Exploding the Myth: Do Deep Socket Fittings or Improper Application of Cement Cause Failure?

BY LARRY WORKMAN

Irrigation systems can really take a heating. Solvent-cemented joints are particularly vulnerable. Every time water bangs through a pipe, it slams into comer fittings with the pressure of the entire system behind it. This can loosen the fitting from the pipe, or worse, cause it to pop right off gushing water everywhere. Some manufacturers believe that the best way to avoid this problem is to use longer sockets. It sounds pretty logical a deeper socket seems like it would provide extra reinforcement for jointed areas. The longer the socket, the stronger the system. But is this really true?

The American Society for Testing Materials (ASTM) has created a series of standards regulating the dimensions of pipe and sockets. Manufacturers must follow these specifications, which are meant to provide enough cementing surface inside a fitting to prevent it from ever separating from the pipe. As part of these standards, the ASTM has mandated a minimum length for all sockets.

We performed a series of tests to illustrate that the depth of the socket in fittings does not affect the strength of the joint, despite the AS TM's minimum standard. We believed that the integrity of an irrigation system relies primarily on the strength and application of the solvent cement. To prove this, we tested three sets of five fittings from three manufacturers.

In one group, the sockets had been shortened to roughly one-half of the ASTM minimum socket depth. The second group had the sockets reduced to seventy-five percent of the minimum socket depth, and the last group had all of the fittings shortened to the ASTM minimum exactly.

The fittings were solvent-cemented to short lengths of Schedule 40 pipe and allowed to cure. They were then subjected to pressures of up to 145 psi. Despite the shortened sockets, all but three of the test samples survived. Two of the samples that failed were the full ASTM minimum length: only one failing sample contained a socket we had shortened. Closer examination proved that this socket had a problem with the fitting itself, not the solvent-cemented joint. The fact that most samples survived the test, and of the failures, only one was a shorter depth socket, lends even more credence to the theory that it is not socket length which gives a system its integrity. But what does this mean in the real world, or in jobsite terms?

It means that the minimum socket depth is more than sufficient to provide a joint that will not come apart under the normal conditions and installations in the field. In fact, even reducing the socket depth by forty or fifty percent does not increase the chances of glue joint failures.

It's also worth noting that we tested our joints at I450 psi. The maximum working pressure of a one-inch Schedule 40 pipe is only 450 psi. If a shallow socket can survive 1450 psi. it will have no trouble in real-world scenarios. Extra socket length does not provide extra insurance against joint failure. The success of a system depends not on the fitting, but the solvent cement.

The preparation of the pipe end, proper application of primer and cement, and sufficient cure time are the requirements that will result in leak-free, strong joints in a system. When the pipe is not inserted to the stop or cut square, there is a greater chance of a joint failure than if the fitting has longer sockets. Look at it this way: Schedule 80 fittings, which are manufactured to withstand higher pressures than their equivalent Schedule 40 counterparts, do not have socket depths that are proportionally deeper.

The chances of collecting a puddle of cement, along with the reduction in wall thickness adjacent to the pipe stop, are by far more responsible for joint failures than shorter socket lengths. Since the fitting socket has a slight taper, a pipe that is not seated to the stop can have a gap between it and the fitting, which has to be filled with enough solvent cement to prevent a leak.

Every brand and every formulation of solvent cement contains PVC, which is left to fill any gaps and voids when the solvents evaporate. That residual PVC is not of the same density as either the pipe or fitting material and it is not as strong. This will result in a joint that is much weaker than one with a tight fit that allows the pipe and fitting materials to fuse as one.

Our analysis of many joints returned from the field over the years clearly illustrates that the most common cause of solvent joint failure is the lack of cement or improper application, not socket depth. Although making a good solvent cemented joint is very basic, there are a few points that need to be emphasized.

The first step is to remove all burrs and rough edges from the end of the pipe. Then, using an applicator at least one-half the diameter of the pipe, apply primer to both the pipe and fitting socket. Immediately, again with an applicator that is half the diameter of the pipe, apply a coat of cement to the pipe end. Apply a light coat of cement to the fitting socket. Add a second coating to the pipe. Assemble both parts with a twisting motion. Finally, allow sufficient time for the joint to cure before moving or applying pressure. If you follow this procedure, you can rest assured the joints will not leak and the socket depth is no longer a concern.

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