

# EBAA IRON Connections™

TECHNICAL DATA FOR THE WATER & WASTEWATER PROFESSIONAL

PV - 4

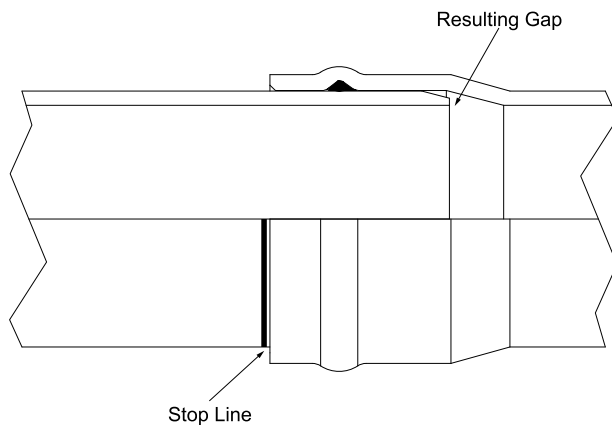
## Mega-Stop Bell Protection System Aids in Pipe Joint Assembly

Water and wastewater piping comes in a wide selection of materials, joints, and diameters to meet the multitude of applications and needs in our nation's infrastructure. While all of these piping varieties have multiple benefits none are perfect for every application. In the US PVC as a piping material has seen significant growth in use in the last 35 years accounting for two-thirds by weight of plastic pipe and almost half of all installed pipe by length in 2004.

Each of the differing materials and joints has its own set of benefits and features along with limitations. PVC pipe has seen its popularity rise because it is so easy to install, will not corrode, and is relatively inexpensive. The ease of installation has also exposed one of its few limitations.

### Over-Belling of PVC Pipe Joints

Most gasketed PVC pipe joints incorporate a bell end with a sealing gasket and a spigot end. The pipe is typically assembled and joined by lubricating the gasket and/or spigot and pushing the spigot into the gasketed bell until the positioning of the spigot is as recommended by the manufacturer. This is generally indicated via a "stop-line" or "insertion-mark" on the spigot being positioned at the end of the pipe bell.



Properly Assembled PVC Pipe Joint

Inspection or verification of proper assembly simply involves the visual confirmation that the stop line is properly located at the lip of the pipe bell. (On cut pipe lengths or if the stop line is missing for another reason it is important to place a stop line on the spigot as directed by the manufacturer.)

A properly installed joint, and the resulting gap between the end of the spigot and the back of the bell, provides an allowance for expansion and contraction caused by temperature changes or soil movement. This gap also, depending on the manufacturer, permits some angular deflection of the joint. If the spigot is pushed too far into the bell (especially so that the end of the spigot is wedged against the back of the bell) the joint is "over-belled" or over-inserted.

Installation instructions for PVC pipe from standard bodies (AWWA and ASTM), the Uni-Bell PVC Pipe Association, and all of the gasketed PVC pipe manufacturers include admonitions to avoid over-insertion. The assembly instructions from ANSI/AWWA C605-05 "Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water" include the following in Section 5.2.2.

... Pipe Spigot ends are pre-marked at the factory with a circumferential insertion line. The line references how far the spigot should be inserted into the adjoining PVC pipe bell.... Pipe-to-pipe joints shall be assembled only to the insertion line. After assembly, the insertion line shall remain visible and be nearly flush with the lip of the adjoining PVC pipe bell. Joints assembled beyond the insertion line shall be considered over-assembled and may result in damaging stresses or leakage.

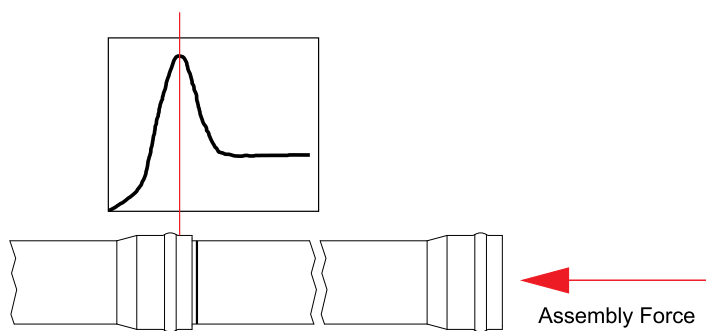
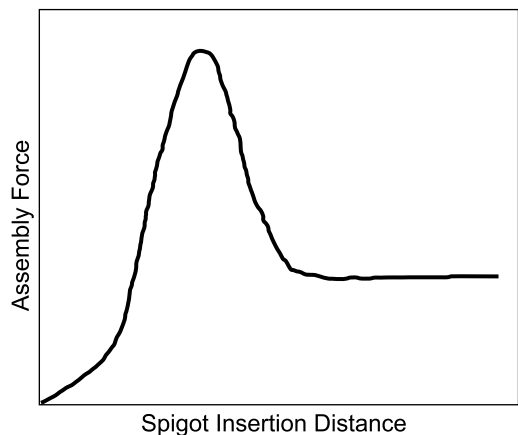
The Uni-Bell PVC Pipe Association Handbook of PVC Pipe also includes this in the installation instructions.

Care must be taken to insure that the spigot is not over-inserted and that previously assembled pipe joints are not disturbed.

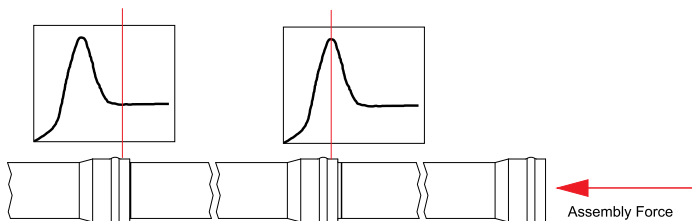
A number of industry technical papers have made the point that over-belled joints are the most likely cause when pipe joint failures occur.

### How are Joints Over-Inserted?

Even the most careful of installers can unwittingly over-insert a joint. The assembly of any push-on, gasketed pipe joint requires a certain amount of force to complete. As is shown in the following figures, the initial amount of force required to deflect the gasket is greater than the amount of force required to further push the spigot past the gasket location until proper positioning is achieved.



This is where the Uni-Bell caution about disturbing “previously assembled joints” comes into play. The force required to assemble a subsequent joint is more than enough to cause previously assembled joints to further-insert because, as mentioned above, the force needed to continue pushing the spigot into the joint is less than that required during the initial assembly/gasket deflection.



This can be more of an issue with larger diameter pipe because the required assembly force is much greater than with smaller diameters. Studies have shown that the assembly of a single joint can affect four to six already assembled and buried joints.

Another consequence of over-inserted pipe is a “loss” of pipe. An over-inserted pipe can have a laying length that is more than 2 inches shorter than specified. Depending on the length of the pipe involved several pieces of pipe can be “lost” as a result.

### How to Prevent Over-Insertion?

While the admonition against it is in place, there is not much help available in preventing over-insertion of newly or previously assembled joints. Some utilities have gone to great lengths to

assure themselves that all of the joints in their system are properly made. Those measures include, among other things, holding pipe lengths in place with pieces of equipment, using temporary stop mechanisms, or slow (particularly in larger sizes) mechanical means such as come-a-longs and cables. Additionally, with some utilities, if inspection reveals that any joints are over-belled the installer is required to expose previously assembled joints until properly made joints are found and the over-inserted joints must be re-installed.

With the development and introduction of the patent pending Mega-Stop bell protection product there is now a means of correctly installing every pipe joint while simplifying inspection and, in some cases, speeding up the over-all progress of pipeline installation. It also allows for expansion, contraction, and deflection as intended by the manufacturer.

The Mega-Stop product is a simple design that has a gripping ring that provides the physical stop and limits the travel of the spigot into the bell. However, the unique Expansion Retention Spring (ERS) separates the end of the bell from the physical stop so that expansion/contraction/deflection can take place as intended by the joint designers and pipe manufacturers. The ERS compresses when additional force is applied to the joint and pushes the joint back to the proper position when the force is removed.

To aid inspection the ERS allows for visual verification of the location of the stop-line on the spigot. In the 4-12 inch design, inspection notches in the rubber spring permit the installer to position the product properly and the inspector to verify that the joint is assembled properly. This can allow the inspector to inspect multiple pipes at ground level after the Mega-Stop products have been installed but before the pipe is placed in the trench.

### Conclusion

The Mega-Stop bell protection system offers a simple, safe, and reliable means of protecting PVC pipe joints. The product’s design, function, and application will be examined in the next Connections Bulletin.

### References

Shah Rahman, **PVC Pipe & Fittings: Underground Solutions for Water and Sewer Systems in North America**, 2nd BRAZILIAN PVC CONGRESS, Sao Paulo, Brazil, June 19-20, 2007

Uni-Pub-10, **When Performance Counts**, Uni-Bell PVC Pipe Association

Steven L. Folkman, A. P. Moser, and Thomas Fronk, **Analytical Model of Stresses Caused by Over-Belling PVC Pipe**, Plastic Pipes XV

Younes YOUSSEF, Sébastien GAUTHIER and Richard ST-AUBIN, **Effect of Over-Insertion and Over-Deflection on the Integrity of PVC Pressure Pipe-Numerical and Experimental Analysis**, ASCE Pipelines 2008

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