**HYDRANT OR FIRE WATER SYSTEM**

In fire hydrant system, large quantity of water is pumped out from the water tank with such a force and speed so that it can reach to the fire affected area. The capacity of these water tanks depends on the height and floor area of building like residential, commercial or industrial, and nature of hazard as well.

 Such type of safety measure and water supply equipment is an essential requirement in some buildings where the chances of getting fire is higher. When the components are combined together with the source of water, it becomes a weapon to fight with the fire. The performance of a hydrant system completely depends on the quality and efficiency of the components used to design the system.

**Advantages of Fire Hydrant System**

* Fire hydrant system is an effective means of extinguishing the fire in the building that can result to heavy devastation.
* The system has the ability to fight the fire from the long distance due to its large piping system.
* As it covers each point of the building, so it has more penetration capability as compared to other fire protection systems. In simply words, high accessibility is its main advantage.
* Hydrant valves are placed at different places throughout the building, leaving no corner in the premises unprotected.
* Disadavntages of Fire Hydrant System:
* It’s function of activation is manually
* Fire hydrat system flow is very strong so that two men neededto hold the hose.
* It may damage instruments or machines.
* It is very popular but not sufficient.
* It is one of the oldest but the most effective and common firefighting solution in industry, a well-designed and well placed out hydrant system forms the backbone of entire fire protection system. It includes heavy duty overhead and underground pipe lines with accessories.External hydrant valves are provided at every strategic locations of the building for effective use at the time of fire case. Fire hydrant is a pipe that allows water to flow from a water main with the control of a valve in order to put out a fire. It help to control fire outage at every stage with most corrective and effective solution.
* Fire hydrant system is designed to fight with fire of huge sizes, in all classes of risks. It is designed to be in operation even if a part of the affected structure collapses.
* Pressure to be applied depend up on various factors – sze and location of the attached water main- generally for powerful flow of water 350kPa

Dry riser and wet riser are the two kinds of fire hydrants. The wet riser fire hydrant holds a constant water supply and while dry riser fire hydrant needs to have a valve to release to let water in. Mostly dry riser hydrant is being used in hilly area where temperature is very low and water freezes in pipe lines due to low temperatures.

***Indian Standard*  
EXTERNAL HYDRANT SYSTEMS—PROVISION AND MAINTENANCE—CODE OF PRACTICE**

IS 13039: 1991

**SPRINKLING SYSTEM**

The **sprinkler pipe size** from the water supply source to a **sprinkler** shall be not less than 3/4 of an inch (20 mm) in diameter. Threaded adapter fittings at the point where **sprinklers** are attached to the **piping** shall be not less than 1/2 of an inch (15 mm) in diameter.

150 **psi** to 175 **psi** is common for fire sprinkler systems, and they are tested at 200 **psi** to 250 **psi**. Depends on the system

At different pressures, the sprinkler head and nozzle will consume different amounts of water. For example, at 35 pounds per square inch (PSI) the **5000** Series Rotor using the 3.0 nozzle will use **3.11** gallons per minute (GPM). If your home's water capacity was 10 GPM, you could place **3 heads** per zone.

TYPES OF FIRE SPRINKLER SYSTEMS

* Wet Pipe System. Wet pipe sprinkler systems—or traditional fire sprinklers—are the most common across residential and commercial buildings. ...
* **Dry** Pipe System. As opposed to wet pipe systems, **dry** pipe systems do not store **water** in their pipes. ...
* Pre-Action System. ...
* Deluge System. ...

are **four types** of fire **sprinkler systems**. Each of these **systems** helps prevent flames from spreading and reduces fire damage.

NFPA 13- Pipe schedule method for fire fighting sprinkling system

## Dry Riser Systems

Dry risers are a requirement of building regulations in occupied buildings over 18m tall. They can also be found in environments with limited access or with compartmentation issues such as multi-level basements or hospital corridors.

As opposed to wet pipe systems, dry pipe systems do not store water in their pipes. Instead, they are filled with pressurized air or nitrogen, which is released if a fire activates the valves in the sprinkler head. The pipes then fill with water and discharge it over the smoke or flames. While this system is more complex and costly than a wet pipe system, it is the most appropriate for cold climates where there is a high risk of frozen pipes halting an emergency fire response.

The system consists of a network of pipes that allow water to be delivered to the upper floors of a building in the event of fire. It comprises of an inlet at ground level that can be accessed by the fire brigade to pump water up into the building to outlets situated on the landings of each floor. This allows a firefighter to attach their hose to any one of these outlets and source pressurised water to set about extinguishing the fire.

The advantage of a riser system is that it is a fixed distribution system within the building and requires none of the fire service’s resources or equipment. It also helps, by design, to maintain the compartmentation of the building.

The three elements of the riser system, namely the external inlet, the pipework and the internal outlets should be designed to meet BS 5041 BS 5306, BS 9990 and Building Approval Regulations.

The external inlet which enables the connection of fire brigade water supplies is usually to be found in an external cupboard or enclosure signed “DRY RISER INLET”.  Within the enclosure is located a collecting head which has at least two BS Instantaneous male couplings. The cupboard will also contain a drain down valve that enables the dry riser to be emptied of water after the fire service operation or after testing. The enclosures need to be vandal proof, but nevertheless, provide immediate access for firefighters. Doors usually have a breakable area to allow urgent fire service connection.

The pipework of dry riser distribution systems is kept free of water and should be of galvanised steel.  The British Standards requirements for the pipe’s internal diameter is 100mm for buildings over 18 metres, which increases to 150mm in taller buildings. The pipework is usually located in fire resistant shafts or enclosures. At the top of the pipework an air valve is located which allows air in the riser to be expelled when the system is charged with water.

The internal outlets or “landing valves” are the connection points in the system that enable the fire brigade to attach and advance its hose lines throughout a building. The outlet consists of either a single or double BS instantaneous female outlet which is under the control of a gate valve.

Like the inlets, outlets are usually protected by enclosures which also have a breakable area in the door to facilitate urgent connection. Outlets are usually located in a protected lobby, stairway or cupboard. This location is usually one of the building’s fire escape staircases, enclosures or lobbies.  Often one outlet is located at roof level to allow for a “testing” outlet.

One outlet should be provided for every 900m2 of floor area on each floor other than the ground floor and must not be more than 60m apart in a horizontal direction. Furthermore, there shouldn’t be any part of the floor area that is more than 60m from an outlet as measured along the route suitable for hose lines.

The local fire brigade should be familiar with the layout, function and operation of dry risers in buildings and if any of these buildings is considered a special or specific special risk (PRM/SSRI), detailed information on the size, location and performance limits of the riser needs to be included within any risk data.

Testing and maintenance of both dry and wet risers should take place annually and is the responsibility of either the property owners or managing agents. British Standard 5306: Part 1 1976 (Revised by BS9990) recommends that the system is not only tested and serviced every twelve months but is also visually inspected every six months to guarantee that the equipment is ready for immediate use in the event of an emergency. It is also recommended that a full wet test is carried out annually, involving a wet pressure test to 150 PSI or 10 Bar.

## Wet Riser Systems

Wet pipe systems are an inexpensive, low-maintenance option appropriate for offices, schools, and commercial properties.

The wet riser system is similar in design to dry risers and can usually be found in buildings over 50m tall. Unlike the dry riser system, it is kept constantly charged with water, in order that it can provide the same level of protection against a fire in the upper reaches of taller properties as on the lower floors. The wet riser system is charged with water from a pressurised supply, which is often pumped from a storage tank.

It is necessary to have wet riser systems in buildings that extend to more than 50m as the pumping pressure required to charge the riser in these cases is higher than that which can be provided by a fire service appliance, and thus ensures an immediate supply of water to high levels.

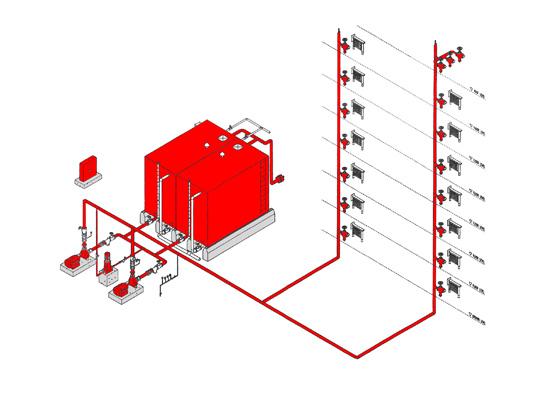
In the event of an emergency, such as a storage tank running low during long operations, it is usually possible for the fire brigade’s pumping appliances to supplement the water supply to wet risers.

A wet riser supply system should generally be able to maintain a minimum running pressure at the roof top outlet of 4 bar at a flow rate of 22.7l/s. The maximum running pressure allowed with only one outlet in operation is 5 bar.

As with dry risers, wet riser systems should be installed within fire-fighting shafts, and where necessary in protected escape stairs. Wet riser outlets should be located within protected lobbies, stairs or enclosures wherever these are available.

Wet risers should be inspected and tested regularly to guarantee that equipment is operating correctly and ready for use. Clearly any problems could have the potential to be very serious in the event of a fire. The usual causes of system failures are vandalism, theft, blockages, or by pipework or connection failure or by outlets being open.

Wet rising mains consist of vertical pipes similar to the dry rising main system with landing valves at each floor except the ground. The pipe system is connected to a permanent water supply normally a tank fed from the town mains. Duplicate automatic pumps, one duty and one standby supply this water to the pipe system.



The tanks are fitted with an automatic warning system to indicate a low water level.

At protracted incidents the wet rising main tank may need to be augmented and this can be acheived using conventional Fire appliances and additional water supplies (Hydrant, Open water etc)

Wet rising mains are designed to supply 1500 litres per minute for 45 minutes as a minimum.

Due to the height of the building and the pressures used, water pressure reduction valves are fitted to the outlets at each floor. Buildings constructed prior to 2006 will have outlet pressures of 4 to 5 Bars. Changes to BS 9990 in 2006 now recommend an outlet pressure of 8 Bars, this recommendation does not affect installations installed before this date.

Dry and wet risers are now an integral part of modern high rise buildings and when properly maintained, allow fire fighters to advance up a building quickly knowing that there will be a source of appropriately pressured water onto which they can attach their hoses at all levels of the building.

**Foam pourer system**

A **foam system** allows a specific amount of **foam** to be mixed with water through the fire apparatus pump mechanisms. Anytime water is used, a **foam system** can be activated to improve water's effectiveness and help expedite firefighting capabilities

In a structure fire, water is used to remove heat from the fire by absorbing the heat in the room and cooling the available fuel. However, rather than directly contributing to the cooling of fuel below the temperature required for sustained burning, a large portion of the water hits the floor after passing through the atmosphere.

benefits of foam include:

* **Break down surface tension of water.** The chemical composition of foam helps break down water surface tension, allowing water to penetrate burning materials, and thus, making water work more efficiently.
* **Reduce the amount of water required to fight fires.** The use of foam extends the usable amount of water on the apparatus. For fire departments without mutual aid or easy access to fire hydrants, the use of foam is beneficial because it means fire fighters can use less water to put out a fire. A foam system is especially beneficial to rural and wildland fire departments, where access to a replenishing water source is not always possible.
* **Cling to burning materials.** Depending on the type of foam being used, it can stick to the surface to help slow or stop burning and improve water penetration.
* **Cool surface temperatures.** One of the key benefits of foam is its ability to cool surface temperatures, helping to reduce rekindling and improve water’s ability to extinguish flames.
* **Short-term fire barrier.** Foam can be sprayed in protect and prevention situations, to reduce the spread of wildfire and forest fire by coating areas before flames reach the region. The use of foam proactively helps to prevent flames from spreading to nearby surfaces, materials and terrain.
* **Visible from ground and air.** Foam spray can be seen on the ground and in the air, which allows departments with mutual aid to work together more effectively on larger or wildland fires.

Foam systems can be adapted to meet the needs of unique geographical areas, fire department operations and even departmental preferences. Foam systems provide versatility and improved efficiency in the battle against dangerous fires.

Foam concentrate, combined with water and compressed air forms a fire extinguishing agent that greatly reduces surface tension compared to that of plain water, enabling the solution to penetrate burning fuels much faster and more efficiently.

*A compressed air foam system’s ability to lower surface tension and cover areas quickly allows fire departments to use half of the amount of water normally required to achieve the same fire extinguishing results with just a foam system.*

Class ‘A’ foam is used for Class ‘A’ fires, which include solid combustibles such as paper, wood, cloth and some plastics. Many Class ‘A’ foams are environmentally friendly and biodegradable when used in appropriate quantities.  
  
Class ‘A’ foam typically runs at 0.3%, 0.5% or 1%. These are the most effective percentages based upon the foam manufacturer’s recommendations; any other percentages are considered running the foam too lean, or too rich, and are not effective. The different percentages are directly related to the size and type of fire at an emergency scene, as well as the equipment being used to apply the water and foam.  
  
Class ‘B’ foam is used for Class ‘B’ fires, which are fires that involve flammable liquids such as alcohol, ether, oil, gasoline or grease. Class ‘B’ fires are best extinguished by smothering or applying a blanket of Class ‘B’ foam, which is meant to float on the surface of burning fluid. When Class ‘B’ foams are sprayed with water, the foam rises to the surface to create a vapor barrier to cut off the fuel source. Class ‘B’ foams require special clean-up after a fire by state or federal authorities.  
  
Class ‘B’ foam typically runs at 1%, 3% or 6%. These are the most effective percentages based upon the foam manufacturer’s recommendations. Much like Class ‘A’ foams, the percentages are directly related to the fire size and type as well as the equipment used.

**STEAM DRENCHING SYSTEM**

Steam is still used in a small handful of applications, usually where the target fire hazard is a combustible liquid heated in an enclosure. A prime example is a thermal oil or “hot oil” system where a furnace (heated electrically or by natural gas or fuel oil) heats the thermal oil in an internal tank or coils. The thermal oil is circulated to chemical processes, plywood manufacturing, and others where direct heating by flame or electricity would be a hazard.

* The steam extinguishing or “snuffing” systems are usually actuated manually, but sometimes automatically. They require a large and constant supply of steam, usually tapped off a large steam grid. The steam supply must be large enough to continuously flood the enclosure long enough for the furnace interior and leaking oil to cool below the boiling point and autoignition temperature. Otherwise, the steam may disperse too soon and result in a reignition or explosion in the furnace. This has happened.
* Steam snuffs fire by displacing oxygen to a low enough concentration that it does not support combustion, much the same way as carbon dioxide (CO2). The steam water vapor has only a minor affect on interfering with the chemistry of combustion since the water vapor has by definition already absorbed as much heat as it can.
* Overall, this is very old technology. They cannot be used in large enclosures or spaces that may be occupied by people due to the oxygen displacement and scalding risks.
* There is a newer fire protection technology known as “water mist”. These systems

**Small droplets provide temperature control and remove oxygen to fight fires**.

Like other fire protection systems, water mist systems do use water, with one key difference: smaller droplets. According to the National Fire Protection Association (NFPA), “water mist” consists of droplets with a diameter less than 1,000 microns (1 millimeter) each. That's roughly a fifth of the size of the droplets [made](https://www.orrprotection.com/mcfp/blog/what-are-water-mist-systems) by standard fire sprinkler systems.

By spraying large numbers of tiny droplets, water mist fire protection systems create a large water surface area that can more readily lower temperatures. When these tiny droplets meet hot air, they evaporate and turn to steam. Steam can absorb more heat per unit of time than larger water droplets, therefore reducing the temperature of the flames faster. Steam also displaces the oxygen in the room so that the fire is suffocated and extinguished.

Water mist fire protection [emerged](https://www.sfpe.org/page/2012_Q2_2/Issues-and-Future-Directions-for-Water-Mist-Fire-Protection-Systems.htm) as an alternative to gaseous fire extinguishing agents and became more popular after the manufacturing of Halon, a widely-used gas agent, was [banned](https://www.facilitiesnet.com/firesafety/article/Why-Halon-Fire-Suppression-Systems-Were-Banned--10300) by the U.S. Environmental Protection Agency. Since 1996, NFPA's rules for water mist systems have been available in [*NFPA 750*](https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=750)*: Standard on Water Mist Fire Protection Systems*.

**Water mist fire protection systems vary in design and purpose**

All water mist systems create fine sprays using water. Some, called "**single-fluid**" systems, use only water. Others use a hybrid of water and air or nitrogen, called "atomizing media," to create smaller droplets. These systems are classified as "**twin-fluid**" systems.

Each water mist system is designed with one or more of the following objectives:

* Extinguishing fires (leaving no burning combustibles)
* Suppressing fires (reducing the rate of heat release)
* Controlling fires (limiting the fire's size and ceiling temperatures)
* Controlling temperatures
* Protecting against exposure to fire

In turn, water mist systems have one of four applications:

* **Local-application water mist systems**, which spray directly on a specific object or hazard.
* **Occupancy protection systems**, which are installed throughout a building or a portion of a building.
* **Total compartment application water mist systems.** All nozzles (sprinkler heads) activate at the same time, providing complete protection of an enclosure or space.
* **Zoned application systems**, a variation on total compartment application systems, activate throughout a given zone or region within a given space.

Even these systems can be roughly [divided](https://www.sfpe.org/page/2012_Q2_2/Issues-and-Future-Directions-for-Water-Mist-Fire-Protection-Systems.htm) into three more types: low-pressure systems, intermediate-pressure systems, and high-pressure systems. Low-pressure systems endure pressures similar to standard fire sprinkler systems—175 PSI or less. Intermediate-pressure systems have pressures between 175 PSI and 500 PSI, while high-pressure systems exceed 500 PSI.

Finally, water-mist systems may be broken into types depending on how they're designed. For pre-engineered water mist systems, testing laboratories and manufacturers prescribe the number and type of pipes, fittings, and sprinkler heads required. On the other hand, engineered water mist systems require designers to account for flow rates, nozzle pressures, and other factors to create a specially-designed set-up suitable for the hazards of a particular environment.

**ADVANTAGES :**

In Annex A, NFPA 750 explains that water mist systems can control a variety of fires in three major fire classes: Class A (ordinary combustible), Class B (flammable liquid), and Class C (electrical fires). However, installers must again carefully consider a range of factors, including the system's goals and major fire hazards present in the space

Gas jet fires, electrical hazards, and railway tunnels may all benefit from water mist systems. They can even [protect](https://www.engr.psu.edu/ae/thesis/portfolios/2005/bwk125/Analysis%202%20Final.pdf) artwork, as they do today at the National Gallery of Art in Washington, D.C.

.The maritime industry—and cruise ships in particular—has played a leading role in the development of water mist systems. Before their adoption on land, water mist systems [protected](https://www.nfpa.org/News-and-Research/Publications-and-media/NFPA-Journal/2014/September-October-2014/Features/St-Patricks-Cathedral/The-Evolution-of-Mist) enclosed compartments on ships and, later, passenger areas on cruise ships. By reducing the amount of water required by as much as 90 percent, these systems lightened the loads ships carried, adding to the stability and fuel economy of large vessels. The technology grew in popularity at sea when, in the early 1990s, the International Maritime Organization (IMO) [required](https://www.sfpe.org/page/2012_Q2_2/Issues-and-Future-Directions-for-Water-Mist-Fire-Protection-Systems.htm) passenger ships carrying more than 36 overnight passengers to install fire sprinkler systems.

Water mist systems have fared well in the maritime industry. They can attack fires at the moment of detection, minimize water damage, clean quickly, and allow ships to recharge the system using sea water. These benefits minimize the time ships spend in port.

. In some cases, they can [replace](https://www.fireengineering.com/articles/2016/03/water-mist-systems-the-future-of-fire-protection-technology.html) clean-agent systems used to slow the spread of electrical fires; those that use agents such as nitrogen and carbon dioxide to safely and cleanly suppress fires. Water mist systems can do the same job with fewer safety signs, less employee training, and no need for specialized audiovisual notification systems. These and other factors combine to lower the comparative cost of water mist systems.

Water mist systems can also reduce costs when compared to dry chemical systems. Used to fight fires fueled by flammable liquids, dry chemical systems may prove difficult to clean and can damage electronic equipment. Water mist systems don't have either of these problems. They can cost less to maintain, test, and refill. What's more, the water they use turns to steam which doesn't cause as much damage—or require as much cleanup—as other water-based systems. This benefit makes them especially useful for buildings with electronics and valuable artifacts, such as art museums.

**DISADVANTAGES :**

* 1. While water mist systems may reduce costs when compared with dry chemical or clean agent systems, traditional fire sprinkler systems may still have a financial edge. The savings in potential damages via water mist can sometimes outweigh this drawback, but the initial costs remain high. A construction management study of the Memorial Hospital Miramar in Miramar, Florida found that water mist systems [cost](https://www.engr.psu.edu/ae/thesis/portfolios/2005/bwk125/Analysis%202%20Final.pdf) over ten percent more than an equivalent preaction system to install—and preaction systems are of course more complex and expensive than standard wet sprinkler systems.
  2. Like other fire protection systems, water mist systems require regular inspection, testing, and maintenance (ITM). However, taking care of these systems may cost more than some purchasers anticipate. Troubles with water storage tanks and releasing valves have unexpectedly [increased](https://www.sfpe.org/page/2012_Q2_2/Issues-and-Future-Directions-for-Water-Mist-Fire-Protection-Systems.htm) costs for some users. Facility managers also may not have access to local ITM contractors versed specifically in the care of water mist systems. Because maintenance needs vary from one manufacturer's product to another, facilities managers may have fewer contractors (and fewer prices) to choose from. The Memorial Hospital Miramar study found that the costs of routine maintenance reached $1,000 to $2,000 each year—roughly double that of a pre-action system.
  3. Another drawback of these systems is that they are not as useful in open areas. In open spaces, water droplets can't turn to steam as easily. As a result, they can't absorb or displace heat as quickly as they need to. However, some kinds of local application water mist systems can be used in outdoor or open area applications ***if*** the system is being used for direct application on a hazard.
  4. As such, NFPA 750 specifically prohibits the use of water mist systems in applications where water may do more harm than good.

**From the 2019 edition of NFPA 750**

**4.1.1.2\*** Water mist systems shall not be used for direct application to materials that react with water to produce violent reactions or significant amounts of hazardous products. Such materials include the following.

(1) Reactive metals, such as lithium, sodium, potassium, magnesium, titanium, zirconium, uranium, and plutonium.  
(2) Metal alkoxides, such as sodium methoxide  
(3) Metal amides, such as sodium amide  
(4) Carbides, such as calcium carbide  
(5) Halides, such as benzoyl chloride and aluminum chloride  
(6) Hydrides, such as lithium aluminum hydride  
(7) Oxyhalides, such as phosphorus oxybromide  
(8) Silanes, such as trichloromethylsilane  
(9) Sulfides, such as phosphorus pentasulfide  
(10) Cyanates, such as methylisocyanate

**4.1.1.3** Water mist systems shall not be used for direct application to liquified gases as cryogenic temperatures (such as liquefied natural gas), which boil violently when heated by water.

In commercial, industrial, and large residential spaces, these systems require more extensive care. Key to these inspections are instructions provided by the manufacturer and the provisions listed in [*NFPA 25*](https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=25)*: Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*.

While facilities managers or building owners may conduct some limited repairs, most components require expert repair, inspection, testing, and maintenance. Floor-level tests must be conducted annually, looking for leakage, corrosion, physical damage, loss of fluid in the nozzles' glass bulbs, aftermarket paint, or loading (covering of heads by dust). Apart from loading, which may be cleaned under some circumstances, these conditions require contractors to replace nozzles.

Water tanks must be drained and refilled annually. The system must be flushed each year. And strainers and filters must be cleaned or replaced as required or after system operation.

**Components for water mist systems require careful selection**

Water mist systems use a mix of hardware. Some parts will be familiar to installers of clean-agent extinguishing systems, while others, including high-pressure pipes and tubing, don't get used in other fire protection systems.

It's important to choose these components carefully—and in accordance with the rules presented in NFPA 750. QRFS offers a wide range of components for fire sprinkler systems, including corrosion-resistant CPVC fittings for low-pressure water mist systems used in light-hazard environments.

Finally, while some water mist system valves require specific listings, valves used for testing and draining water mist systems simply need to be approved by the authority having jurisdiction. For more information, NFPA 750 recommends contacting the manufacturer of the water mist system.