PVC PIPE ASSOCIATION

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UNI-BELL POSITION STATEMENT REGARDING AWWA PIPE STANDARDS & MINIMUM SAFETY FACTOR (SF ≥ 2.0)

EXECUTIVE SUMMARY

Harmonization and Clarity

The Uni-Bell PVC Pipe Association strongly supports thermoplastic pipe standards that are clearly written and formatted to allow for straightforward comparisons. There are currently four AWWA standards for large-diameter thermoplastic pipe (PVC: C900-07 and C905-10; HDPE: C906-07; and PVCO: C909-09). All four standards have similar formats for material requirements, presentation of Pressure Class requirements, and the calculation methods used for pipe design, i.e., pressure design factors and treatment of surge pressures. It is Uni-Bell's position that a concerted effort needs to be made to preserve the consistent and comparable formatting of AWWA's large-diameter thermoplastic pipe standards.

Minimum Design Safety Factor (SF ≥ 2.0)

Proper risk minimization justifies the use of conservative design factors to compensate for unavoidable unknowns in pipe manufacturing, handling, installation, and operation. AWWA has been consistent in requiring a safety factor (SF) of 2.0 or higher [a design factor (DF) of 0.5 or lower] in the standards for steel (AWWA C-200), iron (AWWA C-150), PVC (AWWA C900/C905), HDPE (AWWA C906), and PVCO (AWWA C909) pipe.

Any SF reduction (DF increase) will increase the risk of pipe failure in service, shorten the design life, set a precedent for competing pipe materials to seek lower safety factors, and result in a disservice to the entire industry.

The plastic pipe industry's abilities to improve upon performance and durability depend upon continued material improvements and clear, consistent standards. Allowing a safety factor that goes below that required for AWWA's other distribution and transmission pipes would not be prudent, especially for the newest and yet to be proven HDPE materials that affords the same 1,600 psi HDB as the previous generation of HDPE pipe materials.

Uni-Bell encourages all members of the pipeline community (i.e., utilities, design engineers, system operators, consumers, academicians, and pipe manufacturers) to stay informed and to actively express your own support for clear, consistent AWWA pipe standards and a required minimum safety factor of 2.0 (maximum DF of 0.5).

UNI-BELL POSITION STATEMENT REGARDING AWWA PIPE STANDARDS & MINIMUM SAFETY FACTOR (SF ≥ 2.0)

The major manufacturers of PVC pipe represented by the Uni-Bell PVC Pipe Association are in strong support of standards that are meaningful and clearly written. Uni-Bell supports harmonization of standards for comparable pipe products intended for the same or similar end-use applications. Consequently:

- Uni-Bell supports maintaining the current requirement for a minimum safety factor of 2.0 (maximum design factor of 0.5) for all AWWA pressure pipe materials, e.g., ductile iron, HDPE, PVC, PVCO, and steel; and opposes lowering the safety factor for any pressure pipe, including pipe manufactured from a relatively new HDPE resin.

- Uni-Bell supports including Pressure Class and safety factor information and requirements in all AWWA pipe standards as is the current practice in AWWA C900, C905, C906, and C909.

Background

The AWWA Standards Committee on Thermoplastic Pressure Pipe was established in 1968. AWWA C900-75 was the first standard developed by that Committee. In June 1988, the Thermoplastic Pressure Pipe Committee was divided into two separate committees: the Polyvinyl Chloride Pressure Pipe and Fittings Standards Committee and the Polyolefin Pressure Pipe and Fittings Standards Committee. The subsequent standards developed by the separate committees began to diverge in form and style. Discussions between the two committees began in the 1990's to try and harmonize the formatting and terminologies common among the thermoplastics pipe standards.

Latest Editions of AWWA C900, C905, C906, and C909

Efforts to revise and update AWWA's thermoplastic water distribution pipe standards began in the late 90's. In order to achieve consistency and facilitate objective comparisons, very similar formats and terminologies were incorporated in all of AWWA's thermoplastic pipe standards for water distribution and transmission. As a result, AWWA C900-07, C905-10, C906-07, and C909-09 currently have parallel formats and very similar terminology.

AWWA C906

The efforts that have been invested to harmonize AWWA's thermoplastic water main standards must not be lost. AWWA needs to continue to provide clear and consistent information regarding the requirements for materials, testing, and pressure classification; and not deviate from the currently consistent thermoplastic pipe standard format. It would not be in the users' best interest to change AWWA C906 and allow it to be inconsistent with current standards, and do away with explanation of important design concepts and essential information on HDPE pipe materials.

It is particularly important that AWWA C906 remain consistent with AWWA's other thermoplastic pipe standards and retain the pipe pressure class designation equation (Eq. 1) in a format that clearly defines the relationship between Hydrostatic Design Basis (HDB), Design Factor (DF) and Dimension Ratio (DR). Removal of Design Factor (DF) from the Pressure Class (PC) equation has the effect of hiding the safety factor (i.e., a SF less than 2).

Proper risk minimization requires the use of conservative safety factors to account for inevitable and unavoidable damage during handling and installation, installation errors, jobsite peculiarities, operational unknowns and manufacturing variations. AWWA's common pressure pipe product standards such as those for steel (AWWA C-200), iron (AWWA C-150), PVC (AWWA C900/C905), PVCO (AWWA C909) and HDPE (AWWA C906) all require pressure classification based on a safety factor of 2.0 or greater. To allow pipes made from the newest and least proven HDPE resins to be classified using a safety factor (SF) of only 1.6 (a design factor of 0.63) would not be in anyone's best interest.

A substantial SF reduction (DF increase of 26%) will increase the risk of pipe failure in service, shorten the design life of HDPE pipe, set a precedent for competing pipe materials to seek lower safety factors, and result in a disservice to the entire industry. **No comparative risk analyses have been conducted that justify lowering the SF from 2.0 down to 1.6 for these newest HDPE pipe materials.**

The producers of the new HDPE material advocate lowering the safety factor on the basis of improved slow crack growth resistance, not a higher long-term strength category. However, variability in crack resistance within the range of pipe materials for which AWWA has published standards has not been used to set different design safety factors. A design safety factor of at least 2.0 has consistently been required. Moreover, past improvements in pipe material resistance to cracking, e.g., ductile vs. cast iron and PVCO vs. PVC, did not lower their required design safety factors. Lastly, HDPE affords the lowest tensile strength and shortest record of municipal water distribution service of any of the materials for which AWWA publishes pipe standards.

The AWWA requirements for working pressure rating, recurring pressure surges and occasional pressure surges also need to continue to be included in the mandatory portion of pipe

standards. The temperature coefficients table that is currently in all of AWWA's thermoplastic water distribution pipe standards must be retained. The alteration or deletion of any of these important sections would increase the risk of misusing products manufactured to C906 and deviate from the current formatting of AWWA C900, C905, C906 and C909. Without consistent formatting, comparative evaluations of pipe product options are obscured. Information in the AWWA Design Manual (M55) and Appendix of C906 is only guidance and may be ignored or not read by those using C906.

Table 1 of AWWA C906-07 currently lists the required minimum long-term strength (Hydrostatic Design Basis - HDB) values and HDPE material cell classes per ASTM D3350 and needs to also be retained. Pre-calculated Hydrostatic Design Stress (HDS) values should not be listed or included because they conceal the introduction of a lower SF (higher DF). The best interests of AWWA and the user-community are not served if a standard is written in a manner that does not clearly divulge the required SF.

Recommendations

The plastic pipe industry's abilities to maintain and improve upon performance and durability depend upon continued material improvements and clear, consistent standards. Allowing a safety factor that goes below that required for AWWA's other distribution and transmission pipes would not be prudent, especially for the newest and yet to be proven HDPE material that affords the same 1,600 psi HDB as the previous generation of HDPE pipe materials. If such a drastic change is made, it must be made in a forthright manner so that the user community understands the risks inherent in using a lower safety factor and that the "new" HDPE pipe materials have not been quantifiably evaluated in service.

It is worth noting that HDPE's largest and most successful end-use market is natural gas distribution. The pressure rating for gas distribution and transmission pipe is federally regulated in the U.S., and requires that the maximum pressure rating of PE pipe be determined based on a SF of 3.125 (a DF of 0.32) for previous and newest generation HDPE materials. Similarly, the water industry should maintain a safety factor of 2.0 (a design factor of 0.5) for all metal and thermoplastic (HDPE and PVC) pipe materials.

Finally, all of AWWA's thermoplastic pressure pipe standards should be clearly written and employ consistent formats to minimize confusion.

We encourage all members of the pipeline community (i.e., utilities, design engineers, system operators, consumers, academicians, and pipe manufacturers) to stay informed and to actively express your own support for clear, consistent AWWA pipe standards and a required minimum safety factor of 2.0 (maximum DF of 0.5).