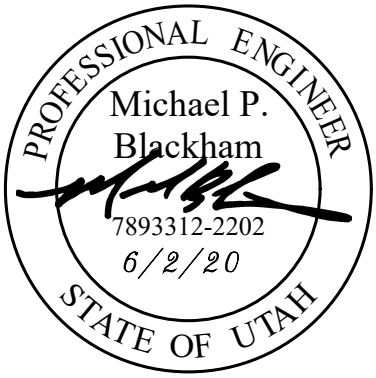
June 1, 2020

Perfect Lined Manhole Hydrostatic & Vacuum Test Data – SDV Joint

*Hydrostatic and Vacuum joint testing per ASTM requirements on the Perfect Lined Manhole SDV Joint



Heather Christensen
Technical Marketing Manager
Cell: (385) 277-6262
Email: hchristensen@genevapipe.com

Mike Blackham, PE
Director of Engineering and Technical Services
Cell: (208) 713-8551
Email: mblackham@genevapipe.com

Contents

Introduction

Over a two day period starting on May 27th and ending on May 29th in 2020, Geneva Pipe and Precast preformed multiple tests on a joint configuration option for the new Perfect Lined Manhole at the Geneva Pipe and Precast Orem Facility located at 1465 N 400 W, Orem, UT 84057. This report provides a description of the joint that was tested, the tests performed and the results of each test.

Joint Description

The Perfect Lined Manhole is a conventional concrete manhole manufactured with concrete thicknesses and reinforcement areas per ASTM C478 with a plastic liner anchored throughout the entirety of the manhole interior. Due to several options available for the manhole joint configuration, Geneva Pipe and Precast decided that the best way to decide which joint configuration to use in the final design was by manufacturing and testing a prototype of each joint option. The joint configuration that performed most favorably during the tests is described below.

SDV Joint

This joint configuration consists of the components described in Table 1 and Figures 1, 2, 3 and 4.

Table 1: SDV Joint Component Descriptions

Joint Component	Qty. Per Joint	Component Description	Purpose
DS SDVseal (see Figure 1)	1	A compression slide ring seal with wedge-shaped cross section and an internally greased closed slide mantel. Connected to the seal is a quartz sand filled load transfer hose.	To seal the manhole joint from infiltration and exfiltration and to transfer the joint load
Liner Clip (see Figure 2)	2	An EPDM rubber clip that is cast into the concrete of the joint and also mechanically attached to the HDPE liner. The Liner Clip is installed on both the bell and spigot of each joint.	To seal the HDPE liner on the interior of the riser to the concrete joint, preventing any exposed concrete

Figure 1: DS SDVseal Cross Section

Figure 2: Liner Clip Cross Section & Image

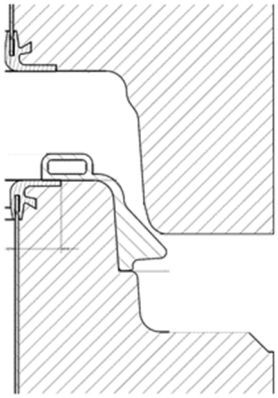


Figure 3: SDV Joint Configuration

Figure 4: Manhole Base with SDV Joint Configuration

Tests Preformed

Both a hydrostatic and vacuum test was performed on the joint configuration described above.

Hydrostatic Test

A hydrostatic test was performed in which a manhole stack was tested to confirm its resistance to exfiltration of liquid through the joints.

Test Setup

A lined manhole stack was created. The manhole stack consisted of the components listed in Table 2 from bottom to top. The joint considered for the hydrostatic test was the joint between the manhole base and riser, hereafter referred to as the "base-riser joint". The base-riser joint for the manhole stack was constructed with the SDV Joint configuration. The hydrostatic test described in the following section was performed on that manhole stack.

Table 2: Manhole Stack Components

Manhole Component	Stack Height (ft.)
48 in. Base	4'
48 in. Riser	4'
48 in. Cone	6'

Figure 5: Manhole Stack Image

Test Description

The manhole stack was filled with water such that the water level reached a total height of 10.25 feet above the base-riser joint. This head of water would result in a total pressure of approximately 4.44 psi on the base-riser joint under consideration. 4.44 psi is equivalent to about 9 in. of mercury which is the passing criteria required for ASTM C1244.

The water was left in each manhole stack overnight and the change of water level was observed the next day.

Vacuum Test

A vacuum test was performed by a 3rd party inspection company called Kevin D. Major Inc. DBA David W Major & Sons. The test was completed per ASTM C1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

Test Setup

The same manhole stack was used consisting of the same components listed in Table 2 from bottom to top. The full manhole stack was then vacuum tested following ASTM C1244.

Test Description

As per the testing specification, the manhole stack was vacuum tested to a negative air pressure of 10 in. mercury (Hg). The total time it took for the pressure to reduce to 9 in. Hg was recorded and compared against the passing criteria listed in the testing specification. For a complete test description, refer to ASTM C1244.

SDV Joint Test Results

Hydrostatic Test Results

No change in water level was observed in the manhole stack upon visual inspection the next day. Therefore, it was determined that the SDV Joint could maintain a minimum of 4.44 psi over a 20-hour period.

SDV Joint Secondary Hydrostatic Test

Geneva Pipe and Precast's team performed a secondary hydrostatic test in which the lubricated gasket portion of the DS SDVseal gasket was cut off as shown in Figure 6. The purpose of removing this section of the gasket was to test the ability of the quartz sand filled load transfer hose to withstand the exfiltration hydrostatic pressure alone. The same protocol described in the Hydrostatic Test section of this report was conducted with the exception of the manhole stack height. For this secondary test, only the manhole base and cone was stacked as shown in Figure 7. The new manhole stack was filled with water such that the water level reached a total height of 4 feet above the joint. This head of water resulted in a total pressure of approximately 1.73 psi on the joint under consideration. The water was left to sit in the manhole overnight and no signs of leakage were observed the following day, approximately 20 hours later.

Figure 6: Section of SDV Gasket Removed

Figure 7: Quartz Sand Filled Load Transfer Hose Secondary Hydrostatic Test Manhole Stack

Vacuum Test Results

As per ASTM C1244, the minimum time needed for the vacuum pressure to drop from 10 in. Hg to 9 in. Hg (a total of 1 in. permissible drop) was 45 seconds. The vacuum test was held at 10 in. Hg for 5 minutes (300 seconds) with a pressure drop of only 3/8 in. Hg. The vacuum pressure was then increased to 12 in. Hg and held for 10 minutes in which a total pressure drop of 1/10 in. was observed.

SDV Joint Secondary Vacuum Test

A secondary vacuum test was performed on the quartz sand filled load transfer hose alone by testing the manhole stack shown in Figure 7. The vacuum pressure was set at 10 in. Hg and held for 10 minutes in which a total drop of 3/4 in. Hg was observed in the first 5 minutes and no drop in Hg was observed for the last 5 minutes.

Summary

Table 3 below provides a summary of the test results for the SDV Joint.

Table 3: SDV Joint Test Results Summary

Test Performed	Acceptance Criteria	Outcome	Result
Hydrostatic Test	Test joint should maintain an acceptable hydrostatic pressure over an acceptable period.	Joint maintained 4.44 psi over 20 hours.	**Passed**
Secondary Hydrostatic Test (sand hose alone)	Test joint should maintain an acceptable hydrostatic pressure over an acceptable period.	Joint maintained 1.73 psi over 20 hours.	**Passed**
Vacuum Test	The manhole is acceptable if the time for the vacuum reading to drop from 10 in. Hg to 9 in. Hg meets or exceeds 45 seconds.	Only 3/8 in. Hg drop over 300 seconds.	**Passed**
Secondary Vacuum Test (sand hose alone)	The manhole is acceptable if the time for the vacuum reading to drop from 10 in. Hg to 9 in. Hg meets or exceeds 45 seconds.	Only 3/4 in. Hg drop over 300 seconds.	**Passed**

It should be noted that ASTM C1244 allows for the negative air pressure to equalize and be re-pressurized up to 10 in. Hg prior to the start of the vacuum test. This is likely why a larger pressure drop (3/8 in. over 5 minutes) was observed during the first part of the test when the pressure was initially raised up to 10 in. Hg and a smaller pressure drop (1/10 in. over 10 minutes) was observed afterwards when the pressure was raised up to a higher pressure of 12 in. Hg.

For any more information on the testing, please contact Geneva Pipe and Precast.