>14" — 48"</b>	<b>4" — 16", 24" coming soon</b>
<b>Pressure Ratings - Pipe Wall &amp; Hydrostatic Design Basis (HDB / HDS)</b>	12" and smaller, 350 psi min 14" 2 0" 250 psi min, 350 psi max 24" 200 psi min, 350 psi max 30" 64" 150 psi min, 350 psi max	DR 51 — 80 psi    DR 41 — 100 psi DR 32.5 — 125 psi    DR 25 — 165 psi DR 21 — 200 psi    DR 18 — 235 psi DR 14 — 305 psi	DR 51 — 80 psi    DR 41 — 100 psi DR 32.5 — 125 psi    DR 25 — 165 psi DR 18 — 235 psi	Pressure Classes 165, 235, 305 psi No diameter ratios (DR) listed yet equivalence would be DR 25, DR 18, and DR 14 respectively.
	Higher pressure pipes are available. HDB = 21,000 psi	Material properties and pressure ratings reduced at temperatures other than 73.4 degrees Fahrenheit. HDS = 2,000 psi Working Pressure Ratings reduced by 38% at 100°F for C900 & C905, reduced 36% for C 909.		
<b>Surge Allowance</b>	100 psi	No surge allowance is included in design. If surge pressures are anticipated, reduce pipe pressure rating by the design or anticipated surge pressure. Cyclic loading reduces the lifespan of the pipe. Pipe is affected by a minor change in velocity of 1.0 ft/sec.		
<b>Internal Pressure Safety Factor</b>	Design Safety Factor is 2.0 based on Design Working Pressure <b>PLUS</b> surge allowance. Cyclic loading does not affect ductile iron pipe properties or performance over time.	Design Safety Factor is 2.0. Stress due to working pressure plus surge pressure cannot exceed the HDB (4,000 psi) divided by 2.0 Safety Factor (HDS = 2,000 psi).		Uses a higher HDB of 7,100 psi and a Safety Factor of 2.5 but no surge allowance. Not proven in practical experience.
<b>Maximum Allowable Velocity</b>	No max allowed velocity due to higher internal design pressure, addition of surge allowance, and safety factor applied to combined working and surge pressure.	C900 - 07 eliminated surge allowance. No surge allowance = The AWWA Standards require the designer to reduce the pressure rating of the pipe to allow for pressure surges. PVC pipe has routinely proven susceptible to rupture from water hammer and other velocity changing conditions. <i>AWWA Manual M-23 "PVC Pipe Design &amp; Installation states; "adequate for operating conditions where flow is maintained at or below 2 fps."</i>		
<b>Capabilities for Fire Flows</b>	Pipe design allows for high velocities plus surges based on instant 2.0+ fps change in velocity. Each fps increase in velocity = a 50 psi change in pipeline pressure.	A 6-inch pipe and hydrant providing typical 1,800 gpm pumper truck flow rate creates a velocity of at least 18 fps. At even just the average listed PVC velocity surge pressure rate of 17.3 psi / fps this equates to a instant 277 psi surge potential, which structurally threatens PVC pipe given it has no surge allowance included in its wall design. <i>AWWA Manual M-23-inch PVC Pipe Design &amp; Installation states; "adequate conditions where flow is maintained at or below 2 fps."</i> <i>AWWA Manual-31 "Distribution System Requirements for Fire Protection lists required fire flows at 2,500 gpm or more, which makes the statement above conservative regarding PVC pressure containment capabilities.</i>		
<b>Special Considerations for Cyclic Loading</b>	None needed because DI does not lose strength over time or from surface scratches.	"Cyclic Loading" or Water Hammer" Cyclic Loading - number of cycles until failure. A scratch with a depth of just 0.01 inch reduces the fatigue factor of PVC pipe.		
<b>Material Description</b>	Recycled steel and iron scrap	Manufactured from Vinyl Chloride monomer and other chemicals.		
<b>Susceptibility to Shipping Damage</b>	Scratch resistant. Not affected by cold temperatures. Not affected by vehicle exhaust	10 percent scratch depth reduces performance to rejection. Becomes brittle when temperatures are below freezing. Subject to vehicle exhaust damage during transit.		

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<b>Susceptibility to UV Rays</b>	Does not affect Tensile or Impact Strength.	Uni-Bell Study: Can lose up to 34 percent of impact strength after one year of exposure. Avoid discolored areas. Warranty Concern: Potential exclusions from coverage due to UV degradation.		
<b>Direct Tap</b>	DIPRA test shows 0.20" wall thickness capable of multiple taps.	Warning: Over-tightening tapping machine may distort the pipe. Do not use a hand-held drill. Rupture Hazard Warning posted on pipe.		Direct Tapping not permitted. Over-tightening tapping machine may distort the pipe. Do not use a hand-held drill.
<b>Susceptibility to Corrosion</b>	V-Bio® Polyethylene Encasement cost effective, proven method of corrosion control.	Resistant to "hot" soils. Does not resist damage from UV rays and temperature fluctuations. Strength breaks down over time.		
<b>Susceptibility to Temperature</b>	Charpy Impact Test performed at -40 degrees Fahrenheit.	PVC becomes less resistant to impact at low temperatures. At elevated temperatures, PVC lowers pressure rating and becomes more flexible and more susceptible to over tightening of tapping machines and saddles.		
<b>Tracer Wire Required</b>	Tracer Wire is not necessary.	Tracer Wire required: Does not help with leak detection.		
<b>Deflection</b>	5 degrees/19 inches	No deflection at joints. Deflection by bending pipe which creates stress (DO NOT TAP HERE).		
<b>Pumping Costs</b>	No increase.	Increased due to wall thickness requirements. Weaker due to less tensile strength.		
<b>100+ Year Service</b>	600 Utilities in the U.S. and Canada with 100 years of service and 23 with 150 years of service.	The first PVC waterline installation occurred in 1955, therefore any communications suggesting PVC has a 100+ year lifespan has not been proven. AWWA's Study "Buried No Longer" gives independent life expectancy of 55 to 70 years.		
<b>Sustainability &amp; Recycled Content</b>	Minimum 90% recycled content. No end of life. Can easily be recycled.	PVC pipe can only be down-cycled, therefore the recyclability of PVC is nearly zero. Releases Carcinogens, Vinyl Chloride, Ethylene, and Dichlorides during manufacturing. Not recognized by any "Green" organization as an environmentally sustainable product.		
<b>Horizontal Directional Drilling</b>	Extreme safe-end-pull capacities. Pipe not affected by scratches or bore loads.	Factors of concern include weakening from scratches and buckling loads from bore fluids or soils.		
<b>Permeability &amp; Absorption</b>	Non-permeable	Susceptible to permeation and absorption of hydrocarbons and other harmful chemicals.		
<b>Combustibility</b>	Non-combustible Melting point of 2,100° F	Combustible and subject to melting. Softens at 180° F and can fully melt at 250° F		

To view an informative blog and video on the advantages of using Ductile iron pipe over PVC, visit [McWaneDuctile.com/blog](https://McWaneDuctile.com/blog).

