

PVC PIPE ASSOCIATION TECHNICAL BRIEF

CYCLIC SURGE PRESSURE: PPI'S "PACE" IS NOT FOR PVC PRESSURE PIPE

The Plastics Pipe Institute (PPI) has recently made a design tool available on its website. The tool, known as "PACE," compares PE and PVC pressure pipes for occasional and recurring (cyclic) surge pressures. This Tech Brief focuses on recurring surge.

PPI DOES NOT REPRESENT THE PVC PIPE INDUSTRY

Although the word "plastics" appears in its name, PPI is the trade association for PE (polyethylene) pipe manufacturers and does not speak for the PVC pipe industry. (See www.uni-bell.org for technical information on PVC pipe.)

PPI'S PACE – DESIGN LIMITATIONS SKEW RESULTS

A case in point is PPI's PACE tool. Driven by PPI's interest to develop design tools that favor PE, PPI has intentionally mandated that only highly unlikely design assumptions and inputs be used:

- **Users cannot input realistic values:** PPI's boxes for data entry do not allow users to input reasonable values – PPI dictates that only extreme conditions can be considered.
 - » **Only very frequent surges are allowed:** PPI mandates that the minimum number of cycles per day must exceed 54. This is equivalent to a pump start/stop every 26 minutes for the life of the pipeline. *These operating conditions are not valid for most municipal water systems.*
 - » **Only high flow velocities are allowed:** the minimum flow velocity permitted by PPI is 4 fps. However, Performance Pipe (the largest PE pressure pipe manufacturer) states in its literature: "Flow velocity is the most significant factor in fatigue life. Most systems operate at velocities of 2 fps to 4 fps." *PPI inputs are outside the range recommended by the industry's own literature.*
 - » **The lowest pressure input permitted is 40 psi:** Many sewer forcemains operate at lower pressures.
- **Flow velocity changes are always treated as complete and instantaneous:** PPI assumes that the flow velocity is always at maximum level and that all changes are instantaneous 100% stoppages. Users cannot input actual pressures. These restrictions are contrary to PPI's own discussion of "ordinary operations" in Chapter 6 of their *Handbook of PE Pipe*.

The conditions imposed by PPI are unrealistic. The high flow velocities and number of surges per day represent poor design and are rarely encountered conditions – especially with today's improved design practices and operational controls.

Here are two examples:

- Distribution pipe design example from AWWA C900: pipe life is 21 million cycles, which equates to 1040 years. Using a safety factor of 2:1, design life is 520 years. PACE forces extreme conditions and calculates a design life of only 42 years!
- Sewer forcemain design example 5.5 in the *Handbook of PVC Pipe*: design life is 213 years. Using a safety factor of 2:1, the design life becomes 107 years. The resulting design life as calculated by PPI is only 4 years!

The PACE mathematical model is correct, but input restrictions cause flawed results. These results are not consistent with the decades of successful use of PVC water and forcemain pipe or studies confirming PVC pipe longevity at more than 100 years.

THE PVC PIPE ASSOCIATION RECOMMENDS:

- If PPI wants to promote its new design tool, it should be done for PE pipe alone.
- PVC pipe design should be done per Appendix B of AWWA C900/C905 or per the *Handbook of PVC Pipe*.

References: PPI PACE webpage; Performance Pipe website; *Handbook of PE Pipe*, PPI; *Handbook of PVC Pipe*, Uni-Bell; AWWA C900 and C905 standards