

Values of C In Hazen-Williams Formula

The Hazen–Williams equation is an empirical formula which relates the flow of water in a pipe with the physical properties of the pipe and the pressure drop caused by friction.

In U.S. units :

$$P_d = \frac{4.52 Q^{1.85}}{C^{1.85} d^{4.87}}$$

P_d = pressure drop in psi/foot

Q = flow in gallons / min

d = internal pipe diameter (inches)

In SI. units :

$$S = \frac{10.67 Q^{1.85}}{C^{1.85} d^{4.87}}$$

S = head loss in m water/m pipe

Q = flow in m³/s

d = internal pipe diameter (m)

TYPE OF PIPE	VALUES OF C FOR PIPES OF DIAMETER:					
	1 in 25 mm	3 in 76 mm	6 in 152 mm	12 in 305 mm	24 in 610 mm	48 in 1219 mm
Uncoated cast iron – smooth and new		121	125	130	132	134
Coated cast iron – smooth and new		129	133	138	140	141
30 yrs old:						
Trend 1: slight attack		100	106	112	117	120
Trend 2: moderate attack		83	90	97	102	120
Trend 3: appreciable attack		59	70	78	83	89
Trend 4: severe attack		41	50	58	66	73
60 yrs old:						
Trend 1: slight attack		90	97	102	107	112
Trend 2: moderate attack		69	79	85	92	96
Trend 3: appreciable attack		49	58	66	72	78
Trend 4: severe attack		30	39	48	56	62
100 yrs old:						
Trend 1: slight attack		81	89	95	100	104
Trend 2: moderate attack		61	70	78	83	89
Trend 3: appreciable attack		40	49	57	64	71
Trend 4: severe attack		21	30	39	46	54
Miscellaneous:						
Newly scraped mains		109	116	121	125	127
Newly brushed mains		97	104	108	112	115
Coated spun iron – smooth and new		137	142	145	148	148
Old – take as coated cast-iron of same age						
Galvanised iron – smooth and new	120	129	133			
Wrought iron - smooth and new	129	137	142			
Coated steel – smooth and new	129	137	142	145	148	148
Uncoated steel – smooth and new	134	142	145	147	150	150
Coated asbestos cement – clean		147	149	150	152	
Uncoated asbestos cement - clean		142	145	147	150	
Spun cement-lined and spun bitumen lined – clean		147	149	150	152	153
Hydraulically smooth pipes (incl. lead, brass, copper, polythene, smooth PVC, etc.) - clean	140	147	149	150	152	153
PVC (wavy) – clean	134	142	145	147	150	150
Concrete: (Scobey)						
Class 1 ($C_s = 0.27$) - clean		69	79	84	90	95
Class 2 ($C_s = 0.31$) - clean		95	102	106	110	113
Class 3 ($C_s = 0.345$) - clean		109	116	121	125	127
Class 4 ($C_s = 0.37$) - clean		121	125	130	132	134
Best ($C_s = 0.40$) - clean		129	133	138	140	141
Tate relined pipes - clean		109	116	121	125	127
Pre-stressed concrete pipes - clean				147	150	150

It is emphasised that the Hazen-Williams Formula is not suitable in form for values of C appreciably below 100, but the values in the above table are approximately correct at a velocity of 1m/s.

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