

ZURN CONTROL-FLO

ROOF DRAINAGE SYSTEM



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⚠ **ADVERTENCIA:** Cáncer y daño reproductivo - www.P65Warnings.ca.gov
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Control-Flo . . . Today's Successful Answer to More

THE ZURN "CONTROL-FLO CONCEPT"

Originally, Zurn introduced the scientifically- advanced "Control-Flo" drainage principle for dead-level roofs. Today, after thousands of successful applications in modern, large dead-level roof areas, Zurn engineers have adapted the comprehensive "Control-Flo" data to **sloped roof** areas.

WHAT IS "CONTROL-FLO"?

It is an advanced method of removing rain water off dead-level or sloped roofs. As contrasted with conventional drainage practices, which attempt to drain off storm water as quickly as it falls on the roof's surface, "Control-Flo" drains the roof at a controlled rate. Excess water accumulates on the roof under controlled conditions... then drains off at a lower rate after a storm abates.

CUTS DRAINAGE COSTS

Fewer roof drains, smaller diameter piping, smaller sewer sizes, and lower installation costs are possible with a "Control-Flo" drainage system because roof areas are utilized as temporary storage reservoirs.

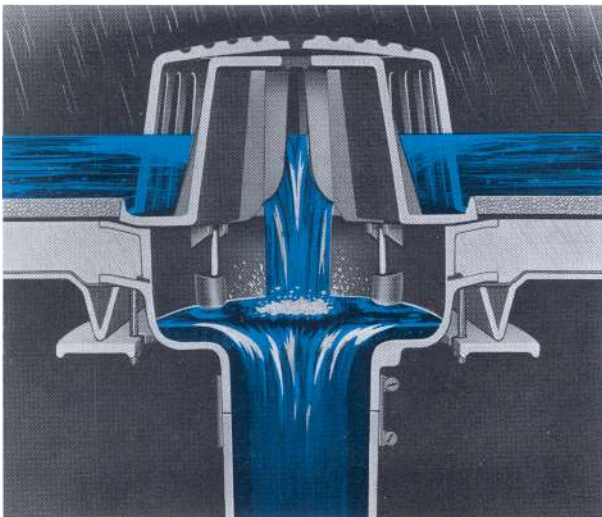
REDUCES PROBABILITY OF STORM DAMAGE

Lightens load on combination sewers by reducing rate of water drain from roof tops during severe storms thereby reducing probability of flooded sewers, and consequent backflow into basements and other low areas.

THANKS TO EXCLUSIVE ZURN

"AQUA-WEIR" ACTION

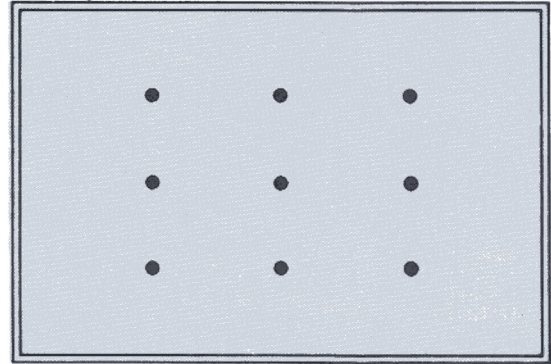
Key to successful "Control-Flo" drainage is a unique, scientifically-designed weir containing accurately calibrated notches with sides formed by parabolic curves which provide flow rates directly proportional to the head. Shape and size of notches are based on pre- determined flow rates, and all factors involved in roof drainage to assure permanent regulation of drainage flow rates for specific geographic locations and rainfall intensities.



DEFINITION

DEAD LEVEL ROOFS

A dead-level roof for purposes of applying the Zurn "Control-Flo" drainage principle is one which has been designed for zero slope across its entire surface.



(Plan View)

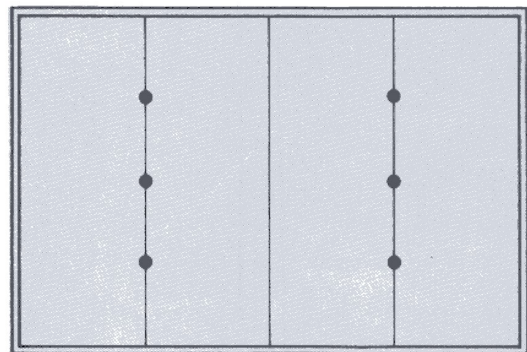


(Section View)

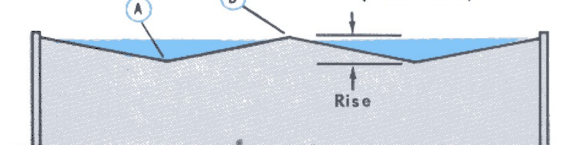
SLOPED ROOFS

A sloped roof is one designed commonly with a shallow slope. The Zurn "Control-Flo" drainage system can be applied to any slope which results in a total rise up to 6"... and data can be calculated for rises exceeding 6".

The total rise of a roof as calculated for "Control-Flo" application is defined as the vertical increase in height in inches, from the low point or valley of a sloping roof (A) to the top of the sloping section (B). (Example: a roof that slopes 1/8" per foot having a 24-foot span would have a rise of $24 \times 1/8$ or 3")



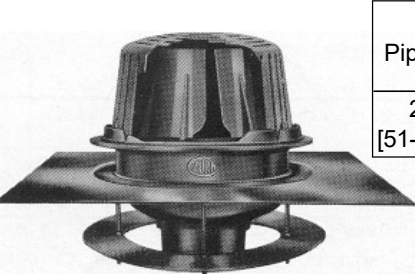
(Plan View)



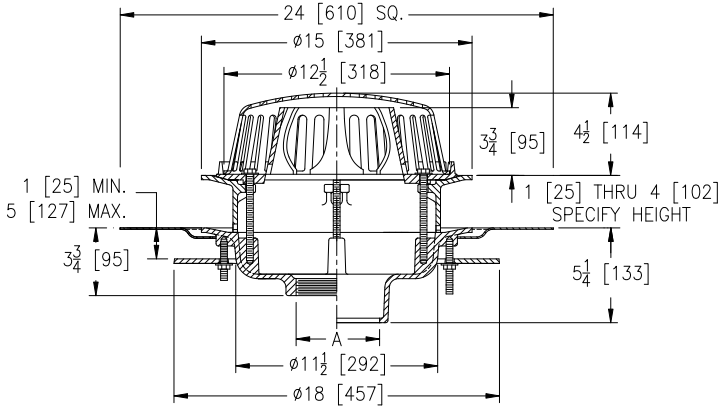
(Section View)

Economical Roof Drainage Installation

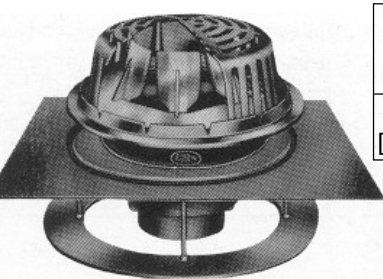
SPECIFICATION DATA



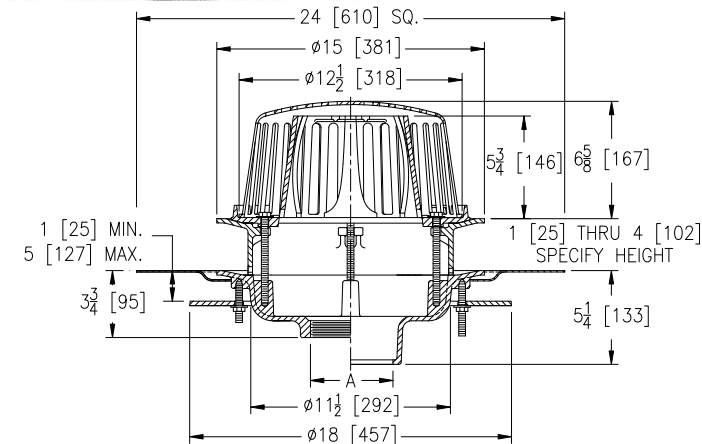
A Pipe Size	Approx. Wt. Lbs. [kg]	Dome Open Area Sq. In. [cm ²]
2-3-4 [51-76-102]	56 [25]	103 [665]



ENGINEERING SPECIFICATION: ZURN Z105-C-E-R 15" Diameter
"Control-Flo" roof drain for dead-level roof construction, Dura-Coated cast iron body, "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/gravel guard, static extension, secondary clamping collar with O-ring, Poly-Dome, roof sump receiver and underdeck clamp. All data shall be verified proportional to flow rates.



A Pipe Size	Approx. Wt. Lbs. [kg]	Dome Open Area Sq. In. [cm ²]
2-3-4 [51-76-102]	60 [27]	148 [955]



ENGINEERING SPECIFICATION: ZURN Z105-C-E-R-10
"Control-Flo" roof drain for Sloped Roof construction, Dura-Coated cast iron body, "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/gravel guard and 6 5/8 [168] high Aluminum dome. All data shall be verified proportional to flow rates.

ROOF DESIGN RECOMMENDATIONS

Basic roofing design should incorporate protection that will prevent roof overloading by installing adequate overflow scuppers in parapet walls.

GENERAL RECOMMENDATIONS

On dead-level roofs, our general recommendations are to design for a 3" depth for the 10-year storm. In this case, even the 100-year storm will not result in a maximum depth of 6". A 6" depth represents a roof load of 31.2 pounds per square foot which approximates the 30 pound per square foot factor commonly used in roof design.

NOTE: A more conservative practice used by a few engineers in the past, depending upon other design considerations, has been to design for the 3" depth with the 25, 50, or even 100-year storm . . . and to also lower scuppers to 5" or 4" above roof level. In either case, the final determination rests with the engineering personnel responsible for this phase of the design.

GENERAL RECOMMENDATIONS

On sloping roofs, we again recommend a 3" design depth for the 10-year storm, but by 3" we refer to an equivalent depth of 3". An equivalent depth is the depth of water attained at the drains that results in the same roof stresses as those realized on a dead-level roof. In all cases this equivalent depth is almost equal to that attained by using the same notch area rating for the different rises to 6". With the same depth of water at the drain the roof stresses will decrease with increasing total rise. Therefore, it would be possible to have a depth in excess of 6" at the drain on a sloping roof without exceeding stresses normally encountered in a 6" depth on a dead-level roof. However, it is recommended that scuppers be placed to limit the maximum water depth on any roof to 6" to prevent the over flow of the weirs on the drains and consequent overloading of drain piping.

NOTE: An equivalent depth is that depth of water attained at the drains at the lowest line or valley of the roof with all other conditions such as notch area and rainfall intensity being equal. For Galveston, Texas a notch area of 1800 square feet results in a 3" depth on a **dead-level** roof for a 10-year storm. For the same notch area and a 10-year storm, equivalent depths for a 2", 4", and 6" rise respectively on a **sloped roof** would be 3.4", 3.8", and 4.6". Roof stresses will be approximately equal in all cases.



Control-Flo Drain Selection is Quick and Easy . . .

The exclusive Zurn "Selecta-Drain". Chart (pages 6, 7, 8, 9) tabulates recommended selection data for several hundred localities in the United States. It constitutes your best assurance of sure, safe, economical additional data for your Zurn "Control-Flo" systems for your specific geographical area.

If the "Selecta-Drain" Chart doesn't not suit your specific design criteria, write directly to Zurn Industries, Inc. Field Service Engineering, Specification Drainage Operations, Erie, Pa for additional data for your locality. Listed below is additional information pertinent to proper engineering of the "Control-Flo" system.

ROOF USED AS TEMPORARY RETENTION

The key to economical "Control-Flo" drainage is the utilization of large roof areas to temporarily store the maximum amount of water without overloading average roofs or creating excessive drain down time during periods of heavy rainfall.

The data shown in the "Selecta-Drain" Chart, which takes all these factors into consideration, represents only one point on a series of curves prepared for each locality and was determined after careful study and research as imparting optimum economy in design.

ROOF LOADING AND RUN-OFF RATES

The values for notch areas selected from the design curves were based on a 3" head on a dead-level roof for the 10-year storm. In low rainfall localities the area per notch was limited to 25,000 square feet to keep the drain down time within reasonable limits. The same area for each respective locality was used for the various roof rises for sloping roofs.

Extensive studies show that stresses due to water load on a sloping roof for any fixed set of conditions are very nearly the same as those on a dead-level roof. A sloping roof tends to concentrate more water in the valleys and increase the water depth at this point. The greater depth around the drain leads to a faster run-off rate, particularly a faster early run-off rate. As a result, the total volume of water stored on the roof is less, and the total load on the sloping roof is less. By using the same area on the sloping roof as on the dead-level roof the increase in roof stresses due to increased water depth in the valleys is offset by the decrease in the total load due to less water stored. The net result is the maximum roof stresses are approximately the same for single span, rise and fixed set of conditions. A fixed set of conditions would be the same notch area, the same frequency storm, and the same locality.

NOTCH FLOW AND WATER DEPTH

The flow through each notch of the "Control-Flo" weir is 10 GPM per inch of head. To compute the depth of water in inches at the drain, obtain the total flow for any fixed set of conditions and locale from the "Selecta-Drain" Chart and divide by 10. For example, for Anniston, Alabama the discharge rates are 30, 35, 39 and 43 GPM for the 10, 25, 50 and 100-year storms respectively on a dead-level roof.

Since the possibility of exceeding 4.3" of water exists only once every 100 years, the drains can be sized to carry 43 GPM per notch and scuppers can be set at a height of 4.3" above the roof to prevent overloading the drains if a worse than 100-year storm occurs. On a similar basis, drain pipe sizes and scupper heights can be selected for various roof slopes and storm frequencies.

ADDITIONAL NOTCH RATINGS

The "Selecta-Drain" Chart along with Tables I and II enables the engineer to select "Control-Flo" Drains and drain pipe sizes for most applications. The "Selecta-Drain" Chart and Tables I and II are computed for a proportional flow weir that is sized to give a flow of 10 GPM per inch of head. However, this data can be applied to other sizes of proportional flow weirs by simple multiplication or division. For example, if a similar weir that is sized to give a flow of 5 GPM per inch is substituted for the 10 GPM per inch weir, the notch area and discharge in GPM would be divided by two, and this opening would be given a 7'2 notch area rating.

PROPER DRAIN LOCATION

The following good design practice is recommended for selecting the proper number of "Control-Flo" drains for a given area.

On dead-level roofs, drains should be located no further than 50 feet from each edge of the roof to assure good run-off regardless of wind direction. Weir should be flush with roof surface, not recessed.

On sloping roofs, drains should be located in the valleys at a distance no greater than 50 feet from each end of the valleys. Weir should be flush with the valley roof surface, not recessed.

On large roof areas, drains should not be spaced at a distance greater than 200 feet.

. Saves Specification Time, Assures Proper Application

QUICK EASY SELECTION

Using the "Selecta-Drain" Chart (pages 6, 7, 8, 9) in combination with the steps and examples appearing below, should save you countless hours in engineering specification time. This vast compilation of data is related to the proper selection of drains for over 200 cities. If a specific city does not appear in this tabulation, choose the city, nearest your area and select the proper drain using these factors.

3 EASY STEPS

AND 3 TYPICAL EXAMPLES FOR APPLICATION OF SURE, SCIENTIFIC CONTROL OF DRAINAGE FROM DEAD-LEVEL AND SLOPING ROOFS WITH THE ZURN CONCEPT

WASHINGTON, D. C.	DEAD-LEVEL ROOF	4 INCH RISE	6 INCH RISE
1 Determine total roof area or individual areas when roof is divided by expansion joints or peaks in the case of sloping roof.	Roof Area: 192 ft. x 500 ft. = 96,000 sq. ft.	3 Individual Roof Areas: 64 ft. x 500 ft. = 32,000 sq. ft. Valleys 500 ft. long 3 x 32,000 = 96,000 sq. ft.	2 Individual Roof Areas: 98 ft. x 500 ft. = 48,000 sq. ft. Valleys 500 ft. long 2 x 48,000 = 96,000 sq. ft.
2 Divide roof area or individual areas by Zurn Notch Area Rating to obtain the total number of notches required.	Zurn Notch Area Rating for Washington, D. C. = 13,300 "Selecta-Drain" Chart Total Notches Required = 96,000 sq. ft 13,300 sq. ft. notch area = 7.2 notches-USE 8 PER AREA	Zurn Notch Area Rating for Washington, D.C. = 13,000 from "Selecta-Drain" Chart Total Notches Required = 32,000 sq. ft. 13,300 sq. ft. notch area = 2.4 notches - USE 8 PER AREA	Zurn Notch Area Rating for Washington, D.C. = 13,000 from "Selecta-Drain" Chart Total Notches Required = 48,000 sq. ft. 13,300 sq. ft. notch area = 3.6 notches - USE 4 PER AREA
3 Determine total number of drains required by not exceeding maximum spacing dimensions in the preceding instructions. Divide total number of notches required to determine the number of notches per drain. Note flow rate for the 100-year storm and divide by 10 to determine maximum water depth at drain and use this dimension to determine scupper height. Maximum scupper height to be used is 6". Use this flowrate to size leaders and drain lines.	6 drains required. 3 along each side within 50 ft. of the side with a spacing of 50 ft. - 200 ft. 200 ft. - 50 ft. Two drains must have two notches for a total of eight notches. Located at diagonally opposite corners. Flow rate for the 100-year storm is 44 GPM. Maximum water depth and scupper height equals 4.4". Size leaders from single notch drains for 44 GPM and leaders from double notch drains for 88 GPM.	3 drains per area required in the valleys 50 ft. from each end with one in the middle. All drains will have one notch. Flow rate for the 100-year storm is 59 GPM maximum. Water depth and scupper height equals 5.9". Size leaders for 59 GPM.	3 drains per area required in the valleys 50 ft. from each end with one in the middle. 4 notches are required there fore one drain must have tow notches. Locate this one in the middle. Flow rate for the 100-year storm is 64 GPM. Locate scuppers at 6" and use 60 GPM as maximum flow rate and 6" maximum depth. The probability of water flowing out suppers is now less than once every 50 years instead of every 100 years. Size leaders for 60 GPM

SPECIAL CONSIDERATIONS

The 3" design water level for the 10-year storm represents a roof load of approximately 15 lbs. per sq. ft. This is only half the usual minimum design roof load rating of 30 lbs. per sq. ft. and so presents no problem from that aspect. However, since it is desirable to contain the design depth of water on the roof and to prevent spillage over the roof in high wind condition, it is recommended that any roof construction, parapets, flashing and curves should be high enough to prevent flooding over them.

Another special case applies to water cooled roofs and here the "Control-Flo" principle can still be used. An adjustable collar on the drain body will retain a pool of water 0 to 3" deep on the roof and a 3" high "Control-Flo" Weir on top of the adjustable collar will control storm water falling on this pool. This restricts maximum depth on the roof to 6" and scuppers should be located at this height. Since the weirs are only 3" high on this drain, they should be selected for a 3" head based on the 100-year frequency storm.



Selecta-Drain Chart

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Anniston, AL	13,300	30 26	35 28	39 29	43 30	37 22	43 24	47 26	50 27	45 16	51 18	55 19	59 21	53 12	59 14	63 15	67 16
Birmingham, AL	10,200	30 20	36 22	40 23	44 24	36 17	41 19	46 20	50 21	44 12	49 13	53 14	57 15	52 9	57 10	61 11	64 12
Mobile, AL	4,000	30 7.8	36 8.5	40 9	44 9.8	36 6.4	40 7	45 7.5	50 8	44 4.5	48 5.1	52 5.5	57 6	52 3.6	56 3.9	59 4	62 4.3
Montgomery, AL	5,330	30 9.5	36 10.5	40 11	44 11.5	35 8	39 9	43 9.5	48 10	43 5.5	47 6	51 6.6	55 7.1	50 4.2	55 4.8	58 5.2	61 5.5
Fairbanks, AK	25,000	14 26	16 30	18 32	19 33	18 22	20 23	22 25	25 28	24 15	27 16	30 18	33 21	30 12	33 14	37 15	39 16
Juneau, AK	25,000	27 41	30 44	31 45	34 48	30 34	33 37	35 38	38 41	37 23	39 24	41 25	44 27	42 17	44 18	47 19	51 21
Phoenix, AZ	25,000	19 33	23 37	26 40	29 43	26 30	30 34	33 37	36 39	33 21	37 23	40 25	44 27	39 16	45 19	48 20	52 22
Bentonville, AR	22,000	30 40	36 44	40 46	43 48	38 38	44 40	47 42	50 44	44 24	50 28	54 30	58 33	52 20	57 22	61 23	64 24
Fort Smith, AR	16,000	30 31	36 34	40 36	45 38	37 28	43 30	46 31	51 32	45 19	50 21	54 23	59 25	52 15	57 16	61 18	65 19
Little Rock, AR	9,500	30 18	36 20	40 21	44 22	36 16	40 17	45 19	50 20	43 11	48 12	51 13	56 14	51 8.5	56 9.5	59 10.5	62 11.5
Eureka, CA	25,000	28 42	33 47	37 50	43 54	32 36	36 39	41 44	45 46	39 24	44 27	48 30	53 32	44 18	49 20	53 22	56 24
Fresno, CA	25,000	15 29	17 32	19 33	21 35	21 24	24 27	26 30	28 32	28 17	32 20	34 21	36 23	33 14	37 15	40 16	43 18
Los Angeles, CA	20,000	30 38	38 44	44 46	49 47	33 30	40 36	46 38	52 42	37 19	44 21	49 26	55 29	42 15	50 18	55 20	60 21
Mt. Tamalpais, CA	25,000	22 36	24 38	26 40	27 41	25 28	28 32	30 34	31 35	32 20	357 22	37 23	39 24	37 15	40 16	42 17	44 18
Port Reyes, CA	25,000	19 33	22 36	25 39	27 41	23 26	27 31	29 33	31 35	31 19	35 22	37 23	39 24	36 15	40 16	43 18	46 19
Red Bluff, CA	25,000	27 41	31 45	36 49	41 52	33 37	38 41	43 45	46 47	40 25	46 28	51 32	56 35	47 19	53 22	57 24	61 26
Sacramento, CA	25,000	22 36	25 39	28 42	31 45	25 28	28 32	30 34	33 37	32 20	36 23	38 24	41 25	37 15	42 17	45 19	48 20
San Diego, CA	25,000	19 33	23 37	26 40	29 43	24 27	27 31	29 33	31 35	32 20	35 22	37 23	39 24	37 15	40 16	43 18	46 19
San Francisco, CA	25,000	22 36	25 39	28 42	30 44	25 28	28 32	30 34	33 38	33 21	36 23	38 24	40 25	37 15	41 17	45 19	47 19
San Luis Obispo CA	17,000	30 33	37 36	43 39	47 41	33 27	38 30	44 32	48 33	38 17	44 19	48 21	53 23	43 12	49 15	54 16	58 17
Denver, CO	25,000	17 32	20 34	23 37	25 39	25 28	28 32	31 35	34 38	33 21	37 23	39 24	42 26	39 16	45 19	48 20	52 22
Grand Junction CO	25,000	12 22	14 26	16 30	18 32	16 20	18 22	20 23	22 25	23 14	25 15	278 16	29 18	27 11	30 12	32 13	34 14
Pueblo, CO	25,000	12 32	21 35	24 38	26 40	26 30	30 34	33 37	37 40	34 21	38 24	41 25	45 28	42 17	46 19	51 21	54 23
Wagon Wheel Gap CO	25,000	14 26	16 30	18 32	19 33	18 22	21 24	23 26	25 28	25 15	29 18	31 19	33 21	30 12	34 14	36 15	38 16
Hartford, CT	25,000	29 43	34 48	38 50	42 53	35 38	39 42	42 45	46 47	41 25	46 28	50 31	54 33	48 20	54 23	57 24	60 25
New Haven, CT	19,000	30 36	36 40	40 42	45 44	36 31	41 34	45 36	49 38	43 21	49 24	53 27	57 29	48 16	53 18	57 19	60 20
Washington, DC	13,300	30 25	27 27	40 28	44 30	38 22	44 24	48 26	51 27	46 16	52 17	56 19	59 20	54 12	59 14	62 15	54 16
Apalachicola, FL	2,670	30 5.1	37 5.8	41 6	46 6.2	35 4.5	40 5	44 5.2	49 5.5	43 3.2	47 3.5	50 3.7	55 4	48 2.2	53 2.4	57 2.6	60 2.8
Jacksonville, FL	4,670	30 8.5	36 9.5	40 10	45 11	36 7.5	40 8	45 9	50 9.5	43 5	48 5.6	52 6	56 6.6	51 4	56 4.5	59 4.8	63 5
Key West, FL	3,300	30 6.2	37 7	42 7.5	47 7.8	35 5.5	41 6	46 6.3	51 6.8	43 3.7	48 4	53 4.7	58 5.2	50 2.8	55 2.9	58 3.3	63 3.7
Miami, FL	2,100	30 4	37 4.5	42 4.8	47 5	35 3.6	41 3.9	46 4.2	50 4.5	43 2.5	48 2.8	52 3.1	56 3.3	50 1.8	54 1.9	57 2.1	61 2.2
Pensacola, FL	1,900	30 3.6	37 4	43 4.5	47 4.7	35 3.2	41 3.6	46 3.8	50 4	43 2	48 2.5	53 2.8	57 3.1	50 1.7	55 1.8	59 2	62 2.1

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Tampa, FL	3,600	30 7	36 7.5	39 7.9	42 8	35 5.9	40 6.3	44 6.9	48 7.2	43 4	48 4.5	52 5	56 5.4	51 3.2	56 3.5	58 3.6	62 3.8
Atlanta, GA	12,100	30 24	35 25	37 26	41 28	36 21	40 22	44 23	48 24	44 14	47 15	50 16	54 17	52 11	55 12	58 12	62 13
Augusta, GA	6,700	30 32	36 36	40 38	45 40	37 29	43 31	47 33	51 36	45 20	51 23	55 25	59 27	53 16	58 17	62 19	66 21
Macon, GA	8,000	30 16	37 18	42 19	48 20	37 14	44 15	49 16	56 17	45 10	51 11	56 12	60 13	53 7.5	59 8.2	63 9	67 10
Savannah, GA	3,800	30 7.2	36 8	40 8.4	43 8.9	35 6.1	39 6.8	43 7.1	48 7.6	42 4.1	47 4.8	51 5.1	54 5.4	51 3.3	55 3.6	58 3.8	61 3.9
Thomasville, GA	4,600	30 8.5	36 9.5	39 10	42 10.5	36 7.2	40 8	44 8.5	47 9	43 5	47 5.5	51 6	54 6.4	51 4	55 4.3	58 4.5	61 4.9
Honolulu, HI	7,300	30 14	37 16	42 17	47 18	36 12	42 13	47 14	52 15	43 8	49 9.5	54 10.5	58 11.5	50 6.5	56 7.2	60 7.8	63 8.1
Boise, ID	25,000	12 22	14 26	15 28	16 30	17 21	19 23	20 23	22 25	23 14	26 16	28 17	29 18	27 11	30 12	32 13	34 14
Lewiston, ID	25,000	13 24	15 28	16 30	17 32	17 31	19 23	20 23	22 25	23 14	25 15	27 17	29 18	27 11	30 12	32 13	34 14
Pocatello, ID	25,000	12 22	14 26	16 30	17 32	18 22	21 24	23 26	25 28	26 16	29 18	31 19	33 21	31 13	35 14	37 15	39 16
Cairo, IL	15,300	30 29	37 32	40 33	45 36	37 26	43 28	47 29	50 30	45 18	51 20	55 22	59 23	53 14	58 15	62 16	66 18
Chicago, IL	25,000	28 42	33 47	37 50	41 52	36 39	41 44	45 46	49 49	44 27	49 31	53 32	57 35	52 22	57 24	61 26	65 27
Peoria, IL	25,000	30 44	35 48	39 51	43 54	37 40	42 45	46 47	49 49	45 28	50 31	54 33	58 36	53 22	57 24	61 26	64 27
Springfield, IL	25,000	30 44	36 49	40 52	44 54	37 40	42 45	46 47	50 50	44 27	50 31	55 34	58 36	52 22	58 24	61 26	65 27
Evansville, IN	25,000	30 44	36 49	40 52	44 54	37 40	42 45	46 47	49 49	45 28	50 31	53 32	57 35	53 22	57 24	60 25	64 27
Fort Wayne, IN	25,000	27 41	30 44	34 48	38 50	34 38	38 41	41 44	44 46	40 25	44 27	48 30	51 32	49 20	53 22	56 24	59 25
Indianapolis, IN	25,000	30 44	37 48	41 51	45 54	38 40	45 44	49 46	53 48	46 28	53 32	57 36	62 39	54 22	60 24	63 26	66 27
Terre Haute, IN	17,000	30 33	36 36	39 38	44 40	37 29	42 31	46 32	50 34	45 20	50 23	54 24	57 26	53 16	57 17	60 18	64 20
Charles City, IA	25,000	30 44	36 49	41 52	45 55	37 40	43 45	47 47	50 50	45 28	50 31	55 34	59 37	53 22	57 24	61 26	65 27
Davenport, IA	25,000	30 44	36 49	41 52	45 55	38 41	44 46	48 48	52 52	46 28	52 32	56 35	60 38	54 23	59 25	63 27	66 28
Des Moines, IA	16,700	30 32	37 37	41 39	46 41	38 30	44 32	48 33	53 36	46 21	53 24	56 25	60 27	54 1	59 18	63 19	66 21
Dubuque, IA	16,700	32 32	36 36	38 38	40 40	29 29	31 31	33 33	36 36	21 21	23 23	26 26	27 27	16 16	17 17	19 19	20 20
Keokuk, IA	20,000	30 38	36 42	40 44	44 46	38 34	43 37	47 40	51 42	46 24	51 27	56 29	60 31	54 19	58 20	62 22	66 23
Sioux City, IA	25,000	27 41	31 45	38 50	42 53	35 38	40 43	45 46	49 49	43 26	49 31	54 33	59 37	53 22	58 24	61 26	64 27
Concordia, KS	14,100	30 27	36 29	41 31	46 32	38 22	45 25	49 26	54 27	46 15	53 19	57 21	61 23	54 13	57 14	61 15	66 19
Dodge City, KS	15,800	30 30	36 33	40 36	46 38	38 28	45 30	40 32	54 33	46 19	53 22	57 24	62 26	54 15	61 17	63 18	68 20
Iola, KS	10,000	30 19	36 21	39 22	42 23	37 17	41 19	45 20	49 21	44 11.5	48 12.5	52 13.5	56 14.5	52 9	56 10	59 10.5	63 11.3
Topeka, KS	8,000	30 15	35 17	40 18	44 19	37 14	42 15	46 16	50 16.5	45 9.5	50 10.5	54 11.5	58 12	53 7.5	58 8	62 9	67 10
Wichita, KS	10,300	30 30	36 36	40 40	44 44	37 37	42 42	47 47	51 51	46 46	50 50	55 55	59 59	55 55	58 58	62 62	66 66
Lexington, KY	16,000	30 31	36 34	41 37	46 39	37 28	43 30	48 31	53 33	45 19	51 21	56 23	60 25	53 16	58 17	62 18	65 19
Louisville, KY	23,000	30 42	36 46	40 49	45 52	34 36	38 39	41 41	43 42	40 24	46 27	50 30	53 31	47 18	53 21	56 22	58 23
New Orleans, LA	3,000	30 6	36 6.2	40 6.8	44 7.2	35 5	40 5.5	44 5.8	47 6	42 3.4	46 3.7	50 4	54 4.3	49 2.6	53 2.8	57 3	60 3.2



Selecta-Drain Chart

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Shreveport, LA	5,100	30 9.5	36 10.5	41 10.9	45 11.6	36 8.2	40 9	45 9.7	50 10.2	43 5.5	48 6	52 6.7	57 7.5	51 4.5	55 4.9	59 5.2	62 5.5
Eastport, ME	25,000	24 38	27 41	30 44	32 46	30 34	34 38	37 40	40 43	37 23	42 26	44 27	48 30	44 18	50 21	53 22	56 24
Portland, ME	25,000	27 41	31 45	34 48	38 50	31 35	35 38	38 41	41 44	38 24	44 27	47 29	50 31	46 19	50 21	53 22	56 24
Baltimore, MD	16,700	30 32	36 36	40 38	45 40	37 27	42 30	46 32	50 34	46 20	51 22	55 24	59 26	52 15	57 17	62 20	66 22
Boston, MA	25,000	28 42	33 47	37 50	41 52	35 38	40 43	43 45	47 47	42 26	46 28	50 31	54 33	50 21	54 23	57 24	61 26
Nantucket, MA	25,000	27 41	32 46	37 50	41 52	35 38	39 42	42 45	46 47	42 26	46 28	50 31	54 33	51 21	55 23	58 24	61 26
Alpena, MI	25,000	20 34	23 37	26 40	28 42	28 32	32 36	36 39	39 42	36 23	40 25	43 26	47 29	44 18	49 20	53 22	56 24
Detroit, MI	25,000	25 39	30 44	34 48	38 50	34 38	39 42	43 45	47 47	42 26	47 29	51 32	55 34	51 21	55 24	60 25	63 27
East Lansing, MI	25,000	21 35	25 39	27 41	29 43	28 32	33 37	36 39	38 41	37 23	40 25	43 26	46 28	44 18	49 20	53 22	56 24
Escanaba, MI	25,000	23 37	27 41	30 44	33 47	30 34	35 38	38 41	41 44	38 24	43 26	46 28	50 31	47 19	51 21	55 23	58 24
Grand Haven, MI	25,000	24 38	28 42	33 47	37 50	32 36	36 39	41 44	45 46	40 25	45 28	49 31	53 32	48 20	53 22	57 24	60 25
Grand Rapids, MI	25,000	24 38	37 41	30 44	34 48	32 36	36 39	39 42	42 45	39 24	43 26	46 28	49 31	46 19	52 22	55 23	57 24
Houghton, MI	25,000	22 36	24 38	27 41	30 44	28 32	31 35	35 38	38 41	36 23	38 24	41 25	44 27	42 17	46 19	49 20	52 22
Marquette, MI	25,000	24 38	28 42	32 46	34 48	32 36	36 39	40 43	43 45	40 25	44 27	48 30	52 32	48 20	53 22	57 24	60 25
Port Huron, MI	25,000	23 37	27 41	29 43	32 46	30 34	35 38	37 40	40 43	37 23	42 26	45 28	48 30	45 19	50 21	54 23	56 24
Sault Ste. Marie, MI	25,000	17 32	21 35	24 38	28 42	25 28	29 33	32 36	35 38	32 20	37 23	40 25	43 26	39 16	44 18	47 19	50 21
Duluth, MN	25,000	24 38	27 41	30 44	34 48	32 36	35 38	38 41	42 45	39 24	43 26	47 29	50 31	47 19	52 22	55 23	59 25
Minneapolis, MN	25,000	27 41	33 47	37 50	41 52	36 39	41 44	45 46	49 48	44 27	50 31	54 33	58 38	52 22	58 24	62 26	66 28
Moorehead, MN	25,000	27 27	33 33	37 37	43 43	34 36	41 41	45 45	51 51	44 44	50 50	54 54	59 59	52 52	58 58	62 62	67 67
St. Paul, MN	25,000	27 41	31 45	35 48	40 42	36 39	39 42	43 45	48 47	44 27	48 30	52 32	56 35	52 22	56 24	60 25	64 27
Meridian, MS	7,800	30 15	36 16	41 18	44 19	38 14	45 14.7	49 15.5	52 16	47 9.5	53 11	57 11.8	61 12.3	56 7.5	61 8	65 9	69 10
Vicksburg, MS	7,300	30 14	35 15	39 16	42 17	37 12	40 13	43 14	48 15	44 8	47 9	50 9.5	55 10.5	51 6.5	54 6.9	57 7.2	62 8
Columbia, MO	21,000	30 39	36 44	40 46	44 47	37 36	41 38	46 40	48 42	45 24	49 27	53 29	57 31	53 19	57 21	60 22	64 24
Hannibal, MO	16,700	30 32	37 36	42 38	49 42	38 28	45 31	50 34	59 38	46 20	53 23	58 25	65 30	54 16	60 19	65 21	72 22
Kansas City, MO	6,700	30 13	36 14.5	41 15.5	46 16	37 12	42 13	47 14	51 14.5	44 8	49 9	54 10	58 11	52 6.2	57 7	61 7.5	65 8
St. Joseph, MO	13,300	30 26	36 28	40 30	45 31	37 23	43 25	47 26	50 27	45 16	50 18	55 20	58 21	53 12	58 14	62 15	65 16
St. Louis, MO	8,300	30 16	36 18	41 20	46 21	37 15	42 16	47 17	51 18	45 10	50 11	55 12	9 13	53 7.5	57 8.5	61 9	65 10
Springfield, MO	17,000	30 33	36 35	40 38	44 40	37 27	42 30	46 32	50 34	44 19	50 22	54 24	58 25	52 15	56 16	60 19	64 21
Havre, MO	25,000	17 32	19 33	21 35	23 37	22 24	25 28	27 31	29 33	30 18	33 21	35 22	37 23	36 14	39 16	42 17	45 19
Helena, MO	25,000	15 28	18 32	20 34	22 36	18 22	20 23	22 25	24 27	24 15	28 17	30 18	32 20	29 12	33 13	35 14	37 15
Kalispell, MO	25,000	14 26	16 30	18 32	20 34	18 22	20 23	22 25	24 27	25 15	28 17	30 18	32 20	30 12	33 13	35 14	37 15
Miles City, MO	25,000	16 30	19 33	21 35	23 37	22 25	25 28	27 31	29 33	30 18	33 21	35 22	37 23	35 15	38 16	42 17	44 18

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Missoula, MO	25,000	13 23	15 28	17 32	19 33	17 21	20 23	22 25	24 27	24 15	27 16	29 18	31 19	29 12	32 13	34 14	36 15
Lincoln, NE	18,000	30 34	37 38	42 41	46 43	36 30	41 32	45 34	49 36	44 21	51 24	56 27	60 29	53 16	59 18	62 20	65 22
North Platte, NE	25,000	27 41	33 47	39 51	43 54	36 39	43 45	47 47	51 51	44 27	51 32	56 35	60 38	52 22	59 25	63 27	66 28
Omaha, NE	22,000	30 40	38 46	43 48	48 52	39 38	44 40	49 43	54 45	46 26	52 29	57 32	62 36	54 21	60 23	64 24	67 26
Valentine, NE	25,000	26 40	31 45	36 49	41 52	35 38	40 43	44 46	49 48	43 26	49 13	54 33	59 37	52 22	58 24	62 26	66 28
Reno, NV	25,000	14 26	16 30	17 32	18 32	17 21	19 23	21 24	22 25	24 15	26 13	28 17	30 18	29 12	32 13	34 14	36 15
Tonopah, NV	25,000	13 23	15 28	17 32	19 33	16 20	18 22	19 23	21 24	20 13	2 14	26 16	28 17	25 10.5	27 11.5	29 12	32 13
Winnemucca, NV	25,000	10 20	12 27	13 23	15 28	16 20	18 22	19 23	20 23	22 14	25 15	27 16	28 17	29 11	29 12	32 13	34 14
Concord, NH	25,000	27 41	32 46	37 50	41 52	32 36	37 40	40 43	44 46	40 25	45 28	49 31	51 32	46 19	51 21	55 23	58 24
Atlantic City, NJ	7,800	30 44	38 50	43 54	48 58	37 40	43 45	48 48	54 52	44 27	50 31	55 34	60 38	51 21	57 24	62 26	66 28
Sandy Hook, NJ	17,000	30 33	36 36	40 38	44 40	37 27	43 30	47 32	50 34	45 20	50 22	54 24	58 25	53 19	58 17	62 20	65 21
Trenton, NJ	25,000	28 42	33 47	38 50	42 53	36 39	40 43	44 46	47 47	43 26	48 30	52 32	56 35	51 21	56 24	59 25	63 27
Albuquerque, NM	25,000	15 28	18 32	20 34	22 36	23 26	26 39	29 33	31 35	31 19	34 21	37 23	39 24	37 15	41 17	44 18	47 19
Roswell, NM	25,000	23 37	27 41	30 44	33 47	31 35	36 39	39 42	43 45	39 24	43 26	47 29	51 32	47 19	52 22	56 24	59 25
Sante Fe, NM	25,000	16 30	18 32	20 34	22 36	23 26	26 30	28 32	30 34	31 19	34 21	36 23	38 24	37 15	40 16	43 18	46 19
Albany, NY	25,000	23 37	26 40	29 43	32 46	28 32	32 36	35 38	37 40	36 23	39 24	42 26	45 28	43 18	47 19	50 21	53 22
Binghampton, NY	25,000	23 37	27 41	30 44	33 47	30 34	34 38	37 40	40 43	38 24	42 26	46 28	49 31	46 19	51 21	55 23	58 24
Buffalo, NY	25,000	23 37	26 40	29 43	32 46	31 35	36 39	39 42	42 45	39 24	43 26	47 29	50 31	47 19	52 22	56 24	59 25
Canton, NY	25,000	25 39	30 44	35 48	39 51	33 37	39 42	43 45	47 47	40 25	46 28	51 32	56 35	48 20	55 23	59 25	63 27
Ithaca, NY	20,000	30 38	35 41	39 44	43 45	35 42	40 36	48 38	48 40	40 21	48 24	51 27	56 30	47 16	54 19	58 21	62 22
New York, NY	15,800	30 31	36 34	41 37	46 38	38 28	43 30	48 31	52 32	46 19	51 22	56 23	60 24	54 15	59 17	64 18	68 19
Oswego, NY	25,000	19 53	22 36	24 38	26 40	25 28	38 32	30 34	32 36	33 21	36 23	38 24	40 25	38 16	42 17.5	45 19	48 20
Rochester, NY	25,000	22 36	26 40	29 43	31 45	30 34	35 38	37 40	41 44	38 24	42 26	45 28	49 31	45 19	51 21	54 23	56 23.7
Syracuse, NY	25,000	26 40	32 46	36 49	41 52	34 38	40 43	45 46	49 49	42 26	48 30	53 32	57 37	50 21	56 23.7	61 26	68 27
Asheville, NC	21,000	30 39	37 44	47 47	47 50	37 36	43 39	47 42	51 43	45 24	51 28	55 30	58 32	52 19	57 21	61 22	65 24
Charlotte, NC	17,000	30 33	35 35	39 38	42 39	35 26	40 29	45 31	50 34	43 19	48 22	52 23	55 24	51 15	55 16	59 18	62 19
Greensboro, NC	16,700	30 32	36 35	41 38	46 40	35 26	38 28	42 30	46 31	41 18	45 20	49 22	52 23	49 15	54 16	57 17	60 18
Hatteras, NC	2,500	30 4.6	38 505	43 5.8	48 6.2	34 4	41 4.7	46 5	51 5.2	40 2.7	46 3	50 3.4	56 3.6	46 1.9	52 2.2	57 2.5	62 2.7
Raleigh, NC	9,000	30 17	36 18	40 20	44 21	37 15	42 17	46 17.5	50 18	45 11	50 12	55 13	59 14	53 8	59 9	61 10	64 11
Wilmington, NC	6,800	30 13	36 14	40 15	45 16	36 11	41 12	46 13	50 14	43 7.5	48 9	52 9.8	56 10	51 6	56 6.8	59 7.2	62 7.5
Bismarck, ND	25,000	22 36	26 40	29 43	33 47	30 34	35 38	38 41	41 44	38 24	43 26	47 29	50 31	46 19	52 22	55 23.3	58 24
Devils Lake, ND	25,000	23 37	27 41	30 44	34 48	30 34	35 38	38 41	41 44	38 24	43 26	47 29	50 31	46 19	52 22	55 23.3	58 24



Selecta-Drain Chart

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Williston, ND	25,000	21 35	25 39	28 42	31 45	29 33	34 38	38 41	41 41	37 23	42 26	46 28	50 31	45 19	52 22	55 23.3	59 25
Cincinnati, OH	25,000	27 41	31 45	38 48	39 51	34 38	32 42	42 45	45 46	42 26	47 29	50 31	53 32	50 21	54 23	57 24	60 25
Cleveland, OH	25,000	23 37	26 40	29 43	32 46	30 34	34 38	37 40	40 43	38 24	42 26	45 28	48 30	46 19	50 21	53 22	56 23.7
Columbus, OH	25,000	22 36	26 40	28 42	30 44	30 34	34 38	37 40	40 43	38 24	42 26	45 28	48 50	46 19	50 21	53 22	56 23.7
Dayton, OH	25,000	24 38	28 42	31 45	34 48	32 36	36 39	39 42	41 44	39 24	43 26	47 29	50 31	47 19	52 22	56 23.7	59 25
Sandusky, OH	25,000	28 42	34 38	39 51	43 54	36 39	42 45	47 47	51 51	44 27	50 31	55 34	59 37	52 22	58 24	63 27	66 28
Toledo, OH	25,000	26 40	30 44	35 48	39 51	34 38	38 41	43 45	46 47	42 26	46 28	51 32	54 33	50 21	54 23	58 24	62 26
Oklahoma City, OK	7,500	30 14	36 16	40 17	44 18	36 12	42 14	46 15	50 16	44 8.5	50 10	54 10.5	58 11.5	52 6.6	57 7.5	60 7.9	64 8.5
Baker, OR	25,000	10 20	12 22	13 24	14 26	17 21	19 23	20 23	21 24	26 14	25 15.5	27 16	29 18	26 11	30 12	32 13	34 14
Portland, OR	25,000	22 36	25 39	29 43	32 46	26 30	30 34	33 37	36 39	34 21	38 21	41 25	44 27	38 16	42 17.5	45 19	48 20
Roseburg, OR	25,000	22 36	25 39	29 43	32 46	26 30	30 34	33 37	36 39	34 21	38 24	41 25	44 27	37 15	42 17.5	49 19	47 19
Erie, PA	21,000	30 39	38 44	44 47	48 50	38 36	45 40	49 42	54 44	45 24	52 29	57 31	62 33	53 19	58 21	63 23	67 25
Harrisburg, PA	25,000	28 42	33 47	47 50	41 52	35 38	40 43	44 46	48 48	43 26	48 30	52 32	56 35	31 21	56 24	60 25	64 27
Philadelphia, PA	25,000	29 43	34 48	38 50	41 52	36 39	40 43	43 45	47 47	43 26	48 30	52 32	56 35	51 21	56 24	59 25	62 26
Pittsburgh, PA	25,000	22 36	25 39	37 41	20 43	29 33	33 36	35 38	37 40	37 23	40 25	43 26	45 28	45 19	49 20	51 21	54 23
Reading, PA	25,000	30 44	37 50	42 53	46 56	38 41	45 36	49 49	52 52	45 28	52 32	57 35	60 38	53 22	59 25	63 27	67 28
Scranton, PA	25,000	26 40	30 44	34 48	38 50	34 38	38 41	41 44	44 46	41 28	46 28	49 31	52 32	49 20	54 23	57 24	60 25
Block Island, RI	25,000	26 40	30 44	34 48	38 50	34 38	38 41	41 44	44 46	41 25	46 28	49 31	52 32	48 20	54 23	57 24	59 25
Providence, RI	25,000	30 44	37 60	42 53	47 57	38 41	44 46	48 48	53 53	46 28	51 32	56 35	61 38.5	54 23	58 24	62 26	66 28
Charleston, SC	3,800	30 7.2	37 8	41 8.5	46 9	36 6.2	40 6.8	46 7.2	51 7.8	44 4.2	48 4.8	54 5.4	59 5.9	51 3.4	56 3.6	60 3.8	63 4
Columbia, SC	16,700	30 32	36 35	40 38	44 39.2	37 27.5	43 30.5	46 32	49 33.5	44 19.4	50 22.2	54 23.8	57 24.6	52 15.5	58 17.5	61 19.5	64 21
Greenville, SC	11,700	30 24	36 25.5	39 26.5	43 28	36 20	41 21.5	45 22.5	49 23	44 13	48 14	52 15.5	56 17	52 11	56 12	60 13	64 14
Huron, SD	25,000	28 38	27 41	30 44	34 48	32 36	36 39	39 42	43 45	39 24	44 27	48 30	52 32	47 19	53 22	56 23.7	59 25
Pierre, SD	25,000	23 37	26 40	28 42	31 45	31 35	35 38	37 40	40 43	38 24	43 26	46 28	49 31	46 19	51 21	54 23	57 24
Rapid City, SD	25,000	25 39	31 45	35 48	39 51	32 36	37 40	40 43	44 46	39 24	45 28	49 31	52 32	46 19	52 22	56 23.7	59 25
Yankton, SD	25,000	27 41	31 45	36 49	41 52	36 39	40 43	45 46	49 49	44 27	49 31	54 33	58 36	53 22	58 24	62 26	66 28
Chattanooga, TN	17,000	30 33	35 35	38 37	41 38	36 27	40 29	43 30.5	46 32	43 19	47 20.7	51 22.7	55 24.3	51 14.8	55 16.7	58 17.5	61 19.5
Knoxville, TN	25,000	29 53	35 49	40 52	44 54	37 40	43 45	47 37	51 51	45 28	51 32	55 34	59 37	53 22	59 25	63 27	66 28
Memphis, TN	9,000	30 17	36 18	40 20	45 21	36 15	41 17	45 17.5	49 18	43 10	48 11	52 12	56 13	51 8	55 9	59 9.5	62 10.2
Nashville, TN	25,000	29 43	35 48	39 51	42 53	37 40	43 45	46 47	49 48	45 28	50 31	55 34	58 36	53 22	58 24	62 26	65 27
Abilene, TX	8,500	30 16	37 17.5	41 18.5	46 20	37 14.5	43 16	47 17	51 18	44 10	50 11	55 12	59 13	52 7.8	58 8.5	61 9	64 9.5
Amarillo, TX	25,000	30 44	37 50	42 53	46 56	38 41	43 45	48 48	52 52	46 28	51 32	56 35	60 38	54 23	59 25	63 27	67 28

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Austin, TX	4,300	30 8.8	36 9.5	41 10	46 10.5	36 7.2	40 7.8	46 8.5	51 9	44 5	49 5.7	54 6.2	59 6.8	52 3.8	57 4.2	61 4.7	65 5
Brownsville, TX	3,500	30 6.8	36 7.2	41 7.8	46 8	36 5.8	40 6.2	45 6.8	50 7.2	44 4	49 4.5	54 5	58 5.5	52 3.1	56 3.3	60 3.5	64 4
Corpus Christi, TX	7,000	30 13.5	35 14	39 15	43 16	36 11.5	41 12.5	45 13.5	49 14	44 8	48 9	52 9.8	56 10.6	51 6	56 6.4	59 7	62 7.5
Dallas, TX	4,500	30 8.5	36 9.5	40 10	44 10.4	36 7.2	40 7.8	45 8.4	50 8.9	43 4.9	48 5.7	52 6	56 6.5	50 3.5	56 4	59 4.4	62 4.7
Del Rio, TX	4,200	30 8.5	38 9.5	43 10.3	48 11	36 7.2	41 8	48 8.8	53 9.2	43 4.9	49 5.7	55 6.2	60 7	50 3.8	56 4.2	61 4.7	66 5
El Paso, TX	25,000	16 29	18 32	20 34	22 36	24 27	27 31	29 33	31 35	32 20	36 23	38 24	40 25	38 16	43 18	46 19	49 20
Fort Worth, TX	6,500	30 12.4	36 13	40 13.5	44 14.8	37 11	41 11.9	45 12.2	49 13	44 7.2	49 8	52 8.8	56 9.5	51 5.7	56 6.2	59 6.5	62 7
Galveston, TX	1,800	30 3.5	38 3.9	45 4.2	49 4.5	36 3.1	43 3.5	49 3.7	53 3.9	44 2.1	49 2.5	54 2.8	59 3	50 1.6	56 1.8	61 2	66 2.2
Houston, TX	2,450	36 4.6	37 5.2	41 5.5	45 5.7	35 4	40 4.3	44 3.7	48 5	43 2.9	47 3.1	51 3.5	54 3.8	50 2.1	54 2.3	57 2.5	60 2.6
Palestine, TX	5,800	30 11	36 12	40 13	44 13.8	37 10	41 10.5	45 11	49 11.5	44 6.5	49 7.5	53 8	57 9	52 5.4	57 5.9	60 6.2	64 6.6
Port Arthur, TX	2,600	30 4.6	38 5.5	43 5.8	47 6	36 4.2	41 4.7	45 5	49 5.3	44 3	49 3.3	53 3.7	57 4	49 2	54 2.3	58 2.7	62 2.8
San Antonio, TX	8,150	30 15	37 17	41 18	46 19	37 14	42 15.2	47 16	52 17	45 9.5	50 10.5	55 11.5	60 13	53 7.2	57 8	60 8.5	64 9.5
Taylor, TX	2,100	30 4	40 4.7	47 5	53 5.3	37 3.7	44 4	51 4.3	57 4.6	44 2.5	50 3	56 3.2	62 3.6	49 1.8	56 2	62 2.3	67 2.7
Modena, UT	25,000	16 29	18 32	20 34	22 36	24 27	27 31	30 34	32 36	32 20	36 23	38 24	40 25	38 16	42 17.5	46 19	50 21
Salt Lake City, UT	25,000	13 23	15 38	16 30	17 32	18 22	20 23	22 35	24 27	25 15	28 17	30 18	32 20	31 13	34 14	36 14	38 16
Burlington, VT	25,000	22 36	25 39	28 42	32 46	26 30	29 33	32 36	35 38	34 21	38 24	40 25	42 26	40 17	44 18	46 19	49 20
Northfield, VT	25,000	26 40	31 45	36 49	41 52	31 35	36 39	40 43	45 46	38 24	43 26	47 29	51 32	45 19	50 21	54 23	57 24
Cape Henry, VA	15,300	30 30	36 32	40 34	45 37	38 27	45 29	49 31	54 32	47 19	53 21	58 24	62 26	56 15	61 17	66 19	70 20
Lynchburg, VA	18,000	30 34	36 38	41 41	45 43	38 30	44 33	48 36	52 38	45 21	51 24	55 26	60 29	52 16	58 19	62 20	66 22
Norfolk, VA	8,300	30 16	35 18	40 19	44 20	36 14	41 15	48 16	49 17	44 9.5	49 10.5	53 12	57 13	52 7.5	56 8	60 9	63 9.5
Richmond, VA	8,000	30 16	37 18	42 19	47 20	37 14	44 15	49 16	54 17	45 9.5	51 10.5	56 12	61 13	53 7.5	58 8	63 9	68 10.5
Wytheville, VA	25,000	29 40	30 44	34 48	38 50	34 38	38 41	42 45	45 46	41 25	46 28	50 31	54 33	49 20	54 23	57 24	61 26
North Head, WA	25,000	22 36	24 38	29 40	28 42	26 30	28 32	29 33	31 35	33 21	36 23	38 24	40 25	37 15	41 17	43 18	45 19
Port Angeles, WA	25,000	15 28	18 32	20 34	22 36	19 23	22 25	23 36	25 28	26 16	29 18	31 19	34 21	29 12	33 13	35 14	37 15
Seattle, WA	25,000	16 30	19 33	21 35	23 37	21 24	24 27	26 30	28 32	27 16	31 19	33 21	36 23	32 13	36 15	38 16	40 17
Spokane, WA	25,000	12 22	14 26	15 28	16 30	17 21	19 23	20 23	22 25	21 13	24 15	26 16	29 18	27 12	30 12	32 13	34 14
Tacoma, WA	25,000	17 32	20 34	22 36	28 38	23 26	26 30	28 32	30 34	30 18	33 21	37 23	39 24	35 14	38 16	41 17	44 18
Tatoosh, WA	25,000	27 41	32 46	33 47	39 51	32 36	36 39	39 42	42 45	40 25	44 27	47 29	50 31	46 19	49 20	52 22	56 24
Walla Walla, WA	25,000	13 23	15 28	16 30	18 32	16 20	18 22	19 23	20 23	22 14	24 15	26 16	27 17	26 11	28 12	30 12	31 13
Yakima, WA	25,000	7 17	9 19	10 20	11 21	16 20	18 22	19 23	20 23	21 16	24 15	27 16	29 18	26 11	29 12	32 13	334 14
Elkins, WV	25,000	27 41	32 46	37 50	41 52	34 38	40 43	44 45	48 48	42 26	48 30	52 32	56 35	50 21	56 24	59 25	62 26
Parkersburg, WV	25,000	23 39	26 42	31 45	34 48	32 36	36 39	39 42	42 45	40 23	44 27	47 29	50 31	43 20	53 22	56 24	59 23



Selecta-Drain Chart

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
Green Bay, WI	25,000	24 38	28 42	31 45	35 48	32 36	36 39	39 42	43 45	39 24	44 27	47 29	51 32	47 19	53 22	36 23	59 25
La Crosse, WI	25,000	23 42	31 45	35 48	39 51	35 38	40 43	48 45	46 47	43 26	48 30	32 32	56 35	51 21	56 24	39 25	62 26
Madison, WI	25,000	29 43	36 49	40 52	44 54	37 40	43 45	47 47	50 50	46 28	51 32	55 34	60 38	54 23	60 25	62 26	65 28
Milwaukee, WI	25,000	25 40	30 44	35 48	39 51	34 38	38 41	42 45	45 46	41 25	45 28	49 31	53 32	49 20	54 23	57 24	60 25
Cheyenne, WY	25,000	17 32	19 33	21 35	23 37	24 27	27 31	30 34	33 37	32 20	36 23	38 24	40 25	39 16	44 18	47 19	50 21
Lander, WY	25,000	15 28	19 33	21 35	23 37	21 24	25 28	27 31	29 33	28 17	32 20	35 22	37 23	33 13	36 14	39 16	42 17
Sheridan, WY	25,000	19 33	24 38	27 41	30 44	2 30	30 34	33 37	39 39	34 21	38 24	41 25	44 27	39 16	44 18	18 20	52 22
Yellowstone Park WY	25,000	12 22	14 26	15 28	16 30	16 20	17 21	18 22	19 23	22 14	24 15	25 15	26 16	26 11	28 12	29 12	30 12
San Juan, PR	3,000	30 5.9	38 6.6	44 7	48 7.3	37 5.3	43 5.7	44 5.8	52 6	45 3.6	50 4	54 4.3	58 4.8	51 2.7	55 2.9	60 3.2	64 3.5

Select Proper Vertical Storm Drain Piping

Roof Drainage Data

While the flow rate for any design condition can be easily computed from the data contained on the preceding pages, the tabulations shown below (and on page 14) can be used to simplify selection of drain line sizes.

TABLE I - Suggested Relation of Drain Outlet and Vertical Leader Size to of the six Z105-10 Zum Control-Flo Roof Drains (Based on National Plumbing Code ASA-A40.8 Data on Vertical Leaders).

No. of Notches in Drain	Max. Flow per Notch in GPM			
	Pipe Size			
	2	3	4	5
1	30	60*	-	-
2	15	45	60*	-
3	-	31	60*	-
4	-	23	48	60*
5	-	18	38	60*
6	-	15	32	60*

* Maximum flow obtainable from 1 notch.

Table I illustrates gallons per minute from each notch of the six Z105-10 drains that can be carried off by various leader sizes. Once the drains are selected for a given roof per this manual, simply read the GPM flow per notch from the chart, refer to **Table I** and select the smallest drain line that will accommodate that flow. Drain pipes should be sized for the 100-year storm unless scuppers are located at a height that will not permit a depth of water to accumulate on the roof that is predicted for the 100-year storm. For example, if your installation is Anniston, Alabama, on a dead-level roof the data for the 100-year storm shows a discharge of 43 GPM per notch. For this application scuppers would be located at a 4.3" height. Using Table I a 3" drain pipe or vertical leader would be used for a drain with 1- or 2- notches. A 4" leader would be used with a 3- or 4-notch drain and a 5" leader with a 5- or 6-notch drain. For Anniston, Alabama, and a roof with a 2" rise, the 100-year storm shows a flow rate of 50 GPM. In this case scuppers should be located at a height of 5.0". A 3" leader would be used with a single notch drain, a 4" leader with a 2- and 3-notch drain, and a 5" leader with a 4-, 5- or 6-notch drain. The same type of selection would be made for a roof with a 4" rise. For Anniston, Alabama, the flow rate for the 100-year storm would be located at a height of 5.9".

For the roof with a 6" rise, the data for Anniston, Alabama, as well as several other localities, for the 100-year storm, shows a flow rate greater than 60 GPM. In these cases the scuppers will be located at the maximum recommended height of 6" and the vertical leaders will be sized for a maximum flow rate of 60 GPM per notch.

In the few cases where the data shows a flow rate in excess of 60 GPM for the 100-year storm, and if all drains and drain lines are sized according to recommendations, the only consequence will be a brief flow through the scuppers more often than once every 100 years.

EXAMPLE

LOCATION	Notch Area Rating	DEAD-LEVEL				2-INCH RISE				4-INCH RISE				6-INCH RISE			
		Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.				Discharge GPM Draindown Time Hrs.			
		10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.	10 Yrs.	25 Yrs.	50 Yrs.	100 Yrs.
La Crosse, WI	25,000	23 42	31 45	35 48	39 51	35 38	40 43	48 45	46 47	43 26	48 30	32 32	56 35	51 21	56 24	39 25	62 26
Madison, WI	25,000	29 43	36 49	40 52	44 54	37 40	43 45	47 47	50 50	46 28	51 32	55 34	60 38	54 23	60 25	62 26	65 28
Milwaukee, WI	25,000	25 40	30 44	35 48	39 51	34 38	38 41	42 45	45 46	41 25	45 28	49 31	53 32	49 20	54 23	57 24	60 25
Cheyenne, WY	25,000	17 32	19 33	21 35	23 37	24 27	27 31	30 34	33 37	32 20	36 23	38 24	40 25	39 16	44 18	47 19	50 21

Select Proper Horizontal Storm Drain Piping

Table II is similar to **Table I** but is used in determining the size of the building storm drain. Use the same flow rate established for sizing the vertical leaders to size the storm drain. Count the total number of notches feeding any one drain or branch to the drain. Enter the Table at the total number of notches and under the proper storm drain slope select the column that gives a flow rate equal to or larger than the established notch flow rate. Read the storm drain size required at the top of this column.

TABLE II - Suggested Relation of Horizontal Storm Drain Size to Zurn Control-Flo Roof Drainage (Based on National Plumbing Code ASA-A40.8 Data on Horizontal Storm Drains w/ 1/8", 1/4" and 1/2" per foot slope).

Total No. of Notches Discharging to Storm Drain	MAX. FLOW PER NOTCH IN GPM										MAX. FLOW PER NOTCH IN GPM										MAX. FLOW PER NOTCH IN GPM									
	Storm Drain Size 1/8" per ft. slope										Storm Drain Size 1/4" per ft. slope										Storm Drain Size 1/2" per ft. slope									
	3	4	5	6	8	10	12	13			3	4	5	6	8	10	12	13			3	4	5	6	8	10	12	13		
1	34	60*	—	—	—	—	—	—			48	60*	—	—	—	—	—	—			60*	—	—	—	—	—	—	—		
2	17	39	60*	—	—	—	—	—			24	55*	60*	—	—	—	—	—			34	60*	—	—	—	—	—	—		
3	11	26	46	60*	—	—	—	—			16	37	60*	—	—	—	—	—			22	52*	60*	—	—	—	—	—		
4	8	19	34	53	60*	—	—	—			12	28	48	60*	—	—	—	—			17	39	60*	—	—	—	—	—		
5	—	13	28	44	60*	—	—	—			—	22	39	60*	—	—	—	—			13	31	60*	—	—	—	—	—		
6	—	13	23	37	60*	—	—	—			—	18	33	52*	60*	—	—	—			11	26	46	60*	—	—	—	—		
7	—	11	20	32	60*	—	—	—			—	16	28	45	60*	—	—	—			—	22	39	60*	—	—	—	—		
8	—	—	17	28	60*	—	—	—			—	14	25	39	60*	—	—	—			—	19	36	55*	60*	—	—	—		
9	—	—	13	25	53	60*	—	—			—	12	22	35	60*	—	—	—			—	17	30	49	60*	—	—	—		
10	—	—	14	22	48	60*	—	—			—	—	20	31	60*	—	—	—			—	15	27	44	60*	—	—	—		
11	—	—	12	20	43	60*	—	—			—	—	18	29	60*	—	—	—			—	14	25	40	60*	—	—	—		
12	—	—	—	18	40	60*	—	—			—	—	16	26	56	60*	—	—			—	13	23	37	60*	—	—	—		
13	—	—	—	17	37	60*	—	—			—	—	15	24	52*	60*	—	—			—	12	21	34	60*	—	—	—		
14	—	—	—	15	34	60*	—	—			—	—	14	22	48	60*	—	—			—	10	31	60*	—	—	—	—		
15	—	—	—	15	32	57	60*	—			—	—	13	21	45	60*	—	—			—	18	29	60*	—	—	—	—		
16	—	—	—	14	30	54	60*	—			—	—	—	20	42	60*	—	—			—	17	27	60*	—	—	—	—		
17	—	—	—	13	28	51	60*	—			—	—	—	18	40	60*	—	—			—	16	26	56	60*	—	—	—		
18	—	—	—	12	26	48	60*	—			—	—	—	17	37	60*	—	—			—	15	24	53	60*	—	—	—		
19	—	—	—	—	25	45	60*	—			—	—	—	16	35	60*	—	—			—	14	23	50	60*	—	—	—		
20	—	—	—	—	24	43	60*	—			—	—	—	16	34	60*	—	—			—	13	22	47	60*	—	—	—		
23	—	—	—	—	20	37	60*	—			—	—	—	14	29	53*	60*	—			—	12	19	41	60*	—	—	—		
25	—	—	—	—	19	34	55*	60*			—	—	—	13	27	49	60*	—			—	—	17	38	60*	—	—	—		
30	—	—	—	—	16	28	46	60*			—	—	—	—	22	40	60*	—			—	—	14	31	57	60*	—	—		
35	—	—	—	—	13	24	39	60*			—	—	—	—	19	35	56	60*			—	—	12	27	49	60*	—	—		
40	—	—	—	—	12	21	34	60*			—	—	—	—	17	30	49	60*			—	—	—	23	43	60*	—	—		
45	—	—	—	—	—	19	31	55*			—	—	—	—	15	27	44	60*			—	—	—	21	38	60*	—	—		
50	—	—	—	—	—	17	27	49*			—	—	—	—	13	24	39	60*			—	—	—	19	34	55	60*			
55	—	—	—	—	—	15	25	45*			—	—	—	—	—	22	35	60*			—	—	—	17	31	50	60*			
60	—	—	—	—	—	14	23	41*			—	—	—	—	—	20	32	58*			—	—	—	15	28	46	60*			
65	—	—	—	—	—	13	21	38*			—	—	—	—	—	18	30	54*			—	—	—	14	26	42	60*			
70	—	—	—	—	—	12	20	35*			—	—	—	—	—	17	28	50*			—	—	—	13	24	39	60*			

* Maximum flow obtainable from 1 notch.

Special Considerations for Structural Safety Rigid Roof Design

Normal Practice of Roof Design is Based on 30-lbs. Per Sq. Ft. ... therefore this factor should definitely be kept in mind as a prime requirement for assuring a structurally sound roof. Otherwise, roof deflection may minimize the advantages of a well-designed roof drainage system.

Failure to recognize the adverse effects of roof deflection, even with conventional roof drainage, may lead to roof failure. With the new concept of "Control-Flo" Roof Drainage, the design condition of deflection is equally important. If severe deflection is permitted, rain water will simply seek low areas, thus intensifying the degree of deflection. Thus it is extremely important that flat roofs are designed in accordance with normal load factors so that deflection will be slight enough in any bay to prevent progressive deflection which could cause water depths to load the roof beyond its design limits.

SCUPPERS AND OVERFLOW DRAINS

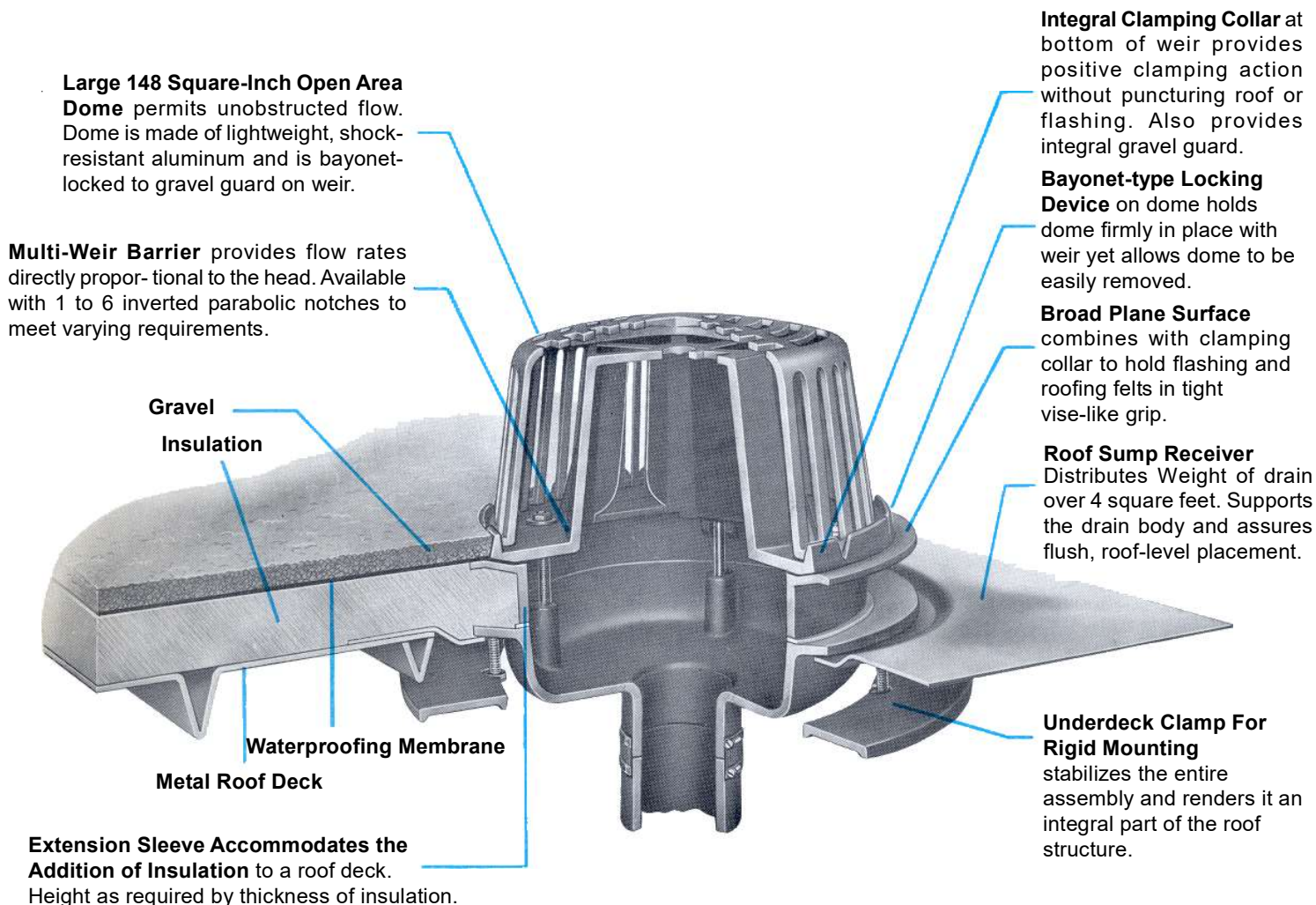
Roofing members and understructures, weakened by seepage and rot resulting from improper drainage and roof construction can give away under the weight of rapidly accumulated water during flash storms. Thus, it is recommended, and often required by building codes, to install scuppers and overflow drains in parapet-type roofs. Properly selected and sized scuppers and overflow drains are vital to a well-engineered drainage system to prevent excessive loading, erosion, seepage and rotting.



Control-Flo Roof Drains

the most advanced drainage control available,
lets you design roof drainage systems with confidence

Check These Years Ahead Engineered Features



Threaded, caulk or No-Hub outlet connections available.
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