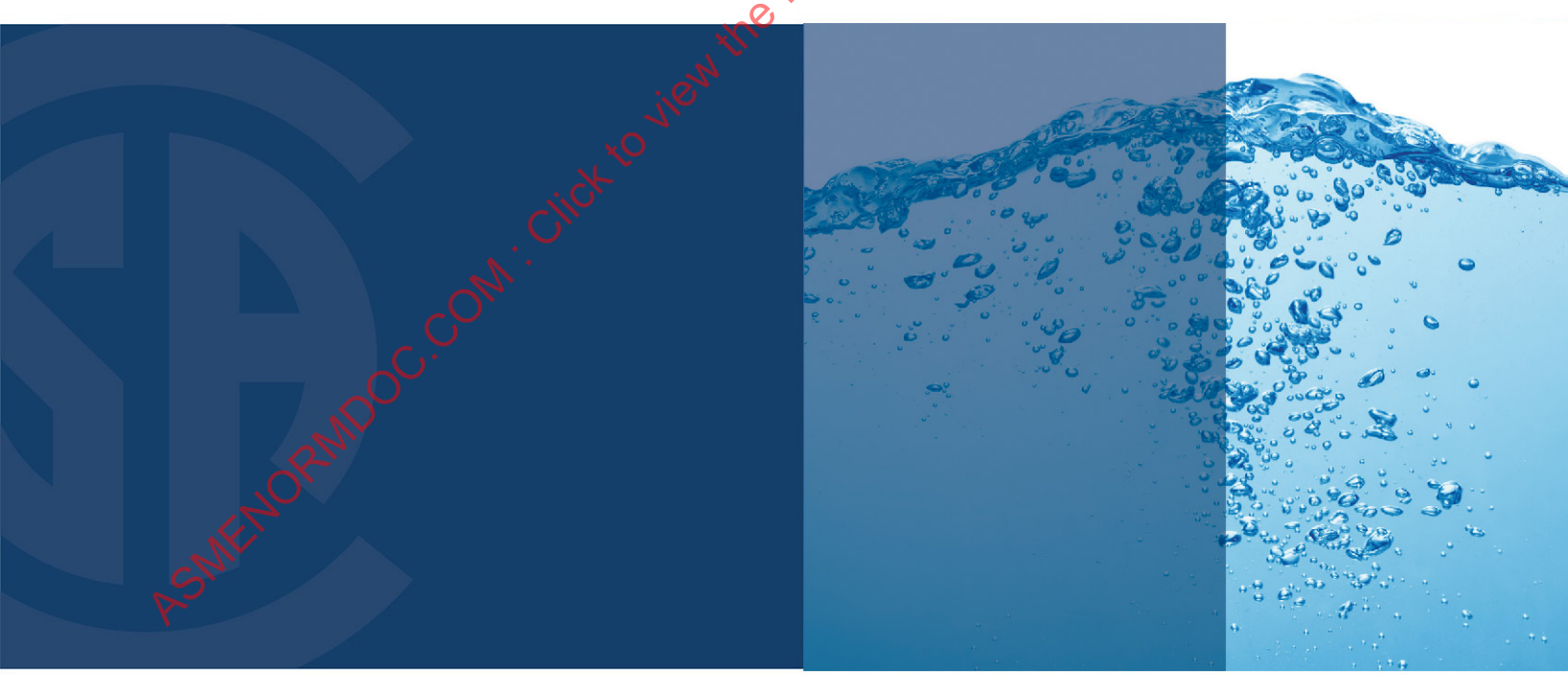
ASME A112.6.9-2022/ CSA B79.9:22

National Standard of Canada
American National Standard

Siphonic roof drains



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Siphonic roof drains

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Preface

This is the first edition of ASME A112.6.9/CSA B79.9, *Siphonic roof drains*. It supersedes CSA B79, *Commercial and residential drains and cleanouts*, published in 2008, and the ASME A112.6.9, Siphonic roof drains Standards.

This Standard was prepared by the ASME/CSA Harmonization Task Group on Drains, under the jurisdiction of the ASME A112 Standards Committee on Plumbing Materials and Equipment and the CSA Technical Committee on Drains and Interceptors. The ASME A112 Standards Committee operates under the jurisdiction of the ASME Board on Standardization and Testing and the CSA Technical Committee operates under the jurisdiction of the CSA Strategic Steering Committee on Construction and Civil Infrastructure.

This Standard is considered suitable for use for conformity assessment within the stated scope of the Standard.

This Standard was approved as an American National Standard by the American National Standards Institute on May 9, 2022.

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ASME A112.6.9-2022/CSA B79.9:22
Siphonic roof drains

1 Scope

1.1 Inclusions

This Standard specifies minimum requirements for the design, installation, examination, and testing of siphonic roof drains. It includes definitions of terms and parameters involved in the design of siphonic drainage systems.

This Standard applies to roof drains designed and manufactured for installation in piping systems that are intended to operate under depressurized siphonic conditions created by the connected piping system.

1.2 Exclusions

1.2.1 Applicability of roof drain standards

Unless noted otherwise in this Standard, the requirements and standards for roof drains specified in ASME A112.6.4/CSA B79.4 do not apply to siphonic roof drains.

1.2.2 Conventional roof drains

This Standard does not apply to conventional roof drains covered under ASME A112.6.4/CSA B79.4.

1.3 Intent of this Standard

It is not the intent of this Standard to specify that a drain of a given diameter must drain a minimum or maximum amount of water. It is the intent of this Standard to provide standardized procedures to ensure that drain products are evaluated equally.

This Standard does not dictate minimum flow or depth performance criteria for siphonic roof drains. Instead, it specifies standard test procedures to be performed on siphonic roof drain products to document their actual performance and physical limits. The Standard is a measurement protocol and does not have a pass/fail criterion; the data is intended to be used by designers for selecting the drain product and entering performance characteristics into design calculations.

1.4 Terminology

In this Standard, “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy in order to comply with the standard; “should” is used to express a recommendation or that which is advised but not required; and “may” is used to express an option or that which is permissible within the limits of the Standard.

Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

Notes to tables and figures are considered part of the table or figure and may be written as requirements.

Annexes are designated normative (mandatory) or informative (non-mandatory) to define their application.

1.5 Units of measure

1.5.1 General

The values given in either SI (metric) or U.S. Customary units of measure are equivalent in application; however, each measurement system is to be used independently of the other. In this Standard, U.S. Customary units are shown in parentheses. Combining values from the two measurement systems can result in non-conformance with this Standard.

1.5.2 U.S. gallons

All references to gallons are to U.S. liquid gallons.

1.6 Alternatives

The requirements of this Standard are not intended to prevent the use of alternative designs, materials, or methods of construction, provided such alternatives meet the intent and requirements of this Standard.

2 Reference publications

This Standard refers to the following publications, and where such reference is made, it shall be to the edition listed below, including all amendments published thereto.

ASME (American Society of Mechanical Engineers)/CSA Group

ASME A112.6.4-2022/CSA B79.4:22
Roof, deck, and balcony drains

ASTM International (American Society for Testing and Materials)

D6917-16
Standard Guide for Selection of Test Methods for Prefabricated Vertical Drains (PVD)

F2021-17
Standard Guide for Design and Installation of Plastic Siphonic Roof Drainage Systems

CSA Group

C22.2 No. 0.15-15 (R2020)
Adhesive labels

UL (Underwriters' Laboratories)

969, edition 5
Standard for marking and labelling systems

3 Definitions and abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

Air baffle — a device that limits the flow of air into a drain, causing the connected drainage piping to run at full-bore flow at dimensional rainfall intensity with a limited water depth on the roof surface.
Note: *Sometimes referred to as an anti-vortex plate, anti-vortex brake, or baffle.*

Depressurized — the condition or state of being below atmospheric or ambient pressure.

Drain outlet — the "neck" of a siphonic roof drain outlet configured to connect to the tailpiece with a standard coupling device.

Full-bore flow — the flow of water in a pipe where theoretically 100% of the cross-sectional are of the pipe is filled.
Note: *In practical terms, full-bore flow is achieved when 95% of the cross-sectional area of the pipe bore is filled.*

Single resistance value, K_i — a coefficient that is characteristic of a pipe fitting's or drain's contribution to energy losses.

3.2 Abbreviations

The following abbreviations shall apply in this Standard:

CFS — cubic feet per second
GPM — US liquid gallons per minute
w.c. — water column

3.3 Symbols

The following symbols shall apply in this Standard:

d_i — pipe inside diameter
f — friction factor
g — gravitational acceleration, 9.8 m/s² (32.2 ft/s²)
h_t — height
K_0 — resistance coefficient
K_i — single resistance value
L — pipe length
L/min — litres (metric liquid) per minute
L/s — litres (metric liquid) per second
P — pressure
Q — volumetric flow
Re — Reynold's number
ρ — fluid density
V — fluid velocity
v — fluid kinematic viscosity

4 Materials

The materials of construction, finishes, and components used to manufacture siphonic roof drains shall comply with the requirements specified in Clause 5 of ASME A112.6.4/CSA B79.4.

5 Design and testing

5.1 General

5.1.1 Conventional drain adaptation

Manufacturers of siphonic roof drains may utilize existing conventional drain body designs with an air baffle or adaptor to achieve siphonic capability when connected to a siphonic drainage piping system. This adaptation, however, requires hydraulic analysis to ensure the air baffle design is stable, will be capable of priming, and will minimize the depth of water on the roof as much as possible.

5.1.2 Verification

Siphonic roof drain shall be verified experimentally and the results shall be documented.

5.2 Design of siphonic drains

5.2.1 Design principles

The design of air baffles and siphonic drains shall follow the following three principles:

a) The siphonic roof drain shall be able to prime the standpipe quickly. Thus, the height of the air baffle above the sump bowl should be minimized to achieve a high Reynolds Number beneath the air baffle and the necessary turbulence for proper air to water mixing during priming.

b) Air baffles shall not introduce a limiting effect with respect to maximum flow. In other words, siphonic roof drains shall be limited in maximum flow capacity by the fixed spigot drain diameter and not by the introduction of an air baffle.

c) The first two principles shall be balanced with the desire to have a minimum of water depth on the roof above the air baffle, which means that the resistance of the air baffle, siphonic roof drain, and strainer combination should be minimized.

5.2.2 Materials and components

The materials, spigot connections, components, and leaf guard designs of siphonic roof drains shall comply with the requirements specified in ASME A112.6.4/CSA B79.4, with the exception of the air baffle design.

5.2.3 Flow path

Spigot-type connections shall not reduce or increase the flow path in a manner that will alter the siphonic roof drain's tested single resistance value, K_i.

5.3 Testing of siphonic roof drains

5.3.1 Applicability

The procedures specified in Clauses 5.3.3 to 5.3.4 shall be applied to siphonic roof drains.

5.3.2 Test purpose

The purposes of the siphonic roof drain test are to:

a) determine the relationship between the flow rate entering the siphonic roof drain and the depth of water at the approach to the drain (i.e., determine the flow rate curve for the siphonic roof drain);
b) determine the single resistance value, K_i (i.e., the head loss coefficient) for the siphonic roof drain to design the piping system in which the siphonic roof drain will be installed; and
c) check the effectiveness of the siphonic roof drain at preventing entry of air and for the speed of response to sudden changes in flow rate.

Note: *This test procedure does not include the performance and flow capacity of the connected siphonic piping system.*

5.3.3 Performance characteristics

The performance characteristics of siphonic roof drains are essential for attaining full-bore flow in the connected piping system.

5.3.4 Head elevation

Siphonic roof drains shall be tested for the most critical condition in which the drain is intended to be installed.

Note: *The relationship between flow rate and water head elevation depends on where the siphonic roof drain is to be installed. For a given flow rate, the depth will be less on a flat roof than in a gutter. The narrower the gutter, the greater the head elevation.*

5.4 Single resistance value (loss coefficient) determination

5.4.1 Test apparatus

The test apparatus (see Figure 1) for determining the single resistance value, K_i, of a siphonic roof drain shall consist of a tank (A) (see Figure 1) with

a) a radius of not less than 1000 mm (39.4 in);
b) a freeboard [i.e., distance from the level test section (B) to top of tank) not less than 305 mm (12 in)];
c) an open top;
d) a level test section (B) not less than 900 mm (35.4 in) radius that does not deviate from level more than ± 4 mm (± 3/32 in); and
e) an overall surface area of not more than 5 m^2 (53.8 ft^2).

5.4.2 Water supply

The test tank (A) shall be supplied with water at four points (C) equally spaced near the tank centre (see Figure 1).

The water shall be pumped from a suitable reservoir using a pump or array of pumps capable of providing sufficient flows for the test. The pumps discharge shall be controllable.

Note: *Flows greater than 126 L/s (2000 gpm) might be required.*

5.4.3 Flow rate measurement

Flow rate shall be measured with an accuracy of ± 1% by a suitable flow measurement device in the supply pump discharge with a turndown ratio of 100:1.

5.4.4 Water depth measurement

Water depths in level test section (B) (see Figure 1) shall be measured to an accuracy of ± 1 mm (± 0.04 in) at a location 500 mm ±25 mm (20 in ± 1 in) from the centre of the drain. For gutter flow simulations, the water depth shall be measured along the centreline of the simulated gutter.

5.4.5 Roof drain installation

The siphonic roof drain (D) (see Figure 1) shall be installed at the centre of the level test section (B) by fastening the siphonic roof drain's flashing clamp and body to a fixed circular opening or sump receiver installed in accordance with the manufacturer's installation instructions.

5.4.6 Standpipe discharge configuration

A vertical standpipe (E) (see Figure 1) shall be connected to the roof drain outlet. The standpipe shall

a) be 3.0 m ± 0.1 m (118 in ± 4 in) long;
b) have an inside diameter equal to that of the drain outlet inside diameter ± 2 mm (± 0.08 in); and
c) discharge to a suitable water reservoir for recirculation [see discharge (G) in Figure 1].

5.4.7 Standpipe pressure measurement

The standpipe pressure shall be measured at full-bore conditions using two static pressure transducers. The static pressure transducers [see items (H) and (J) in Figure 1] shall be

a) installed
   i) not less than ten pipe diameters from the drain outlet;
   ii) not less than ten pipe diameters apart (refer to dimensions *h1* and *h2* in Figure 1);
   iii) not less than 500 mm (20 in) from the standpipe discharge; and
   iv) without pipe joints or couplings between them.
b) calibrated before starting the test; and
c) capable of reading to an accuracy of ± 2.5 mm w.c. (± 0.1 in w.c.).

5.4.8 Flow rate determination procedure

The flow rate determination procedure test shall be conducted as follows:

a) Supply water to test tank (A) as specified in Clause 5.4.2.
b) Slowly increase the flow rate to the tank until the drain reaches its maximum capacity.
c) Reduce the flow rate until water depth stabilizes. The flow rate at a stabilized water depth shall be the fully primed flow rate for the drain with the connected standpipe.
d) If the drain fails to prevent air entrainment into the standpipe, the test shall be terminated.

5.4.9 Number of readings

Pressure readings at a sample rate of 100 Hz shall be logged at fully prime flow, and an average of not fewer than 1000 readings shall be calculated.

Note: *The purpose of taking at least 1000 readings is to account for the characteristically "noisy" pressure condition in the standpipe due to turbulent flow.*

5.4.10 Calculations

5.4.10.1 General

The data collected in accordance with Clause 5.4.8 (the measured flow, q) and Clause 5.4.7 (i.e., the static pressures in the standpipe, P_H and P_J), and the standpipe inside diameter, d_i, shall be used in Clauses 5.4.10.2 to 5.4.10.5.