Jay R. Smith Mfg. Co.®
Siphonic Roof Drains

The level approach to roof drainage™

Designed, Engineered and Manufactured by:

SMITH® JAY R. SMITH MFG. CO.
CUSTOMER DRIVEN

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Saves money in time, material and site preparation!

Specification plumbing and drainage products for the professional designer and installer

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Siphonic Roof Drains from Jay R. Smith Mfg. Co.®

Introduction

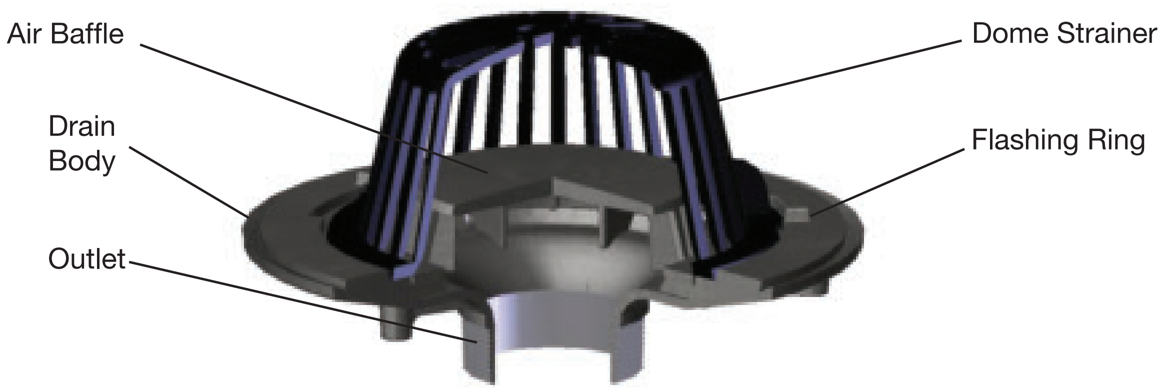
After several years of prototype development and testing, Jay R. Smith Mfg. Co.® is pleased to provide owners and the plumbing engineering community patent-pending, specified roof drain products for siphonic roof drainage systems.

- Jay R. Smith Mfg. Co.'s siphonic roof drains promote full-bore flow within engineered siphonic roof drainage piping systems.
- Fully tested and certified in accordance with ANSI/ ASTM A112.6.9 "Siphonic Roof Drains" and representing the first-line of specified roof drains complying with this American National Standard.
- Cast of solid ASTM 48 grey iron and utilizing the same set of accessories already familiar to the plumbing engineer and installer, thus making specification and installation as easy as traditional roof drains.
- The castings contain mainly recycled metal content making the products a part of a sustainable consumer cycle.
- The low-profile nature of the baffle component of competitive siphonic roof drains can make them prone to quicker blockage by debris. Smith's siphonic roof drains have a polyethylene dome strainer to help protect the baffle from debris accumulation and allow for the passage of water even if debris collects around the strainer base. This design makes our siphonic roof drains behave in the same manner as traditional roof drains in all types of rainfall and roof conditions.

Overview

In a siphonic roof drainage system, Smith's specially engineered and tested roof drain baffle allows and sustains negative atmospheric pressure in the connected piping and inhibits the admission of air into the piping system hence sustaining full-bore flow and higher flow volumes and velocities. The hydraulic balance in a siphonic roof drainage system is achieved by an engineer employing hydraulic calculations to ensure that the piping system fills up automatically in cases of moderate to heavy precipitation. The resulting full-bore or siphonic action allows for the installation of horizontal, i.e., level, drainage manifold piping serving multiple roof drains. Siphonic roof drainage systems are powered by and discharge to grade by means of a vertical stack into the point of discharge through the influence of gravity making them true gravity systems.

Siphonic Roof Drain Anatomy



Components of a Siphonic Roof Drain

A siphonic roof drain looks much like a traditional roof drain. The distinguishing feature of a siphonic roof drain is the <u>air baffle</u>. This air baffle is engineered and tested to prevent air from entering the piping system at peak flows.

Other than the baffle, a siphonic roof drain has the same features as a traditional roof drain including a drain body, flashing ring, dome strainer, and fastening hardware.

In contrast to traditional roof drains, siphonic roof drains are not designed with a large diameter or deep sump bowl because their operation is by means of sub-atmospheric pressure generated at the under side of the baffle and outlet. The depth of water maintained on the roof is dependent only on the resistance value of the drain assembly while operating under siphonic conditions. Any viscous weir effect of the drain body becomes minor and the flow is determined by simple inertial hydraulic effect of flow from a high pressure (atmospheric pressure at the roof surface) to low pressure (within the piping system).

Unlike a traditional roof drain system, a siphonic system is designed to operate with the piping completely filled with water during a rainstorm. Several drains tie into a horizontal collector that is routed to a convenient point where it transitions into a vertical stack. This stack, once it reaches the ground, is piped to a vented manhole or inspection-chamber where the water is discharged at atmospheric pressure and low velocity into the storm system.

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The Siphon Principle

The principle of the siphon has been recognized for ages. A siphon is created by a tube or other type of conduit filled with the fluid to be siphoned, thereby creating a continuous and closed path. In any siphon, the discharge end of the conduit must be lower than the level of the fluid in the source reservoir. Atmospheric pressure at the reservoir surface becomes the driving force pushing the fluid through the tube to the lower point of discharge. Most examples of siphons include an inverted "U" shape, this configuration is necessary to lift the fluid out of the source reservoir that cannot be tipped, much like a car's gas tank shown above. However, the actual path of the siphon tube is irrelevant to the fluid's ability to flow. In the practical case of siphonic roof drainage, the drainage piping is installed in the simplest way possible: flat and level. This allows the piping to drain completely when it is not raining and then to prime full into a continuous and closed path on its own during a rain event.

People know that it is necessary to prime the tube in order to achieve the siphonic flow. Ask anyone who has received a mouthful of gasoline while trying to siphon gas from their car's gas tank to fill a lawnmower. Therefore, the ability of a siphonic roof drainage system to prime itself might be counter intuitive. However, these systems prime up simply because the roof drain design and flat installation make full-bore flow occur. This tendency is exactly why plumbing codes have a set of rules for venting of sanitary waste systems. Without venting, water flow through even a pitched or vertical pipe will create zones of reduced or increased pressure that defeat fixture trap seals and under the right conditions can cause instances of full-bore flow. Still not convinced? The next time you flush a siphon-jet water closet consider why the water gets drawn out of the bowl.

Main Principles of Traditional and Siphonic Drainage

Roof surfaces of a building can be drained on the basis of two different principles, either by means of traditional atmospheric, (i.e. gravity) drainage or by means of full-bore, siphonic action drainage.

Overview of Traditional Drainage	Overview of Siphonic Drainage
Open outlets. The most common but least efficient roof drainage solution.	**"Closed" Outlets.** Drain has an air baffle that promotes "full-bore" flow.
Pitched horizontal piping. Gradient of the pipe induces "downhill" flow to the point of discharge.	**Horizontal piping is not pitched.** Flow is induced by natural hydraulic action of siphoning.
Atmospheric pressure throughout the system. Potential energy is not exploited.	When system primes, the piping depressurizes. **Atmospheric pressure** pushes the water into the drains with a force of 14.7 pounds per square foot.
Capacity is limited by the size of the drain and the depth of water around it during a rain event.	**Capacity** is determined by the piping system and the height of the roof above the point of discharge. Makes full use of gravity (i.e. potential energy).
Piping is about 1/2 to 2/3 full. Only 1/3rd full in vertical pipes.	**Piping** primes and operates 100% full (i.e. full-bore flow).
Water flow is a function only of drain rim diameter and slope.	**Water is drawn** through the outlets and piping faster than gravity "channel flow" alone due to negative pressure.
Inefficient material use due to pipe diameters sized to be only part full even during maximum storm intensity.	**Lower material expenditures** due to smaller pipe diameters.
If below grade, the longer the horizontal run, the deeper the pipe trench must go to accommodate pitch thus requiring **additional costs for excavation, bedding, and backfill.**	Pipe inverts leaving the building are at a minimum, making **deep trenching on the site beyond the building unnecessary.**

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How Traditional Gravity Drainage Works

As seen in illustration 1, **a traditional gravity drainage system** consists of a network of roof drains connected by open outlet to a vertical downpipe. The pitch in the piping allows rainwater to flow to a discharge point. This configuration necessitates relatively large diameter stacks which connect into an even larger underground drainage network.

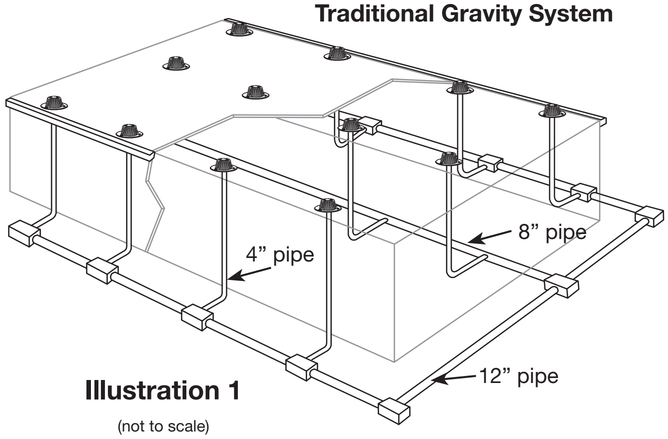
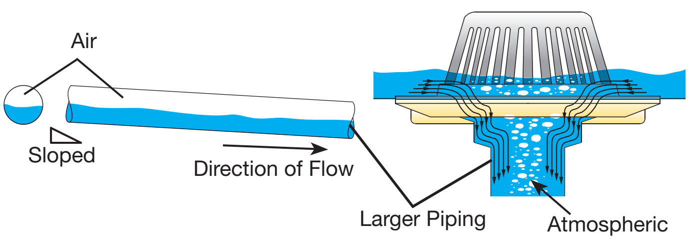


Illustration 1

(not to scale)

A traditional system is sized and pitched to be at atmospheric pressure throughout. Since pressure is constant from inlet to outlet, the only thing inducing flow is the pipe pitch. In horizontal pipe segments, illustration 2,



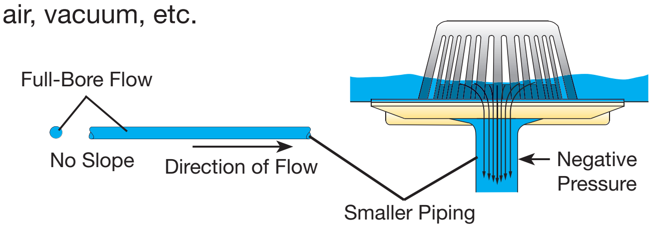
Traditional Gravity System

Illustration 2

water cascades along the invert of the pipe. About 1/2 of the pipe cross section is used to convey water and the remaining 1/2 is air at the maximum expected rainfall rate. Conceptually, if air can be removed, you need only 1/2 of the traditional pipe size to drain the same amount of water. Since the air is not removed, it works at only a fraction of its design capacity. This reduced capacity results in low flow velocities and poor internal cleaning of debris. This type of design is inherently inefficient in the use of materials since large pipe sizes are specified to handle a rainfall event that may occur only a few times during the life span of a building.

How Full-Bore Siphonic Action Works

Siphonic systems induce flow by creating a full-bore continuous path of water making pitch unnecessary, as seen in illustration 3. The full-bore flow in a siphonic roof drainage system is achieved through natural hydraulic action and is not produced by any sort of moving part, special fitting or control in the piping network. There is no need for any utilities such as electricity, compressed air, vacuum, etc.



Siphonic Roof Drainage System

Illustration 3

Siphonic systems do not require any special installation kit or procedure. The pipe materials and fittings used with siphonic roof drains are the same as those required for traditional drainage systems. Siphonic roof drainage is not so much a ‘system’ in terms of a pre-engineered product or package; it is instead a technique of no-pitch pipe design used to achieve desired flow from roof drains to point(s) of discharge. With a flat, level design, long horizontal runs above overhead ceilings are possible, as shown in illustration 4. This reduces or even

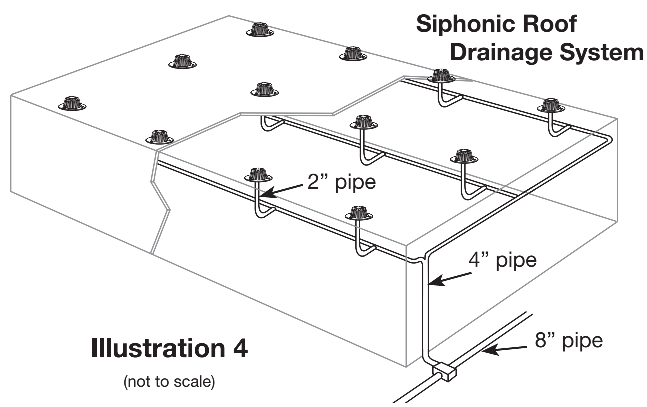


Illustration 4

(not to scale)

eliminates the need for buried pipe and the associated costs with trenching, bedding, and backfilling within the building’s footprint. Siphonic systems are designed to operate under sub-atmospheric pressure when primed full. The horizontal piping in the system can have higher velocities than the terminal velocity that can be achieved in a traditional vertical stack. This means rainwater is moved off the roof faster during the heavy but infrequent storms. During light rainfall events, that are more common, the piping still drains but in the traditional open channel flow mode. Therefore, siphonic roof drainage systems are more efficient in the use of materials since smaller pipe diameters can be specified to handle a wide range of rainfall events.

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The Self-Priming Process in a Siphonic System

Priming first occurs at the smaller diameter branch sections that connect each roof drain to the main horizontal carrier pipe or manifold. At this point, each siphonic roof drain acts independently as a mini-siphonic system. As water accumulates in the manifold, air is purged out of the point of discharge until the manifold and stack is 95% to 100% full-of-water. The system is then completely siphonic and under predominantly negative pressure.

Chart 1

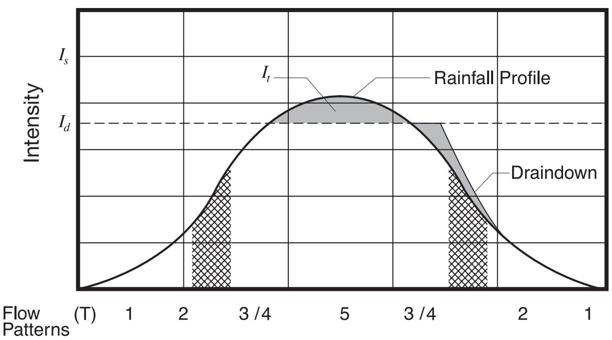
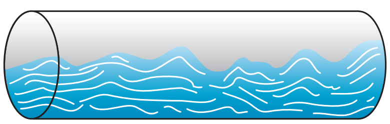
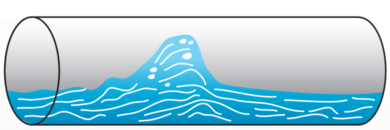


Chart 1 represents a design where the rainfall intensity (I_d) is less than the statistical rainfall intensity (I_S) of a storm of return rate (T) and duration (t). The excess water (I_r) is retained safety on the roof until the point of overflow.



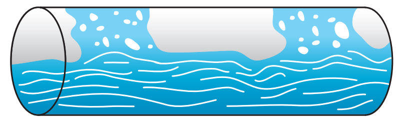
Pattern 1: Wavy flow

Wavy flow (Pattern 1) is seen during rainfall events far below the piping system's ability to prime. Light showers will typically produce this flow condition until rainfall intensity increases to a point where branch pipes can fully prime.



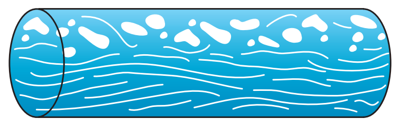
Pattern 2: Pulsating flow

The so-called pulsating flow (Pattern 2) ordinarily happens at the junctions of the branch pipes with the main collection piping. This is due to the sudden decrease in pipe velocity as the water transitions from the smaller diameter branch pipes to the larger main collection pipe. At this juncture, a hydraulic jump occurs as the fluid transitions from super-critical to sub-critical flow. At this stage, sudden increases in velocities take place accompanied by decreases in pressure. Eventually the peaks of these hydraulic jumps come in contact with the crown of the pipe and begin to propagate downstream and (if the dimensional rainfall intensity continues) the plug flow



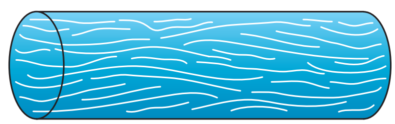
Pattern 3: Plug flow

pattern (Pattern 3) becomes prominent. As the rainfall event increases in intensity or the time of concentration is approaching, the pipe becomes more full of water and less full of air. The high flow velocity of the water captures and emulsifies the remaining air and a frothy



Pattern 4: Bubble flow

"bubble" flow forms (Pattern 4). This frothy flow condition becomes gradually clearer until all of the remaining air is purged out of the point of discharge and only water is present. Although a small percentage of air is always



Pattern 5: Full bore flow

induced by the siphonic drains, it is quickly carried downstream and a full-bore (Pattern 5) condition occurs.

It is rare that a rainfall event will occur at the exact design intensity (I_d) for any sustained period. Therefore, a system will typically experience flow Pattern 3 to Pattern 5 during heavy rainfall. During light rainfall events, Pattern 1 and 2 may develop, but roof drainage is still accomplished and with a more efficient sized pipe system.

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Why You Should Consider a Siphonic Roof Drainage System

Smaller pipe diameters with a siphonic system can be used, reducing material costs.

Full-bore flow within the piping reduces pipe diameter as compared to open-channel, traditional gravity flow. The smaller pipe size equates to savings in material. For example, a traditionally designed system calls for an eight (8”) inch pipe, a siphonic system of equal drainage capacity may need only a four (4”) inch or six (6”) inch pipe to drain the same quantity of water.

Siphonic action permits level pipe installations allowing fewer vertical stacks, saving ground work and building costs.

Traditional systems are designed to be atmospheric throughout and rely on pipe gradient or pitch to induce flow to the point of discharge. This pitch necessitates the pipe elevation to become increasingly lower as it runs laterally. Full-bore flow is achieved independently of pipe gradient in a siphonic system. The piping can be installed flat like any other mechanical system such as sprinklers and it simplifies coordination with other building elements. With siphonic piping being horizontal, the building height may be reduced by 3 to 4 feet, saving on construction costs.

Driving head of the siphonic system is up to 100 times that of a traditional system (i.e. height of building vs. depth on roof).

Siphonic roof drainage systems make full use of a building’s roof height to drive the drainage capacity. The resulting higher operating velocities (3 ft/sec up to 30 ft/sec) of a siphonic system further reduce pipe size and promotes self-cleaning of debris.

In a siphonic system, below-slab installation costs are minimized, thus reducing excavation, backfill costs and exterior underground piping.

Level installation allows for longer lateral runs overhead thereby reducing or eliminating pipe installed below slab and the associated costs of excavation, bedding and backfill. If overhead, traditional drainage pipe has to quickly drop vertically to avoid a conflict with the ceiling, structural elements or HVAC systems. If below grade, the longer the horizontal run, the deeper the pipe trench must go to accommodate pitch. Siphonic systems reduce or eliminate these issues. This means there are lower site preparation costs.

Within a siphonic roof drain system, stack and horizontal pipe locations are highly flexible.

Level installation and freedom of placement of vertical stacks reduces buried pipe depths and the associated costs of trenching, bedding, shoring, and dewatering. The flexibility of stack placement also facilitates on-site rainwater harvesting by allowing flexibility for cistern locations either below or above ground.

A siphonic system allows for maximum use of open space without intrusion of drainage piping.

Smaller diameter piping conforming to structural and architectural lines present a less intrusive presence in an open area. Level installation and freedom of placement of vertical stacks reduces the size of exterior storm sewer infrastructure. The point of discharge for the roof can be concentrated to one corner typically rather than out the building at several points.

These benefits enable significant savings in terms of time and money. Large roof construction similar to those found on factories, warehouses, airports, convention centers, stadiums and “big box” retailers will realize the benefits of siphonic roof drainage and favor this type of roof drainage system. However, all buildings regardless of size or height can realize the economic and technical benefits offered by siphonic roof drainage.

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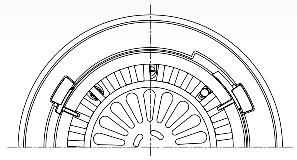
Product Selection

SIPHONIC ROOF DRAIN
15 1/4”(390) DIAMETER - LOW PROFILE DOME

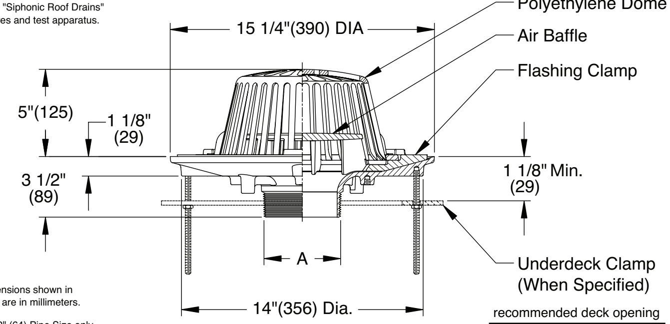
U.S. Patent No. D578,619S

**Performance Data		
A(Pipe Size) in. (mm)	Max. Capacity cfs (lps)	Resistance Value, K
02 (50)	0.50 (41.2)	0.13
0250 (64)	0.60 (17.0)	0.13
03 (75)	1.40 (39.5)	0.16
04 (100)	1.70 (48.1)	0.23

**As tested and certified by ANSI/ASME A112.6.9 "Siphonic Roof Drains" Procedures and test apparatus.



Free Area
102.5 Sq. In.
(661) Sq. Cm.



NOTE: Dimensions shown in parentheses are in millimeters.

***NOTE:** 2 1/2" (64) Pipe Size only available with male threaded outlet.

A(Pipe Size) = 02(50), *0250(64), 03(75) or 04(100)

recommended deck opening

with suffix -R	17 (430) DIA
less suffix -R	14 (355) DIA

Figure Number: **1005T** Male Thread Outlet
1005Y No-Hub Outlet

FUNCTION: For use in engineered siphonic roof drainage systems. May be used in flat roof of any construction. The large low profile dome provides sufficient free area for quick drainage of rainwater and protects the drain sump, baffle and connected piping from the intrusion of debris. Internal air baffle creates siphonic drainage action producing a more efficient drainage than traditional roof drains.

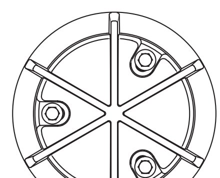
VARIATIONS:
- ☐ Sump Receiver -R
- ☐ Underdeck Clamp -C
- ☐ Underdeck Clamp for 10" Deck Opening -C10
- ☐ "L" Shaped Underdeck Clamp -CL
- ☐ Vandal Proof Dome -U

OPTIONAL MATERIALS:
- ☐ Aluminum Dome -AD
- ☐ Cast Iron Dome -CID
- ☐ Galvanized Cast Iron Dome -CIDG
- ☐ Galvanized Cast Iron -G
- ☐ Rough Bronze Dome -RBD

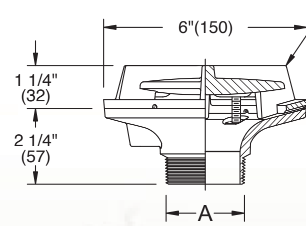
Regularly Furnished: Duco Cast Iron Body, Flashing Clamp, Air Baffle and Polyethylene Dome.

SIPHONIC GUTTER DRAIN
6”(150) DIAMETER - LOW PROFILE GUTTER DRAIN

U.S. Patent No. D576, 257S



Free Area
5.42 Sq. In.
(35) Sq. Cm.



Performance Data *		
Size (A) in(mm)	Max Capacity cfs (lps)	Resistance Value, K
02 (50)	0.40 (11.3)	0.66

A(Pipe Size) = 02(50)

Figure Number: **1605T** with Male Thread Outlet
1605Y No-Hub Outlet

FUNCTION: For use in engineered siphonic roof drainage systems for gutters, parapets, small balconies, sills, cornices, marquees and other small overhanging areas where drainage of rainwater is required. Air baffle creates siphonic drainage action producing a more efficient drainage than traditional gutter drains.

VARIATIONS:
- ☐ Vandal Proof -U

OPTIONAL MATERIALS:
- ☐ Galvanized Cast Iron -G

*As tested and certified by ANSI/ASME A112.6.9 "Siphonic Roof Drains" procedures and test apparatus.

Regularly Furnished: Duco Cast Iron Body with Combination Flashing Clamp and Air Baffle.

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Installation and Application

Installations by Roof Type

Poured Concrete

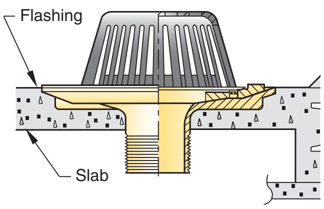
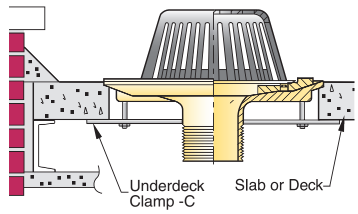


Figure No. 1005

Drain set in poured roof deck slab. Flashing is secured by a non-puncturing flashing clamp.

Precast Deck

Figure No. 1005 (-C)



Drain with underdeck clamp -C used where roof drain openings are presleeved or sawed-out in the slab. Underdeck clamp provides positive anchoring of the drain body. May be used in any slab or deck. NOTE: Drain flange rests in a recessed portion of the deck, eliminating sump receiver.

Any Insulated Deck

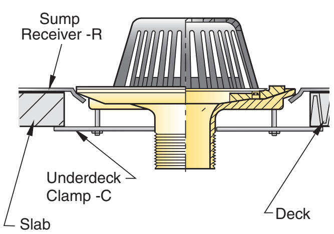
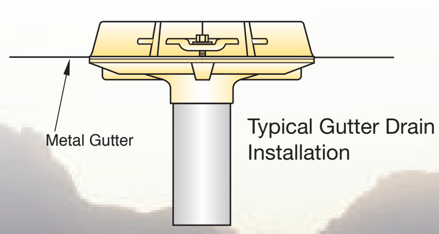


Figure No. 1005 (-R-C)

Drain with sump receiver -R and underdeck clamp -C. Under deck clamp provides positive anchoring of the drain body. The sump receiver is a square metal plate that accepts the drain body flange and eliminates the puddle of water surrounding the roof drain.

Gutter Drain Installation

Figure No. 1605



Gutter drain set in poured roof deck slab. Flashing is secured by a non-puncturing flashing clamp. For more on installations, see the roof drain section of the Smith Yellow Pages Catalog.

Application

Although any building or structure can benefit from siphonic roof drainage, siphonic systems are especially ideal for low-rise buildings with large footprints such as:

- Airport Terminals
- Aircraft Hangers
- Covered Malls
- Office Complexes
- Factories
- Convention Centers
- Warehouses
- Train Stations
- Retail
- Distribution Centers

Siphonic Roof Drainage for Building Retrofits

Building renovations typically involve the replacement of the roof waterproofing system and roof drains. The replacement of roof drains may also require the replacement of the drainage piping. Depending on the age of the building being renovated, an upgrade to current building codes may be required and these codes may require roof drains and piping sized for higher rainfall intensity and the use of independent secondary (i.e. emergency) overflow systems.

With smaller pipe diameters and no pitch, siphonic roof drainage is ideal for building retrofits, especially where architectural preservation is desired. Not only can it accommodate tight ceiling spaces and limited chase and wall space, it reduces construction costs. It also makes it possible to install all the new piping overhead (in ceilings) thereby eliminating the need to saw cut existing floor slabs to excavate and replace buried piping.

In the context of the LEED® rating system, siphonic roof drainage contributes to the reduction in materials used by allowing for smaller piping. It also facilitates the achievement of LEED credits for the reuse of existing buildings. Siphonic roof drainage is also useful for the replacement of exterior downspouts particularly along facades that must be preserved due to historic value.

Siphonic roof drainage is environmentally friendly, enables historic preservation, is easier to install, and saves money that can be used on other renovation efforts.

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APPENDIX

Specifier's Guide

How to use these charts:
Start by calculating the area of the roof surface to be covered by the drain, including any contributions from vertical surfaces and/or other surfaces discharging indirectly. For example, consider a project at a location where the local building code requires a 4.0 inch per hour rainfall intensity.

1. A roof drain on a single-ply membrane roof covering 9,500 square feet will receive 0.88 cubit feet per second (cfs) as determined using **Chart A** or by using the Rational Method.*

2. With this maximum required flow, enter **Chart B** along the X-axis at 0.88 cfs. This chart indicates that this flow falls within the range of the Model 1005T03 and the depth of water around the drain when fully primed will be 2.5 inches referenced from the flashing ring surface.

3. Having selected Model 1005T03, enter **Chart C** at the listed outlet size, in this case 3 inches. Chart C indicates that the 1005T03 has a resistance coefficient of 0.16 to be used in hydraulic calculations. Also, this drain model has a maximum rated capacity of 1.40 cfs (39.6 liters per second).

4. Enter the drain resistance value (0.16) and design flow (0.88 cfs) into your hydraulic calculations and proceed with sizing your system.

5. Repeat these steps for all the included siphonic roof drains to select drain model, resistance coefficient and design flow.

Roof Area to Volumetric Flow Conversion (cfs)

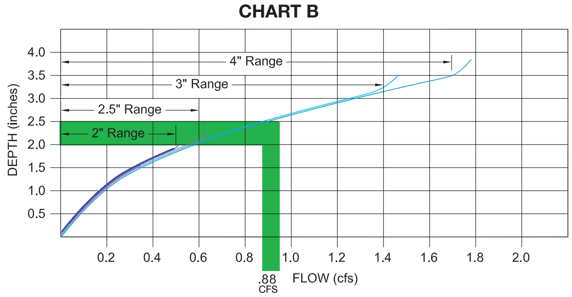
CHART A

Roof Area to Volumetric Flow Conversion (cfs)													
Area	Rainfall Intensity (inches/hr)												
sq ft	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
500	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.08
1000	0.01	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.10	0.12	0.13	0.14	0.15
1500	0.02	0.03	0.05	0.07	0.09	0.10	0.12	0.14	0.16	0.17	0.19	0.21	0.23
2000	0.02	0.05	0.07	0.09	0.12	0.14	0.16	0.19	0.21	0.23	0.25	0.28	0.30
2500	0.03	0.06	0.09	0.12	0.14	0.17	0.20	0.23	0.26	0.29	0.32	0.35	0.38
3000	0.03	0.07	0.10	0.14	0.17	0.21	0.24	0.28	0.31	0.35	0.38	0.42	0.45
3500	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.32	0.36	0.41	0.45	0.49	0.53
4000	0.05	0.09	0.14	0.19	0.23	0.28	0.32	0.37	0.42	0.46	0.51	0.56	0.60
4500	0.05	0.10	0.16	0.21	0.26	0.31	0.36	0.42	0.47	0.52	0.57	0.63	0.68
5000	0.06	0.12	0.17	0.23	0.29	0.35	0.41	0.46	0.52	0.58	0.64	0.69	0.75
5500	0.06	0.13	0.19	0.25	0.32	0.38	0.45	0.51	0.57	0.64	0.70	0.76	0.83
6000	0.07	0.14	0.21	0.28	0.35	0.42	0.49	0.56	0.63	0.69	0.76	0.83	0.90
6500	0.08	0.15	0.23	0.30	0.38	0.45	0.53	0.60	0.68	0.75	0.83	0.90	0.98
7000	0.08	0.16	0.24	0.32	0.41	0.49	0.57	0.65	0.73	0.81	0.89	0.97	1.05
7500	0.09	0.17	0.26	0.35	0.43	0.52	0.61	0.69	0.78	0.87	0.95	1.04	1.13
8000	0.09	0.19	0.28	0.37	0.46	0.56	0.65	0.74	0.83	0.93	1.02	1.11	1.20
8500	0.10	0.20	0.30	0.39	0.49	0.59	0.69	0.79	0.89	0.98	1.08	1.18	1.28
9000	0.10	0.21	0.31	0.42	0.52	0.63	0.73	0.83	0.94	1.04	1.15	1.25	1.35
9500	0.11	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.10	1.21	1.32	1.43
10000	0.12	0.23	0.35	0.46	0.58	0.69	0.81	0.93	1.04	1.16	1.27	1.39	1.50
10500	0.12	0.24	0.36	0.49	0.61	0.73	0.85	0.97	1.09	1.22	1.34	1.46	1.58
11000	0.13	0.25	0.38	0.51	0.64	0.76	0.89	1.02	1.15	1.27	1.40	1.53	1.66
11500	0.13	0.27	0.40	0.53	0.67	0.80	0.93	1.06	1.20	1.33	1.46	1.60	1.73
12000	0.14	0.28	0.42	0.56	0.69	0.83	0.97	1.11	1.25	1.39	1.53	1.67	1.81
12500	0.14	0.29	0.43	0.58	0.72	0.87	1.01	1.16	1.30	1.45	1.59	1.74	1.88
13000	0.15	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.66	1.81	1.96
13500	0.16	0.31	0.47	0.63	0.78	0.94	1.09	1.25	1.41	1.56	1.72	1.88	2.03
14000	0.16	0.32	0.49	0.65	0.81	0.97	1.13	1.30	1.46	1.62	1.78	1.94	2.11
14500	0.17	0.34	0.50	0.67	0.84	1.01	1.17	1.34	1.51	1.68	1.85	2.01	2.18
15000	0.17	0.35	0.52	0.69	0.87	1.04	1.22	1.39	1.56	1.74	1.91	2.08	2.26
15500	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44	1.61	1.79	1.97	2.15	2.33
16000	0.19	0.37	0.56	0.74	0.93	1.11	1.30	1.48	1.67	1.85	2.04	2.22	2.41
16500	0.19	0.38	0.57	0.76	0.95	1.15	1.34	1.53	1.72	1.91	2.10	2.29	2.48
17000	0.20	0.39	0.59	0.79	0.98	1.18	1.38	1.57	1.77	1.97	2.16	2.36	2.56
17500	0.20	0.41	0.61	0.81	1.01	1.22	1.42	1.62	1.82	2.03	2.23	2.43	2.63
18000	0.21	0.42	0.63	0.83	1.04	1.25	1.46	1.67	1.88	2.08	2.29	2.50	2.71
18500	0.21	0.43	0.64	0.86	1.07	1.28	1.50	1.71	1.93	2.14	2.36	2.57	2.78
19000	0.22	0.44	0.66	0.88	1.10	1.32	1.54	1.76	1.98	2.20	2.42	2.64	2.86
19500	0.23	0.45	0.68	0.90	1.13	1.35	1.58	1.81	2.03	2.26	2.48	2.71	2.93
20000	0.23	0.46	0.69	0.93	1.16	1.39	1.62	1.85	2.08	2.31	2.55	2.78	3.01

* The flow to a roof drain using the Rational Method is calculated as a function of the roof runoff factor, design rainfall intensity, and the area draining to the roof drain.

Flow vs. Depth Profile Selection Chart

CHART B



Siphonic Roof Drain Data

CHART C

Model	Resistance	Maximim Flow	
1005	Coefficient	Capacity	
Size (in)	K*	cfs	lps
2	0.13	0.50	14.2
2.5	0.13	0.60	17.0
3	0.16	1.40	39.6
4	0.23	1.70	48.1

Model	Resistance	Maximum Flow	
1065	Coefficient	Capacity	
Size (in)	K*	cfs	lps
2	0.66	0.40	11.3

*As calculated by ANSI/ASTM A112.6.9.

$$H = K\left(\frac{V^2}{2g}\right)$$

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Points on Sizing a Siphonic System

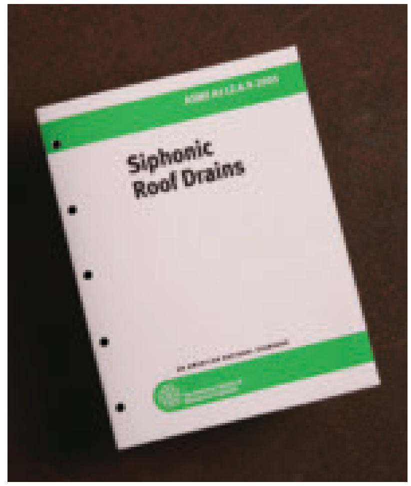
In sizing a siphonic roof drainage system, much of the design centers on the balance between the energy available to the system and the energy lost from each drain to the point of discharge. Energy within the system is lost as a result of viscous flow through the piping system in a full-bore steady state condition to achieve the specified drainage rate. For example, the height of the building represents the available "potential energy" to the system and is akin to a centrifugal pump performance curve. With a given roof surface area to be drained at specific rainfall intensity, the total design flow, including the flow to each drain, is the designer's starting point. The pipe system diameters, bends, increasers and even drains are then selected and analyzed for energy loss to a point where the energy balance is satisfied to achieve the design flow, requiring fairly precise calculations.

The required resistance coefficients for common pipe components like elbows and increasers are available from engineering references. Siphonic roof drains have their own specific resistance coefficient and a maximum flow capacity. This data is also required. The data for siphonic roof drains is available in ANSI/ASME A112.6.9 "Siphonic Roof Drains" and the pending ASPE Standard on Siphonic Roof Drain. Smith's 1005 and 1605 Siphonic Roof Drains meet both of these standards. For assistance on sizing, see the Specifier's Guide.

The hydraulic principles of siphonic roof drainage are quite simple and no different than any other piping system, but the calculations are easier to resolve with the assistance of computer software to facilitate in the repetitive calculation process and enhance accuracy of the results.

To download the SiphoniTec Sizing Software, visit www.jrsmith.com/siphonitec

Codes and Standards



In August of 2002, the American Society of Mechanical Engineers (ASME) Committee A112 "Plumbing Materials and Equipment" formed A112 Support Team PT 6.9 (PIR 02-6) for the purpose of drafting a standard for siphonic roof drains. On March 15, 2004, this proposed standard (designated A112.6.9 "Siphonic Roof Drains") was approved. It was then submitted to and approved by the American National Standards Institute (ANSI) on July 8, 2005. This standard establishes the testing procedures for siphonic roof drains used to determine the product resistance coefficient, flow range and response to varying flow rates.

Hydraulic tests were performed at CRM Laboratory, Bury, United Kingdom, under the supervision of HR Wallingford, on Smith's siphonic roof drains. The tests were performed in a test rig conforming to the ASME Standard A112.6.9-2005. The test covered the following aspects: observation of water patterns and effect of debris on capacity, determination of rating curve and single resistance value, and response to sudden inflow. All of Smith's siphonic drains were tested successfully. A copy of the certificate is available upon request.

The test procedures for our drains are based on the exact tests used by drain manufacturers in Europe where the siphonic drainage method has been successfully used for many years. All manufacturers of siphonic roof drains offering products for sale in the United States will need to certify their product(s) as compliant with this standard in the same way other plumbing fixtures and equipment must comply with ASME standards. Smith siphonic roof drains are at the forefront of product certification.

There are no U.S. testing laboratories equipped to test siphonic roof drains. CRM Laboratory has the test facility, expertise and experience to perform and certify siphonic roof drain testing not only to satisfy European Standards but also the ASME Standard A112.6.9-2005 Siphonic Roof Drains.

Always dedicated to the enhancement of technical expertise in the evolving community of plumbing engineering, Jay R. Smith Mfg. Co. is actively involved in the American Society of Plumbing Engineer's (ASPE) publication of their technical standard for the design of siphonic roof drainage systems. This technical standard is based upon the hydraulic principles common to all mechanical piping design and catered to the specific parameters of siphonic roof drainage. The standard is the "gold standard" in siphonic roof drainage design and provides the design professional with everything necessary to validate engineering calculations.

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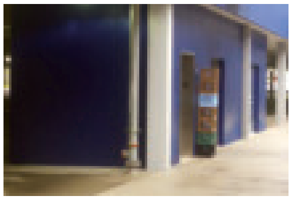
Case Studies

IKEA Home Furnishings Store



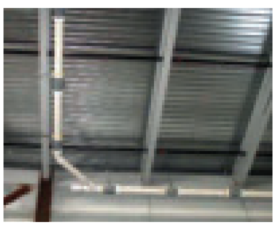
A typical siphonic roof drainage system stack. The vertical stack can be thought of as the "pump" that induces flow. A siphonic system can have a reduction in pipe size in the vertical stack to control flow and system pressures.

Paramus, New Jersey

The IKEA Store in Paramus, NJ represents the first siphonic system installed in the United States. In a value engineering exercise, it was determined that siphonic roof drainage would be less expensive and the plumbing engineer's traditional design was replaced with an engineered siphonic design. The traditional design consisted of twelve stacks each ten to twelve inches in diameter. The siphonic system consisted of only six stacks ranging from six to eight inches in size resulting in a substantial savings in pipe and fittings.

Demographics of IKEA Paramus

Roof Area (square feet)	250,000
Height (feet)	50
Design Rainfall Intensity (in/hr)	5.0
Number of Discharge Points	5
Total Discharge (cfs)	28.9
Number of Drains	23
Pipe Material	ASTM A53 Schedule 10 Galvanized Steel with roll-groove mechanical couplings.



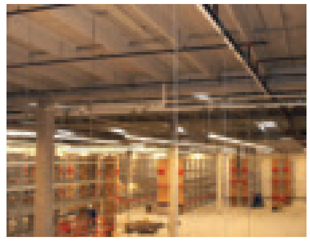
Siphonic roof drainage manifold installed above a ceiling. The manifold offsets easily around building elements such as an elevator shaft, structural steel, fire protection piping, and ventilation.

New Haven, Connecticut

IKEA selected an abandoned industrial site in New Haven for this siphonic installation. The site is best described as a brownfield and the reuse of such sites is beneficial not only to the economy but also to the environment. The challenge presented by building on such a site is the cost associated with handling and treating excavated soil that may be contaminated by prior industrial activities. In addition, construction difficulties were compounded by the fact that the water table was quite high. If traditional roof drainage were used for this project, rather deep trenching would have been required. The use of siphonic roof drainage for this store eliminated hundreds of feet of trenching and minimized the depth of trenching that was necessary. The use of siphonic roof drainage made the construction of a large retail establishment on a brownfield site far more economical. The use of siphonic roof drainage in this instance supports not only economic development, but also environmental preservation by "recycling" real estate.

Demographics of IKEA New Haven

Roof Area (square feet)	200,000
Height (feet)	33
Design Rainfall Intensity (in/hr)	2.8
Number of Discharge Points	7
Total Discharge (cfs)	12.96
Number of Drains	24
Pipe Material	ASTM D2665 Schedule 40 PVC



Horizontal manifold of a siphonic roof drain system in a warehouse. The roof drain branch ties into the manifold with a 45° lateral. This system runs level and parallel to the structure. The overhead installation eliminates roof drainage leaders at columns and under slab trenching.

Atlanta, Georgia

The IKEA store in Atlanta, Georgia is located in the 138 acre Atlantic Station redevelopment site. This site was once the home to the Atlantic Steel Hoop Company. The construction of the IKEA store on this site posed two challenges. First, the placement of over 230,000 square feet of roof surface on the site would have increased the site runoff rate and quantity to the culvert, which by current standards is aged and non-compliant with environmental regulations. Second, the connection to the culvert was difficult from a civil engineering perspective. The engineering solutions included underground detention tanks and pumps that were reportedly estimated at almost one million dollars in excess of initial construction estimates.

However, there was a regional storm water retention pond near the site. Unfortunately, the configuration of the site and position of the building made access to this storm drainage system impossible by traditional gravity methods. The implementation of siphonic roof drainage, on the other hand, did make it possible to drain the roof to the rear of the building where storm drainage piping could be installed below the delivery access road and off the site towards the retention pond.

Not only did IKEA realize savings with the use of siphonic roof drainage inside the building, but the company saved significantly in site infrastructure costs, avoided a lengthy permitting process and contributed to the overall environmental revitalization of the area.

Demographics of IKEA Atlanta

Roof Area (square feet)	226,000 roof, 61,270 parking deck
Height (feet)	35
Design Rainfall Intensity (in/hr)	3.7
Number of Discharge Points	5 from roof, 1 from parking deck
Total Discharge (cfs)	19.4 from roof, 5.25 from parking deck
Number of Drains	33 on roof, 10 on parking deck
Pipe Material	ASTM A888 No-Hub Cast Iron with MG Couplings.

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Case Study

Historical Disney Building, Pasadena, CA

Problem

A historical Disney building in Pasadena, California was being refurbished and needed a roof drainage system that allowed the exterior to remain unchanged. Clive Wilkinson Architects contacted Elmco/Duddy, the local Jay R. Smith Mfg. Co. representative for insight on using Siphonic Roof Drains on the job. Enrique Muñoz of Elmco/Duddy agreed to work with the architects in order to find a solution to their problem. The local ordinance required that the exterior of the 100 year old building could not be changed and that all overflow drainage be piped into the city storm drainage system. Additionally, the job required a quick and viable roof drainage solution.

Solution

The Siphonic Roof Drain, Figure #1005 by Jay R. Smith Mfg. Co. was selected and used because the overflow can be controlled to a specific point on the building. In the original design there were no overflows in place so the siphonic drains were the perfect solution to their problem. Mr. Muñoz showed the architect how the siphonic action of the roof drains allow the piping system to be run horizontal. This piping design enabled the overflows to be evacuated on the side of the building, which satisfied both the architect and the city of Pasadena.

A siphonic roof drain by Jay R. Smith Mfg. Co. has the same features as a traditional roof drain including the drain body, flashing ring, dome strainer, and fastening hardware. The difference is an air baffle, which prevents air from entering the piping system during peak flows. This technology provides full bore flow within engineered siphonic roof drain piping systems, making piping pitch unnecessary. Several drains can tie into a horizontal collector that is routed to a convenient point where it transition into a vertical stack. This stack, once it reaches the ground, is piped to a vented manhole where water is discharged into the storm system.

The Disney Pasadena project was a success with the customer, the architect, and the city officials being all pleased that the siphonic roof drain was able to solve their problems.

Benefits of using a Siphonic Roof Drainage System

- Smaller pipe diameters can be used reducing material cost
- Level pipe installations allowing fewer vertical stacks, saving ground work and building costs
- Driving head is greater which further reduces pipe size and promotes self-cleaning
- Vertical stack and horizontal pipe locations are highly flexible
- Maximum use of open space without intrusion of drainage piping
- Can be used as a retrofit, which helps to achieve LEED credits for reuse of existing buildings

These benefits provide significant savings in terms of time and money. Large roof construction similar to those found in factories, warehouses, airports, convention centers, stadiums, and retailers will realize the benefits of siphonic roof drainage.

For more information on this and other Jay R. Smith Mfg. Co. products, or to contact your local representative, visit www.jrsmith.com

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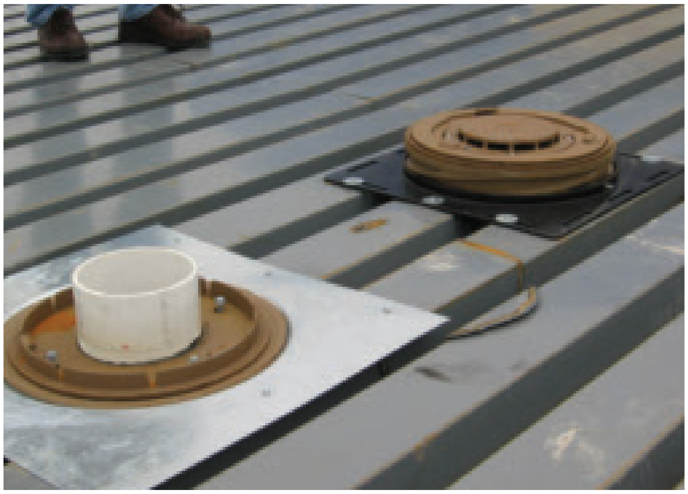

Figure # 1070 Overflow Standpipe Drain used with Figure # 1005 Siphonic Roof Drain.

Marshall Erdman, a Design-Build General Contractor in Madison, Wisconsin used green building strategies in order to achieve LEED® "Gold" certification on their new office building. They not only wanted their office building to be a prime LEED® building model, but a place of business for which they could be proud. Tom Breu, an engineer with Marshall Erdman had experience with products by Jay R. Smith Mfg. Co. and was aware of the potential Siphonic Roof Drains could provide him in value engineering the project while still incorporating other LEED® efforts.

This project was the first Siphonic Roof Drain project in the state of Wisconsin; that meant educating both the state and the city engineers on the product performance and use. The Jay R. Smith Mfg. Co. representative in Wisconsin, Steve Mellone of Northland Sales worked with Erdman during this approval process. It was important to them to have the Siphonic Roof Drains approved statewide so that they could be used on future design-build projects. Upon approval by the state, the state simply reviews the hydraulic calculations, plans and specifications to confirm proper technique is used.

During the approval and design process, Erdman worked with Rainwater Management Solutions (RMS), a partner with Jay R. Smith Mfg. Co. on Siphonic roof drains. Together they used the Siphoni-Tec® Siphonic Roof Drain Design Software to successfully design the siphonic roof drain system for the office building. The use of the siphonic software provided many benefits in designing the roof drainage system. At the conclusion of the design, Jay R. Smith Mfg. Co. Figure number 1005 siphonic roof drains were specified and used.

H & H Industries was the plumbing subcontractor for the job and is a MCAA member. Justin Vils, Plumbing Manager for H & H estimates an approximate savings of 30% in both labor and material costs by using a siphonic roof drain system instead of a conventional roof drain system. The amount and the size of the piping decreased, which saved money in material and manpower.

Benefits of Using a Siphonic Roof Drainage System

- Smaller pipe diameters can be used reducing material costs – 2", 3", and 4" vs. conventional 6", 8", and 10"
- Labor savings due to horizontal piping – Less manpower
- One main rain leader conductor instead of multiple rain leader conductors
- Sleeving and Coring – One main riser as opposed to four
- Below slab piping – One 10" connection point as op posed to four smaller connection points
- Maximum use of space without intrusion of piping – Avoid elevation conflicts with HVAC and lighting

The Erdman Office Building project was a success for the engineer, the representative, and the plumbing contractor. Not only does the siphonic roof drain system help to promote a new way of value engineering it also saves time and money on the job. Justin Vils with H & H Industries states, "We expect this type of system to be utilized more and more in the future, and eventually, become an industry standard."

For more information on Siphonic Roof Drains, Siphoni-Tec® design software, or to contact your local representative, visit www.jrsmith.com.

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Case Study

Carousel Center Mall, Syracuse, NY

Carousel Center Mall addition – Syracuse, New York
Jay R Smith Mfg. Co. Siphonic Roof Drain, figure #1005

Burns Brothers Mechanical, a MCAA Contractor, in Syracuse, New York has knowledge of the efficiency and savings that siphonic roof drains can provide on large commercial projects, especially jobs with large flat roofs. As these types of installations work well with an engineered siphonic roof drain system.

The building owner also knew about siphonic roof drains and wanted Burns Brothers to use them on the Carousel Center Mall project based on the value engineering benefits of the system*. The decision was made by the owner and Burns Brothers to use Jay R. Smith Mfg. Co.'s siphonic roof drains and to install a siphonic roof drain system on the Carousel Center Mall shopping addition because of these benefits. The shopping mall addition is to be built in three phases. The project scope is in excess of 1.3 million square feet.

*(*Smaller Piping = Cost Savings: In as siphonic system, the pipe diameters on any installation can be cut in half. In other words, if traditional pipe sizing for horizontal pipe requires an 8 inch pipe, a siphonic roof drainage system can drain the same quantity of water with a 4 or 5 inch pipe. This translates to cost savings. There have been many cost saving numbers posed but a conservative estimate is around a 40 percent savings overall compared to a traditional system.)*

The Carousel Center shopping addition is the first siphonic roof drainage system project for Burns Brothers Mechanical. To aid them with the design and product education, the Jay R. Smith Mfg. Co. representative in upstate New York, Kolstad Associates, worked closely with this MCAA contractor during the design process. Mike Kolstad of Kolstad Associates knew that on a job of this size the siphonic roof drain system design had to be done correctly so that the installation went smoothly. To ensure the proper design of the system, the SiphoniTec® Siphonic Roof Drain Design software (by Rainwater Management Solutions and distributed by Smith) was used. Using the siphonic software provided many benefits in designing the roof drainage system for the mall addition. It ensured that all of the siphonic calculations were correct and that the installed system would work as engineered. At the conclusion of the design, Smith figure number 1005, siphonic roof drains were specified and used with the engineered siphonic system.
The siphonic roof drainage system is an excellent way of transporting rainwater from the roof to a single point of discharge from the building*. The full-bore flow of the siphonic system also reduced pipe diameter on the project and allowed the piping to be run horizontally. The horizontal piping allowed for additional open space in the mall's design and did not interfere with the mechanical systems.

(Pipe Consolidation: The ability to run drainage pipe horizontally overhead gives the designer the opportunity to combine several drain systems into one manifold and one stack. So it is possible for a building's roof drain system to use one eight inch stack (just for example) instead of three eight inch stacks.

Benefits of Using a Siphonic Roof Drainage System on the Carousel Center Mall

- The smaller horizontal pipe diameters reducing material costs – 2", 3", and 4" pipe vs. conventional 6"and 8" pipe
- Labor savings due to horizontal piping – Less manpower to install as the pipe is hung without pitch.
- Fewer main rain leader conductors instead of multiple rain leader conductors
- Less sleeving and coring – One main riser as opposed to four risers
- Below slab piping – Separate main conductors as opposed to several connection points
- Maximum use of space without intrusion of piping – Avoid elevation conflicts with HVAC and lighting systems

Dan Grove, a project manager for Burns Brothers Mechanical has been impressed with the installed siphonic roof drain system and says "*anytime you can use smaller diameter pipe and less of it you really open up the ceiling, which creates more room for mechanical systems and makes the architect happy.*" He also understands the importance of saving money for the building owner and states "*we quoted the job using a traditional system versus a siphonic system and the savings that the siphonic system provided really opened the eyes of the owner."*

The Carousel Center Mall is a massive project. It is still in the construction phase. However, most of the siphonic roof drain system has been installed and both the MCAA contractor and the Smith representative are pleased with the results. This project is a great example of how siphonic roof drainage can save time and money in a value engineering application.

For more information about siphonic roof drains and to download the free SiphoniTec® Siphonic Roof Drain Design software, please go to www.jrsmith.com.

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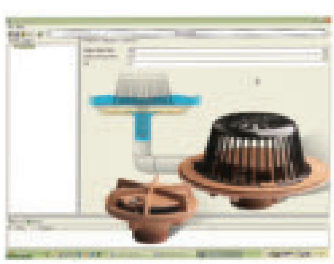
Siphonic Roof Drain Resources on www.jrsmith.com

Jay R. Smith Mfg. Co.® has made it a priority to provide on-line training and education tools for the design professionals. We have assembled an extensive offering of webinars, continuing education courses, presentations, case studies, articles, and videos. These tools are easily accessed and can be viewed at your pace. For 24/7 on-line training and education for the plumbing design professional visit www.jrsmith.com.



SiphoniTec® Design Software for Siphonic Roof Systems
We are pleased to offer the siphonic design software, SiphoniTec®, developed by Rainwater Management Systems (RMS), our partner in siphonic roof drains. This software greatly aids in the design of siphonic piping systems that will be compatible with Jay R. Smith Mfg. Co.® siphonic roof drains.

SiphoniTec® is an easy to use and is beneficial in roof drain piping system design for large roof applications. It is suitable for all siphonic system project requirements. It was designed by an engineer for engineers.

Some of the features include:
(1) Calculation details and imbalance tabs,
(2) MS Excel report features,
(3) GUI tree design, and
(4) the ability to load and remove multiple projects.

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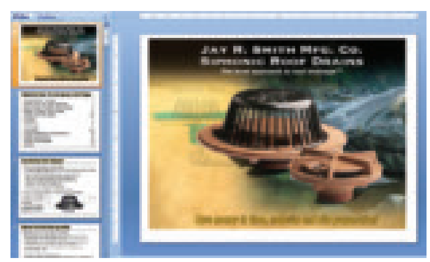

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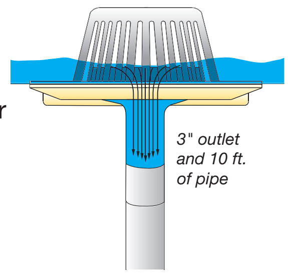
Cost Savings Application Examples: Using a Siphonic Roof Drain System

Example 1:

A traditional roof drain on a roof covers a tributary area of 7,840 square feet of roof surface at a rainfall intensity of 3.25 inches per hour. According to IPC 2000, Chapter 11, Table 1106.2 the required roof drain outlet size and connected drain pipe size would be 5 inches. A five inch drain with polyethylene dome and the first ten feet of 5 inch pipe with 1 inch insulation covering would cost about $840.00.



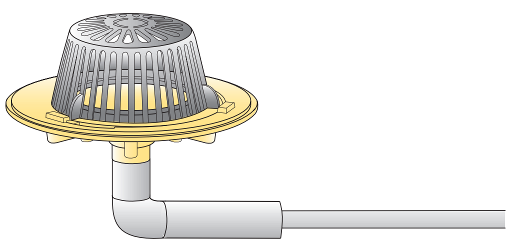
An existing siphonic system design covering the same roof area and rainfall intensity includes a 3 inch siphonic roof drain. A three inch siphonic drain and the first ten feet of 3 inch pipe with 1 inch insulation covering would cost about $610.00.

That's a savings of $233.00 per drain and ten feet of branch piping or almost 28 percent less than a traditional design.

0.5900	cfs		
3.2500	in/hr		
0.2708	ft/hr		
0.0001	ft/sec		
		52 pct	
7842.4615	sf		
5.0000	inch	$843.00	per 10 ft
3.0000	inch	$610.00	per 10 ft
	Save	**$233.00**	per 10 ft
	27.6%	**savings**	

Example 1: Calculations

Example 2:



A horizontal segment of a traditional roof drain system is designed to drain 15,685 square feet of roof surface at a rainfall intensity of 3.25 inches per hour. At a pitch of 1/8" per foot (about 1 percent), the required pipe diameter is 10 inches (IPC 2000, Table 1106.3). At this design flow, the pipe would be 52 percent full and have a velocity of 4.0 feet per second. Cast iron pipe with hangers every 5 feet on center and a 1 inch fiberglass insulation cover and couplings every 10 feet would cost about $1,057.00 per ten foot section. If installed below grade, the cost is about the same if insulation cover is replaced with the cost of trenching and backfill.

An existing siphonic system design covering the same roof area and rainfall intensity has a calculated pipe manifold of 6 inches. Even without pitch, the design velocity is 6.1 feet per second and 100 percent full. Cast iron pipe this size with hangers every 5 feet on center and a 1 inch fiberglass insulation cover and couplings every 10 feet would cost about $515.00 per ten foot section.

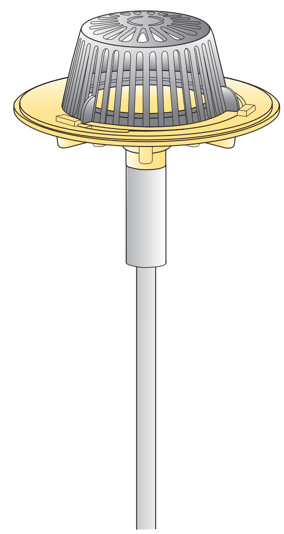
That's a savings of $542.00 per ten foot section in this part of the system or about 51% less than a traditional design.

1.1800	cfs			
3.2500	in/hr			
0.2708	ft/hr			
0.0001	ft/sec			
		52 pct		
15684.9231	sf			
10.0000 inch	$1,057.00		per 10 ft	4 ft/sec
6.0000 inch	$515.00		per 10 ft	6.1 ft/sec
	Save	**$542.00**	per 10 ft	
	51.3%	**savings**		

Example 2: Calculations

Example 3:

A vertical stack of a traditional roof drain system is designed to drain 63,940 square feet of roof surface at a rainfall intensity of 3.25 inches per hour. According to IPC 2000, the required pipe diameter is 12 inches. At this flow, the pipe would be about 25 percent full and would achieve a terminal velocity of 24 feet per second. Cast iron pipe for this stack size would cost about $1,488.00 per 10 foot section.



An existing siphonic system design covering the same roof area and rainfall intensity has a calculated stack diameter of 8 inches. The design velocity is 14 feet per second and the pipe is 100 percent full. Cast iron pipe for this stack size costs about $627.00 per 10 foot section.

That's a savings of $861.00 per ten foot section for this part of the system or almost 58 percent less than a traditional design.

4.8100	cfs			
3.2500	in/hr			
0.2708	ft/hr			
0.0001	ft/sec			
		25 pct		
63936.0000	sf			
12.0000	inch	$1,488.00	per 10 ft	4 ft/sec
8.0000	inch	$627.00	per 10 ft	6.1 ft/sec
	Save	**$861.00**	per 10 ft	
	57.9%	**savings**		

Example 3: Calculations

Based on R. S. Means Construction Cost Data 2005. These cost calculations are examples from real world applications; your cost may be different. These costs are given for illustration only.

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LEED® / Green Building Design

The LEED® (Leadership in Energy and Environment Design) Green Building Rating System™ was devised as a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. LEED was initially created by the U.S. Green Building Council (USGBC) to establish a common measurement to define "green building." It has since grown into a program aimed at raising awareness of and promoting integrated "green" building projects.

How does a building become a "green" building? Through design and construction that concentrates on:

- Conserving water;
- Reducing energy consumption;
- Reducing the depletion of natural resources and materials;
- Creating a sustainable site;
- Use of innovative design;
- Improving indoor environmental quality.

To become LEED® certified, the building is rated by these six categories. Within each category, points are awarded based on the LEED Green Building Rating System™.

LEED® awards points to building designs for a variety of energy-efficient and environmentally friendly features, from the installation of radiant heating to reduction of energy consumption, to grey water recycling, to the use of local building materials that require less energy to transport. LEED points are not given to individual products, but to an aggregate of the building system that saves water, energy, and contributes to a healthy indoor environment. An example of this is Wal-Mart's use of green building designs on a prototype store in Dallas, Texas, one feature of the design is the capture of rainwater for use throughout the building and grounds; i.e. rainwater harvesting.

By using Smith Siphonic Roof Drains in a siphonic design, LEED® points can be awarded for using recycled material (cast iron), reducing site preparation (less buried pipe), and extra points can be awarded by using "Innovation and Design" concepts. Additional points can be awarded if the siphonic system is used for rainwater harvesting. For more information on how siphonic systems can be used in rainwater harvesting, see page A.10

Environmental Design Credits

The benefit of using Smith Siphonic Roof Drains in a siphonic design is that this concept helps achieve the ultimate goal of USGBC: to promote buildings that are environmentally responsible, profitable and a healthy place to live and work. Here's how to get design credit:

❒ SS Credit 5.1:Site Development - "Protect or Restore Habitat" – 1 Point (26 possible points under Sustainable Sites)

Reduced, shallower trenching – *"To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity."*

Did you know that a siphonic roof drain system requires less site preparation?
In a siphonic system there is a de-pressured flow (a higher flow capacity since flow is a full-bore) which means there is much more flexibility where pipe routing is concerned – thus the pipe work can be run just horizontally below the roof rather than below ground; this means there is less need for groundwork such as site trenching, bedding, and backfilling.

❒ SS Credit 6.1 "Stormwater Design - Quality Control" – 1 Point (26 possible points under Sustainable Sites)

Controlled flow roof drainage – *"To limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants."*

Did you know that a siphonic roof drain system can reduce stormwater runoff from the roof?
In a siphonic system several roof drain outlets can be connected to a single vertical discharge pipe reducing the number of discharge points. And fewer discharge points mean the water can be easily routed for storage and reuse. This in turn controls the amount of rainwater being fed into the stormwater systems or runoff area. Once the water is stored it can be used for landscaping irrigation, toilet and urinal flushing, and custodial uses.

❒ WE Credit 3 "Water Use Reduction" – 2-4 Points (10 possible points under Water Efficiency)

Rainwater harvesting

Water Efficiency – *"To further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems."*

Did you know that a siphonic roof drain system can be used successfully with water harvesting?
A siphonic system allows for piping to a water harvesting system so that it can be stored and used for non-potable applications such as in irrigation, toilet and urinal flushing, mechanical systems, and custodial uses.

❒ "Recycled Content"

Did you know that most cast iron is "green?"
Most cast iron drainage products use 100% post-consumer recycled materials and can be re-melted and recycled after their useful life. Such is true with all Jay R. Smith Mfg. Co., cast iron, plumbing and drainage products and our siphonic roof drains.

❒ ID Credit 1 "Innovation in Design" – 1-5 Points (6 possible points under Innovation & Design Process)

Achieve Measureable Environmental Performance – *"Award points for exceptional performance above the requirements set by the LEED Green Building Rating System™."*

Did you know that a siphonic roof drain system is an innovative design?
A siphonic roof drain system allows for smaller diameter piping and more flexibility where pipe routing is concerned. These characteristics enable significant savings of time and money in the construction of large industrial or commercial buildings. The need for vertical rainwater piping inside a building can be eliminated, saving approximately 1/2 a square meter per stack. This allows greater flexibility in the use of space within open-plan buildings, permitting larger uncluttered areas in large public structures. If used in conjunction with a rainwater harvesting system, there can be increases in water use reduction percentages.

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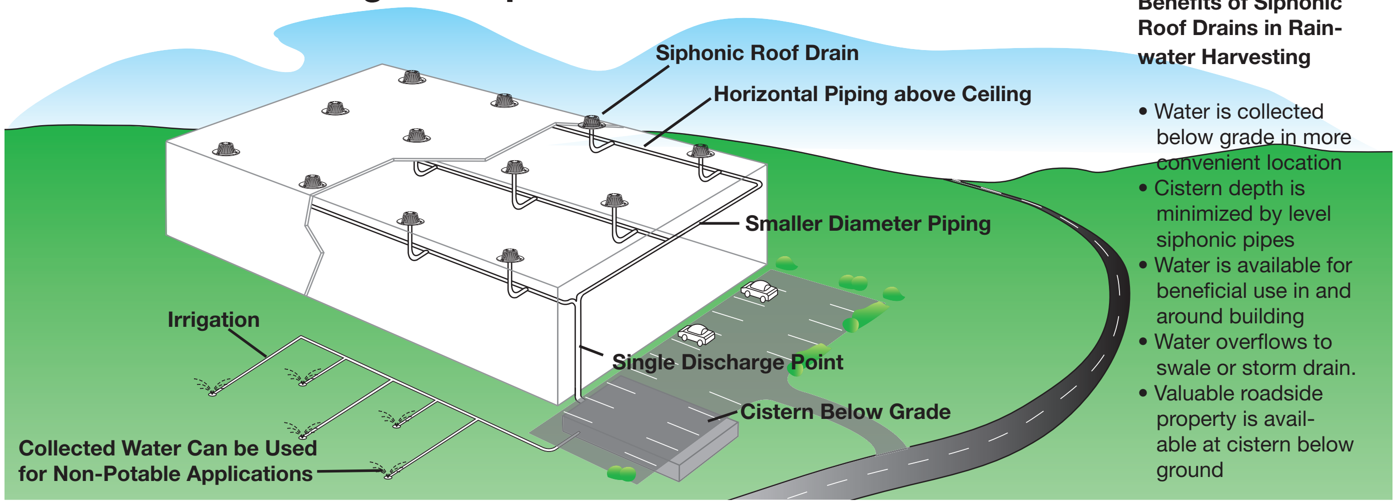
Rainwater Harvesting and Siphonic Roof Drains



Benefits of Siphonic Roof Drains in Rain-water Harvesting

- Water is collected below grade in more convenient location
- Cistern depth is minimized by level siphonic pipes
- Water is available for beneficial use in and around building
- Water overflows to swale or storm drain.
- Valuable roadside property is avail-able at cistern below ground

A siphonic roof drainage system is one of the most effective technologies offered for capturing rainwater from a building roof top to aid in implementing rainwater harvesting. In a siphonic system several roof drain outlets can be connected to a single vertical discharge pipe. Fewer discharge points and no requirement for pitch in the piping means the rainwater can be easily routed horizontally below the roof to a storage tank or cistern. The stored rainwater is now available for use in non-potable applications such as toilets and urinal flushing, mechanical systems, custodial uses, and for site irrigation.

One of the major benefits of designing a building with siphonic roof drainage and rainwater harvesting systems is reduced overall construction and facility operation costs.

Additional benefits include reduced discharge of rainwater to lakes, streams, rivers and sanitary systems, and decreased dependence on municipal water supplies.

Benefits of Rainwater Harvesting:

1. Industrial and Commercial Use

   a. Water conservation
      i. site irrigation,
      ii. toilet and urinal flushing,
      iii. janitorial use, and
      iv. fire protection.

   b. Reduced municipal water consumption and industry uses
      i. car washes,
      ii. commercial laundry,
      iii. process water (e.g., microelectronics, metal molds, electroplating, printing, etc.),
      iv. evaporative cooling tower make-up,
      v. mechanical equipment make-up water, and
      vi. evaporative cooling of roof surface (reduction in A/C load).

   c. Stormwater runoff reduction
      i. assists storm water NPDES permitting,
      ii. allows for better use of property (e.g., less area used for on-site detention),
      iii. above ground and below ground storage (cisterns) reduce mosquito nuisance on site,
      iv. decreases soil erosion and local flooding by reducing run-off rate and quantity, and
      v. improves water quality to near by streams, rivers, and water sheds.

   d. Can offset “roof top taxes” imposed by local and state authorities.

   e. Promotes good public relations (i.e., showing a positive environmental concern by eliminating run-off).

2. Military Use

   a. Can be used for all industrial/commercial uses listed above,
   b. decreases dependency on delivered water supplies, and
   c. can serve as reserve source if primary water supply is contaminated.

3. Residential Use

   a. Water conservation
      i. lawn and garden irrigation,
      ii. toilet flushing,
      iii. laundry,
      iv. car washing,
      v. filling pools and hot tubs, and
      vi. residential fire protection supply (can reduce insurance premiums).

   b. Reduced dependency on strained municipal water supplies
      i. reduce monthly water bill by reducing municipal water needs,
      ii. avoid water restrictions by collecting your own water,
      iii. reduce or eliminate need for water treatment systems (e.g., softeners), and
      iv. adds sale/resale value to homes with reduced water bills and fewer water restrictions.

4. Supplement or replace well sources of low yield or water quality

   a. Rainwater is naturally soft (low in mineral content)
      i. reduces/eliminates water softening equipment, and
      ii. reduce the amount of detergent needed for laundry.

   b. Can be used to supplement low volume wells instead of drilling additional or deeper wells.
   c. Can enable development in areas without sufficient municipal or well water sources.
   d. Can enable development adjacent to wetland areas and streams due to reduction in rainwater discharge rate and quantity to surrounding waters.
   e. In many cases can be used as potable water supply (can be completely “off the grid” where necessary).

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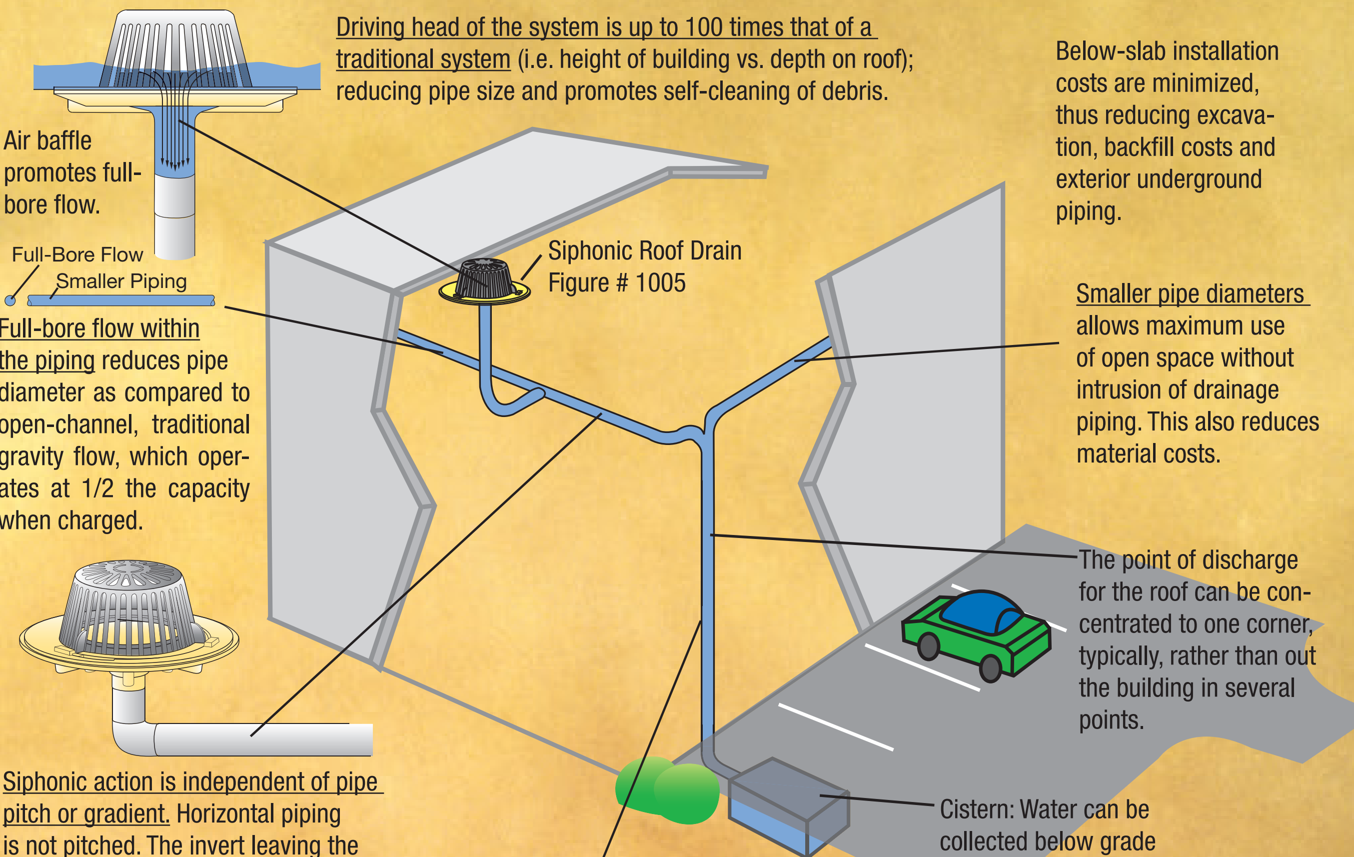
The Many Benefits of Using The Jay R. Smith Mfg. Co.® Siphonic Roof Drain System



Driving head of the system is up to 100 times that of a traditional system (i.e. height of building vs. depth on roof); reducing pipe size and promotes self-cleaning of debris.

Below-slab installation costs are minimized, thus reducing excavation, backfill costs and exterior underground piping.

Air baffle promotes full-bore flow.

Full-bore flow within the piping reduces pipe diameter as compared to open-channel, traditional gravity flow, which operates at 1/2 the capacity when charged.

Smaller pipe diameters allows maximum use of open space without intrusion of drainage piping. This also reduces material costs.

The point of discharge for the roof can be concentrated to one corner, typically, rather than out the building in several points.

Siphonic action is independent of pipe pitch or gradient. Horizontal piping is not pitched. The invert leaving the building is eliminated.

Cistern: Water can be collected below grade for use in and around building.

Level installation and freedom of placement of vertical stacks reduces buried pipe depths and the associated costs of trenching, bedding, shoring, and dewatering. The flexibility of stack placement also facilitates on-site rainwater harvesting systems.

Contact your local representative

Quick-Read on Siphonic Roof Drain Design

SMITH® CUSTOMER DRIVEN

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