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June 21, 2018

HTS Report #:	BLDF834.001A.Doc - Proprietary	
Mr. Tim Matheson BLD Services, LLC 2424 Tyler Street Kenner, LA 70062	Customer Project Name: Date Sample Tested:	BLD's SCS+L 10,000 Hour Hydration/Dehydration Cyclical Test 4/20/17 – 3/13/18

Executive Summary

HTS Pipe Consultants (HTS) observed the testing of BLD Services' "Service Connection Seal + Lateral" (SCS+L) Cured-In-Place Pipe (CIPP) lateral lining system over a period of 10,000 hours. The testing was conducted at the BLD Services' headquarters located at 2424 Tyler Street in Kenner, LA.

The BLD SCS+L CIPP lateral lining system, using Adeka Ultra Seal P-201® hydrophilic paste material, was tested over the 10,000 hour period while being subjected to varying hydration/de-hydration cycling at varying hydrostatic pressures ranging from 0 to 58 psi (134 feet of head pressure).

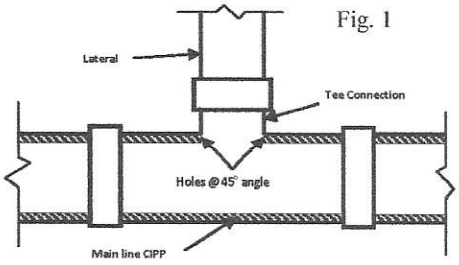
The SCS+L CIPP lateral system eliminated infiltration over the duration of the 10,000 hour test. The SCS+L effectively sealed the connection at the main line pipe and the service lateral, and at the terminating end of the CIPP lateral through the multiple hydration/de-hydration cycles at the varying hydrostatic head pressures.

As a result, BLD's SCS+L CIPP lateral lining system has demonstrated that it is an effective long-term solution to eliminate infiltration at the main line and service lateral connection.

Test Parameters

- Installation of a CIPP liner, per industry standards, into a main line pipe by a 3rd party main line CIPP contractor.[1]
- Reinstatement of the service lateral connection using standard internal reconnection practices commonly used in the CIPP industry,[2]
- Holes in the main line (see fig. 1) to simulate a substandard connection and source for infiltration. Care to ensure that infiltration points made only penetrate through the main line pipe and not through the main line CIPP.
- Placement of the lined pipe assembly in a "pressure canister" with each end of the main and lateral pipes secured using high pressure Furnco seals.
- Measurement of the volume of water infiltration entering the main line pipe prior to installation of the SCS+L at varying pressures to establish baseline pre-lateral lining infiltration levels.
- Installation of the SCS+L into the pressure canister by BLD operations personnel with active infiltration in order to replicate actual field conditions that otherwise might not be accurately simulated during an installation made under environmentally controlled laboratory conditions.[3]

Fig. 1

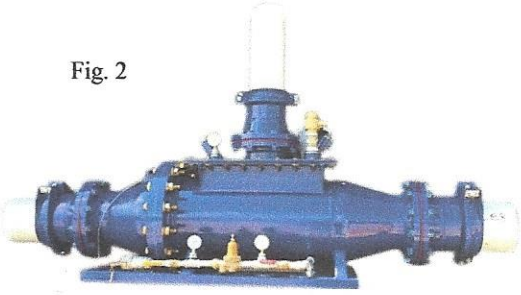


The SCS+L was installed using standard BLD process devices and installation procedures resulting in the resin saturated felt being against the main CIPP and lateral host pipe. The SCS+L was installed during the presence of 3 psi active infiltration to simulate actual field conditions. Curing of the installed SCS+L was conducted in accordance with the resin manufacturers' recommended cure schedule.

Pressure Canister[5]

Upon completion of the installation and curing of the SCS+L, the pressure canister (see Fig. 2) was filled with water, ensuring that all air was purged. The hydrostatic pressure was adjusted to the desired level and the volume of infiltration observed. Infiltration was monitored at varying pressures ranging from 0 to 20 psi during the 10,000 hour test period and the pressure was increased to 58 psi at the conclusion of the 10,000 hour test. Frequent emptying and re-filling of the pressure canister was conducted to simulate the effects of hydration/de-hydration cycling associated with changing groundwater conditions in order to demonstrate the ability of the SCS+L system to adequately eliminate infiltration. Cycles varying from 2 days to 6 weeks were used to substantiate the ability of the SCS+L lateral lining system to eliminate infiltration over both short and prolonged periods of hydration and de-hydration

Fig. 2



Observation Results

See Attachment 2

Sincerely,

Rick Eastwood
Vice President

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[1] The main line CIPP was installed 30 days prior to installation of the SCS+L.

[2] An operator in a TV van using a robotic cutter and Closed Circuit TV (CCTV) to simulate internal reinstatement practices commonly used in CIPP.

[3] Installation of the SCS+L was conducted per BLD standard procedures.

[4] The SCS+L system utilizes a "full-wrap" that surrounds the entire circumference of the inside diameter of the main line pipe with a sewn/sealed connection to the CIPP lateral. Adeka Ultra Seal P-201®, a hydrophilic material in paste form, was used at the interface connection of the main line pipe. In addition, a ½" band of cured Adeka Ultra Seal P-201® was used at the terminating end of the service lateral.

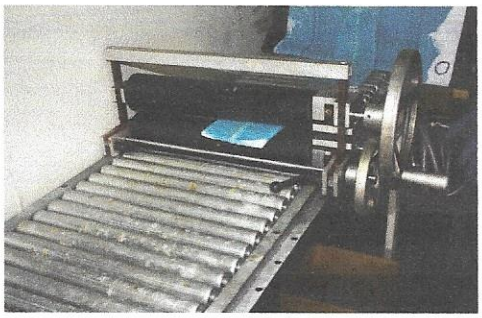
[5] The pressure canister was manufactured to allow the release of trapped air and provide regulated hydrostatic pressure around the entire LPA to simulate pressures associated with varying ground water levels. The pressure canister containing the LPA was placed in a temperature controlled environment to simulate ground temperatures of approx. 50° F) for buried pipe. The PC remained in the controlled temperature environment for the duration of the 10,000 hour test.

PROCESS

SCS+L Resin Saturation (Wet Out)

The SCS+L was wet-out using neat polyester resin with a catalyst package and mixing ratios/procedures per the manufacturer's recommendations. The wet out was conducted while vacuum was applied to both the full-wrap and lateral liner and visually inspected via the transparent/translucent coating to ensure thorough resin saturation into the felt. Blue dye was used to provide visual confirmation to ensure thorough resin/catalyst mixing and resin saturation during wet out.

Machined pinch rollers with calibrated gage blocks were used to set the recommended gap setting to ensure proper resin saturation



SCS+L Installation

The pocket of the resin saturated backing ring was filled with Adeka Ultra Seal P-201® immediately prior to installation.

Silicate resin was evenly distributed over the exterior of the full-wrap for additional adhesion to the host pipe.

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- Regular emptying and re-filling of the pressure canister during the 10,000 hour test period. Measurements of infiltration at various pressures to analyze the capability of the SCS+L lateral lining system to effectively eliminate infiltration during hydration/de-hydration cycling.

Materials Used

8" x 6mm Main Line CIPP Liner

An 8" x 6mm felt liner with sewn seams was used to line the main pipe. Wet out was conducted using vacuum impregnation and a roller system with a gap setting (distance between rollers) that would ensure even resin distribution and saturation.

Polyester Resin

Standard neat isothalic polyester resin using an industry standard catalyst package was used to wet out the main CIPP liner. Manufacturer recommended mixing procedures were followed.

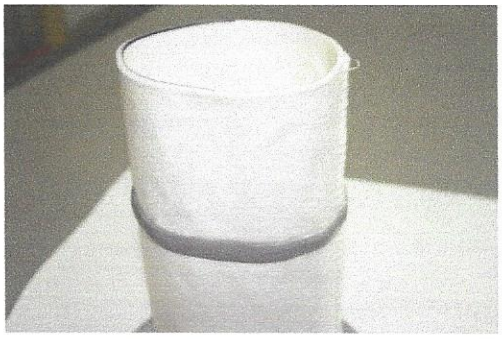
Service Connection Seal + Lateral (SCS+L) Liner[4]

A 3mm coated felt material was used for the full-wrap of the SCS+L liner. The full-wrap was attached to a 6" x 5mm lateral liner via a sewn seam. The sewn connection was sealed and inspected via vacuum prior to wet out to ensure water tightness. An engineered plain felt "backing ring" was attached on the plain felt side of the full-wrap and lateral connection with a "pocket" around the full inner circumference of the ring.

Adeka Ultra Seal P-201® Hydrophilic Material

Adeka Ultra Seal P-201® is described as a water-swelling single component urethane rubber used as a water stop in a variety of Cured-In-Place-Pipe (CIPP) applications to seal infiltration at connections and annular spaces.

The Adeka Ultra Seal P-201® was used at the full-wrap/lateral interface and at the terminating end of the CIPP lateral. The Adeka Ultra Seal P-201® at the lateral end was cured prior to wet out and installation.



Note: Adeka Ultra Seal P-201® was used around the full outside circumference of the host pipe and between the main CIPP to seal potential exit points of water tracking through annular spaces and to ensure a water tight LPA.

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ADEKA CIPP Applications

Using ULTRASEAL® P-201

OCM

PRODUCT DESCRIPTION

Single component hydrophilic urethane grey paste

PAKAGING

24 cartridges per case
320 ml (10.8 oz.) per cartridge

EXPANSION INFORMATION BY VOLUME

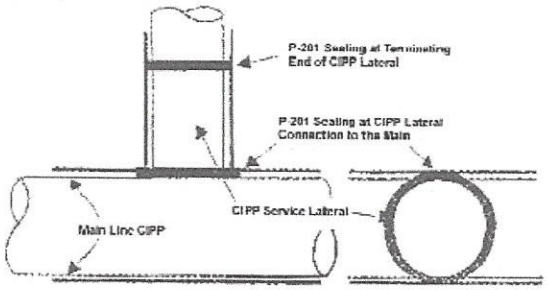
Approximately 100% (2 times by volume)

GENERAL DESCRIPTION

P-201 is a water swelling single component urethane rubber used as a water stop in a variety of Cure-In-Place-Pipe (CIPP) applications to seal infiltration at connections and annular spaces. P-201 is a material that can be applied on wet or uneven surfaces and functions in a wide range of temperatures, ground water conditions, pressures, and hydration/dehydration cycling.

TYPICAL USES

ADEKA ULTRASEAL® P-201 has been utilized in a wide variety of construction applications including the elimination of infiltration between the main line and installed CIPP main line and service laterals. P-201 will expand in the direction of least resistance. When expansion is inhibited, the product will produce expansion pressure against pipe walls effectively sealing off infiltration with hydrostatic head pressures as high as 150 ft.



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CURED-IN-PLACE-PIPE (CIPP)

ADEKA ULTRASEAL® P-201 is an excellent product to seal infiltration tracking that occurs between host pipes and installed mail line and service lateral CIPP.

MAIN LINE CIPP

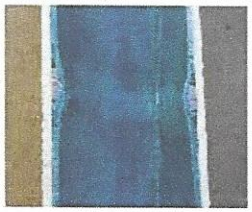
P-201 has successfully been used in installed CIPP at the ends near manholes to seal annular spaces that occur between installed main line CIPP and the host pipe. This sealing eliminates water tracking in the annular space that otherwise would enter manholes and service laterals that have not been rehabilitated.

SERVICE LATERAL CIPP

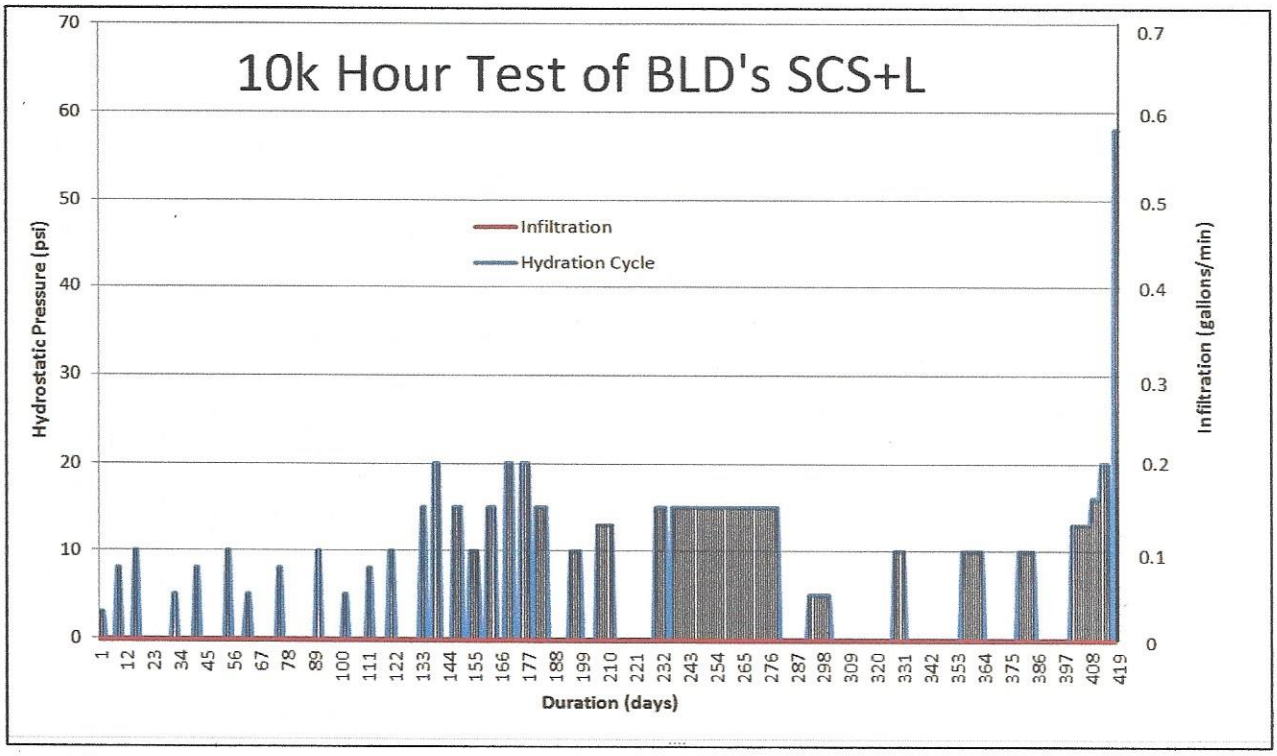
P-201 is a commonly used material to effectively eliminate infiltration at the connection of the lateral to the main and the terminating end of installed CIPP service laterals

The ability for P-201 to be applied to wet surfaces with cracks and voids makes it an ideal material for CIPP service lateral applications.

Inspection of CIPP laterals that have been in service for more than 15 years show that P-201 is capable of sealing and eliminating infiltration, even after years of hydration and dehydration cycling.



Attachment 2



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