

## TESTING CONFIRMS PVC PIPE HYDRAULIC COEFFICIENTS

The PVC Pipe Association (PVCPA) re-evaluated the friction factor for PVC water and sewer pipes to re-confirm that recommended hydraulic coefficient values were conservative. A two-pronged test program was undertaken which consisted of: (1) laboratory testing of new pipe; and (2) field testing of installed pipe.

The goals of the test program were:

- To determine design coefficients for pressure and nonpressure pipes
- To see if coefficients were conservative compared to traditional values

Traditional factors used for hydraulic design of PVC pipe are:

- Pressure pipe — Hazen-Williams “C” factor = 150
- Nonpressure pipe — Manning’s “n” number = 0.009

Test procedures and results are described in “Hydraulic Testing of PVC Pipe: Laboratory and Field Tests Confirm Coefficients.” The report is available by [clicking here](#).

### LABORATORY TESTING

Hydraulics testing was performed in March 2022 at Utah State University’s Water Research Laboratory. Two pipe sizes were used (6- and 12-inch). To ensure accuracy of results, minimum pipe length for each test was more than 200 times pipe inside diameter. Tests were run at more than 12 different velocities for each pipe.

These flow coefficients were quantified:

1. Hazen-Williams “C” factor — average value 159 for 6-inch pipe and 155 for 12-inch
2. Manning’s “n” number — average value 0.007 for 6-inch pipe and 0.008 for 12-inch

### FIELD TESTING

Tests were performed to determine Hazen-Williams “C” for installed 8-inch PVC pressure pipe. The pipe run that was used has been in service since 1976 (46 years). To ensure consistency, these field tests were run under the guidance of the same professor who had overseen the laboratory tests described above.

Field tests were performed by M.E. Simpson Co., Inc. in November 2022 at West Valley City, UT. A run of 8-inch PVC pipe between two hydrants was used. Distance between the hydrants was 278 feet.

Two tests were performed on the same run of pipe. Each test used a different flow velocity:

- Test #1: velocity of 3.86 fps — “C” factor was 164.2
- Test #2: velocity of 8.73 fps — “C” factor was 163.3

## TESTING SHOWS PVC PIPE’S TRADITIONAL FLOW COEFFICIENTS ARE CONSERVATIVE

The two questions addressed by hydraulics testing were answered:

1. Results of testing performed in the 1970s were verified
2. Conservatism of traditional coefficients was confirmed. Tests showed that:
  - Hazen-Williams “C” = 150 is conservative for pressure pipe design
  - Manning’s “n” = 0.009 is conservative for gravity sewer pipe design

Designers of PVC pipes can be confident that the use of these coefficients will provide conservative results.

### THE IMPORTANCE OF USING CONSERVATIVE FRICTION FACTORS

Designers should realize that recommended PVC pipe Hazen-Williams “C” = 150 and Manning’s “n” = 0.009 are conservative values compared to test data. In fact, despite using a wide range of flow velocities, every data point in recent PVC pipe hydraulic research has been at or better than these recommended values. When making comparisons with other materials, it is important to avoid using average values for friction factors for hydraulic design, since average values are not conservative. Users are encouraged to review test data from other pipe materials to understand how their recommended values were obtained. Additionally, it is essential that recommended industry coefficients include any internal pipe-wall or pipe-lining degradation.

Reference: “Hydraulic Testing of PVC Pipe: Laboratory and Field Tests Confirm Coefficients,” Uni-Bell PVC Pipe Association (2023)