



What are wet and dry rising mains?

A rising main is a system of pipework and valves, often found in high-rise buildings, which allows fire fighting water to be easily delivered to all floors. It consists of a vertical pipe with an inlet at ground level on an outside face of the building allowing fire and rescue service personnel to pressurise the main from their appliances and outlets (known as landing valves) usually fitted in cabinets on each floor that act as outlets, enabling the fire service to connect their fire hoses into the water supply.

Rising mains in buildings can be either filled with water (Wet Riser) or left dry (Dry Riser). Where mains are supplied from rooftop tanks and pumps in very tall buildings, the mains are referred to as 'Falling Mains' or sometimes 'Downcomers'.

The installation of risers removes the need for fire fighters to have to drag charged fire hoses all the way up through tall buildings which could delay fire-fighting operations or create a hazard during evacuation.

The current British Standard used for design, installation, testing and maintenance of Wet and Dry Risers is: BS9990:2015 Non-automatic fire-fighting systems in buildings Code of practice.

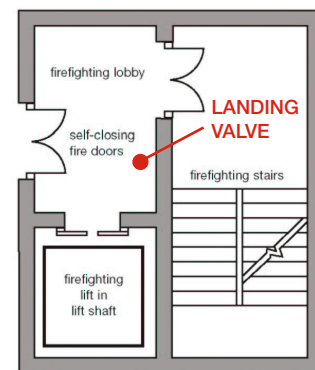
Do wet or dry risers have to be installed?

Approved Document B (Fire Safety) of the Building Regulations (England & Wales) requires that any building more than 18m high, measured from the fire brigade access level to the top floor, or which has floors more than 10m below ground must be provided with 'fire fighting shafts' and a fire fighting rising main.

If the building has a floor level higher than 18m but less than 50m or has floors more than 10m below ground, the fire main can be either a Dry or a Wet riser. When a building is more than 50m high the rising main has to be a Wet riser. In Scotland, the Technical Handbooks of Scottish Building Standards contain similar requirements.

Fire fighting shafts

Fire fighting shafts are required in buildings with a floor over 18m above or 10m below the emergency service access level. These shafts provide the fire brigade with a safe area from which to fight a fire in the building. The shafts usually have stairs and a protected well ventilated lobby and may be provided with a fire fighting lift. Fire fighting shafts must also be provided in some buildings with a storey of 900m² or more in area, where the floor is at a height of more than 7.5m above fire service vehicle access level, for example shops, commercial, storage and non-residential buildings.



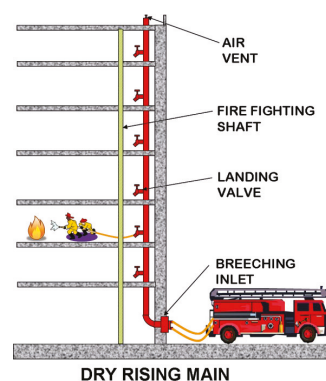
Fire fighting shaft

Fire fighting shafts in buildings with a sprinkler system

The installation of sprinklers allows the distance between fire fighting shafts to be increased from 45 metres to 60 metres. This is due to the fact that sprinklers prevent fire growth and therefore allow more time for fire-fighters to attack a fire. This effectively translates into increased allowable travel distances.

Dry rising mains

The pipes in dry risers are empty and are only filled with water by the fire brigade when they arrive. The fire brigade use hoses to connect the pump outlet on their appliance to the dry riser inlet. Water is then drawing from the nearest fire hydrant (fed by the water suppliers service main²)



DRY RISING MAIN

and this is pressurised by the fire pump on the fire tender to provide water at the correct flow and pressure for fire fighting operations at the relevant floor level.

Falling mains

Some fire mains are described as 'falling' mains where they are installed for fire fighting below ground level or where a fire water supply is provided at high level.

1 Note that in the context of the Water Regulations and their associated guidance, what are commonly referred to as 'tanks' should be more properly referred to as 'cisterns'.

2 Formerly known as the 'Towns' Main'

Fire service inlets

The water feed from the fire service pump into the Dry Riser is routed through an inlet (more correctly described as an inlet breeching connection) which is installed at the fire brigade access level, usually on an external wall. The breeching connections are usually contained in a red glass fronted box with the wording 'Dry Rise Inlet'. These should be kept locked shut, though in an emergency the glass panel can be broken to gain access to the hose connections.



This inlet should be positioned as close as possible to the rising main in order to reduce pressure losses.

The inlet breeching unit for a 100mm diameter dry riser has two 65mm male instantaneous hose connections which must comply with BS 336 *Specification for fire hose couplings and ancillary equipment* 1989. For larger diameter dry risers a breeching inlet with four hose connections will usually be needed.

When selecting a location for the inlet breeching valve the first consideration must be the safety of firefighters. Some of the more important things to consider are ease of location for attending crews, proximity to fire appliance parking and exposure of fire-fighters to fire, falling debris, and collapsing walls. To this end an access road, suitable for a fire appliances must be provided. This should allow positioning of the fire appliance to within 18m and preferably within sight of the inlet box.



Inlet boxes and breeching inlets should be manufactured to comply with BS 5041. The lower edge of the inlet box must be located between 400mm and 600mm above the ground. The inlet is fitted with a drain valve to drain water from the dry fire main at the end of operations.

Landing valves



Landing valves are invariably constructed of gunmetal with a flanged inlet and should be designed to BS 5041 Part 1 *Fire hydrant systems equipment. Specification for landing valves for wet risers* 1987. The valves should be fitted with a wheeled valve connected directly to one (or in the case of larger risers, two) 65 mm

instantaneous female coupling to BS 336, with removable blank cap and retaining chain. They are installed at each floor level, including the ground floor. The landing valve should preferably be located inside an easily recognisable red metal box with a glass panel, labelled Dry Riser. The boxes are locked and have a glass panel that can be broken to gain access to connect the fire



hose. The most commonly installed landing valves are either horizontal instantaneous hose connection or 'bib nosed' with a downwards angle each with a 65mm instantaneous hose connection.

On Dry Rising mains a landing valve may be installed, at roof level for periodic testing, if required by the authority having jurisdiction.

Landing valve location

Usually there is only a single landing valve at each floor level, but occasionally two may be provided if required by building control department on the advice of the fire and rescue service. Landing valves should preferably be located in well-ventilated and fire resistant lobbies within the fire fighting shafts. Alternatively the fire brigade may accept other locations such as within a stairwell.

On dry mains, landing valves should be provided at roof level for test purposes if practicable.

BS9990: Non-automatic fire-fighting systems in buildings Code of practice requires that the landing valve must be installed with its lowest point at 750 mm above floor level.



Air release valve

An air release valve must be fitted at the top of the Dry riser to expel air when filling the main and allow ingress when draining the system.



Security of riser equipment

As this equipment is susceptible to vandalism and theft installing them in lockable boxes is the preferred option. All risers can have brass or bronze components and as such are also a target for thieves.

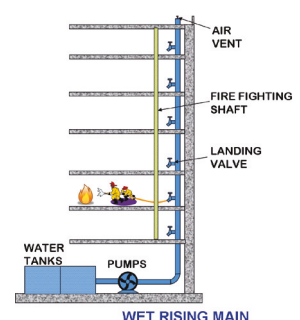
Water charged dry mains

When dry mains have a very large volume they can be permanently charged with water by a small water tank of about 300 L capacity. This tank will have a permanent infill connection to a local water supply.

This arrangement means that the fire brigade can commence fire fighting operation almost immediately as they do not have to fill the riser pipe-work. An example of where water charged dry mains can be used is in long underground tunnels where the temperature is above 4 C° at all times.

Wet rising mains

The pipes in wet risers are full of water at all times and have pumps that deliver the water to the outlets, these pumps drawing water from storage tanks. The pumps operate when the pressure in the rising mains



drops when a landing valve is opened. They do not depend on the fire brigade appliance or water from the local mains.

Pumps for wet risers

The water pressure from a service main will be insufficient to serve a wet rising main so pumps and tanks will have to be installed.

Wet Risers must have two pumps and two tanks. The pumps have to be capable of delivering 1 500 L/min which is enough to supply each of two fire service hoses with 750 L/min. The pump must provide enough pressure to give a continuous pressure of 8 bar at each of the two operating landing valves.

Pump arrangement for Wet risers can be either two electrically-driven units or one electric and one diesel engine driven units. One pump is designated as the 'duty' pump, and the other acts as a standby should the duty pump fail or additional pumping capacity be required. The system has a small capacity 'jockey pump' which starts automatically to maintain system pressure and prevent intermittent starting and stopping of the main pumps.

Power supply for two electric pumps

Where two electrically-powered pumps are used, the preferred power source is two independent incoming electric supplies. If these are not available a single incoming electric supply can be used in conjunction with a separate supply which can be an on-site emergency generator. These two supplies are connected to an automatic changeover panel which ensures that both pumps have power in the event of any power failure.

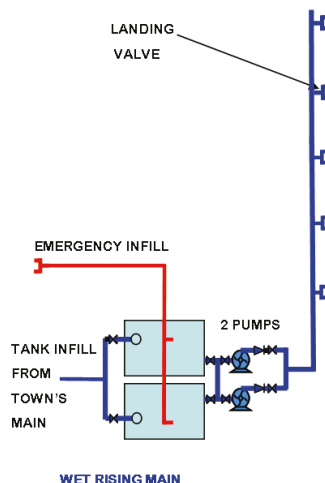
Electric power supplies must be sufficient to allow the wet riser pumps to run for at least 3 hours.

Isolating valves

Isolating valves are installed at intervals not exceeding 10m on the rising mains so that sections can be isolated to enable repairs to be carried out. These valves should be secured in the open position by a chain and padlock or fitted with monitoring devices to indicate at the fire control panel or interconnected to the BMS or in some other staffed location such as a security control room if any valve is not fully open.

Water tanks for wet risers

An on-site supply of stored water must be capable of supplying enough water to provide two landing valves with not less than 750 L/min each for at least 45 minutes. The total water requirement for a wet riser would therefore normally be 67 500 L.



BS9990 requires that the minimum volume of stored water for a wet riser is two interconnecting tanks each with a volume of 22 500 L each giving a total of 45 000 L. The other 22 500 L can be supplied automatically to the two tanks from the service main through ball valves fitted to each tank.

Another option is to install two tanks each with a capacity of 33 750 L so that there is no dependence on the towns main during a fire incident. This has the benefit of allowing the fire brigade to utilise the service main independently of the wet riser.

Emergency tank filling

All wet riser tanks must have a facility to allow the fire brigade to replenish their contents. This is done by installing an inlet breaching connection at a convenient and safe location for the fire brigade to pump water from the service main into the tank/s. Electrical high and low water level alarms are fitted to the tanks to allow them to monitor the water level. This pipe must be at least 100mm diameter for tanks that are located no higher than 60m above ground level.

Combined water tanks

It is not usual that water tanks for domestic purposes are used for wet rising mains. It is acceptable to use a common tank but the domestic water connection must be positioned such that the minimum reserve of 45,000 litres is always available for the wet rising main.

Note that the use of water from a sprinkler system's tank/s is unlikely to be acceptable if the sprinkler system is being provided to satisfy requirements under building regulations or the system is designated for life safety purposes.

Water pressure for wet risers

The water pressure required at the level of the highest landing valve is 8 bar.

For a building 60m high, the minimum pressure required at the water source is at least 15 bar or for a 100m high building it could be 20 bar.

Pressure regulating valves (PRV's)

PRV's are designed to ensure that the pressure in a fire hose does not exceed 12 bar when the hose jet is shut.

In very high buildings the water pressures can be 25 bar or more which requires the installation of a pressure regulating valve to ensure the safety of fire-fighters and their equipment..

These PRV's are incorporated into the landing valve and regulate the high pressure in the rising main to a safe 8 bar at the hose connection.

In BS9990 there is an allowable tolerance for flow and pressure at the landing valve of (750 ± 75) L/min at (8 ± 0.5) bar.



Number of rising mains required

In the past, the number of rising mains was determined by reference to BS 5588-5. Fire precautions in the design, construction and use of buildings. Access and facilities for fire-fighting 2004. However this standard has been withdrawn and is superseded by BS 9999: Code of practice for fire safety in the design, management and use of buildings 2008. Note that the relevant information can be found in S.23 which refers to 'fire mains' rather than 'risers'.

Testing of wet and dry risers

BS9990: initial static pressure test of risers

The system should be completely charged with water to a pressure equal to its design operating pressure measured at the inlet for a period of at least 15 min. During this period, an inspection of the system should be made to check whether there is any leakage of water at any of the joints or landing valves. If any leaks are identified, appropriate remedial action should be taken and the system should be retested.

BAFSA ADVISORY COMMENT:

While BS 9990 requires only that the system be pressure tested as above it is BAFSA's view of industry best practice that all Wet and Dry systems should initially be static pressure tested to at least one and half times the system's predicted maximum operating pressure for at least one hour.

All dry fire mains should be checked every six months to ensure that all valves are fully serviceable, and a wet pressure test should be carried out annually to ensure that there is no leakage.

Wet fire mains should be similarly checked and, in addition, the water storage tanks and booster pumps should be checked for operational serviceability.

Defects in equipment should be rectified as soon as possible by a competent person and if delay ensues, the fire service should be warned, and warning notices should be posted in the building at the appropriate place. The fire service should be informed as soon as the equipment is serviceable again.

BS 5306 Part 0: 2011 Fire protection installations and equipment on premises - Guide for the selection of installed systems and other fire equipment provides useful information on the test and maintenance regime for risers.

Components for risers

Note that all components which are to be installed in any system which is to be connected to the service mains or any water company pipework comply with the Water Fittings Regulations 1999 or (Scottish) Water Byelaws 2014 and must be approved for its intended use by the Water Regulations Advisory Scheme. (WRAS). See: <http://www.wras.co.uk/>

Pipes for rising mains

Fire mains should have a nominal bore of 100 mm and the system should be designed to withstand a pressure of one and half times its predicted maximum operating pressure.

The most commonly used pipe for Wet and Dry risers is manufactured to BS EN 10255:2004 Non-alloy steel tubes suitable for welding and threading.

Fire mains pipework and fittings should be of suitable heavy quality steel to meet the pressure, robustness and durability requirements of the system, including galvanizing where necessary.

Pipes for Wet and Dry risers installed in locations where they are susceptible to corrosion must be galvanized.

Pipes for Dry risers are normally galvanized.

BAFSA ADVISORY COMMENT:

While BS 9990 requires only that pipe should be galvanised where necessary it is BAFSA's view of industry best practice that all DRY riser pipework and fittings should be galvanised to BS EN 10240:1998.

WET riser pipework and fittings should be galvanised where this is required by the specifier or AHJ or where circumstances such as atmospheric conditions or water quality dictate.

Pipe fittings for rising mains



Pipe fittings can be either screwed, grooved or flanged and are normally galvanized. The most common arrangement is that the straight sections of the rising main are joined with



mechanical grooved couplings with a long radius tee at each floor level that connects to the landing valve with a flanged joint.

Reference documents

- BS9990:2015 Non-automatic fire-fighting systems in buildings Code of practice.
- Approved Document B Part 2:2006 (2007, 2010, 2013 amendments): Buildings other than dwelling houses
- BS 5041-1:1987 Fire hydrant systems equipment. Specification for landing valves for wet risers
- BS 5041-2:1987 Fire hydrant systems equipment. Specification for landing valves for dry risers
- BS 5041-3:1975 Fire hydrant systems equipment. Specification for inlet breechings for dry riser inlets
- BS 336:2010 Specification for fire hose couplings and ancillary equipment
- BS 5306-0:2011: Fire protection installations and equipment on premises. Guide for selection of installed systems and other fire equipment
- BS 9999:2008 Code of practice for fire safety in the design, management and use of buildings
- BS EN 10255:2004 Non-alloy steel tubes suitable for welding and threading. Technical delivery conditions.
- The Water Supply (Water Fittings) Regulations 1999.
- BS EN 10240:1998 Internal and/or external protective coatings for steel tubes. Specification for hot dip galvanized coatings applied in automatic plants

Presented by:

