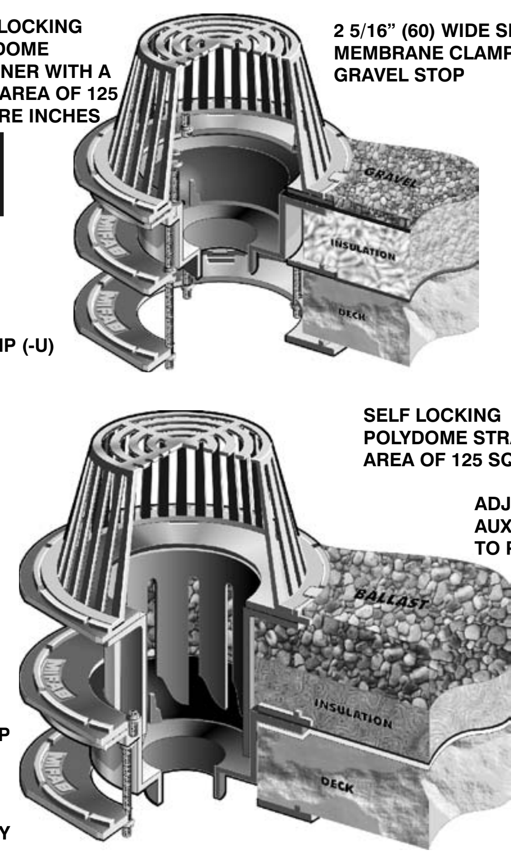
ROOF DRAINS



ROOF DRAINS

MIFAB Roof Drain Selection Guide

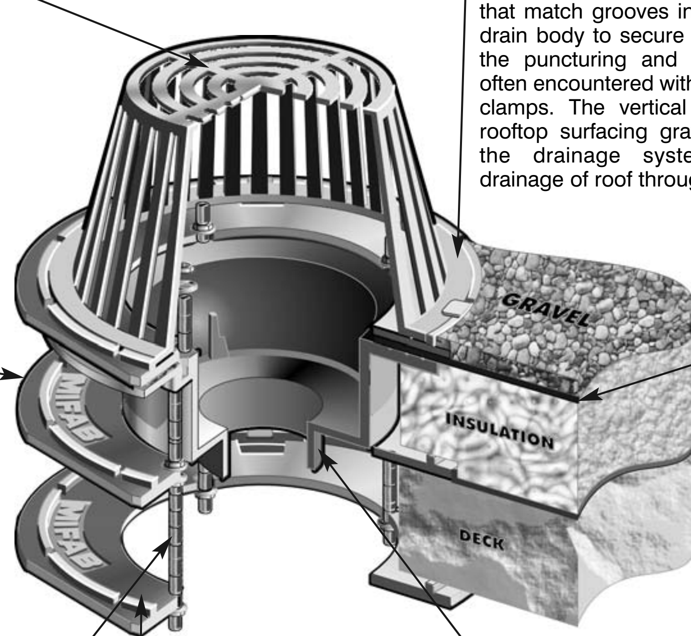
The object of equipping a roof drain with an adjustable top via its adjustable extension is to place the top or inlet of the drain at the right height above structural deck level to accommodate various thicknesses of insulation. This avoids the necessity of tapering or feathering the insulation layer down to the fixed body flange level of the drain causing a loss of insulation value at the drain location. MIFAB ACCOMPLISHES THE ADJUSTMENT BY INSTALLING A DECK FLANGE ONTO THE ROOF DECK AND SUPPORTING THE ROOF DRAIN BODY FLUSH OR SLIGHTLY BELOW THE MEMBRANE LEVEL (ABOVE THE INSULATION) UTILIZING THE HS-3 HARDWARE SET. A DECK CLAMP (SUFFIX -U) IS SECURED BENEATH THE DECK ON THE SAME HARDWARE TO ENSURE A RIGID INSTALLATION.

IN ALL CASES, THERE IS NO USE OF GASKETS OR MASTIC COATINGS. THIS PRECLUDES THE POSSIBILITY OF ANY LEAKAGE DUE TO BACK-UP IN THE DRAINAGE SYSTEM AS A RESULT OF SURCHARGE OR BLOCKAGE.

On Promenade decks, a collar with a cam provides finite adjustment, with the collar being secured by three locking screws to the body of the roof drain. A similar system is used with the R1200-HC in IRMA (Inverted Membrane) systems. You do achieve the precise height with MIFAB roof drains with a minimum of effort. Moreover, MIFAB roof drains provide flexibility in top height often necessary to overcome construction irregularities impossible to compensate for with fixed extension drains.

LOCKING DOME
Once in place stays in place to provide positive protection for the roof drain and drainage system entrance. The vertical perimeter openings provide sufficient free drainage area, in compliance with codes and standards, for prompt and efficient drainage of the roof while protecting the system against entrance of potentially damaging objects. With the open or free area on top, which is merely for flood conditions, the dome has a total free area in excess of 125 square inches.

COMBINED FLASHING CLAMP AND GRAVEL STOP
Features a broad clamping area with ridges that match grooves in the flange of the roof drain body to secure the membrane without the puncturing and troublesome wrinkling often encountered with so-called locking type clamps. The vertical gravel stop prevents rooftop surfacing gravel from washing into the drainage system while permitting drainage of roof through the V-type weirs.



ROOF MEMBRANE

ADJUSTABLE EXTENSION DECK FLANGE (SUFFIX –E)
Adjustable extension is placed on the structural deck level to accommodate various thicknesses of insulation, thereby avoiding the necessity of tapering or feathering the insulation layer down to the fixed body flange level of the drain causing a loss of insulation value at the drain location. **MIFAB accomplishes the adjustment by installing a deck flange onto the roof deck and supporting the roof drain body flush or slightly below the membrane level (above the insulation) utilizing the HS-3 hardware set. A Deck clamp (suffix -U) is secured beneath the deck on the same hardware to ensure a rigid installation.**

R1200-EU (ILLUSTRATED)

BODY
This basic component made of cast gray iron of commercial drainage fitting quality features a wide top entrance and support flange with large contoured deep sump for optimum flow of water into the roof drainage system.

UNDERDECK CLAMP (SUFFIX –U)
Serves to unite roof drain and roof deck in a common bond through a vise-like compression principle that assures a positive permanent installation. The deck is sandwiched between the drain flange, or sump receiver and the underdeck clamp to preclude membrane or flashing rupture that could occur if the underdeck clamp is not utilized.

HARDWARE SET (HS-3)

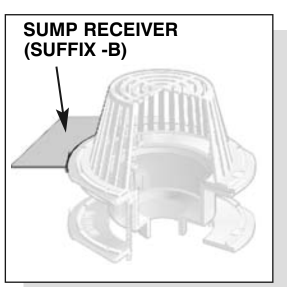
MIFAB, Inc., 1321 West 119th Street, Chicago, Illinois 60643-5109, USA **Toll Free 1-800-465-2736, Fax 773-341-3049**

MIFAB Roof Drain Selection Guide (Cont'd)

Roof drains and accessories combine to form the upstream or entrance terminals of the roof drainage system and as such play a key role in the success or failure of the system. Sizing and placement of roof drains are thoroughly covered in the next section of this catalog. However, prior to sizing and placement of drains, there are certain basic roof design factors that must be considered when selecting and specifying the proper roof drains and accessories for the job. Even though all roofs serve the same basic purpose of protecting the building and its contents from the elements, their design, composition, construction and drainage requirements do vary. Accordingly, when the specifications for the roof drains and accessories are developed, it is of vital importance that all design factors of the roof be addressed and reflected in the products specified to ensure a trouble free, successful installation. Also, insistence upon compliance with the specifications is essential, for departure therefrom could result in a substandard roof drain installation potentially doomed to ultimate failure. Basic roof design factors for consideration with recommended drainage products follow.

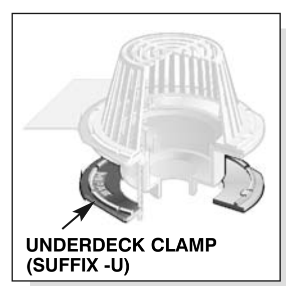
ROOF DECKS
ROOF DRAIN SUPPORT SUMP RECEIVERS

Roof decks, owing to the broad range of types and materials of construction, provide perhaps the greatest challenge to the specifier in his quest for the proper method of roof drain support for installation in a given deck. Unless the drain is being installed in a poured concrete deck with drain in place completely surrounded and supported by the deck it will be necessary to provide a deck opening in which to set the drain. It is when such openings are required that drain support becomes the foremost consideration. Even though minimum deck openings are recommended in this catalog for each drain and maximum openings are stated based on the drain's outside sump diameter, maintenance of the actual opening size within the range cannot always be assured. Therefore, a sump receiver, sometimes called drain receiver should be specified with the drain to compensate for deck opening irregularities and provide proper support for the drain. The sump receiver is simply a thin steel ring with a wide, flat flange and depressed center opening into which the roof drain body flange fits, supported by the lip of the opening. In addition to easing the deck opening tolerance requirements, the sump receiver helps to distribute the weight of the drain over a broader surface of the deck. **By placing the top of the drain flange at deck level where it should be, the sump receiver helps to avoid the dam-like effect created when the drain flange rests on top of the deck opening. Specify Suffix –B**



ROOF DECKS
ROOF DRAIN SECURING UNDERDECK CLAMPS

Proper roof drain support having been resolved through employment of the sump receiver, it becomes necessary to consider a practical method of securing the drain to the deck. If the drain is not in a "poured-in-place," thus secured, installation of an auxiliary securing means must be provided. The most effective and positive means available in response to this requirement is the underdeck clamp (suffix -U). With the drain in place and the sump receiver on top of the deck, the underdeck clamp of circular configuration, surrounding the drain and connected piping, is brought to bear against the bottom of the deck and drawn tightly in place with hardware provided. This in effect sandwiches the deck into a positive union with the drain. Thus secured into place, the roof drain becomes an integral component of the deck with assurance of installation stability and optimum performance in its role as entrance terminal of the roof drainage system. **Specify Suffix –U**



ROOF DRAINS

MIFAB Roof Drain Selection Guide (Cont'd)

ROOF DECKS
EXPANSION AND CONTRACTION EXPANSION JOINTS

Expansion and contraction, primarily caused by alternating hot and cold environmental conditions, are of particular concern with roof decks and topping materials. Accordingly, these opposing reactions are compensated for in the roof structure by strategically located expansion joints which yield to maintain integrity of the roofing system. Equally important in the preservation of integrity of the roofing system is the roof drain's connection to the drainage piping system. This must permit the drain, an integral component of the roof, to move with the roof during the expansion and contraction process without rupture of either the connection or the watertight bond of drain to roof. In response to this requirement, horizontal offsets in leader piping immediately below the drain connection, which provide a swing joint effect, are employed as are in some cases a side outlet. When bottom outlet roof drains are selected, flexible expansion joints should be used to compensate for expansion and contraction of the roof if the leader cannot be horizontally offset. **Specify Series R1900 Vertical Expansion Joints.**

ROOF DRAINS
APPLIED INSULATION ROOF DRAINS WITH ADJUSTABLE EXTENSION (DECK FLANGE)

The insulation layer, which is normally applied over the structural deck, merits consideration in the selection and specification of the roof drains. A common practice has been to feather or taper the insulation layer down to meet the drain top at the structural deck level. This creates a sump surrounding the drain into which roof topping materials are brought for bonding with the drain flange by means of the flashing clamp. Such sumps, or roof depressions at the drains, even though favored by some designers for their positive drainage aspects, have a downside as receptacles for debris with adverse effects to drainage and potential premature failure of the drain-roof bond. To avoid these potential problems, an adjustable extension is placed on the structural deck level to accommodate various thicknesses of insulation. This avoids the necessity of tapering or feathering the insulation layer down to the fixed body flange level of the drain causing a loss of insulation value at the drain location. MIFAB accomplishes the adjustment by installing a deck flange and supporting the roof drain body flush or slightly below the membrane level utilizing the HS-3 hardware set.
Specify Suffix –E.


R1200-EU (ILLUSTRATED)

PARAPETS
ROOF PERIMETER PROJECTIONS DRAINAGE

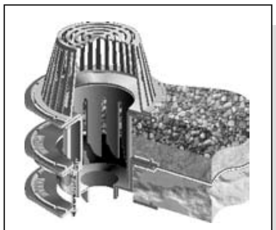
Parapets, normally building outer wall projections above roof elevation, serve important functions in building structure and architectural aesthetics. Parapets also act as barriers against water being swept off the roof during storms, a potentially hazardous condition to passersby and to the building walls themselves. However as an adjunct to the primary roof drainage system, drainage through the parapets at their roof level base or at a predetermined overflow elevation through proper drains or scuppers is recommended, for parapet base-roof level drainage. **Specify Series R1300 or R1320 and for overflow drainage specify Series R1940.**

ROOF DECKS (IRMA)
INSULATED MEMBRANE ROOF DRAINS WITH EXTENSION BALLAST GUARD

The increased popularity of insulated roof membrane assembly (IRMA) type roof construction, sometimes referred to as inverted roof construction (because the membrane is under the insulation layer) has led to the development of roof drains equipped with ballast guards. The primary object of insulating the membrane is to protect it from damaging weather conditions thereby prolonging its integrity. In the insulated roof membrane assembly, the waterproof membrane is applied directly to the structural deck surface. Then specially designed insulation planks with drainage grooves are set in place on top of the membrane. Above this, a percolation layer of aggregate gravel is applied to secure the insulation, while permitting efficient

MIFAB Roof Drain Selection Guide (Cont'd)

drainage away from the surface. With this arrangement of layers, rainfall quickly percolates through the gravel to the surface of the insulation layer from where over 90 percent gravitates to the roof drain and the balance finds its way between the insulation planks via the grooves to the roof drain. Thus with the bulk of the water arriving at the drain well above waterproof membrane elevation it is desirable to provide a ballast guard on the drain above structural deck level to screen out the undersized aggregate gravel that is carried through the gravel layer with the flowing water. Roof drains equipped with ballast guards are ideally suited for this application and should be specified for installation in all insulated roof membrane assembly type roofs. There are basically two schools of thought as to the proper location of the dome on ballast guard equipped roof drains. One suggests it be in its normal position assembled to the flashing clamp at structural deck level with the ballast guard surrounding the dome making for a dome recessed drain assembly. The other option is to place the dome and its retaining ring on top of the ballast guard at the surface of the aggregate gravel layer The decision as to which type to specify remains with the engineer, as either type will function satisfactorily for the purpose intended.


R1200-HC (ILLUSTRATED)

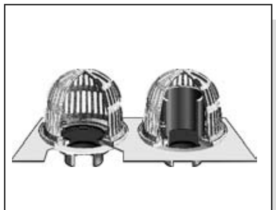
ROOF DECKS
ROOF DRAINS WITH WATER DAM

Sometimes, roofs are designed to contain a predetermined amount, thus depth, of water at all times for various reasons. Roof drains for installation in such roofs are equipped with a watertight open top collar either internal or external of the dome, with its flood level at the prescribed elevation above deck to serve as a dam to retain and maintain the desired amount of water on the roof. Excess water, treated for drain sizing purposes as rainfall, floods over the dam and is discharged into the roof drainage system in the normal manner. Specify suffix -R or -W.


R1200-R (ILLUSTRATED)

ROOF DECKS
OVERFLOW DRAINAGE

Most codes require that an overflow system be installed in the event of a blockage or surcharge of the main storm drain system. This may be accomplished by installation of scupper drains (R1300) with downspout nozzles (R1940). Another method to meet the code requirement is install a completely separate with external water dams (R1200-R) or internal standpipes (R1200-W). MIFAB has also developed a combination primary and secondary roof drain in one unit requiring a single deck opening. Specify R1150 Series or R1270 Series.


R1150 (ILLUSTRATED)

ROOF DECKS
GUTTER AND BALCONY DRAINAGE
GUTTER DRAINS

Drainage requirements for gutter and small roof areas, such as balconies and the like, are handled by small compact roof drains referred to as gutter drains. Such drains, owing to their compact size, can readily be installed in confined locations which otherwise may not be properly drained. Specify Series R1400 through R1420.

MIFAB Rainfall Considerations for Roof Drains

Flat roof drainage is accomplished through a system of roof drains, vertical leaders, and horizontal storm drains sized and located in accordance with established criteria in conformance with local plumbing and building codes. Therefore, when considering the design of a roof drainage system, it is recommended that local code authorities be consulted regarding the rainfall rate acceptable in their jurisdiction for design purposes. National rainfall rate information is provided in the chart below, listing rainfall rates in inches per hour for selected cities. On the next page, is an isopluvial (equal or similar rainfall line) map based on data for a storm of one hour duration and a 100 year return period from the National Weather Service, National Oceanic and Atmospheric Administration, Washington, D.C. When the rainfall rate for the locale of the project has been resolved, sizing of the roof drains, leaders and horizontal drainage piping can proceed.

Rainfall Rates for Selected Cities (inches per hour)

Based on a storm of one hour duration and a 100 year return period.
Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

ALABAMA	
Birmingham	3.8
Huntsville	3.6
Mobile	4.6
Montgomery	4.2
ALASKA	
Fairbanks	1.0
Juneau	0.6
ARIZONA	
Flagstaff	2.4
Nogales	3.1
Phoenix	2.5
Yuma	1.6
ARKANSAS	
Fort Smith	3.6
Little Rock.	3.7
Texarkana	3.8
CALIFORNIA	
Barstow	1.4
Crescent City	1.5
Fresno	1.1
Los Angeles	2.1
Needles	1.6
Sacramento	1.6
San Diego	1.3
San Francisco	1.5
COLORADO	
Denver	2.4
Durango	1.8
Grand Junction	1.7
Pueblo	2.5
CONNECTICUT	
Hartford	2.7
New Haven	2.8
DELAWARE	
Georgetown	3.0
Wilmington	3.1
DISTRICT OF COLUMBIA	
Washington	3.2
FLORIDA	
Jacksonville	4.3
Key West.	4.3
Miami	4.7
Pensacola	4.6
Tampa	4.5
GEORGIA	
Atlanta	3.7
Macon	3.9
Savannah	4.3
Thomasville	4.3
HAWAII	
Hilo	6.2
Honolulu	3.0
IDAHO	
Boise	0.9
Pocatello	1.2
ILLINOIS	
Cairo	3.3
Chicago	3.0
Peoria	3.1
Springfield	3.3
INDIANA	
Evansville	3.2
Fort Wayne	2.9
Indianapolis	3.1
South Bend	3.0
Terre Haute	3.2
IOWA	
Burlington	3.3
Davenport	3.3
Des Moines	3.5
Dubuque	3.3
Sioux City	3.6
KANSAS	
Atwood	3.3
Dodge City	3.4
Topeka	3.7
Wichita	3.7
KENTUCKY	
Ashland	3.0
Bowling Green	3.2
Lexington	3.1
Louisville	3.2
Middlesboro	2.8
Paducah	3.3
LOUISIANA	
Baton Rouge	4.8
Lake Charles	4.7
New Orleans	4.8
Shreveport	3.9
MAINE	
Bangor	2.2
Caribou	2.0
Portland	2.4
MARYLAND	
Baltimore	3.2
Hagerstown	2.8
Salisbury	3.1
MASSACHUSETTS	
Boston	2.5
New Bedford	2.6
Pittsfield	2.8
Springfield	2.7
MICHIGAN	
Alpena	2.5
Detroit	2.8
Escabana	2.4
Grand Rapids	2.8
Lansing	2.8
Marquette	2.4
Sault Ste. Marie	2.2
MISSISSIPPI	
Biloxi	4.7
Columbus	3.9
Jackson	4.0
Natchez	4.4
MISSOURI	
Columbia	3.3
Kansas City	3.6
St. Louis	3.3
Springfield	3.4
MONTANA	
Billings	1.9
Havre	1.6
Helena	1.5
Missoula	1.3
NEBRASKA	
Grand Island	3.5
Omaha	3.8
Sidney	3.2
Valentine	3.2
NEVADA	
Carson City	1.1
Elko	1.0
Las Vegas	1.5
NEW HAMPSHIRE	
Berlin	2.5
Claremont	2.5
Portsmouth	2.4
NEW JERSEY	
Atlantic City	3.0
Newark	3.1
Trenton	3.1
NEW MEXICO	
Albuquerque	2.0
Hobbs	3.0
Las Cruces	2.0
Santa Fe	2.0
NEW YORK	
Albany	2.6
Binghamton	2.3
Buffalo	
2.3New York	3.0
Syracuse	2.3
Watertown	2.2
NORTH CAROLINA	
Asheville,	4.1
Charlotte	3.7
Greensboro	3.5
Raleigh	3.7
Wilmington	4.2
NORTH DAKOTA	
Bismarck	2.8
Fargo	3.2
Grand Forks	3.0
Williston	2.6
OHIO	
Cincinnati	3.0
Cleveland	2.8
Columbus	2.8
Toledo	2.8
Youngstown	2.7
Zanesville	2.8
OKLAHOMA	
Oklahoma City	3.8
Tulsa	3.8
OREGON	
Medford	1.4
Pendleton	1.0
Portland	1.3
PENNSYLVANIA	
Erie	2.6
Harrisburg	2.8
Philadelphia	3.1
Pittsburgh	2.6
Scranton	2.7
Williamsport	2.6
RHODE ISLAND	
Providence	2.6
SOUTH CAROLINA	
Charleston	4.3
Columbia	4.0
Greenville	4.2
SOUTH DAKOTA	
Aberdeen	3.3
Pierre	3.2
Rapid-City	2.9
Sioux Falls	3.6
TENNESSEE	
Chattanooga	3.5
Knoxville	3.2
Memphis	3.7
Nashville	3.3
TEXAS	
Abilene	3.6
Amarillo	3.5
Brownsville	4.5
Corpus Christi	4.5
Dallas	4.0
El Paso	2.4
Houston	4.6
Lubbock	3.3
Odessa	3.2
San Antonio	4.2
Tyler	3.9
UTAH	
Cedar City	1.6
Salt Lake City	1.3
VERMONT	
Brattleboro	2.5
Burlington	2.2
VIRGINIA	
Bristol	2.7
Charlottesville	2.9
Norfolk	3.4
Richmond	3.3
Roanoke	3.2
WASHINGTON	
Bellingham	1.1
Seattle	1.1
Spokane	1.0
Yakima	1.0
WEST VIRGINIA	
Charleston	2.8
Elkins	2.7
Parkersburg	2.8
WISCONSIN	
Ashland	2.5
Eau Claire	3.0
Green Bay	2.5
La Crosse	3.1
Madison	3.0
Milwaukee	3.0
WYOMING	
Casper	1.9
Cheyenne	2.2
Rock Springs	1.3
Sheridan	1.7
Yellowstone Park	1.4

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Sizing and Placement of MIFAB Roof Drains

As a first step in the sizing procedure it will be necessary to determine the quantity and placement of the drains required for the roof. Even though there are a number of opinions regarding roof areas that can be effectively drained by one drain, it is recognized that for minimized ponding with adequate drainage, two roof drains are required for roof areas of 10,000 square feet or less, and at least one drain is required per 10,000 square feet of area for larger roofs. Individual judgement will be necessary when considering quantity and placement of drains on roofs where shape and size of sections may require departure from the 10,000 square feet per drain recommendation. In the replacement of drains, uniform distribution is desirable for proper roof drainage. Locating drains within 50 feet of the roof perimeter and no more than 100 feet apart is acceptable practice. Also, careful consideration of roof structural members, dividers, expansion joints, and other projections including rooftop equipment is essential in planning the roof drainage system for adequate drainage of each area of the roof. Consultation with the architect and structural engineer regarding roof details is recommended.

RAINFALL CONVERSION:
INCHES PER HOUR TO GPM

For sizing purposes, rainfall-which is expressed in inches per hour, (in the following calculation) - is converted to gallons per minute per square foot of roof area. A one (1) inch per hour rainfall converts to .0104 GPM per square foot. For any given rainfall, multiply the inches per hour by .0104 to arrive at the GPM per square foot of roof area. Then multiply that figure by the square feet of roof area to be drained to arrive at the total gallons per minute to be handled by the drainage system.

For example: consider a 4-inch per hour rainfall on a 10,000 square foot roof:

0.0104x4x 10,000 = 4l6 GPM

Roof Drain Sizing: Other Considerations

• OVERFLOW DRAINAGE

Overflow scuppers and drains, as essential components of the roof drainage system, are employed to prevent potentially damaging overloading of roof structures. They must be installed in conformance with local codes. Generally, scuppers are installed in adjacent parapet walls no more than 5 inches above the low point of the roof at a ratio of at least one scupper per 20,000 sq. ft. of roof area. Overflow drains of the same size as the roof drains having above roof inlet elevation as specified by code, connected to drain lines independent from the roof drains, may be installed in lieu of scuppers.

• VERTICAL WALLS

Finally, vertical walls that project above and permit storm water to drain on the roof area to be drained must be considered when planning the roof drainage system. An acceptable rule to follow in sizing roof drains, leaders, and horizontal drainage piping is to add one half of the area of any vertical wall that diverts rainwater to the roof to the projected area of that roof. By multiplying the area thus obtained by the GPM/sq. ft. conversion of inches per hour rainfall, the new total GPM discharge requirement is determined for the roof.

MIFAB Roof Drain Selection Guide (Cont'd)

ROOF DECKS
VENT STACKS
VENT CAPS

Even though vent stack and stack vent terminals extending above roof deck level are components of the sanitary drainage system of the building, they are included for consideration in this section because of roof penetration and roof level maintenance requirements. Vents maintain the air-hydraulic balance of the building's sanitary drainage system and in serving that purpose must be maintained open for positive circulation; i.e., the escape of gas and intake of fresh air. Because of the vent terminals exposure to the elements above the roof, it is vulnerable to fouling by various means-leaves, twigs, bird nests, etc., that somehow have a tendency to become lodged therein. To preclude this undesirable condition protective vent caps that permit free circulation of air while protecting the vent terminal against fouling are recommended.

Specify Series R1940.

ROOF DECKS
VANDALISM
VANDAL PROOFING

Because of their "out of building" rooftop location, the exposed components of the roof drainage system, particularly roof drain domes and grates, are subject to vandalism. This is especially true on roofs having easy access. Domes are occasionally removed and at times flung over the roof edge to the detriment of any unfortunate person below. Also, drains congested with debris are rendered useless. To avoid these unlawful damaging circumstances, vandal proofing of roof drain domes and grates is recommended. Vandal proofing is accomplished by securing these components to their fixed mating parts with vandal proof screws or bolts which require special tools, available only to authorized maintenance personnel, for application and removal.

Specify Suffix -6.

Introduction Controlled Flow Roof Drainage

In the early 1960's, the pervasive industrialization of the post war boom lead to a new problem for plumbing engineers. As more industrial parks, malls, entertainment facilities, factories and warehousing were built, the load on the local storm sewer system due to extensive paved areas surrounding these buildings for parking as well as their own extensive square footage of roof created an unprecedented demand. Where rain once fell on undeveloped land, and was subsequently absorbed or abated by natural drainage, it now fell on pavement, where no absorption factor meant the total rainfall for vast new areas now had to be conducted by municipal storm sewer systems. To avoid overtaxing the local systems, engineers began to be design flat roofs with controlled flow roof drains. Instead of just getting rid of the rain as fast as it fell, the idea was conceived of using the roof itself as a reservoir from which water could be drained off gradually after a storm abated, thus sparing the storm sewer from being overwhelmed. Roofs could then be built with 6" parapets to not only store the rainwater, but also act as wind break against miniature waves that might be caused on the reservoir in high winds with consequent spillage. On buildings with greater than 6" parapets, scupper drains had to be installed at the 5" level to guard against overloading should the drain system fail.

The Heart of the Controlled Flow Roof Drainage System, The Accuflow Weir

In order to use the roof as a reservoir,it was necessary to design a system where the rate of flow was easily determined for any possible rainfall conditions. The problem is that the rate of flow naturally varies exponentially with the depth of stored water on the roof (a.k.a. head pressure). This made the calculations necessary to design a roof top rain storage system very difficult. **The answer was to design a flow control weir with a parabolic opening which would make the flow off the roof linear instead of exponential.** This meant that once a constant linear flow rate was decided, a weir was designed to admit water to the system at only this fixed rate. The MIFAB system uses a fixed rate of 5 U.S. G.P.M. per inch of water.

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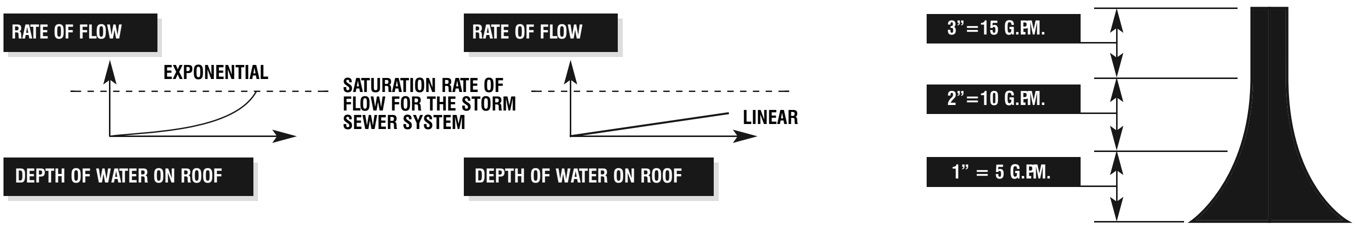
ACCUFLOW CONTROLLED FLOW ROOF DRAIN SYSTEM

INAN UNREGULATED SYSTEM, FLOW IS EXPONENTIALLY PROPORTIONAL TO DEPTH OF RAINWATER ON THE ROOF, AND QUICKLY REACHES THE SATURATION POINT OF THE SYSTEM.

IN AN CONTROLLED SYSTEM, FLOW IS LINEARLY PROPORTIONAL TO DEPTH OF RAINWATER ON THE ROOF AND GRADUALLY DRAINS WITHOUT OVERLOADING THE STORM SEWER SYSTEM.

THE SPECIALLY DESIGNED PARABOLIC OPENING OF THE ACCUTROL WEIR CREATES A CONSTANT FLOW OF RAINWATER THAT INCREASES PROPORTIONATELY AT A RATE OF 5 GPM PER INCH OF STANDING WATER UP TO 30GPM ON THE R1200 SERIES AND 15 GPM ON THE R1100 SERIES.



Controlled Flow Roof Drainage: Design Considerations.
Three main considerations must guide the design of a controlled flow roof drainage system:

1. It must drain quickly enough to avoid the weight of water building to the point of being an architectural hazard.
2. It must drain slowly enough to prevent overloading the sewage system with the consequent risk of flooding or pollution or both.
3. It must drain down in a reasonable time to minimize the risk of freezing in low temperatures.

To meet these requirements, regional rainfall values had to be carefully considered. From these values, it is possible to calculate the number of gallons per minute (GPM) need to be drained to ensure the buildup in the worst conditions did not exceed a depth of three inches. The consideration of the worst conditions had to be determined from government statistics. The figures used were compiled by the Meteorological Branch of the Department of Transport. The information was combined to produce values that would predict the worst conditions that one could expect over a period of time, in this case ten, twenty-five and fifty years. Hence the expression, "ten year rain" or "fifty year rain".

As well, there are also the local building codes, which specify drain down time (in hours) and maximum head of water on the roof in inches. The maximum drain down time has been determined to be 30 hours to eliminate the possibility of freezing. A constant rate of flow makes it possible, with the use of our Area Selection Table, to quickly determine the number of drains needed for any size of roof where this value is known.

Controlled Flow Roof Drainage: Factors that can effect Roof Drain Sizing & Position.
Where a roof area is surrounded by vertical walls, some consideration must be given to the volume of rainwater that these walls might add to the total volume to be drained under "driving rain" conditions:

1. One wall: Add 50% of wall area
2. Two walls: Add 35% of wall area
3. Two walls opposite of differing heights: Add 50% of the difference in wall area of that part which extends above the lower wall.
4. Walls on three sides: Add 50% of the inner wall area above the top of the lowest wall(s).

Other Factors to consider:

5. Drains should be located with preference to the downwind side of the roof. In a storm, it is not uncommon for the rainwater level to differ significantly from one side to another due to the effects of high winds.
6. Drains should not be located at columns or other high spots.
7. Rooftop mechanical equipment shall be installed with proper allowances for the "ponding" a control flow roof drain system will create.
8. Parapets should be high enough to prevent spillage or worse, for in winter there is the danger of ice or snow blowing off the road that must be considered.

Controlled Flow Roof Drainage: Sizing Procedure.

A Determine the roof area(s) (individual areas when the roof is divided by expansion joints, parapet walls, control joints, etc.) to be drained making the allowances for any of the factors (above) which may effect the total square footage of the roof.

B Follow the location and placement guidelines for conventional roof drains as found on the next pages (viii & ix), allowing no more than 50 ft. from an edge, no more than 100 ft. apart, and a maximum square footage of 10,000 per drain, etc.

C Calculate the number of weirs. Divide the total square footage by the area factor (from chart below) for the location of the roof. If the number of weirs is greater than the number of drains from **step B**, add 2-slot weirs to roof drains as necessary, starting with the drains closest to the downwind edges of the roof. If the number of weirs is fractional, round up. If the number of weirs is less than the number of drains, every drain should still be equipped with a one slot weir.

D Based on the slope and area to be drained by each weir, the maximum flow from all the drains on the roof (see chart below) can be added together to determine vertical leader sizing and horizontal storm sewer requirements.

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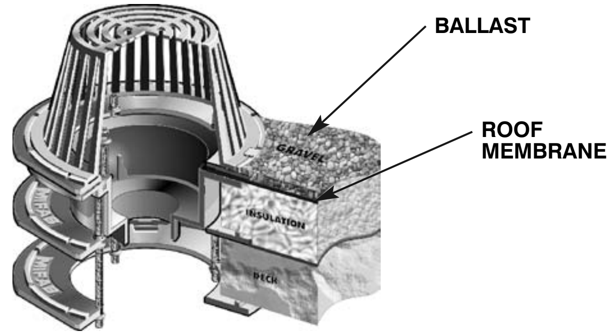
MIFAB Typical Roof Drain Installations

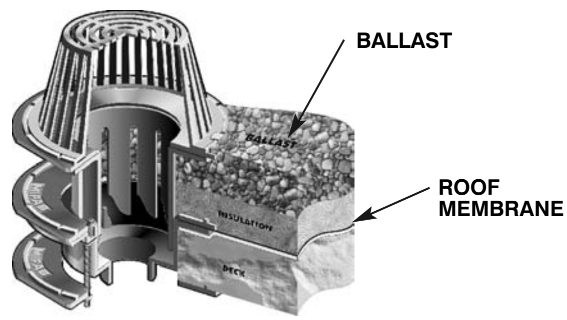
R1200-EU

Roof Drain with adjustable deck flange for varying thicknesses of insulation. Type of roof illustrated would have the waterproofing membrane above the insulation and below the ballast. (See Page R13)



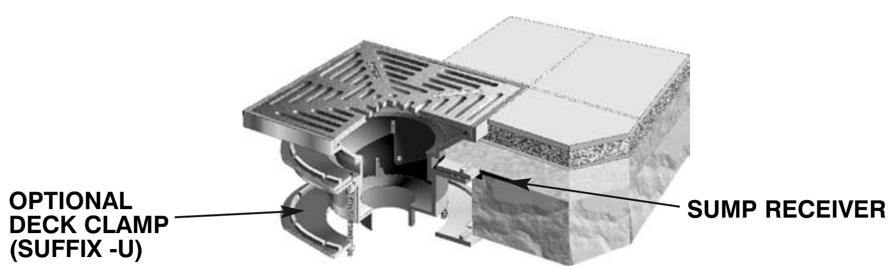
R1200-HC

Roof Drain with adjustable cast iron iron ballast and insulation guard. Used with Insulated Roof Membrane Assembly (IRMA) type roofs. An adjustable slotted extension serves to retain ballast on a flat roof **and slots are sized to pass fines**. (See Page R16)



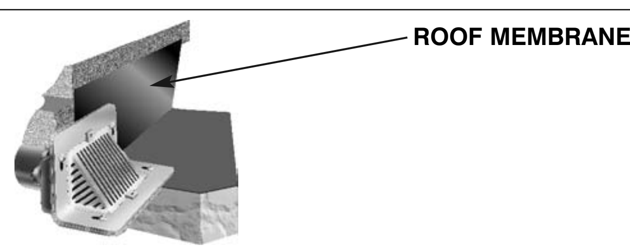
R1200-P-BU

Promenade Roof Drain with sump receiver and adjustable collar to easily position grate to roof surface elevation. Type of roof illustrated shows pedestrian tile roof deck above an insulated precast concrete slab. (See Page R6 or R18)



R1300 or R1320

Scupper Drain with flat or angle grate and flashing clamp grate frame. For installation at the base of parapets. Specify (–1) for Nickel Bronze or (-50) for cast iron. Available with 45° or 90° outlet. (See Page R35-38)



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QUICK GUIDE TO GENERAL ROOF DRAIN SIZING

CHARTS A and B
As an aid to the sizing and placement of MIFAB roof drains, please refer to Charts A and B, which give leader and horizontal storm drain capacities at various slopes, with capacities in GPM and maximum projected roof areas in square feet in each case. It will be noted that a 6-inch leader, thus 6-inch drain, will be indicated by the preceding example. The horizontal storm drain required, depending on slope, would be 6 or 8 inch. However, remembering that two drains are recommended for areas of 10,000 square feet or less, it would be advisable to select smaller drains with total capacity of 416 GPM or more. The maximum projected roof areas in Charts A and B are based on the flow capacity of each pipe size shown. The total of the projected flows from the vertical leaders will determine the size and slope of the horizontal storm sewer required in chart B.

CHART A:
Vertical leader capacity in GPM with maximum serviceable roof area in square feet based on various anticipated hourly rainfall rates.

VERTICAL LEADER SIZE	CAPACITY (GPM)	ROOF AREA SQUARE FEET	ROOF AREA SQUARE FEET	ROOF AREA SQUARE FEET	ROOF AREA SQUARE FEET	ROOF AREA SQUARE FEET	ROOF AREA SQUARE FEET
RAINFALL INCHES PER HOUR →		1	2	3	4	5	6
2	30	2880	1440	960	720	575	480
3	92	8800	4400	2930	2200	1760	1470
4	192	18400	9200	6130	4600	3680	3070
6	563	11600	27000	17995	13500	10800	9000
8	1208	116000	58000	38660	29000	23200	19315

CHART B:
Horizontal storm drain capacity in GPM for slopes given with maximum serviceable roof area in square feet based on system capacity.

	1/8 INCH PER FOOT SLOPE		1/4 INCH PER FOOT SLOPE		1/2 INCH PER FOOT SLOPE	
DRAIN PIPE SIZE (INCHES)	DRAIN CAPACITY (GPM)	MAXIMUM ROOF AREA (SQUARE FEET)	DRAIN CAPACITY (GPM)	MAXIMUM ROOF AREA (SQUARE FEET)	DRAIN CAPACITY (GPM)	MAXIMUM ROOF AREA (SQUARE FEET)
3	34	822	48	1160	69	1644
4	78	1880	110	2650	157	3760
5	139	3340	197	4720	278	6680
6	223	5350	315	7550	446	10700
8	479	11500	679	16300	958	23000
10	863	20700	1217	29200	1725	44100
12	1388	33300	1958	47000	2775	66600
15	2479	59500	3500	84000	4958	81900

ROOF DRAIN SIZING - EXAMPLE

A warehouse is being built in a geographical area where the maximum hourly rainfall (from rainfall map) is 2.8 inches per hour. The building will be 200' x 400' and have a flat roof with no appreciable vertical surface.

CALCULATIONS:

- Total area to be drained (200 x 400) **80,000 Sq. ft.**
- Number of drains required **8**
  (From sizing rule, one drain per 10,000 sq. Ft)
- Rainfall conversion from in. per hour GPM **2330**
  (0.0104 x 2.8 x 80,000)
- Expected flow from drain **292**
  (GPM + number of drains) (2330 ÷ 8)
- Size of leader (from Chart A) **6 inch vertical**
- Size of horizontal storm sewers
  (from Chart B 1/4/ foot slope, combined
  flow of vertical leaders **8,10,12,15, inches**

Roof Drainage System Layout indicated by the sizing example.