



JAY R. SMITH MFG. CO.®

article

Flood-Gate® Automatic Backwater Valves **by William Cook, Jay R. Smith Manufacturing Co®., Inc.**

The Flood-Gate® Automatic Backwater Valve, which was invented by myself and licensed for production by Jay R. Smith Mfg. Co., has many features that make it different than any other backwater valve. It is a full-port valve - (with no enlargements or restrictions). The internal surface of the valve in the open position is precisely the same as the internal surface of the piping. The gate automatically closes with a positive seal under both low head and high head conditions. It has in-line construction and it is completely automatic. It requires no action on the part of the user. All of the energy required to close and reopen the valve is provided by the forces that are created by the backup of the sewer. No electricity or other outside power source is required.

The Flood-Gate® was initially introduced in 1995 in Montreal, Canada by Bibby - St. Croix, a small foundry in Quebec. Two years later Bibby was purchased by the McWane Group, a large corporation. Because the Flood-Gate is primarily an LTL product, it did not fit McWane's truckload marketing strategy and consequently, they offered it for sale. Jay R. Smith Mfg. Co. was the successful bidder and Smith purchased the entire product line; including the inventory, patterns and molds, trademark rights, etc. Smith engineers then further refined the valve; one of the significant improvements was the reduction in the minimum bury depth. This allows the valve to be installed in many more existing buildings where the building drain is shallow at the point of exit. Smith also designed Special Installations that are illustrated on page seven in the brochure.

Many early public sewer systems were built as combination storm and sanitary sewers. Some of these combination systems are still in operation today. These combination systems experience extreme backup problems during periods of heavy rains. Even some of the systems

that are separate become stressed at times with the infiltration of storm water causing flooded basements. These backup conditions have been a continuing problem for operators of public sanitary sewer systems. Some of these problems have become even worse when new housing developments are added to an already overtaxed system.

There are also other reasons that cause a malfunction of a public sewer system. It could be a complete failure of a lift station. It could be vandalism; or it could simply be a failure of proper maintenance. Any time that a plumbing fixture opening in a building is below the top of the downstream manhole in the public sewer, the potential for a backup is present. The new National Plumbing Code addresses this problem by requiring these particular fixtures to be protected by a backwater valve. Beyond the conditions that are addressed by the National Plumbing Code, there is even the possibility of damage occurring in buildings above grade from surges in the sanitary sewer system; especially a building at the bottom of a hill. While this is not nearly as likely to happen as basement flooding; under certain conditions it can and does happen.

There have been many attempts to design a backwater valve that will offer automatic protection from damage that occurs when a public sewer malfunctions and also allows the unrestricted passage of the sewage during normal conditions. The Flood-Gate® has that capacity.

The most common backwater valve in service today is the flapper valve. In the best scenario, flapper valves will work; they do not always fail, but in actual usage their failure rate is very high. The flapper is often held open by debris accumulated in the valve. That is why many

professionals are reluctant to specify or install a flapper valve. The offset construction of the flapper valve makes it difficult for proper installation in an existing drain line. The outlet on these valves is three quarters of an inch lower than the inlet. Sufficient piping must be removed and replaced on the downstream side of the flapper valve in order to maintain the proper fall and prevent trapping. If the existing drain line has the usual one quarter inch per foot fall, it would require the removal and replacement of three feet of the downstream drain pipe just to remain level. It would require an additional replacement of three more feet of piping to allow for the minimum fall of one eighth of an inch per foot. The proper installation of a flapper valve on an existing drain line is rarely done and the valve is usually installed in a trapped condition. This further aggravates the situation, leading to even more unsatisfactory service.

This problem does not exist with the Flood-Gate® because it is an in-line valve with the inlet and the outlet on the same plane. The Flood-Gate is entirely different. It is a gate type valve construction. The gate is a piece of stainless steel with a hole in it the size of the drain line. A stainless steel spacer, along with the gate, is sandwiched between the two halves of the cast iron valve body. This spacer is slightly thicker than the gate, allowing free movement of the gate between the two halves of the valve body. Each half of the valve body has a machined groove to accept a large "O" Ring. As the two valve halves, with the spacer and gate between them, are bolted together the pressure on the "O" Rings against the gate forms a positive seal. The two halves are identical except that the outlet half (the sewer side) of the valve has a large open port that allows the backup water to enter the expansion chamber; creating pressure on the air trapped in the chamber that causes the gate to rise.

In the normal "Open" position, the gate is down, with the hole in the gate in line with the drain piping thus allowing the sewage to pass uninhibited through the gate. When the valve is activated, the gate rises & the blind part of the gate is then in line with the drain piping, closing the drain line with a positive seal. The top part of the valve consists of the diaphragm, the counter weight, the valve stem, the stiffener, clamping ring & the cover. The diaphragm is a soft PVC which is Dip-Molded. The valve stem is stainless steel and the cover and stiffener are spun

polyplastic. The clamping ring is a coated steel similar to the clamping rings used on air brake systems for many years. The stiffener is placed inside the diaphragm, forming a rigid vertical wall in the diaphragm that prevents its collapse in the "open valve position". The valve stem (attached to the gate) is inserted through the top of the diaphragm. This assembly is then secured to the valve body with the clamping ring sealing the bottom of the diaphragm to the valve body forming an air tight expansion chamber. The counter weight is bolted to the top of the diaphragm. The valve cover is then placed over the diaphragm assembly and attached to a skirt on the clamping ring. The valve cover acts as a casing to contain the expansion of the diaphragm; much like a tire restricts the expansion of an inner tube.

At the bottom of the inlet side of the valve body is an eighth inch iron pipe size tapping. After the valve has been assembled, a grease fitting is inserted into this tapping. With the valve in the normal open position, waterproofed grease is forced through the grease fitting filling the cavity in the lower part of the valve body with grease. This provides near permanent operating lubrication. (A laboratory test was performed with one thousand cycles opening and closing the valve, using waste water from the foundry & a sufficient amount of grease still remained in the valve body after these one thousand cycles.) After the grease has been injected, the valve is water tested using conditions similar to those present in the field. The grease fitting is then removed- draining any water that may have remained from the testing procedure- & an eighth inch pipe plug is inserted into the tapping. If it should become necessary because of unusual circumstances, this tapping can provide means to re-lubricate the valve in the field.

Code Approvals

The first Code Approval for the Flood-Gate® was issued by the State of Ohio in July, 1995. This was followed by official code approvals from the States of Illinois, Wisconsin and Kentucky. Verbal approvals were given by West Virginia, Indiana, North Carolina and Michigan and Ontario, Canada. Meanwhile, the valve was submitted to CSA, a highly respected independent testing laboratory in our industry, for extensive testing. A "Certificate of Compliance" Reference T.I.L. No. MSE-30 was issued by CSA in 1997. Since then, ASME and IAPMO approvals have been issued.

No code authority has rejected the installation of the Flood-Gate valve. However, the code approval is an ongoing process.

The installation instructions furnished with each valve must be strictly followed. It must be installed in a ventilated pit that is open to the atmosphere. As the valve is closing, 500 cubic inches of air is expelled through the opening in the top of the cover. This opening in the valve cover must never be obstructed.

The pit must be ventilated because a sealed pit would cause the air in the pit to become compressed and retard the valve closing action. Also when the sewer recedes from its flooded condition the evacuation of the water causes a low pressure area in the expansion chamber. The atmospheric pressure on top of the diaphragm aids in the reopening of the valve.

The installer must abide by the minimum bury depth. If the valve is installed too shallow, the basement floor will flood before the valve can be activated.

An accessible cleanout MUST be provided on the sewer side of the Flood-Gate®. This cleanout is essential for:

- 1) Testing purposes.
- 2) Removing any stoppage beyond the Flood-Gate; such as roots, etc.

The valve must be installed with the proper direction of flow. The outlet side of the valve (the sewer side) is the larger side. It has the large port that allows the water to enter the expansion chamber. If the valve is installed backwards - it will close but it will not reopen.

An owners manual is also provided; along with a tee handle that allows the user to manually activate (open & close) the valve after long periods of inactivity.

On new installations the Flood-Gate® should be placed in the system where all plumbing fixtures below grade flow through the backwater valve. All other fixtures should be connected on the downstream side of the Flood-Gate. This will permit the continued use of all fixtures above grade while protecting the lower fixtures from flooding. Only those fixtures below grade will be

put out of service. This practice should also be followed on existing installations wherever possible. An alarm system can be provided to alert users that all or part of their drainage system is inoperable, thus preventing internal flooding.

The Flood-Gate® is really a very simple device. This simplicity is truly a valuable asset. The Flood-Gate is normally installed near where the drain exits the building; although it can be installed outside if necessary.

When the public sewer malfunctions the backup fills the lateral and begins to enter the building drain. As the sewer backs up, more the underground piping begins to fill with water. When the water level in the building drain rises to the top of the horizontal line (where the Flood-Gate® is installed) the air that is present in the expansion chamber is trapped. As the water enters the expansion chamber (through the large port in the sewer side of the valve body) the water rises compressing the air in the expansion chamber. The force of the counter weight is overcome and the gate rises forming a positive seal before the sewer can back up through any open drain in the building, even though the underground building drain is filled with water. The valve will remain closed as long as the main sewer is malfunctioning. As soon as the backup in the main sewer recedes and the main becomes operable; the Flood-Gate will automatically reopen. It is now ready for the next incident.

The rising head of the sewer water backing up provides all of the energy required to both close and reopen the valve. The energy used to reopen the valve is stored in the counter weight during the closing cycle. No other power source is required. This is significant because power outages often accompany heavy storms. These power outages nullify any system that depends on the Public Utility for its energy.

The Flood-Gate® has a large expansion chamber to produce the necessary power for its operation. The diaphragm has a surface area of 113 square inches. The rising water creates a force of .431 pounds on each square inch of this surface area for each foot of water height. This means that the cumulative force exerted on the diaphragm for each foot of water head is 113 times .431 which equals 48.7 pounds. Therefore, each inch of water head differential in the Flood-Gate System

exerts a force of more than four pounds on the diaphragm surface which is then transferred to the stainless steel gate. That is why the Flood-Gate can easily cut through normal sewage debris. When the sewer backs up the stainless steel gate rises and forms a positive seal; automatically. When the main sewer becomes functional again the gate lowers and fully opens; automatically (the hole in the stainless steel gate is once again in line with the drain piping). The rising action of the gate eliminates the groove at the bottom that is present in conventional gate valves; which has a tendency to collect debris that restricts its closing.

The action that occurs inside the Flood-Gate® expansion chamber is the same action that takes place inside a manhole when a surge occurs in a main sanitary sewer. The air trapped in the manhole (if the cover is sealed - as they sometimes are) is compressed by the water rising in the manhole. The energy is then transferred from the rising water to the compressed air and ultimately exerted on the manhole cover. The cumulative force that is created and transferred to the manhole cover amounts to nearly two hundred pounds for every foot that the water rises. That is why cast iron manhole covers can be blown off so easily. Witnessing a blown manhole cover - and wondering why - is how the Flood-Gate was born.

The First Flood-Gate® Installation

The first Flood-Gate was installed in Bexley, Ohio, a Columbus Suburb, in October, 1995. For more than fourteen years this family had been plagued with sanitary sewer backups every time the area experienced a heavy rain. It was a perfect spot for a test case. Since the installation the valve has been activated many times each year. It has never failed to close properly when the main sewer malfunctioned, protecting the basement and its contents. These backups still occur on a regular basis. The City has never corrected the problem because it would require extensive renovation. Since 1995 there have been hundreds of Flood-Gate valves installed; protecting the Health and Property of many potential victims.

There are many municipalities that have the same problems as Bexley, Ohio; some more than others. In the past it was possible to sometimes relieve these overloaded conditions in the public sanitary sewers by dumping raw and untreated sewage into the lakes and streams. This practice is now under scrutiny.

The EPA has adopted current and future rules that restrict this practice. The local EPA rules vary somewhat but the overall Federal strategy is to become more and more restrictive about dumping raw and untreated sewage into our lakes and rivers. These restrictions will result in many more sewer backup situations in the future that have not yet been a problem.

Who is responsible for sewer backup damages?

This has long been a debatable issue. However, the courts have determined that local governments are liable for the negligent operation of a sewer system. A local government is deemed negligent if it fails to correct a defective condition that it knew about or should have known about. The EPA restrictions, and the growing number of irate citizens who are seeking relief by legal action, have caused some municipalities to take a new look at the sewer backup incidents. Some cities have offered programs that help homeowners defray the expense of installing sewer backup protection. The Flood-Gate® has been offered as a remedy in a number of these Municipal plans. Charlotte, North Carolina was the first city to use the Flood-Gate Automatic Backwater Valve to address the sewer backup problem. They have used the Flood-Gate valve for more than five years in these trouble spots. Prior to that they were forced to rely on the unreliable flapper valve.