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FINAL ACCEPTANCE OF CIPP

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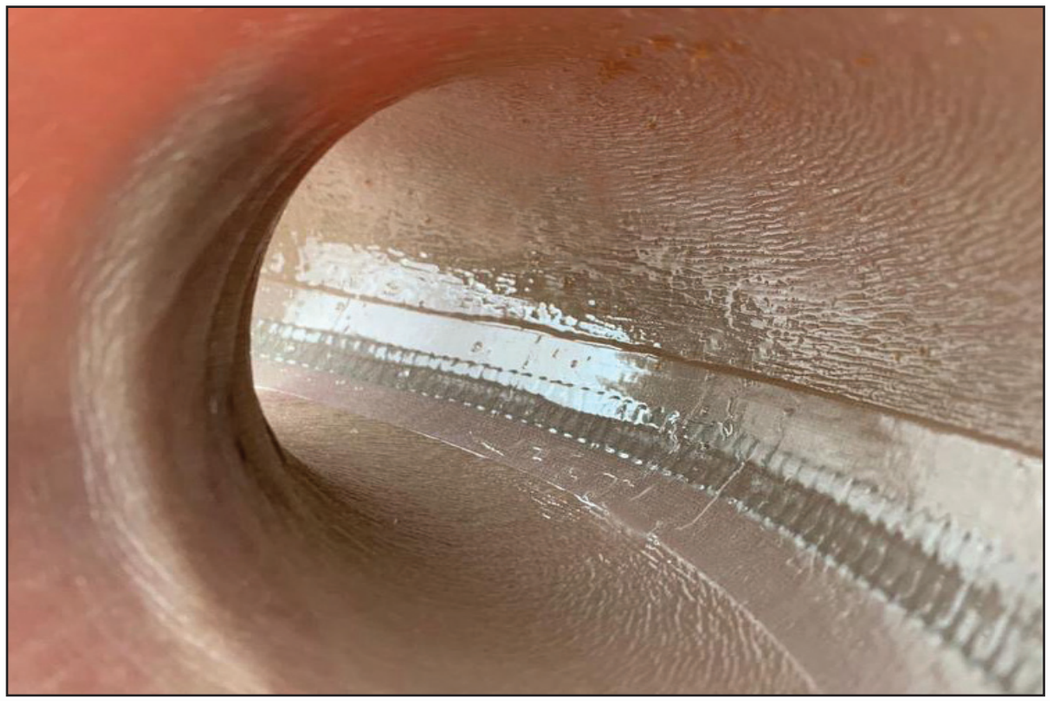

Photo Courtesy of Applied Felts Inc.

Final acceptance of cured-in-place pipe (CIPP) can be challenging when the owner and/or the engineer are inexperienced or have unrealistic expectations of what this renewal solution is actually capable of producing. Of the various quality assurance components of projects involving CIPP, the two most recognized standards for acceptance of the CIPP installer's work are: 1) fit and finish and 2) finished mechanical properties.

Ideally one would like to see an efficient liner thickness that is easy to make conform to the irregularities of the host pipe wall structure. The tighter the fit the more capable the CIPP is to resistance of the external hydrostatic pressures that will act on the finished CIPP. The fit and finish of the CIPP with the host pipe can be adversely affected by unnecessarily thick liners. CIPP tube materials are undersized by design so that the installation process will "stretch" the unhardened CIPP into the shape of the host pipe, producing as smooth an interior wall surface as the host pipe will allow. Add in the difficulty of fitting the CIPP to egg-shaped and arch-shaped pipe geometries and one can easily see why less thickness equates to more quality of the fit and finish. Poorly fitting CIPP can come from incorrect designs as well as inadequate installation practices of the CIPP installer. They can also come from size variations throughout the host pipe. For these reasons some finning of the CIPP inner layer (the part one sees from the inside of the pipe) can occur from time to time.

The second most frustrating issue for contractors and engineers regarding the quality assurance part of the project is the material properties testing of the restrained samples. Historically in North America, plain felt CIPP has been tested by capturing restrained cylindrical samples at an intermediate or the end manhole. The samples are then sent to a lab that will extract them from their restraint system and cut them into 0.5-inch-wide specimen following the longitudinal orientation of the pipe. Since ASTM D790 refers to flat beam specimen for testing the flexural properties of a plastic, the specimen cannot be cut from the circumferential direction. Adding to that frustration, enter the reinforced felt fiber and glass fiber CIPP products which have their real strength in the circumferential direction, the orientation of pipe loading in the real world. So why not test in the circumferential direction? ISO 11296-Part 4 has long used samples cut in the circumferential direction (making arched beam specimen) for measuring the finished physical properties of CIPP; both for CIPP using plain felt or reinforced tubes. Recognizing the need for the ASTM D790 to use curved beam specimen, ASTM F2019-20 recently added an appendix to address this need. "Appendix X2. Modifications to Test Method D790 for Flexural Properties Testing" presents how to test these curved-beam specimen following the long-proven method in the ISO 11296-Part 4 standard's Annex B.

Along with a test procedure that allows the finished CIPP to be tested in the orientation of its loading, the newly revised standard gives better insight into how to get better testing results such as 1) choosing samples that are close enough in their dimensions to produce a valid average test value; and 2) recognizing the limits of the accuracy in the testing itself to give guidance on acceptance. On the latter, paragraph 7.3.1 of the revised standard states, "When flexural testing is conducted using curved beam specimen a value of 85% or higher of the flexural properties used in the wall thickness calculations shall be considered as passing." This is because the value of the apparent flexural modulus derived from a curved test piece is generally lower than that obtained from a flat piece of the same material due to geometric effects and slippage on the supports. At a nominal span to thickness ratio of 16, the maximum discrepancy is on the order of 10% to 15%. This recognized practical allowance is key to the engineer and owner's understanding of what should be considered as passing.

It should also be noted that the revised F2019 standard also addresses the design of circular and non-circular pipes that will ultimately result in an efficient liner thickness that will better deliver on the fit and finish.