LSW
Lining Services (Waterford) Ltd.

Hydro-Valve

TECHNICAL SPECIFICATION

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1.0 INTRODUCTION

1.1 Scope

The scope of this document is to provide engineers, architects and designers an understanding of the operation and application of a Hydro-Valve vortex flow control device. The document outlines the application, operation, performance, design, manufacture, testing and installation of a Hydro-Valve vortex flow control device.

1.2 Application - SuDS

SuDS are defined by the Construction Industry Research and Information Association (CIRIA) as “a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques”. These systems were developed because of the need to control the rate at which stormwater leaves newly developed sites.

Fig.1 (Flooding in Co. Wexford)

Rainfall on a greenfield site is either absorbed into the ground or runs off slowly to the nearest watercourse. When these sites are built upon, much of the area becomes impermeable increasing surface water runoff which is piped to the nearest outfall or storm drain. This increased run-off coupled with global climate changes have caused large scale flooding in many areas with conventional storm water drainage systems being over-loaded.

Hydro-Valves as can be seen in figure 2. are used as part of a SuDS system to control the rate at which stormwater leaves a particular site. Stormwater is stored on site in an underground storage tank which can be in the form of a modular block system, large diameter pipes, concrete tank or thermoplastic culvert.

Fig.2 (Hydro-Valve)

1.2.1 Allowable Discharge

The allowable discharge rate for a particular site depends upon the pre development greenfield runoff rate This can be calculated from formulas such as the institute of hydrology report no.124 and FSR regression equation. Some local authorities put a limit on developed the run-off rate between 3-5 l/s/ha but the correct figure is site specific.

2.0 OPERATION

2.1 General

A Hydro-Valve is a device for controlling fluid flow by hydraulic effect without requiring moving parts. At low flow rates, water enters through the inlet passes through the vortex chamber to the outlet with no restriction. As head height increases hydrostatic pressure also increases, this pressure forces fluid through the valve with enough energy to create a vortex in the vortex chamber which results in a considerable pressure drop between the inlet and outlet restricting flow to the required discharge rate (e.g. 5 l/s)

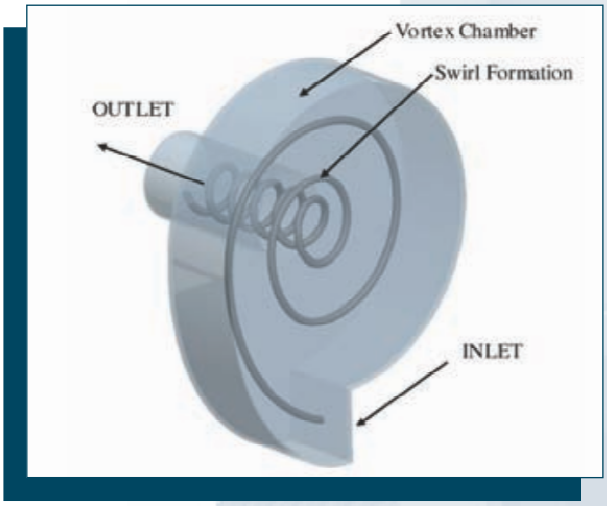

Fig. 3 (Vortex Chamber)

The creation of a forced vortex in the chamber allows an outlet orifice much larger in size (3-5 times the CSA) than that of conventional devices. A forced vortex ensures highest velocity will occur at the outer wall, this will inherently shift any solids towards the centre where velocity is lowest. The solids can then exit the valve minimising the risk of blockage.

Hydro-Valves have many advantages which include no moving parts, self activating, self cleansing, no external power source required and minimal maintenance.

2.2 Performance

DESIGN FLOW

This is generally the maximum flow that is required at the designed upstream head of water. (e.g. Pre-development run-off rate of 5 l/s)

FLUSH FLOW

This is the point at which a pressure difference begins to initiate in the vortex chamber having a throttling effect over the flow. The closer this is to the design flow the more water that will pass through this unit in the early stages of a rainstorm event.

KICK-BACK FLOW

This is the point at which the vortex has been initiated and at which time the curve begins to return back to that of an orifice plate performance curve.

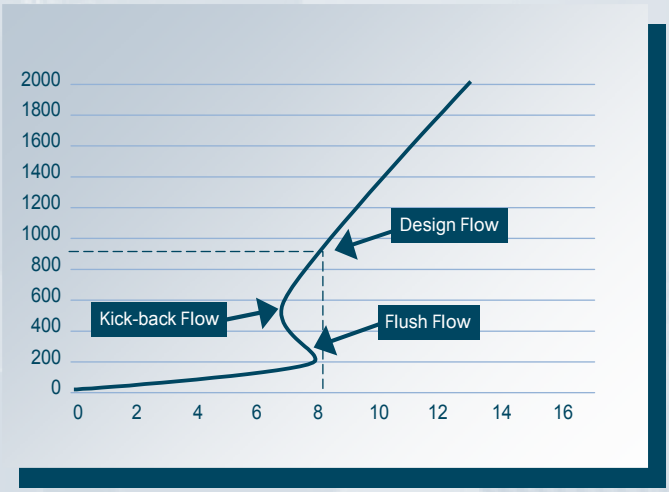

Fig. 4 (Typical Discharge Curve)

3.0 FEATURES

3.1 General

Hydro-Valve vortex flow control devices have patented features such as the unique mounting adaptor which allows the easy installation of the Hydro-Valve onto the curved surface of a 1200mm manhole or the flat surface of a rectangular manhole. This unique mounting adaptor has an integrated bypass facility operated by a wire rope from the top of the manhole in the unusual event of a blockage. Another maintenance feature is a removable service plate on the back of the vortex chamber. (see figure 5.)

A neoprene gasket between the Hydro- Valve and manhole creates a watertight seal.

Outlet pipe sizes are Ø225mm CorriPipe and Ø300mm CorriPipe as standard, other outlet pipe sizes are available upon request.

3.2 Installation Manhole

There are two main types of mounting adaptors available with all Hydro- Valves:

- To suit a Ø1.2m Manhole (plastic or concrete, see fig. 5)
- To suit a rectangular manhole (precast, cast in situ or blocked)
- Customised Manhole adaptors available on request.

See installation drawings on pages 6 & 7 for more details.

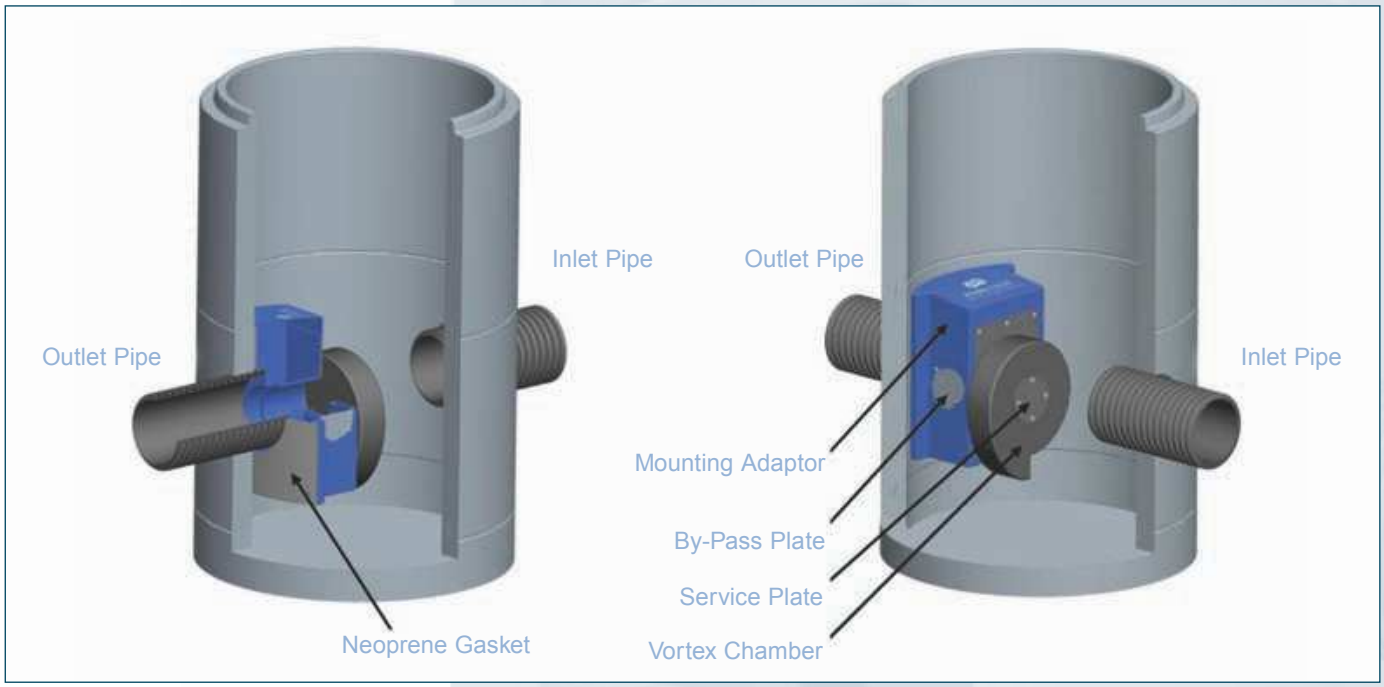

Fig. 5 (Ø1200mm Manhole Installation)

4.0 DESIGN AND MANUFACTURE

4.1 General

All Hydro-Valves are designed and developed in-house in our development centre. They are manufactured under an IS0 9001 quality assurance system on the same site in Tuam, Co. Galway, Ireland.

The following information is required before we can design a suitable Hydro-Valve vortex flow control device for a specific application. This information is required as each valve is individually designed depending on specification.

- Design Flow (litres / second)
- Design Head (mm)
- Proposed size of installation manhole
- Application

4.2 Design Flow

The design flow is the maximum allowable discharge from the valve and is site specific. In the case of a Hydro- Valve being used with an attenuation system on a new development, the maximum allowable discharge will generally be the pre-development runoff rate. This figure is calculated based on a site audit, soil samples and local rainfall data by a consultant engineer or hydrologist.

4.3 Min / Max design flows

Hydro-Valves can be manufactured with flow rates between 1-50 l/s. Below 5l/s the orifice tens to be quiet small (less than 80mm) so it is recommended that a 25mm stainless steel mesh guard be fitted to the Hydro-Valve manhole to prevent possible blockage from contaminants. This guard will have to be suitably placed in the manhole and may require periodic maintenance.

4.4 Design Head

The design head is the maximum height of water upstream of the Hydro- Valve. In the case of an attenuation system it is the distance from the base to the top of tank assuming the outlet invert is at the same level as the base of the tank. The design head has a large effect on the size of a vortex chamber for any given flow rate, this is due to relationship between the hydrostatic pressure and the design head.

4.5 Manufacture

The two main components of a Hydro- Valve are the vortex chamber and the mounting adaptor. Both of these parts are rotationally moulded from a special grade polyethylene that exhibits excellent strength, stiffness, durability and chemical resistance. All Hydro- Valves are manufactured to ISO 9001 quality standards.

5.0 TESTING AND VERIFICATION

5.1 General

Hydro-Valve vortex flow control devices are tested in-house using a full scale test-rig. The test rig has been designed and developed in-house with consultancy from leading academic institutions and fluid mechanic consultants.

5.2 Test-Rig

The test rig has a full scale Ø1200mm manhole into which the Hydro-valve is placed. During testing the manhole is primed with water to the invert level of the outlet pipe. It is then filled in increments of 100mm with the valve being allowed to run for a set period of time at each interval while the complex measuring equipment computes the flow rate from the valve.

Performance curves are generated by plotting flow rate in litres per second against head height in millimetres.

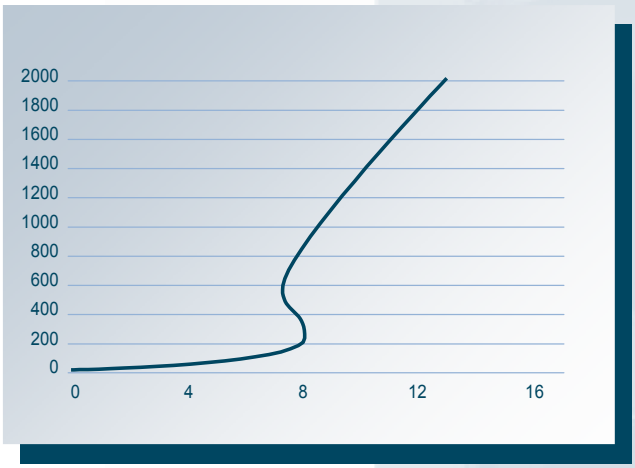

Fig. 7 (Performance Curve)

5.3 Verification

The test procedures have been verified by fluid mechanics experts in leading academic institutions in the Republic of Ireland.

6.0 MAINTENANCE

6.1 General

Minimal maintenance is required on Hydro-Valve flow control devices. If there is a large amount of containments (e.g. plastic bags, sticks, leaves, silt, grit etc.) there is a possibility of blockage. If this occurs the valve can be by-passed using the manual wire rope which will empty the tank allowing maintenance to be carried out on the valve and remove the contaminants.

Hydro-Valves (as with all vortex valves) with flow rates below 5l/s tend to have quiet small outlet orifices (less than 80mm) so it is recommended that a 25mm stainless steel mesh guard be fitted to the Hydro-Valve manhole to prevent possible blockage from contaminants. This guard may require periodic maintenance depending on the amount of contaminants allowed into the system.

7.0 INSTALLATION

7.1 General

As standard all Hydro-Valves are manufactured to suit a Ø1.2m manhole ring. For some large valves in may be necessary to use a rectangular manhole because of the physical size of the unit.

See installation instruction for both Ø1.2m manhole rings and rectangular manholes on page 6 and 7.

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Ø1.2m Manhole Installation Instructions for Large Mounting Box

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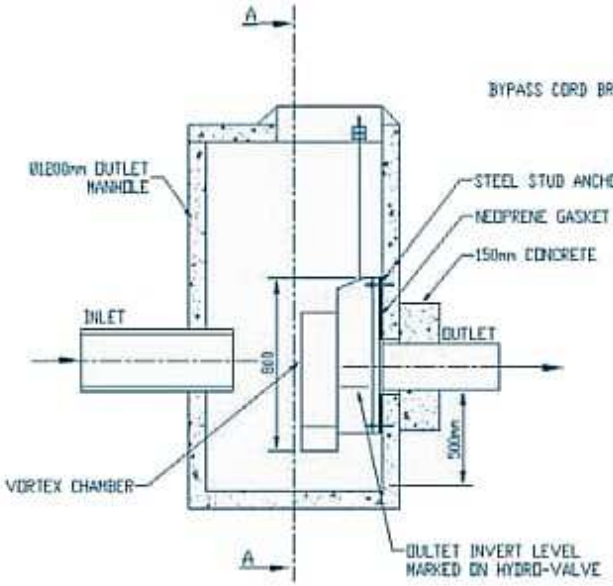
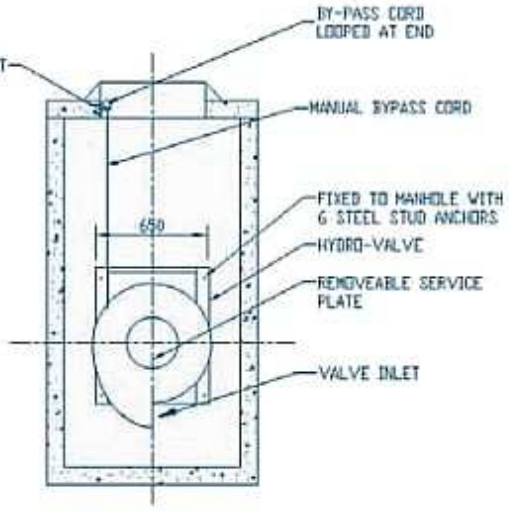
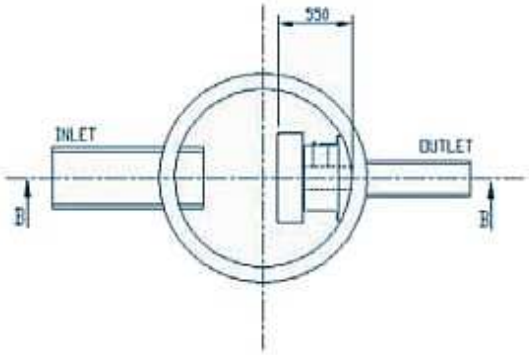


SECTION B-B



SECTION A-A



PLAN

Watertight Seal

- The neoprene gasket seals the Hydro-Valve to the wall of the Manhole preventing any water from entering the outlet pipe without going through the valve.
- The concrete casing prevents any water that leaves the valve from entering the ground around the outlet pipe.

INSTALLATION NOTES

1. Cut out a hole in the Ø1200mm manhole for outlet pipe ensuring it is larger than O.D. of outlet pipe.
2. Mount the Hydro-Valve on inside of Ø1200 manhole so outlet invert is the same level as invert mark on the Hydro-Valve.(moulded in on opposite side to by-pass plate)
3. Mark manhole through 6 holes on Hydro-Valve and drill using 12mm drill bit supplied.
4. Fix Hydro-Valve to Manhole with 6 steel stud anchors supplied.
5. Push the outlet pipe through the manhole untill it seats aginst the Hydro-Valve.
   - A 225 Corrugated Pipe will fit into the reciever with a seal
   - All other pipe sizes will seat aginst front of Hydro-Valve.
6. Case the outlet pipe with 150mm of concrete as shown above.
7. Fix the first by-pass cord bracket to the inside wall of the precast biscut vertically above the by-pass plate.
8. Fix the second bracket to the inside wall of the precast biscut in a position that leaves easy access to the by-pass cord handle.
9. Adjust the length of the by-pass cord using the u-clamp on the by-pass plate to leave easy access to the handle
10. Ensure the cord operates freely.

HYDRO-VALVE

Rectangular Manhole Installation Instructions for Large Mounting Box

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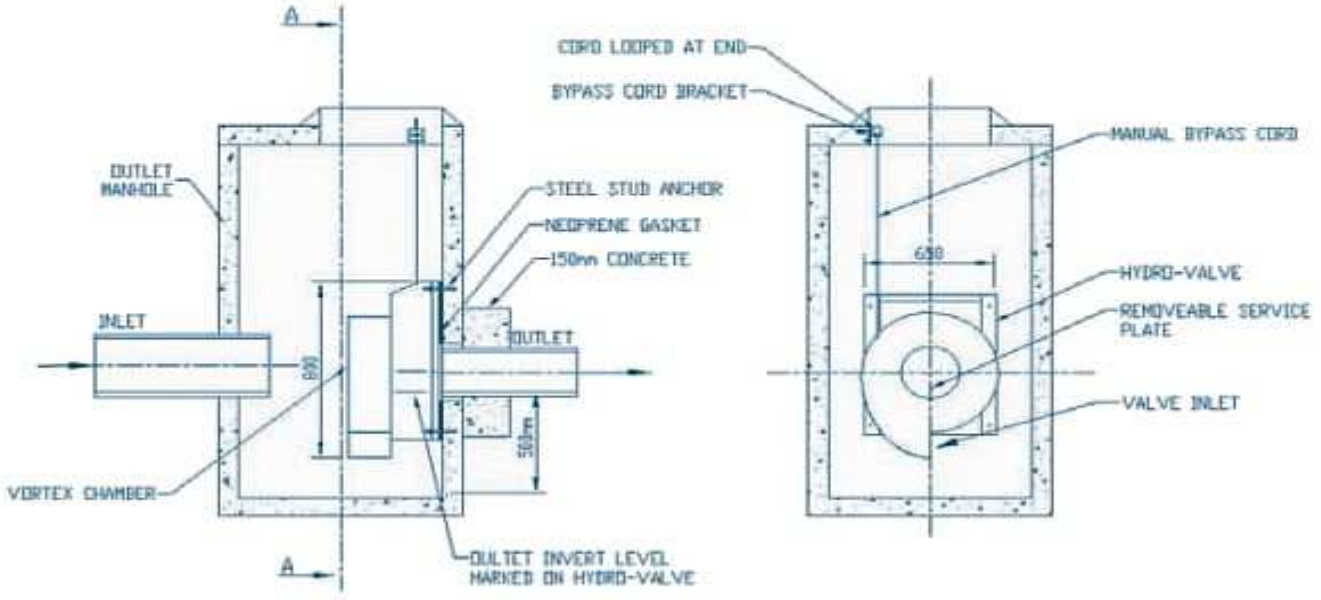

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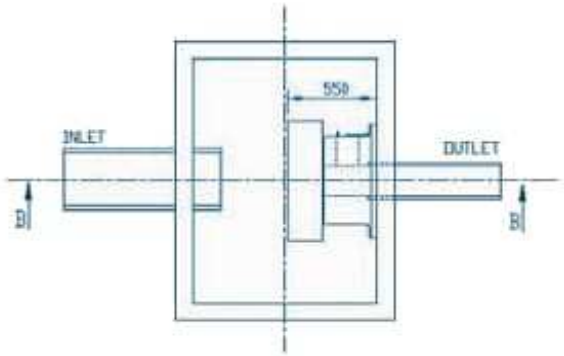
SECTION A-A



PLAN

Watertight Seal

- The neoprene gasket seals the Hydro-Valve to the wall of the Manhole preventing any water from entering the outlet pipe without going through the valve.
- The rubber seal around the pipe seals the Hydro-Valve to the pipe ensuring no water enters the surrounding ground.

INSTALLATION NOTES

1. Build a rectangular manhole around the inlet pipe with a minimum sump of 500mm.
2. Mount the Hydro-Valve on inside of rectangular manhole so outlet invert is the same level as invert mark on the Hydro-Valve (moulded in on opposite side to by-pass plate)
3. Mark manhole through 6 holes on Hydro-Valve and drill using 12mm drill bit supplied.
4. Fix Hydro-Valve to Manhole with 6 steel stud anchors supplied.
5. Push the outlet pipe through the manhole untill it seats against the Hydro-Valve.
   - A 225 Corrugated Pipe will fit into the reciever with a seal
   - All other pipe sizes will seat aginst front of Hydro-Valve.
6. Case the outlet pipe with 150mm of concrete as shown above.
7. Fix the first by-pass cord bracket to the inside wall of the precast biscut vertically above the by-pass plate.
8. Fix the second bracket to the inside wall of the precast biscut in a position that leaves easy access to the by-pass cord handle.
9. Adjust the length of the by-pass cord using the u-clamp on the by-pass plate to leave easy access to the handle
10. Ensure the cord operates freely.