SIPHONIC STORMWATER SPECIFICATION FOR AUSTRALIAN PROJECTS

Introduction

Ultraflow Siphonic Roof Drainage was established in 1994 by Swedac Pty Ltd. We have been the sole continuous agent of the original Scandinavian siphonic system “UV-System” invented 1968. We have been a family owned and operated business from the beginning and today operate under Ultraflow Siphonics Pty Ltd. In the last 21 years we have always delivered first class service, built a strong reputation and upheld a flawless track record. We have listened to our clients and now extend our services to pipeline - prefabricated bathroom units, siphonic stormwater filters and rapid discharge pits. We also offer indoor climate technologies such as under floor hydronic heating and ceiling cooling.

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1. Siphonic Contractor

The entire siphonic system, inclusive of design, pipes and fittings, bracketing, roof outlets and installation should be completed by the nominated siphonic specialist contractor. The specialist contractor should have experience in world class projects, delivered over 20 years of industry pedigree and maintain a flawless track record. The Installation may be carried out by installers trained and approved by the nominated contractor.

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2. Siphonic Design Software

The siphonic specialist must use advanced software to design the siphonic system and calculate the required gutter size in accordance with their outlet performance. The software used must be verified by an independent accredited third party testing facility.

3. Siphonic Design Parameters

3.1 Performance Requirements

AS/NZS 3500.3–2015, specifies the performance requirements for roof drainage systems, both main and overflow systems. Where significant inconvenience or injury to people or damage to property is;

- An unlikely occurrence (Eaves Gutters, External) design to 1 in 20yr ARI
- A likely occurrence (Box Gutters, Concrete Roofs, Internal) design to 1 in 100yr ARI
- All calculated for a 5 minute duration period

3.2 Design rainfall intensity and flow rates

The design rainfall intensity for the applicable Average Recurrence Interval (ARI) is determined from current Intensity Distribution Frequency (IDF) charts prepared by the Australian Bureau of Meteorology.

The design flow rates are calculated using the catchment areas calculated in accordance with AS/NZS3500.3-2015 and design rainfall intensities established above.

Any adjacent vertical surface should be considered where applicable to 50% of the total height up to a maximum of 10m. The potential impact of any rain shadows should also be considered by the siphonic designer.

3.3 Minimum allowable system pressure

Internal operating pressures in siphonic systems are typically sub-atmospheric and the pipe material must be able to accommodate these pressures without the risk of imploding. Systems are not to be designed for operating pressures of greater magnitude than negative 8.8mH_2O at an elevation not exceeding 500 meters above sea level. For systems at elevated altitudes and/or temperatures the permitted negative operating pressures shall be adjusted having regard to the ambient vapour pressure to avoid cavitation.

3.4 Minimum flow velocity

The minimum flow velocity in tailpipes and horizontal pipework longer than 1.0m should not be less than be 1.0m/s for self-cleansing purposes. Siphonic system water velocity provides the active self-cleansing function removing debris, mud and silt build up. Minimum velocity in vertical pipework should be 2.2m/s.

3.5 System imbalance

The overall imbalance in a siphonic system is defined as the difference between the maximum and minimum calculated residual heads between any of the outlets in the entire system. The imbalance in the system shall not exceed 0.5m$H_2$0 or 10% of the total available head – whichever gives the lower value.

3.6 Priming

To minimise the possibility of gutters overflowing, the whole of the system must attain full capacity quickly. The design of the system should fully prime within 60 seconds during design rainfall intensity. The number of outlets, gutter capacity and pipe volume must be considered when calculating allowable priming times.

3.7 Overflow systems

Where overflows are employed they shall be designed in accordance with AS/NZS3500.3.1–2015. The hydraulic capacity of an overflow system shall be not less than the design flow for the associated main gutter system. The overflow should be designed to discharge to atmosphere in a visible location, to alert the building occupier of any overflow event.

3.8 Siphonic gutter design

The specialist siphonic contractor shall supply final gutter dimensioning and determine max water depth within the gutter. Gutter falls should be minimum 1 in 200 with flat level expansion joints to allow free flow between outlets and necessary overflows. Sumps are not required in siphonic box gutters unless the gutter is sloping at greater than 1 in 20 or has a depth less than 200mm when requiring a siphonic overflow system. It is essential that the minimum free board of 30mm is maintained as per AS/NZS 3500.2015.

4. Siphonic Components

4.1 Siphonic outlets

Siphonic outlets supplied by the contractor should be constructed from a single stainless steel sheet and generally in accordance with AS/NZS 2179.1-2014. The outlet spigot should be machined to the same measurement tolerances as HDPE pipe for connection with a flexible rubber fitting. Threaded connections are to be avoided as they are prone to leakage and require silicon sealant to create a complete seal. A flexible rubber connection also allows for movement between the siphonic outlet and pipework as the gutter flex with thermal forces and weight from water. Any secondary fixings that require holes to be made in the outlet body are not permitted.

The siphonic outlet must be complete with an air baffle designed to limit air intrusion into the pipework. The construction of the baffle should be from durable materials such as UV-Stabilized PP or HDPE. The siphonic outlet should carry a warning to “remove, clean and re-install air baffle”, advising future building maintenance personnel. The debris guard must prevent large items entering the pipework whilst permitting small items to pass through the systems as opposed to blocking the outlet. The siphonic outlets shall be independently tested by a certified testing facility, to determine head loss coefficient and water depth vs. flow rate curve.

Where siphonic outlets are to have load bearing trafficable grates, the siphonic contractor must supply a siphonic outlet and sump constructed from a single sheet of stainless steel. The grate should be stainless steel and rated to Class C, generally in accordance with AS3996-2006. The outlet and connecting pipe must be designed with (3) three physical barriers to ensure the waterproof integrity of the concrete slab. The outlet and grate is to be circular to prevent the propagation of surface cracks in the concrete which is common on square framed installations and to maintain visual alignment on the slab during construction. All grates are to be heel friendly and independently tested and NATA approved.

Where siphonic overflow outlets are required, the height shall be determined by hydraulic modelling of the gutter and certified by the siphonic specialist contractor. The overflow upstand should limit any restriction to the flow of water in the gutter and have a cylindrical shape for free flow around the upstand. The upstand must be no wider than ¼ of the gutter’s total width.

4.2 Pipes and fittings

Pipes and fittings used in siphonic systems must be of suitable material to withstand the positive and negative pressures imposed by the system under design conditions. Special attention must be given to the material selection for systems with possible high positive pressures e.g. high-rise buildings. The most common pipe material used in siphonic drainage systems is HDPE which should be minimum PN6.3 (SDR 26) regardless of grade of HDPE. For pipework to be used in systems with a maximum negative pressure of 4.5mH_2O, PN4 (SDR 33) may be used. The Colebrook-White roughness value for HDPE pipes and fittings should be as prescribed by AS/NZS3500.3-2015 i.e. 0.015mm.

Pipe sizes below 44mm internal diameter (i.e. 50mm OD for HDPE) are prohibited. Butt jointing of pipework on site shall take place in a clean, level area, using a purpose made butt fusion machine operated by a certified operator. Pipes smaller than 110mm OD shall not be butt welded unless the internal welding bead is removed. All electro-fusion sockets should be manufactured in accordance with AS/NZS 5056:2005 or AS/NZS 4129:2009 for pressure applications.

4.3 Tailpipes

Tailpipes are to be designed with a vertical and horizontal section between outlet and main collector pipe. The vertical section of the pipe must be true vertical as sloping tailpipes can fail to prime. There must be sufficient vertical distance between the outlet and collector pipe to achieve enough capacity to prime the system within the prescribed time. The first transition from vertical to horizontal should be made with a smooth radius sweep bend or alternatively (2) two close coupled 45-degree bends.

4.4 45-Degree branches

Siphonic tailpipes connect to the main collector pipe with 45-degree branches. All branches 50mm to 160mm must be moulded 45degree branches, whilst 200mm to 315mm are factory prefabricated 45-degree branches. Under no circumstances are 90-degree tee branches to be used.

4.5 Collector pipes

The collector pipe is the horizontal section of pipe between the tailpipes and the downpipe. The collector pipe shall be installed to prevent air pockets forming and assist water drainage towards the downpipe. Increasers and reducers (Level Invert Taper, LIT) shall be eccentric, i.e. enlargement in pipe size in direction of flow shall be installed with level soffit (Flat On Top, F.O.T.) whilst reduction in size in direction of flow shall be installed with level invert (Flat On Bottom, F.O.B.).

4.6 Downpipes

The correct design of downpipes in siphonic systems is of great importance for the overall performance of the system. The downpipe must not be designed to have a greater diameter than the connecting collector pipe. Downpipes that increase in size in direction of flow are not permitted as priming of the siphonic system will be affected.

4.7 Discharge

The siphonic system shall terminate at a point where the siphonic action transitions into gravity flow. Normally, this is achieved by discharging into an open grated stormwater pit, detention or rainwater tank or by connecting to a turn-up at ground level. Where the system discharges into a pit or tank, the horizontal discharge pipe may need to be increased to reduce the discharge velocity to an acceptable limit.

When the system is connected to a conventional turn-up the dimension of the turn-up should be at least one pipe size larger than the downpipe unless the turn-up and associated in-ground pipework is part of the siphonic system. In all cases the connecting conventional in-ground drainage must be dimensioned not to surcharge during design rainfall intensity.

4.8 Inspection openings

Siphonic systems are designed to achieve self-cleansing velocities. If serious blockage did ever occur then the blocked or damaged pipe should be cut, replaced, secured and re-sealed with new electrofusion sockets and pipe. Inspection openings have been a source of air intrusion and puncturing of the siphonic system in the past. Inspection openings should not be installed in siphonic systems.

5. Siphonic Installation

Pipes & fittings must be installed exactly in accordance with the installation drawings provided by nominated siphonic specialist contractor.

The whole siphonic system shall be installed only by fully trained and qualified personnel approved by the siphonic contractor. A formal training and induction program should be completed by all siphonic installers, under the supervision of a siphonic specialist.

5.1 Support system

All siphonic systems are to be supported with a continuous rail “Uni-Strut” type bracketing system, securely fixed to the main building structure. The pipe brackets are to be rigid medium duty “Ultraclip” type nut clips, tested to withstand the siphonic and thermal forces.

The installation method for siphonic systems should be as a rigid system with anchor points at the location of each branch and change of direction. An anchor point should be made by two clips around an electrofusion socket and clipping on either side of the 45 degree branches. The continuous rail must be supported at minimum 2m intervals from the main building and clip distances no more than 10 times the pipe diameter along the main collector pipes. Vertical pipework will be rigidly fixed to the main building structure with pipe clips spaced at no more than 10 times the pipe diameter.

Pipework shall be fixed neatly, securely and adequately to prevent movement during extreme operating conditions including thermal movement, oscillating pressure, axial movement and vibration. In circumstances where the pipe is within 200mm of concrete soffit then pipes can be fixed directly to concrete building elements or suspended via a continuous rail system adequately supported and braced laterally to prevent excessive movement during all operating conditions.

6. Siphonic Acoustic Treatment

Where specified the siphonic pipework should only be acoustically treated in habitable zones as defined by the BCA. Therefore; car parks, loading zones and common thoroughfares do not require acoustic treatment, unless nominated in the acoustic engineering report.

Where nominated the siphonic pipes are to be lagged with a layer of 8kg/m^2 loaded vinyl having an outer aluminium foil backing. The inner layer should be separated by a 25mm thick open cell foam, similar to NuWrap 5. Overlapping of all joints in the loaded vinyl are to be a minimum of 50mm and taped airtight with aluminium foil tape.

7. Siphonic Testing and Commissioning

7.1 Testing

Upon completion, or as necessary, the system shall be air tested to 30kPa for 15minutes, equivalent to 3m H_2O. Alternatively, the system may be tested in accordance with AS/NZS3500.3-2003.

The siphonic contractor must complete an approved Inspection Test Plan (ITP) at the final stage of the project and if required an Inspection Leak Report to satisfy the main contractor that the system is completely sealed and water tight.

7.2 Commissioning

Satisfactory completion of the system test shall be synonymous with the Acceptance of the Complete Installation.

8. Siphonic Maintenance, Inspection and Cleaning

Periodic inspections should be carried out to ensure that the outlets and gutters, or other catchment areas, are free from leaves and other debris which could impair the performance of the system. When necessary, the outlet air baffles shall be removed, the outlets cleaned and the air baffles reinstalled. The frequency of inspections should be established by regular initial inspections.

9. Siphonic System Warranty and Certification

9.1 Warranty

The siphonic contractor should warrant the entire system including material, performance and workmanship for a period of no less than 10 years from project practical completion.

9.2 Certification

The siphonic specialist contractor is required to issue a Design Certificate. An Installation Certificate shall be issued by the same contractor or approved installation team.