A Red Valve Company
And Tideflex Technologies White Paper

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ELASTOMERIC INLINE CHECK VALVES FOR CONTROL AND PREVENTION OF SANITARY SEWER OVERFLOW

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Abstract

It is costly for municipalities when sanitary sewer overflow (SSO) occurs. SSO can happen in a residential, commercial or institutional building, as well as in a street or environmentally sensitive area. The costs of cleaning, damages, noncompliance and possible litigation are daunting. Mechanical inline flapper and swing check valves are sometimes used to stop SSO in gravity sewer lines. However, they have an inherent inability to close off against sewage debris. Also, their high failure rate, frequently required maintenance, high headloss and high cracking pressure make them an ineffective solution. This is why the overwhelming majority of gravity sanitary sewer infrastructures do not use check valves.

This paper is a brief discussion of the techniques and use of both Duck Bill and Inline All Elastomer Check Valves to prevent SSO, CSO and sewage back-ups; as well as controlling inflow and infiltration in gravity sanitary sewer infrastructures and provide odor mitigation.

Keywords

Sanitary Sewer Overflow, Combined Sewer Overflow, Infiltration, Inflow, All Elastomeric Duck Bill Check Valves, All Elastomeric Inline Check Valves

Introduction

Infiltration, inflow and backup of sewage in homes or businesses is costly and causes undo suffering. Use of engineering studies, video mapping, instrumentation and SCADA can reveal the sources of the problem. They do not solve the problem. Actual repair and/or replacement of buried pipe and infrastructure is expensive and requires engineering and extensive construction or relining of the pipes.

In 1981,[1] to combat these and other problems relating to combined sewers, storm sewers and sanitary sewers; the EPA research division[2] commissioned Red Valve Company to create and test an “All Elastomeric Duck Bill Check Valve.”[3] In fact, the first All Elastomeric Duck Bill Tideflex® Check Valve (54”) that Red Valve manufactured and installed in New York City, in 1984, is still in service today.

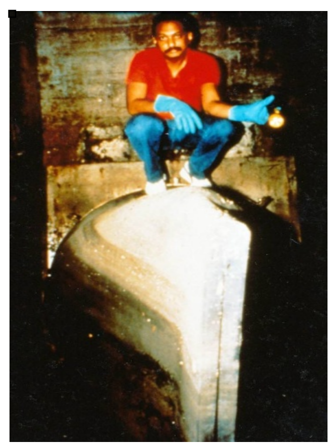

Figure 1 -
Wards Island Outfall
New York City, NY
Installed in 1984

Combined sewer overflow (CSO) occurs in a system specifically designed with a combined sewer.[4]

Currently, over 600,000 large and millions of smaller Tideflex® Check Valves are solving CSO, storm sewer, SSO and drainage backflow problems around the world. The latest All Elastomeric Duck Bill Tideflex® Check Valve, Model TF-1, continues the tradition of reliable backflow checking in both “outfall” and “inside the structure” applications. No matter what the debris, head pressure and back pressure conditions are, Tideflex® Elastomeric Check Valves are proven to perform over the years.

Causes and Effects of SSOs

Figure 2 - Man Unclogging Sewer Overflow in Chennai, India

"Occasional unintentional discharges of raw sewage from municipal sanitary sewers occur in almost every system. These types of discharges are called sanitary sewer overflows (SSOs). SSOs have a variety of causes including, but not limited to, blockages, line breaks, sewer defects that allow storm water and groundwater to overload the system, lapses in sewer system operation and maintenance, power failures, inadequate sewer design and capacity, and vandalism. The untreated sewage from these overflows can contaminate our waters, causing serious water quality problems and illness. Lack of capacity in the system causes back-up of sanitary flow into basements, causing property damage and threatening public health. EPA estimates that there are at least 23,000 - 75,000 SSOs per year (not including sewage backups into buildings)." [5]

All Elastomeric Check Valves in Combined and Sanitary Sewers

Figure 3 - Failed Open Swing Flap Gate

Gravity sanitary sewer lines seldom use check valves even when SSO sources are known. Mechanical inline flapper and swing check valves are occasionally used to stop SSO in gravity sewer lines. However, they have an inherent inability to close off against sewage and debris. Also, their high failure rate, frequently required maintenance, high headloss and high cracking pressure make them an unpopular and ineffective solution

Figure 4 - An Elasomeric "Duckbill" Tideflex® Check Valve Flowing

In 1981, the EPA realized that municipalities with combined sewers (as well as tidal storm sewer systems) that were then using flap gates, "incurred tremendous costs annually due to failing check valves."[7] Municipalities also had to increase their budgets to cover the high maintenance and operating expenses that mechanical check valves require.[6] On an EPA grant, the Elastomeric "Duckbill" Tideflex® Check Valve was developed to eliminate the operational and maintenance problems associated with flap gates.[6] "In particular, the elastomeric gates are designed to close tightly around objects that might otherwise prevent a flap gate from closing."[6]

There are physical characteristics that are required to achieve the low headloss, high back pressure and the "close tightly around objects" [6] abilities of the Elastomeric Tideflex® Check Valves. The main one being that the duckbill opening is 1.57 X the I.D. of the pipe.[8] This is what enables the Tideflex® Check Valve to achieve the abilities mentioned above. The size of the bill has no drawbacks in most applications. However, in gravity sanitary sewers it is often necessary modify the end of the pipeline or add a manhole to add the Tideflex® Check Valve.

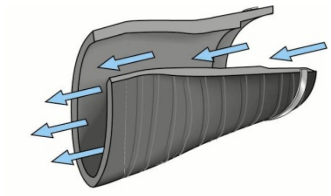

Figure 5 - Tideflex® Check Valves Open with Positive Pressure

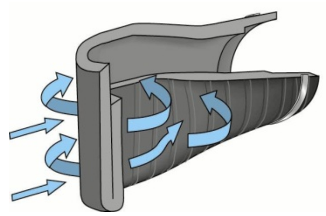

Figure 6 - Reverse Pressure Seals the Curved Bill of Tideflex® Check Valves to Prevent Backflow

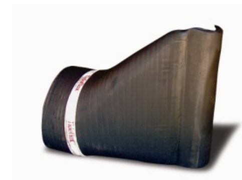

Figure 7 - The Curved Bill of the Model TF-1 Closes on Backpressure, Even Sealing Tightly Around Debris

Using the All Elastomeric CheckMate® Inline Check Valve for Control of Sanitary Sewer Inflow and Infiltration

In response, Red Valve Company has created the All Elastomeric CheckMate® Inline Check Valve for gravity sanitary sewers, storm sewers, combined sewers and drainage applications. The CheckMate® is designed to have the same benefits of Tideflex® Check Valves, but with one big advantage. **The CheckMate® fits inside of the pipeline, which significantly reduces construction and installation costs.**

Figure 8 - The CheckMate® Valve on Low Flow

The CheckMate® Inline Check Valve prevents backflow, opens with less than 1” of pressure and closes on debris. Because the CheckMate® opens greater then 90% of the pipe I.D., it has extremely low headloss and it will pass just about anything that flows down the pipeline. .

Manufactured by Red Valve Company, the CheckMate® Inline Check valve is used for backflow prevention of sewage and odor mitigation. It is easily installed inside of the incoming and outgoing inverts and laterals of manholes and wet wells. It can also be located remotely from structures in buried pipe runs for area control of inflow and infiltration.

Like the Tideflex® Check Valve, the CheckMate® Inline Check Valve’s unique elastomer fabric-reinforced design provides a proven record of maintenance-free performance, cost savings and results that no other inline check valve can match.

Also like the Tideflex® Check Valve, the CheckMate® closes around debris and has a 100% fabric and elastomer construction that eliminates corrosion problems. Because the CheckMate® is made with the same unibody construction, there are no mechanical components to catch debris, corrode or fail.

Both Tideflex® Check Valves and CheckMate® Inline Check Valves are made in the United States in Gastonia, NC.

Advantages of Elastomeric Over Metal and Mechanical Checks

Because of the severe service, continuous debris and highly corrosive conditions in gravity sanitary sewers, there are difficulties with service life and maintenance of metal and mechanical devices. Below is a short list outlining the advantages of elastomeric over metal and mechanical checks.

- Extremely low headloss.
- Durable, 100% elastomer construction.
- No mechanical parts.
- 25 year life expectancy.
- Operates on differential pressure.
- Virtually maintenance-free.
- Less than 1" of head pressure cracks open valve.
- Closes on debris.
- Silent, non-slamming.

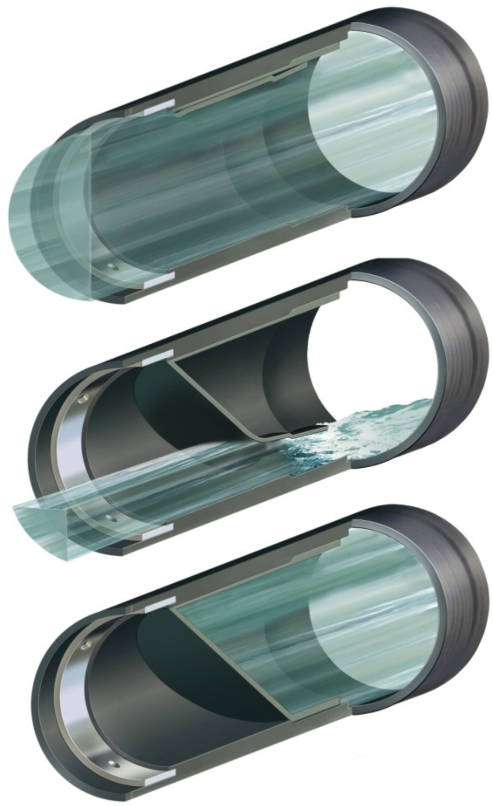

Figure 8 – Cross Section Views of a CheckMate® Valve Showing the Various Stages of Flow - Open (Top), Flowing (Middle) and Closed (Bottom)

CheckMate® Inline Check Valves are readily available in sizes 4" to 72".

To view an animation of a CheckMate® Inline Check Valves in action, visit http://www.tideflex.com/checkmate.

For more information on Tideflex® Check Valves, visit http://www.tideflex.com.

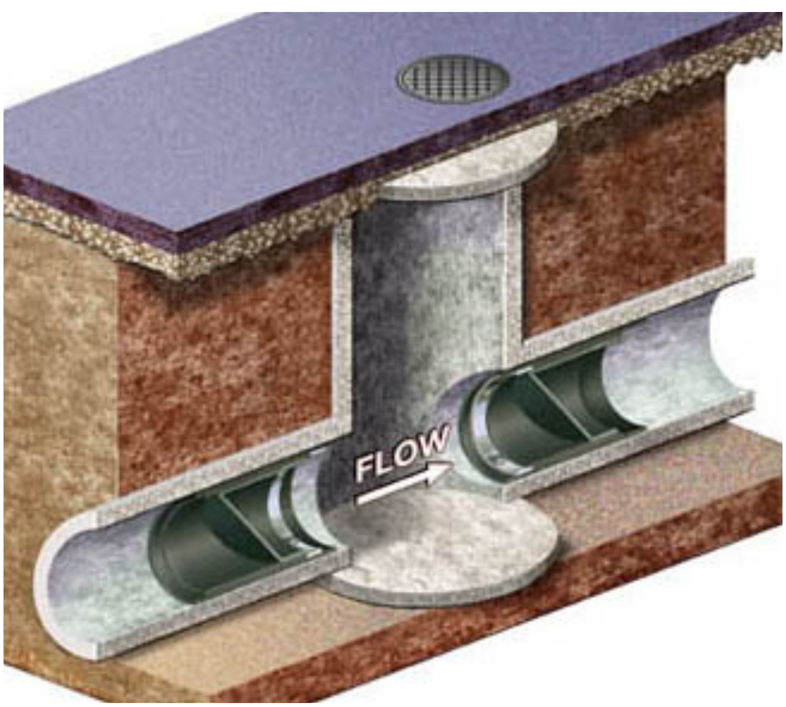

Figure 9 - A Cross Section of CheckMate® Valves Installed in a Manhole

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[8] Specification TT-TF-1 1.02:E: Bill slit conforms to 1.57 times the pipe diameter