ANSI/SPRI RD-1 2025

Performance Standard for Retrofit Roof Drains

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Disclaimer
This standard is for use by architects, engineers, consultants, roofing contractors and owners of low slope roofing systems. This standard specifically does not address existing building drainage capacity or overflow drainage requirements and should not be used for those purposes. It is intended to provide data and guidance necessary to understand the implementation and use of retrofit roof drainage elements. Do not assume all existing buildings have code compliant drainage. SPRI, IT'S MEMBERS AND EMPLOYEES DO NOT WARRANT THAT THIS STANDARD IS PROPER AND APPLICABLE UNDER ALL CONDITIONS.

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1.0 Introduction

This standard is a reference for those that design, specify, or install *retrofit roof drains* which are designed for installation in existing drain plumbing on existing roofs. This standard does not include consideration of all roof storm water drainage code requirements for specific building sites. Design is dictated by local code requirements. As such, this standard shall be used in conjunction with local code and the installation instructions from the manufacturer of the specific *retrofit roof drain*.

2.0 Definitions

For the purposes of this Document, the following definitions apply:

2.1 Available Inlet Area

The combined area of all the openings in the *strainer*.

2.2 Drain Body

The basic drain, consisting of the *drain flange* and interconnected *drain stem*. There may be a sump between the flange and the stem.

2.3 Drain Flange

The part of the *drain body* that extends horizontally, in the plane of the roof. It is used for attachment of the drain to the roof deck and for clamping and sealing the roof membrane flashing plies to the drain.

2.4 Drain Flashing

The watertight connection(s) between the *retrofit roof drain* and the existing roofing system.

2.4.1 Clamping Ring

A component of the *retrofit roof drain* that creates a mechanical compression seal with the membrane flashing plies by clamping the membrane flashing plies between the *clamping ring* and the *drain flange*.

2.4.2 Heat Welding

A method for creating a watertight seal between the electric heat-welded membrane flashing plies and the *drain flange*.

2.4.3 Backflow Seal

The part of the *retrofit roof drain* that creates a watertight mechanical compression seal between the *drain stem* and the existing plumbing

2.5 Drain Stem

A part of the drain that is inserted through the existing roof drain bowl for connection to the existing roof drain plumbing. The *backflow seal* is integral to the stem.

2.6 Effective Drain Diameter

The least cross-sectional flow area between the *drain body* and the outlet of the *drain stem* expressed as a diameter.

2.7 Retrofit Roof Drain

A factory fabricated drain, installed within an existing roof drain on an existing roof. *Retrofit roof drains* are installed from the roof surface and are provisional with a horizontal flashing flange for adhering membrane flashing materials, and coupling to provide a mechanical backflow compression seal to the existing plumbing. A *retrofit roof drain* is designed so that it may be installed without removing the existing roof *drain body* and plumbing.

2.8 Strainer

A component of the drain which minimizes the amount of debris that enters the drain.

3.0 General Design Considerations

3.1 The drain manufacturer's installation instructions shall reference the information required for proper installation of the roof *drain body*, *backflow seal*, and *strainer* and shall include at least the following:

3.1.1 A requirement that all *retrofit roof drain* installations shall meet the requirements of this standard and the requirements of the local authorities having jurisdiction. Where local codes conflict with this standard, local codes shall have priority.

3.1.2 A description of the *drain body*, *backflow seal* and *strainer* and the equipment needed for proper assembly and installation.

3.1.3 Information regarding proper storage and handling of the *retrofit roof drain* materials prior to and during installation.

3.1.4 Description of all limitations, special installation instructions and design criteria associated with the performance of the *retrofit roof drain*.

3.2 The *retrofit roof drain* size shall be the proper size to be compatible with the existing drain. It shall provide adequate performance based on the more stringent flow requirements of either the governing building code, or the flow requirements as noted in Section 8. See Table 1 in the Commentary of this Standard.

3.3 Roofing Watertight Seal

The bond between the roof membrane and the *drain flange* shall provide a watertight seal using a manufacturer's approved water block adhesive and *clamping ring*, with bolts evenly cinched to membrane or by *heat welding* to the roofing membrane.

3.4 Backflow Seal

The *backflow seal* shall extend below the top of the existing drain and be long enough to create a watertight connection with the properly prepared and cleaned interconnecting portion of the existing drain system.

4.0 Materials

Retrofit roof drains shall be constructed of polymeric or metal materials or any combination of metals and polymeric materials that perform satisfactorily in the rooftop environment. Roof system manufacturers shall be contacted to determine membrane system compatibility.

5.0 Testing

Retrofit roof drain manufacturers shall test samples that are representative of standard production per the RF-1 test specified in this section.

5.1 Leakage

Drain bodies with *backflow seals* shall withstand a continuous test pressure of 4.33 lbf/in.^{2} (30 kPa) above the elevation of the *backflow seals* in a way that applies the test pressure to all end use critical sealing features of the *backflow seal* without any visible leakage after 24 hours. Laboratory test method RF-1 shall be used to test the *backflow seals*. The 4.33 lbf/in.^{2} (30 kPa) referenced, originated from the original test standard that uses a 10-foot (3.05m) column to apply pressure to the seal which is equivalent to 4.33 lbf/in.^{2} (30 kPa).

5.2 RF-1 Test Standard

5.2.1 Setup

Insert a representative *retrofit roof drain* into a vertical plumbing pipe large enough to receive the *retrofit roof drain stem* and the *backflow seal*. Seal the existing plumbing pipe below the *drain stem*-to-plumbing pipe juncture. Affix a vertical pipe at least 10 ft. long (3.05 m), of an appropriate diameter that can be sealed to the *drain body* so that water can flow through the pipe and to the seal between the plumbing and the *backflow seal*. Alternative test setups are also possible in which a fixture/apparatus can be used to apply an equivalent pressure to the seal. See commentary for examples.

5.2.2 Test Method

Employ a test method that achieves the required pressure of 4.33 lbf/in.^{2} (30 kPa) above the elevation of the *backflow seal*. The test shall be conducted for a minimum of 24 hours -0/+1 during which the required pressure of 4.33 lbf/in.^{2} (30 kPa) shall be maintained. See commentary for examples.

5.2.3 Test Results

The drain shall be acceptable if there is no visible leakage at the backflow seal.

6.0 Strainers

Strainers extending above the surface of the roof, shall extend not less than 4 in. (100 mm) above the surface of the roof immediately adjacent to the roof drain. To facilitate normal flow of water, dome shaped *strainers* shall have an *available inlet area*, above roof level, of not less than one and one-half times the inside cross-sectional area of the drain diameter. The design height of the *strainer* is important in roofing applications to allow water to continue to flow even if debris from the roof causes blockage at the lower section of the *strainer*. For additional *strainer* considerations reference the commentary section.

7.0 Installation

The *retrofit roof drain* shall be installed in compliance with the drain manufacturer's instructions. The roof cover tie-in shall be completed in compliance with the roof system manufacturer's instructions.

8.0 Flow requirements

Flow capacity calculations shall be based on the *effective drain diameter*. There shall be a sufficient drainage to accommodate a one-hour rainfall rate based on a 100-year return period or the local code, whichever number is greater. Local code requirements for overflow requirements shall be confirmed with a local building code representative. Consult Commentary Figure 1 or local weather stations for local statistics.

Where separate roof sections are drained independently, flow calculations shall be performed on each section. Each section shall have at least one drain. Drain capacities shall be determined from the applicable plumbing code. The pipe diameter shall be the inside diameter of the retrofitted *drain stem*, not the original drain diameter.

Commentary

This Commentary consists of explanatory and supplementary material designed to help designers, roofing contractors and local building authorities in applying the requirements of the preceding Standard. It is intended to create an understanding of the requirements through brief explanations of the reasoning employed in arriving at these requirements.

This Standard addresses the design of retrofit primary drains. Note that local codes may also require a secondary or overflow drain and this secondary drain may be required to have greater flow capacity than the primary drain.

Test Setup Examples

Fill a pipe with water to a height of 10 ft. (3.05m) above the *backflow seal*. The test shall be conducted for a minimum of 24 hours -0/+1 hour during which the 10-foot (3.05m) head of water shall be maintained. See Figure 2a.

Another option would be to build an apparatus that applies air pressure on top of a smaller column of water, submerging all necessary drain components. This would result in equivalent pressure being applied to the *backflow seal*. See Figure 2b.

Flow Requirements

Flow capabilities are addressed in the standard. There should be sufficient total cross-section area of drains to drain the entire roof area. Drain rates should be determined using the ASPE/IAPMO/ANSI Z1034-2015 testing standard.

A previous method of calculating flow for drains is listed in Table1. The values in Table 1 can be approximated using the formula below. Table 2 derives from the same formula but focuses on the minimum number of drains per roof area.

$$A = 464 \times D^{2.66} \div r$$

A = area drained (ft.^{2})

D = drain diameter (in.)

r = rainfall rate (in./hr.)

The International Code Council/International Plumbing Code Formula (ICC/IPC) (Q = 0.0104 x A x i) will produce slightly different values.

Q = Volumetric Flow Rate (gal./min.)

A = Roof Area (ft.^{2})

i = Rainfall rate (in./hr.)

Existing drain capacities frequently exceed requirements. When more drain capacity is needed, consult with the *retrofit roof drain* manufacturer for a compatible solution.

Strainers

Additional considerations for *strainers* can include “balcony” and “plaza” style drains. These drain applications result in *strainers* that don’t meet the criteria listed in section 7 (*Strainers*) and include but are not limited to *strainers* that are flush with the “roof” surface. Considerations for these *strainers* will have the biggest impact on “*available inlet area*”.

Table 1

Roof Areas (ft.^{2}) Drained vs. Drain Diameter and Rainfall Rates

Rainfall in./hr.	Drain Diameter (in.)					
	2	3	4	5	6	8
0.8	3,670	10,780	23,170	41,950	68,130	146,440
1.0	2,930	8,620	18,540	33,560	54,500	117,150
1.2	2,440	7,190	15,450	27,960	45,420	97,620
1.4	2,090	6,160	13,240	23,970	38,930	83,680
1.6	1,830	5,390	11,580	20,970	34,060	73,220
1.8	1,630	4,790	10,300	18,640	30,280	65,080
2.0	1,470	4,310	9,270	16,780	27,250	58,570
2.5	1,170	3,450	7,410	13,420	21,800	46,860
3.0	980	2,870	6,180	11,190	18,170	39,050
3.5	840	2,460	5,300	9,590	15,570	33,470
4.0	730	2,160	4,630	8,390	13,630	29,290
4.5	650	1,920	4,120	7,460	12,110	26,030
5.0	590	1,720	3,710	6,710	10,900	23,430

Drainage areas in Table 1: Vertical façades (walls), that can shed wind-driven rain onto roof sections, should be accounted for when determining effective roof areas. Tributary vertical façade areas are generally considered to be 50% effective—that is, the tributary wall area is reduced by 50% to determine the equivalent effective tributary roof area which is then added to the roof section drainage area to determine the total effective roof drainage area.

Table 1 may be interpolated for intermediate effective pipe diameters and rainfall rates. Drainage areas assume roof conditions will allow sufficient water flow to the drain.

Table 2

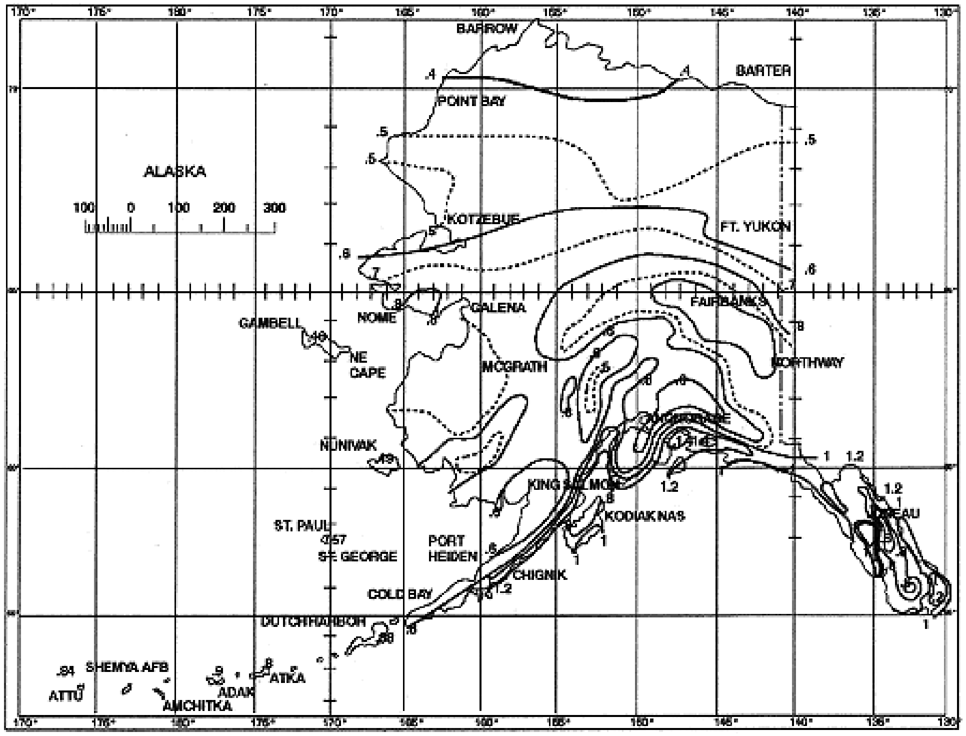
Minimum Number of Drains per Thousand Squares (100,000 ft.^{2})

Rainfall in./hr.	Drain Diameter (in.)					
	2	3	4	5	6	8
0.8	28	10	5	3	2	1
1.0	35	12	6	3	2	1
1.2	41	14	7	4	3	2
1.4	48	17	8	5	3	2
1.6	55	19	9	5	3	2
1.8	62	21	10	6	4	2
2.0	69	24	11	6	4	2
2.5	86	29	14	8	5	3
3.0	103	35	17	9	6	3
3.5	120	41	19	11	7	3
4.0	137	47	22	12	8	4
4.5	154	53	25	14	9	4
5.0	171	58	27	15	10	5

Drain sizing tables should be used with care. Roof design may not be capable of conducting rain from a very large area (ex: 40,000 ft.^{2}), to a single drain even if the drain could handle the water flow.

Figure 1a

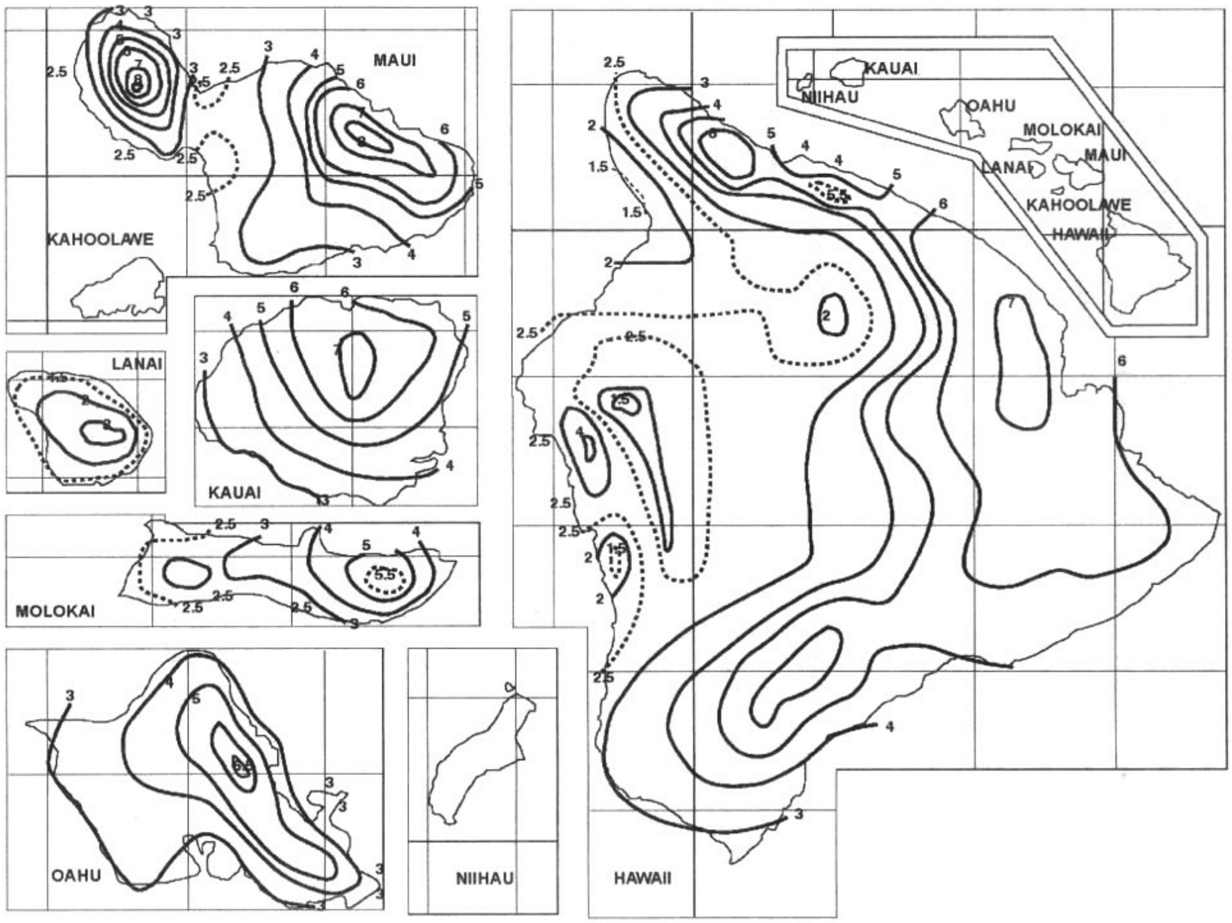
One-Hour 100-year Return Rainfall Rates for Alaska



Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

Figure 1b

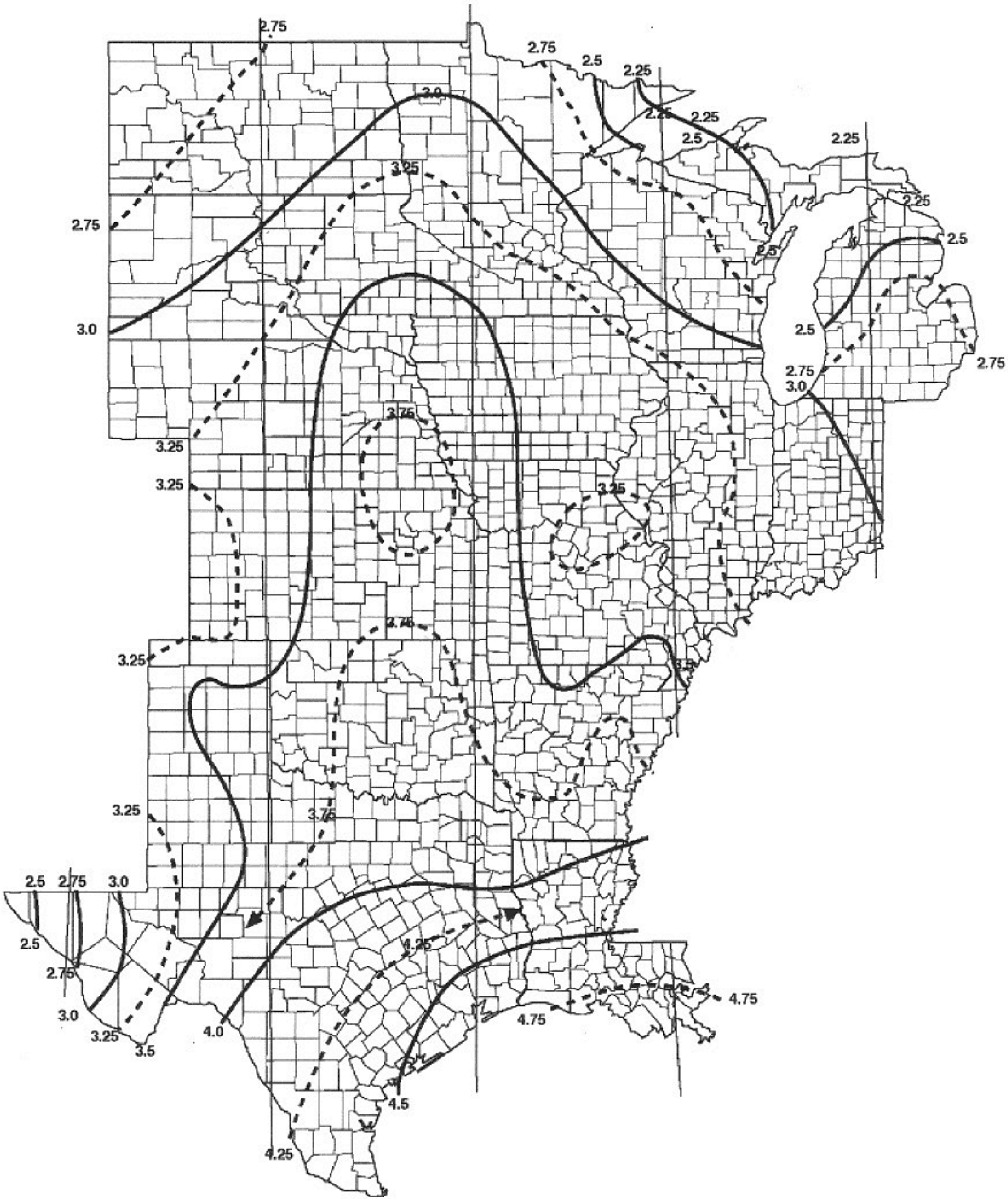
One-Hour 100-year Return Rainfall Rates for Hawaii



Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

Figure 1c

One-Hour 100-year Return Rainfall Rates for Central U.S.



Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

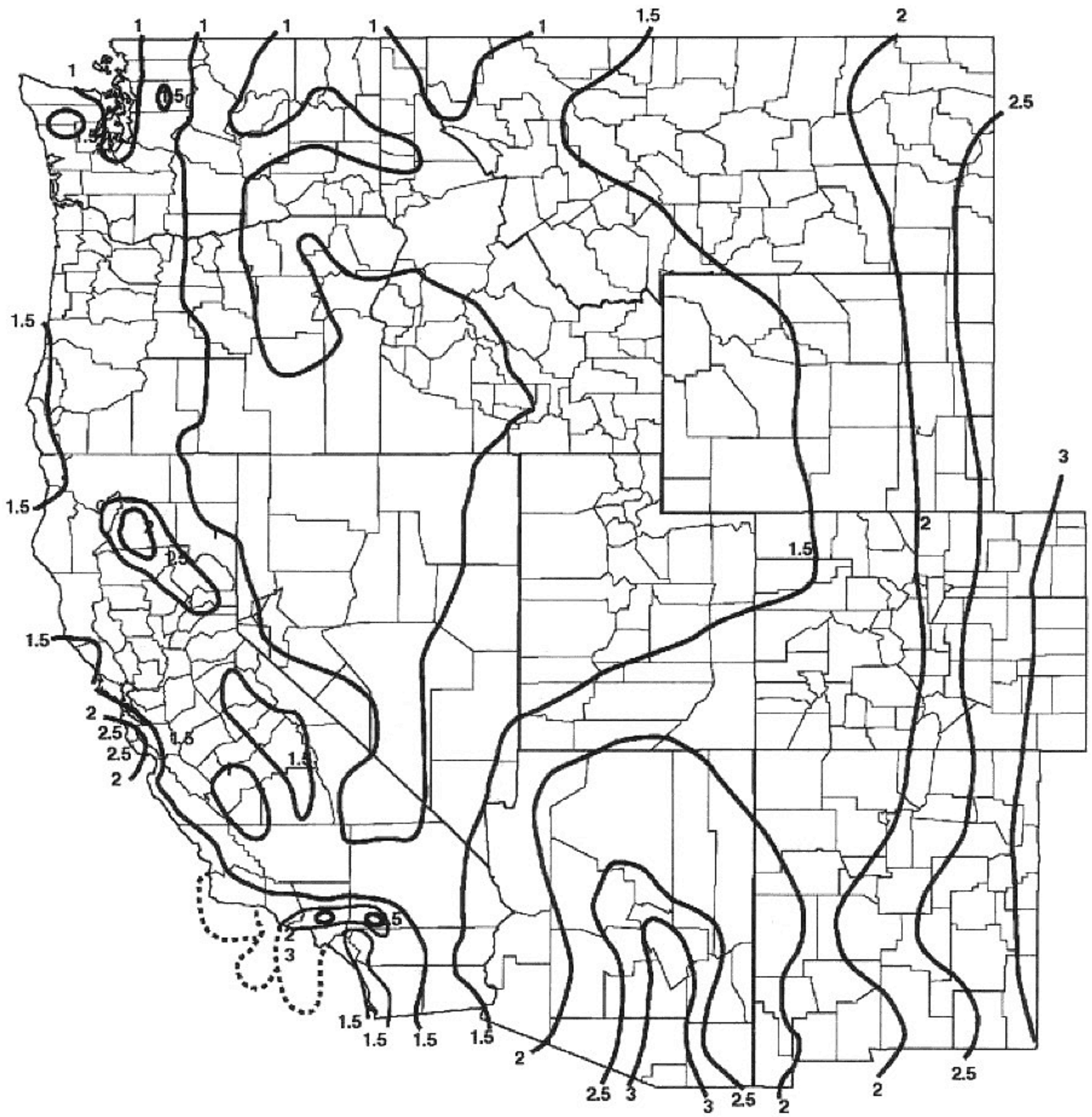
Figure 1d

One-Hour 100-year Return Rainfall Rates for Eastern U.S.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

Figure 1e

One-Hour 100-year Return Rainfall Rates ror Western U.S.



Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington D.C.

Figure 2a

Diagram of testing using 10-foot column of water pressure to evaluate the seal

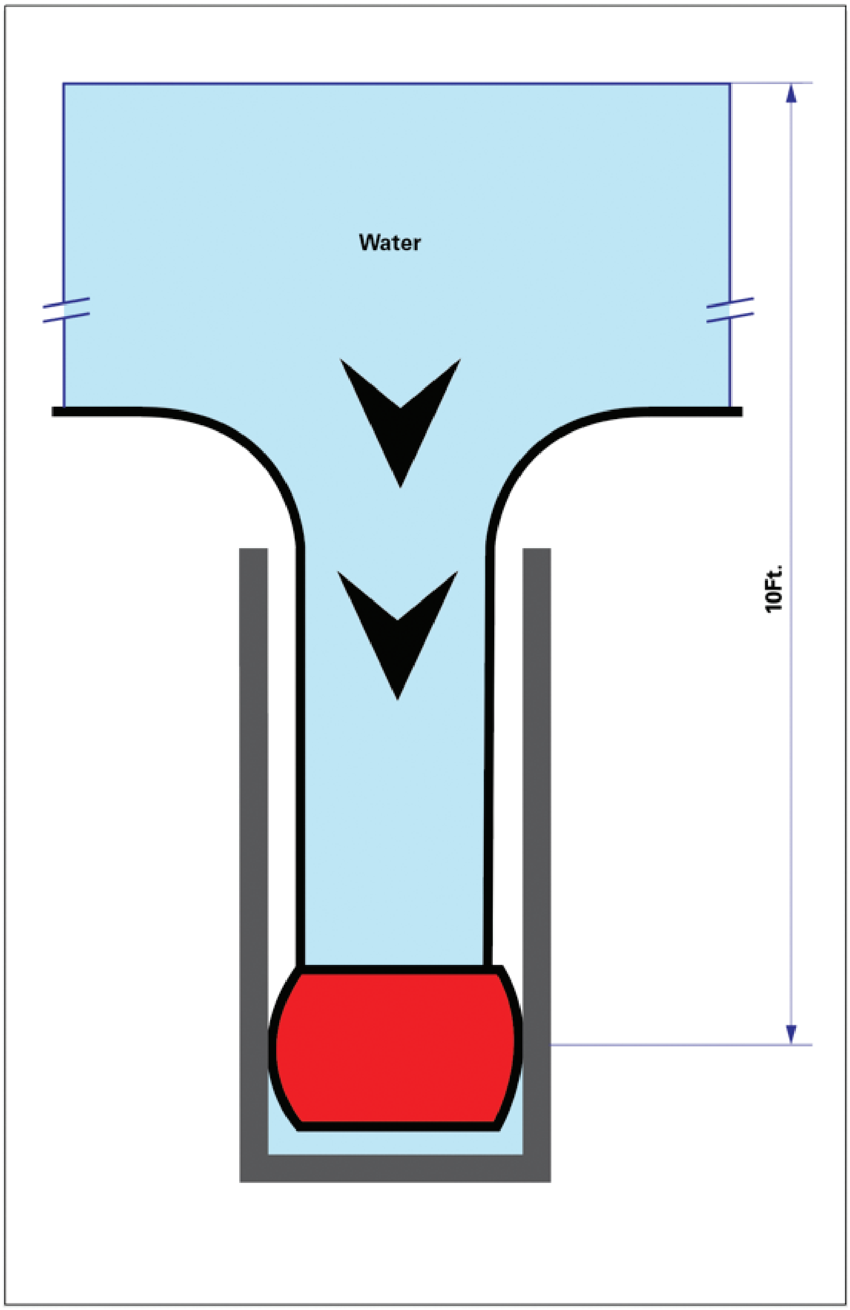


Figure 2b

Diagram of testing using air pressure and water to evaluate the seal

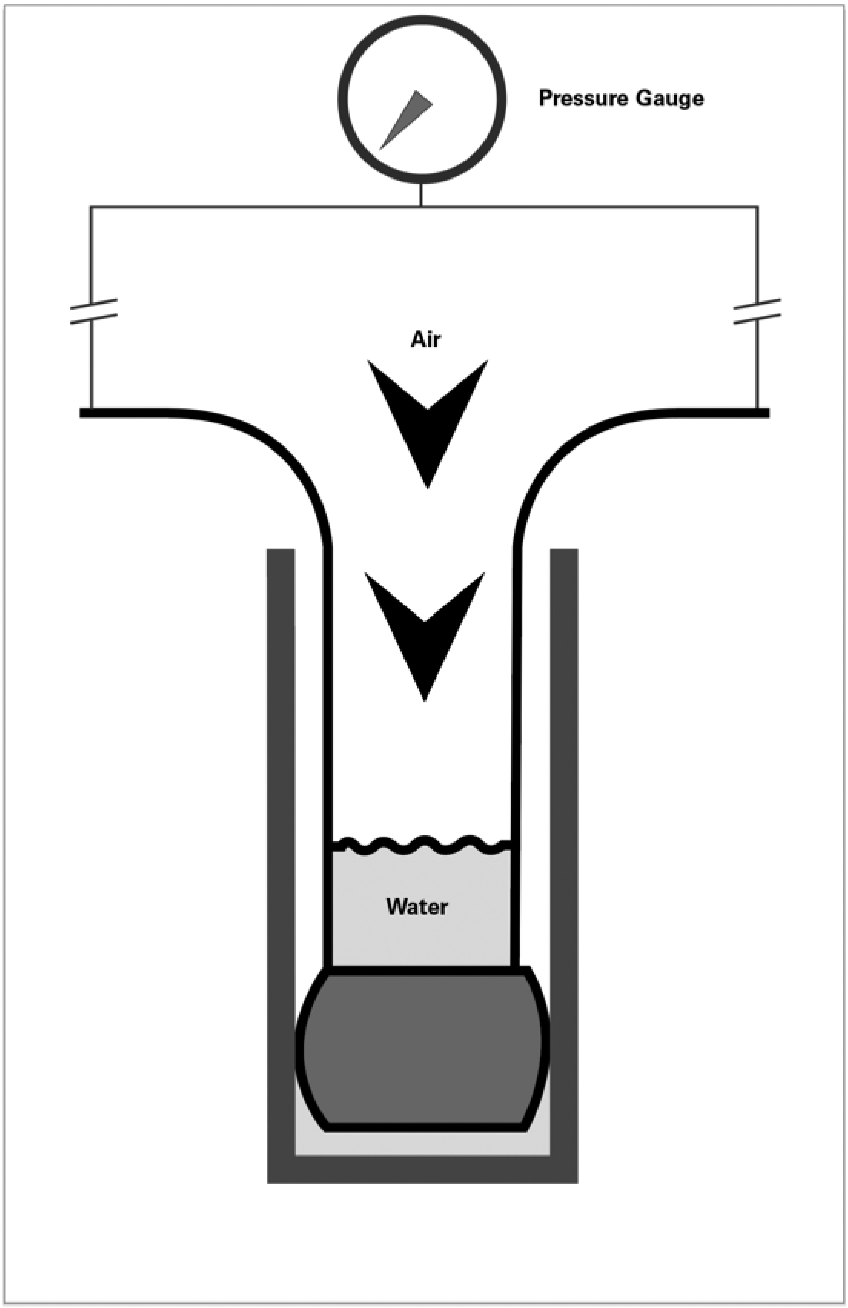


Figure 3

Test rig example that utilizes air and water to provide appropriate pressure to the drain and seal.