2.2 SIPHONIC RAINWATER SYSTEM

A. Performance Objectives

1. Where noted on the plans, the rainwater from the roof drains (outlets) will be
MIFAB®®-HydroMax® Siphonic roof drains referenced on the drawings, manufactured by MIFAB® Inc., 1321, West 119th Street, Chicago, IL 60643. T800.465.2736.

Drains must be independently tested to ASME A112.6.9 standard and certified by IAPMO file number 6009.

The MIFAB®-HydroMax® siphonic rainwater drainage system shall be designed, supplied, installed and tested in full compliance with ASPE Plumbing Engineering and Design Standard 45. Drains located at roof level, will be collected and discharged to the below grade drainage system by a siphonic drainage system

The design of the siphonic system will be based on full-bore, flow conditions. The pipe dimensioning will be evaluated using the extended Bernoulli equation, the Darcy-Weisbach formula and Colebrooke-White formula. Calculations must use recorded data to incorporate losses through fittings within the system design calculation. The independently tested analytical design software program, HydroTechnic®, provided by MIFAB®® HydroMax®, shall be used to calculate the system dimensioning.

Under no circumstances should the Hazen-Williams formula be used to design and dimension siphonic drainage systems.

This portion of work is submitted as a variance to the [Insert Applicable Code].

2. The Plumbing Contractor will design and install all rainwater pipework including all rainwater outlets and connections to drain. The installer should note that the specification cannot be deviated from and the installer must ensure that all other designers are aware of particular technical requirements such as syphon breaks etc.

3. The design will generally comprise of:

(a) Siphonic rainwater system complete, including rainwater drains (outlets), pipework, supports and siphon break using Wye branch venting to air using MIFAB®® HydroMax® siphonic termination vent ref# MH-F1460 up to 6” or MH-F1560 up to 12” and connection to storm drainage.

(b) The provision of all design information, including drawings to comply with Building Regulations will be provided by [Insert the source of information; ]

(c) Provision of all drawing and calculation design information as described in ASPE/ANSI Plumbing Engineering and Design Standard 45:2013 Section 10 to meet the requirements of the construction team.

B. Design Parameters

1. The design calculation should be carried out using independently tested and proven MIFAB®® HydroTechnic™ analytical design software program designing in accordance with ASPE/ANSI Technical Design and Engineering Standard 45:2013.

Calculations must be provided by the installer, containing the following information and within the specified limits:

Pipe Sizes: 1½” to 16" diameters.

Pipe Material: [no-hub cast iron, schedule 40 solid wall PVC (no foam core permitted]

Roof Drain Single Resistance Factor (“K” factor) must be equal to the values as determined by roof drain outlet pipe connection size.

|  |  |  |  |
| --- | --- | --- | --- |
| Primary Drain outlet size | “K” Factor | Secondary Overflow Drain outlet size | “K” Factor |
| 3” | 0.05 | 3” | 0.095 |
| 4” | 0.07 | 4” | 0.12 |
| 5” | 0.06 | 5” | 0.11 |
| 6” | 0.11 | 6” | 0.14 |

Negative Pressure: Not to exceed -26.247 water column

Minimum Velocity in Horizontal Piping: Not less than 3.0 ft/sec

Minimum Velocity in Vertical Piping: Not less than 7.5 ft/sec

Maximum Velocity: Not more than 26.7 ft/sec

Out of Balance Pressure: Not to exceed 1.5 feet water column or 10% of the Disposable Head, whichever is less

System Fill Time: Not to exceed 60 seconds (calculated within independently accredited design software for complying with calculation method prescribed ASPE/ANSI Plumbing Engineering and Design Standard 45:2013.)

2. Roof drains will operate in accordance with the MIFAB®® HydroMax® performance flow graphs. The flow graphs provide compliance with IPC 2015 clause 1105.2.

The MIFAB® HydroMax®™ performance flow chart should be utilized to ensure roof drains within gutters are compatible with the gutters.

The minimum working capacity will be 23 gpm.

3. Rainfall rate for the siphonic rainwater system shall be determined by the engineer of record and be equal to or greater than code requirement.

A secondary overflow system should also be determined by the engineer of record and be equal to or greater than code requirement.

4. A design check will be carried out to monitor site changes and adjustments made where necessary. The revised calculations will be included in the operating and maintenance manuals.

Failure to install pipework exactly as designed may adversely affect the siphonic action. The Installer should immediately report to the designer any issue which may prevent the pipework from being installed exactly as designed.

Where a change to the drawn pipe routing or to the calculation design lists is required, the installer should notify the person responsible for the design to make the necessary re-calculation.

Permitted tolerances are as follows:

Piping 4” (100mm) and smaller shall be installed within + or – 4.039” of the designed length.

Piping larger than 4” (100mm) shall be installed within + or – 8.787” of the designed length.

5. The designer shall ensure that the maximum water depth on the roof is analyzed and that it is within acceptable tolerances for loadings on the roof and overflow.

C. System Description

1. The siphonic rainwater pipework will comprise:

2. The Primary siphonic rainwater disposal system shall use MIFAB® HydroMax® siphonic roof drains designed to [Insert Rainfall rate]"/hr rainfall intensity which should be equal or greater than code design rainfall rate.

3. An overflow (secondary) siphonic rainwater disposal system shall use MIFAB® HydroMax® siphonic overflow roof drains designed to [Insert Rainfall rate]"/hr rainfall intensity which should be equal or greater than code design rainfall rate.

4. The complete system will be installed using a roof drain made by MIFAB® HydroMax® fitted within the roof construction and pipe conveying the surface water to drain. The pipework will collect the rainwater from the roofs and be routed at high level to the point where it will drop and connect to the atmospheric drain. The connection to the below ground drainage will be carried out in a manner which will break the siphon at that point.

D. Materials

1. All piping components materials shall be in accordance with ASPE/ANSI Plumbing Engineering and Design Standard 45:2013 Section 2.

2. All component parts of the system will be covered by manufacturer’s warranty.

3. Pipe materials shall be in conformance with local building and plumbing codes.

 All pipe and fittings shall be installed in accordance with the standards under which the materials are approved and in accordance with the manufacturers written instructions.

 Pipe fittings and accessories: PVC Solid Wall Schedule 40 and

 No-Hub Cast-Iron with Standard or Heavy Duty couplings, braced to prevent separation in accordance with ASTM and CISPI written recommendations may be used as determined by ASPE/ANSI 45.

 NOTE: Foam core PVC shall not be used under any circumstances.

 4. The roof drains (rainwater outlets) will be capable of being fixed to the roof deck or suspended and properly supported with under deck clamps

5. The fastening system materials to must be capable of withstanding all stress produced by thermal expansion and vibration of the pipework.

E. Installations

1. A MIFAB® HydroMax® Pre-Installation call covering MIFAB® HydroMax® check-list must be completed and signed prior to the installation. The Pre-Installation conference shall include the EOR, General Contractor, plumbing installer and manufacturer is required.

 Please contact:

 Brennan Doherty, National Specifications Manager

 bdoherty@MIFAB.com (312-241-5224)

2. The siphonic rainwater system will be installed strictly in accordance with the design and specification. All pipe and fittings shall be installed in accordance with ASPE/ANSI Plumbing Engineering and Design Standard 45:2013 Section 8 and 11 and with the standards under which the materials are approved and in accordance with the manufacturers written instructions.

3. All pipe and fitting joints including the joint to the outlet will be in accordance with manufacturers written guidelines.

4. All bends, unless otherwise specified to be DWV ¼ (90°) or 1/8th (45°) fittings. Tight or sharp bends are strictly forbidden in the siphonic system.

5. All branches to be single 45° Wye branches – Do Not Use, combination branches, or 90° branches or double branches.

1. All piping is to be securely braced to the building structure in a manner which prevents pipe sway and is braced against the thrust forces generated by the flowing water. The installer is advised to visit site to survey the proposed routes. If drop rod hangers are longer than 18” then sway bracing shall be required at maximum 30 ft.
2. Ensure all pipework is firmly fixed at both vertical and horizontal tail pipes below roof drains, at each side of each change of direction and all 3 connections to a Wye branch. The pipework needs to rigidly fixed to prevent movement of the pipework under the flow conditions in a siphonic system.
3. Any pipe lengths which are not full 10 ft lengths should have visible chalk or indelible marker markings to be visible from the ground identifying length.
4. All pipework should have markings stating MIFAB® HydroMax® Engineered Siphonic Rainwater Piping – “DO NOT ALTER PIPE WORK WITHOUT ENGINEER OF RECORD CONSENT”

**Failure to install pipework exactly as designed and supplied may adversely affect the siphonic action**. The Installer should immediately report to the designer any issue which may prevent the pipework from being installed ***exactly*** as designed.

For this purpose, a Request for Alteration should be made. The installer should provide as much information as possible – including a dimensioned sketch where applicable – and return to the designer. The designer will input this information into the MIFAB® HydroTechnic™ program and advise installer of results.

Siphonic drainage is an engineered piping system. All piping components form part of the hydraulic design calculation which has been engineered to create a siphonic action and make the system function.

The Installer must refer to both the layout drawings and design calculation sheets to identify correct configuration, lengths of pipes, locations of bends, wye branches and reducers. It is essential that the installation follows the design.

Where a change to the drawn pipe routing or to the calculation design lists is required, the installer should notify the person responsible for the design to make the necessary re-calculation.

**Permitted tolerances in accordance with ASPE/ANSI 45:2013 are as follows**:

Piping 4” (100mm) and smaller shall be installed within + or – 4” of the designed length.

Piping larger than 4” (100mm) shall be installed within + or – 8” of the designed length.

Before beginning the installation of siphonic pipework, the installer should:

* Ensure the drawings and design information are in hand.
* Check all necessary materials – pipework, bracketry, loose items, etc. – are on site and in good condition.
* Check that the siphonic roof drains are installed in roof/gutter and are accessible for connection.
* Check that the drawings supplied accurately reflect the layout of building and that all heights and reference dimensions are accurate and achievable.
* Check that the working access equipment is suitable and safe for site conditions.

If necessary, contact the relevant personnel to rectify any of the above points.

The piping system will comprise of swept fittings with ¼ (90°) bend or ⅛ (45°) bends and ⅛ (45°) wye branches.

90° branches (straight or sanitary tees) are not permitted at any time.

Where a right angle branch is required it should be made using a 45° wye branch connecting to a 45° bend or a combination wye and 1/8th bend.

Cleanout/Access Points should not be incorporated into a siphonic piping system (because they will normally create an air-pocket which will interfere with the siphonic action).

The only permitted use of cleanout/access points are where the fitting protects the integrity of the interior of the pipe without creating an air-pocket.

It is important to note that the velocity of the water within the system ensures self-scouring of the pipework.

**Installation of Horizontal Pipework**

**The horizontal pipework should be installed level without any pitch gradient. This is to ensure speedy priming process which creates the siphonic action.**

The horizontal pipe is installed with top of pipe (crown) level, NO PITCH. Any changes in diameter are created with the transition slope at the invert. The drawings will notate the Top of Pipe level (t.o.p.) unless eccentric reducers are not available and as such concentric reducers are used as straight replacements without the need for recalculation.

The horizontal (collector) pipework will be suspended from the structure of the building by means of pre-determined fixing methods.

Generally, support fixings will be installed consistent with accepted industrial practice at no more than the pipe manufacturer’s written instruction or with the governing plumbing codes for piping full of water.

Additional brackets shall be installed at both sides of every change of direction within a foot.

Additional brackets shall be installed at all three sides of every Wye branch within a foot.

In addition to the above brackets, pipework should be bracketed to building structure to form lateral restraint at convenient locations at no more than 30 feet intervals. This is to reduce the possibility of movement and vibration during operating conditions.

As the installation of horizontal collector pipe progresses, ensure that specified heights to top of pipe level are achieved throughout the run and that branches in collector pipe coincide with roof drain locations.

Reducers (increasers) should be of the eccentric type and oriented to ensure the crown of the two adjoining diameters remains level and the diameter transitioning sloped pipe is at the invert. If eccentric reducers are not available, concentric reducers shall be used as straight replacements without the need for recalculation.

**Connecting to Roof Drains**

Ensure the roof drain has the correct connection for compatibility with the piping materials.

The Installer must refer to design calculation sheets to identify correct lengths of pipes, locations of reducers, etc for each tail-pipe connecting to the horizontal collector pipe.

Reducers should be eccentric type (if available) on horizontal runs with the top of the pipe remaining level. Concentric reducers are permissible without recalculation if the eccentric reducers are not available.

Reducers can be concentric type when installed on the vertical section of the tail-pipe below the roof drain.

Increase in diameter on the vertical section of the tail-pipe below the roof drain is not permitted.

Ensure all pipework is firmly fixed at both vertical and horizontal tail pipes below roof drains

**Vertical Pipework (Downpipes)**

The vertical pipework (downpipe) will be supported from the structure of the building by means of pre-determined fixing methods.

When fixing to cladding rails, a length of secondary support steel or channel rail should first be attached to the structural elements of cladding. Pipe supports can then be positioned to suit locations as required. The spacing of brackets should be in accordance with local administrative authority having jurisdiction.

Generally, pipework will be designed to be as close as possible to supporting structure.

Cleanout/access points are not required on a siphonic system. If special circumstances arise where cleanouts are used then these should be fitted in such a manner to allow unrestricted entry to remove screw-cap. These cleanout fittings should not create an air pocket and it is therefore a requirement for these to be a removable spool piece.

Eccentric reducers placed on the vertical just after an elbow turning down shall have the flat side oriented with the outside radius of the elbow. Concentric reducers are permissible without recalculation if the eccentric reducers are not available.

**Connection to Below Grade Drainage**

A common method of connecting siphonic pipework to underground pipework is my means of a connection onto a wye branch sized for gravity flow of the required GPM flow. The wye section should rise to grade level and be terminated with a MIFAB® HydroMax® siphonic vent piece reference MH-F1460 up to 6” or MH-F1560 up to 12” or detail as per ASPE/ANSI 45 clause 9.9.

Refer to assembly detail drawing for typical layout.

**Inspection and Testing Procedures**

All siphonic pipework must be tested prior to the installation of insulation (where required) and the final handover to client. Testing must be carried out as described in the relevant specification.

It is impractical to perform an operational or flow test of a siphonic system and this is not therefore required. Required testing to permit full warranty of the MIFAB® HydroMax® siphonic roof drainage system by MIFAB® Inc. is as follows:

1. The purpose of testing the PIPE is to inspect for workmanship (installation) and product quality.
2. The required testing is equivalent to ASTM and or manufacture’s testing requirements for the applicable piping material.
3. For Cast Iron soil pipe and Schedule 40 PVC, 10 foot of water column, 3.4 ***PSI*** is sufficient to determine acceptability of the piping material.
4. Although ASPE Plumbing Engineering and Design Standard 45, Section 12 recommends other testing methods, piping systems tested in accordance with the procedure defined in the MIFAB® HydroMax® Installation Manual ensure the system will properly function and are fully warranted by MIFAB® Inc.
5. The use of air test is not recommended by MIFAB® Inc.. The use of air tests create negative safety issues and should not be employed.
6. **A Pre-Insulation check-list provided by MIFAB® HydroMax® must be completed and signed by the installer prior to the insulation being affixed.**

Please contact:

Brennan Doherty, National Specifications Manager

bdoherty@MIFAB®.com (312-241-5224)

Upon completion of test, all sealing plugs and temporary joint restraints must be removed from roof drains and pipework at the earliest opportunity to prevent damage caused by flooding or water ingress.

Before Insulation is installed, the Engineer of Record must be notified and a site visit taken to inspect the installation for accordance with this specification.

F. Protection

1. Throughout the installation of the siphonic rainwater system the installer will be responsible for preventing the entry of debris into the roof drain outlets and pipework.

2. Roof areas will be kept free from debris and outlet inducers will be fitted as soon as the system is ready for use.

G. Working Drawings

1. The designer will submit working drawings showing sizes, routing, invert levels, points of access, connection to drain and outlets prior to commencing installation works. Drawings will be as produced using computer aided drafting or equal.

A full set of Construction-Issue drawings shall be prepared, sealed and signed by a professional engineer, licensed in [Insert State] including:-

* Roof layout showing positions of siphonic roof drains with each drain tagged
* Floor plans showing routes of high-level siphonic pipework with sufficient detail to instruct the installer on the size, orientation and support of the pipe, fittings and drains
* A detail drawing of the roof drain installation and flashing
* Typical sectional views and details
* System Designer’s name and contact details for notifying any Requests For Change.

and for each individual siphonic system,

* Isometric Schematic Diagram showing all lengths (Not drawn to scale for clarity)
* Pipe Run Lists detailing ‘Overall Parameters’ data sheets with hydraulic results.
* Bills of Materials list for each individual system

The Roof layout drawing is issued to the contractor prior to start date to allow the correct positioning and installation of roof drains.

The Floor plan(s) shall indicate the routes of siphonic pipework within the building and will clearly identify installation heights of pipework above a suitable datum, diameters of pipework and will show distances to pipework from grid-lines or points of reference. Drawings will also show locations of sectional views and details.

All heights shown on installation drawings are from datum to the top of pipe level which are to be constant throughout runs of pipework (unless specified otherwise).

The Sectional Detail drawings are provided to show the typical configuration of tailpipes and main collector pipes and will indicate the height of pipework, bracketry required to support the pipework from the structure of the building and how the designer has envisaged the method of supporting pipework.

2. Two copies of the working drawings and calculations will be issued to the Engineer.

H. Record Drawings

1. The installer will keep a set of working drawings on site marked-up to show "as installed" routes, sizes, access locations, invert levels etc. On completing the installation the installer will incorporate the alterations onto their working drawings using computer aided drafting and issue to the owner via the engineer.

2. It should be noted that the installation would not be deemed complete until the record drawings and where necessary revised calculations have been issued and accepted.

I. Operating and Maintenance Manuals

1. The installer will issue [Insert #] bound copies of Operating and Maintenance manuals for the rainwater disposal system to include the following as minimum:

(a) Indicating names and address of client, project manager, architect, consulting

engineers, contractors and installer.

(b) Description of systems installed.

(c) Planned maintenance requirements.

(d) Details of guarantee.

(e) Calculations.

(f) Isometrics (which have been produced using CAD).

2. It should be noted that the installation would not be deemed complete until the Operating and Maintenance Manuals have been issued and accepted.