

BRITISH STANDARD

Code of practice for non-automatic fire-fighting systems in buildings

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Foreword

Publishing information

This British Standard was published by BSI and came into effect on 31 May 2006. It was prepared by Technical Committee FSH/14, *Fire precautions in buildings*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This British Standard partially supersedes BS 5306-1:1976, which will be withdrawn upon publication of a revision of BS 5306-1 in 2006.

Information about this document

BS 9990 brings up to date the guidance on private fire mains (both internal and external), taking into account research carried out by the Office of the Deputy Prime Minister [1, 2]. The principal changes from BS 5306-1 are that the new standard no longer gives guidance on when and where such systems are needed (which is now given in, for example, guidance in support of national building regulations), but deals solely with the design of the systems, including recommendations for provision, siting, installation and maintenance. The guidance on hose reels and foam inlets remains in the revised BS 5306-1; requirements for hose reels are given in BS EN 671-1.

It is important for the fire protection of a building to be considered as a whole. The provision of fire mains is an essential element of the fire protection systems in large and complex buildings due to the difficulties in providing water supplies at the point of use for fire-fighting and search and rescue. It is essential that these systems be carefully maintained to ensure instant readiness when required.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

Presentational conventions

The provisions in this standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is “should”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Attention is drawn to legal requirements in respect of planning and approval, and to the need to consult with the appropriate bodies, which might include the building control body, the local water undertaking and the fire authority.

1 Scope

This British Standard gives recommendations for non-automatic fire-fighting systems in buildings. It covers good practice in matters affecting the design, installation, testing and maintenance of such systems including wet and dry fire-fighting mains.

This British Standard does not cover hose reels, foam inlets, automatic foam systems and portable fire-fighting equipment. These systems are covered in BS EN 671-1, BS 5306-1, BS 5306-3, BS 5306-8 and BS EN 3-7.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 750, *Specification for underground fire hydrants and surface box frames and covers*

BS 1710, *Specification for identification of pipelines and services*

BS 5041 (all parts), *Fire hydrant systems equipment*

BS 5499-1, *Graphical symbols and signs – Safety signs, including fire safety signs – Part 1: Specification for geometric shapes, colours and layout*

BS 5499-5, *Graphical symbols and signs – Safety signs, including fire safety signs – Part 5: Signs with specific safety meanings*

BS 5588-5, *Fire precautions in the design, construction and use of buildings – Part 5: Access and facilities for fire-fighting*

BS 5588-12, *Fire precautions in the design, construction and use of buildings – Part 12: Managing fire safety*

BS 6387:1994, *Specification for performance requirements for cables required to maintain circuit integrity under fire conditions*

BS 7629-1, *Specification for 300/500 V fire resistant electric cables having low emission of smoke and corrosive gases when affected by fire – Part 1: Multicore cables*

BS 7346-6, *Components for smoke and heat control systems – Part 6: Specifications for cable systems*

BS 7430, *Code of practice for earthing*

BS 7671, *Requirements for electrical installations – IEE Wiring Regulations – Sixteenth edition*

BS 7846, *Electric cables. 600/1 000 V armoured fire-resistant cables having thermosetting insulation and low emission of smoke and corrosive gases when affected by fire*

BS 8434-2, *Methods of test for assessment of the fire integrity of electric cables – Test for unprotected small cables for use in emergency circuits – Part 2: BS EN 50200 with 930 °C flame and with water spray*

BS EN 1092 (all parts), *Flanges and their joints – Circular flanges for pipes, valves, fittings and accessories, PN designated*

BS EN 1515 (all parts), *Flanges and their joints – Bolting*

BS EN 14384, *Pillar fire hydrants*

BS EN 14339, *Underground fire hydrants*

BS EN 60702-1, *Mineral insulated cables and their terminations with a rated voltage not exceeding 750 V – Part 1: Cables*

3 Terms and definitions

For the purposes of this British Standard the following definitions apply.

3.1 bridgehead

part of a building, usually the floor below the fire (floor above in the case of basements), from which fire-fighting teams can be safely committed to attack a fire

3.2 competent person

person, suitably trained and qualified by knowledge and practical experience, and provided with the necessary instructions, to enable the required task(s) to be carried out correctly

3.3 coupling

device for connecting lengths of hose so as to secure continuity from the source of a water supply to the delivery point

3.4 depth

distance of the lowest point of the floor of the lowest storey of a building to the fire service access level measured at the centre of that face of the building where the distance is greatest

3.5 fire-fighting lobby

protected lobby provided within a fire-fighting shaft giving access from a fire-fighting stair to an accommodation area, and normally to any associated fire-fighting lift and fire main

NOTE Common corridors serving residential accommodation can be regarded as fire-fighting lobbies.

3.6 fire-fighting shaft

protected enclosure containing a fire-fighting stair, fire-fighting lobbies, a fire main and, if provided, a fire-fighting lift together with any machinery space

3.7 fire-fighting stair

protected stairway communicating with an accommodation area only through a fire-fighting lobby

3.8 fire hydrants

3.8.1 fire hydrant

assembly comprising a valve and outlet connection from a water supply

3.8.2 pillar fire hydrant

fire hydrant whose outlet connection is fitted to a vertical component projecting above ground level

3.8.3 underground fire hydrant

fire hydrant contained in a pit or box below ground level

3.9 fire mains**3.9.1 fire main**

water supply pipe, fitted with an outlet and control valve at specified points, installed in a building for fire-fighting purposes

3.9.2 dry fire main

water supply pipe installed in a building for fire-fighting purposes, fitted with inlet connections at fire service access level and landing valves at specified points, which is normally dry but is capable of being charged with water usually by pumping from fire and rescue service appliances

3.9.3 ring system fire main

water main which encircles a building or series of buildings or other associated fire risks and which feeds fire hydrants, fire mains or other fire-fighting apparatus

3.9.4 wet fire main

water supply pipe installed in a building for fire-fighting purposes and permanently charged with water from a pressurized supply, and fitted with landing valves at specified points

3.10 fire service access level

level at which there is suitable entry to the building and to a fire-fighting shaft from an area to which fire and rescue service appliances have access

3.11 height

distance of the surface of the highest point of the floor of the highest storey (excluding any such storey consisting exclusively of plant rooms) to the fire service access level measured at the centre of that face of the building where the distance is greatest

3.12 hydrant outlet

component of a fire hydrant to which a standpipe and/or hose is connected

3.13 inlet connection

assembly comprising a valve and inlet to enable supply of water to a fire main

3.14 K-value

coefficient of discharge that is related to flow rate and pressure at the branch/nozzle

NOTE The K-value is calculated from:

$$Q = K \times p^{1/2}$$

where:

- Q* is the flow rate through the branch, in litres per minute (l/m);
- P* is the pressure at the entry to the branch, in bar;¹⁾
- K* is the branch constant.

¹⁾ 1 bar = 10⁵ N/m² = 100 kPa.

3.15 landing valve

assembly comprising a valve and outlet to enable connection of fire-fighting hose to a fire main

3.16 suction tank

tank supplying inlet water to a fire pump

4 Fire mains

4.1 Design considerations

4.1.1 General

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.

Isolating valves should be incorporated in the system at intervals not exceeding 10 m so that sections of the fire main can be isolated to enable repairs to be carried out. Such valves should be secured in the open position by a chain and padlock or incorporated within a monitoring system to indicate when the valve is not fully open.

4.1.2 Materials

Fire mains and associated pipework and fittings should be of suitable heavy quality steel to meet the pressure, robustness and durability requirements of the system in question, including galvanizing where necessary. Pipework should be jointed by screwing and socketing, or by any other means selected as suitable for use, except at valves or other fittings where appropriate flanges in accordance with the relevant parts of BS EN 1092 and BS EN 1515 may be used. Such means may be selected on the basis of practical tests and evidence of satisfactory performance in similar applications such as wet or dry system sprinkler installations. All changes in the direction of the run of the piping should be made with standard bends, springs or long turn fittings. Elbows should not be used.

4.1.3 Dry fire mains

4.1.3.1 Design operating pressure

Dry fire mains should have an operating pressure of 10 bar.²⁾

4.1.3.2 Inlets

A dry fire main should be fitted with a two-way inlet breeching for 100 mm mains. Each breeching should conform to BS 5041-3. Such breeching should be accommodated in an inlet box conforming to BS 5041-5, the box being positioned with its lower edge between 400 mm and 600 mm above ground level.

²⁾ 1 bar = 10^5 N/m² = 100 kPa.

4.1.3.3 Drain valves

BS 5041-3 relating to inlet breechings provides that each breeching should be fitted with a 25 mm drain valve to facilitate draining the rising main after use.

4.1.4 Wet fire mains**4.1.4.1 Design operating pressure**

Systems should be designed such that maximum system pressures serving a fire main outlet do not exceed 20 bar.

4.1.4.2 Location

Wet rising mains should not be located against or near external walls unless they are adequately insulated or otherwise satisfactorily protected against frost (see BS EN 806-2).

4.1.5 Landing valves

A landing valve should be provided at each floor level where personnel can connect and fill hose lines in relative safety before entering the fire compartment. When selecting the position of landing valves, consideration should also be given to ease of access; exposure to fire from the accommodation if a door is open; obstruction of fire doors by the hose line; and the risk of unintentional discharge of water hitting the lift doors or controls.

Each landing valve should be sited:

- a) within a ventilated lobby of a lobby approach stairway, where this is provided; or
- b) in a stairway enclosure; or
- c) in any other position as agreed with the appropriate authority.

On dry mains, landing valves should be provided at roof level for test purposes if practicable. For tests on fire mains see **7.3.1**.

In all cases a landing valve should be installed with its lowest point about 750 mm above floor level.

Landing valves for fire mains should preferably be protected by, and installed within, a box in accordance with BS 5041-4. Landing valves should also be protected against interference and attack by thieves and vandals as far as it is possible to do so without adversely affecting operational capability. This should be done in accordance with Annex A.

Landing valves for dry mains should conform to BS 5041-2 and those for wet mains should conform to BS 5041-1.

It is recommended that outlets should be flanged rather than directly threaded to allow for ease of maintenance.

4.2 Provision and siting**4.2.1 General**

Where fire mains are installed and there are no floors higher than 50 m above fire service access level, wet or dry fire mains may be installed. Where there are floors higher than 50 m above fire service access level,

wet fire mains should be installed owing to the pressures required to provide adequate fire-fighting water supplies at the landing valves at upper floors and also to ensure that water is immediately available at all floor levels.

NOTE 1 This height is based upon using 51 mm hose and a fire-fighting branch having hydraulic characteristics of K -value = 230.

NOTE 2 Guidance on when a fire main should be installed is given in BS 5588-5.

4.2.2 Position of inlets

Inlet connections for a fire main should be installed in an external wall or in a boundary wall of a building as close as possible to the position of the main which they serve, ideally on the exterior face of the fire-fighting shaft, and any run of connecting pipe between the inlet and the vertical run of the main should be kept to a minimum and should be given a fall towards the drain valve.

Where the fire-fighting shaft or fire-fighting stair is not adjacent to a perimeter wall, consideration should be given to providing more than one inlet which are sufficiently remote from one another to provide viable alternative locations from which to charge the fire main.

Access to the inlet connections should be in accordance with BS 5588-5.

In selecting positions for inlet connections, regard should be paid to the positions of fire hydrants, the parking locations for fire appliances, and the effect that falling debris and other possible occurrences during a fire might have on the continuing viability of the location (see BS 5588-5).

It is recommended that inlets be flanged rather than directly threaded to allow for ease of maintenance.

4.2.3 Number of rising mains

The number and disposition of rising mains should be in accordance with BS 5588-5.

4.3 Electrical earthing

Fire mains should be electrically earthed in accordance with BS 7671 and BS 7430. Those joints which do not provide electrical continuity should be bonded.

5 Private fire hydrants

5.1 Design considerations

The design and installation of hydrant systems should be closely correlated with all other services being provided in the building, and ducts may be shared. The water supply to hydrants should be kept entirely independent from other water supplies including those for other fire-fighting systems.

Hydrant systems should be afforded all possible protection against frost (see BS EN 806-2).

5.2 Provision and siting

5.2.1 When they are considered to be necessary, private fire hydrants should be provided within the confines of the site after consultation with the local water and fire authorities. Their installation should conform generally to this British Standard and also to any specific requirements of these authorities or the insurance company.

5.2.2 Fire hydrants should be positioned in such a way that the parking, loading and unloading of vehicles is unlikely to obstruct them, and in choosing locations for them regard should be paid to the availability of statutory hydrants in public thoroughfares nearby.

5.2.3 Where fire hydrants are to be installed, they should be included as part of a ring fire main system (see **6.7**) and be positioned not more than 90 m from an entry to any building on the site and not more than 90 m apart. They should preferably be sited immediately adjacent to roadways or hard-standing facilities suitable for fire and rescue service appliances. To ensure that they remain usable during a fire they should be sited with consideration of the effect that falling debris and other possible occurrences during a fire might have on the continuing viability of the location, and should be not less than 6 m from the building or other risk.

NOTE The positioning of hydrants can have an effect on the positioning of inlets; see 4.2.2.

5.2.4 Siting of underground fire hydrants in roadways should be avoided but where necessary the frame and cover should be in accordance with BS 750 and capable of bearing the heaviest vehicle anticipated to use the roadway.

5.2.5 Underground fire hydrants should be in accordance with BS 750 and BS EN 14339.

5.2.6 Pillar hydrants should be in accordance with BS EN 14384. Where pillar hydrants are installed, care should be taken to protect them from mechanical damage and from damage by frost.

6 Water supplies and pumping arrangements

6.1 Means of supply

6.1.1 For wet fire mains it is essential that pressures and flows are at all times adequate to serve two fire-fighting jets. This is irrespective of the source of water supply.

6.1.2 For dry fire mains a high pressure supply is not essential as the pressure can be controlled by fire and rescue service pumps. Dry fire mains can be supplied from static or open water supplies, although it is normal in built-up areas to rely upon town's water.

6.1.3 External hydrants usually depend on supplies available from town's mains.

6.2 Adequacy of basic supply

In all cases where town's main supply is involved, the capacity of the mains is important and should be checked. Generally a water supply capable of providing a minimum of 1 500 l/min at all times will be required (see 6.3.1).

6.3 Supplementing the basic supply for wet fire mains

6.3.1 Where the town's main supply does not provide sufficient pressure and capacity (see 6.2) to provide the necessary supply, each fire main should be fed from two interconnected tanks of nominal equal capacity and having a total minimum capacity of 45 000 l. The tanks should be automatically supplied from a town's main(s) controlled by ballvalve(s) and the capacity of these mains together with the contents of the tanks should be such as to maintain a flow of water capable of supplying two fire-fighting jets for 45 min when water is being used at a total rate of 1 500 l/min. Each tank should be fitted with isolating valves to enable one tank to be taken out of service for maintenance or repair.

6.3.2 Where more than one fire main is installed in a building, regard should be paid to the potential need for additional storage capacity to meet the recommendations given in 6.4.1.

6.3.3 Tanks supplying water for domestic purposes should not be used as suction tanks for wet rising mains unless arrangements have been made for these domestic supplies to be drawn off in such a manner that the requisite reserve of water for the rising main is always preserved.

6.4 Pumps for wet fire mains

6.4.1 General

6.4.1.1 Two automatic pumps should be installed to feed the wet fire main, one of which should act as standby, and be arranged so that when acting as duty pump it will operate automatically, i.e. on a flow of water or a fall in pressure on the installation. The secondary pump should be so arranged that it will operate automatically on a failure for any reason of the duty pump. Both pumps should be primed automatically at all times. This will be effected if the pumps are sited so that at least two thirds of the effective capacity of the suction tank is above the level of the top of the pump casings. Where this is not possible, separate priming tanks and foot valves should be provided for each pump. The pumps should be driven either by electric motors or diesel engines.

Where both pumps are electrically driven they should either be:

- a) separately driven by independent supplies (see 6.4.2.5); or
- b) driven from the same supply with an automatic changeover to a completely independent secondary supply (see 6.4.2.5) in the event of failure of the primary supply.

6.4.1.2 All pumps should be capable of being started and stopped manually.

6.4.1.3 An audible and visual alarm should be provided at an agreed position to indicate that the equipment and the pumping plant have operated.

6.4.1.4 Each pump should be capable of providing a flow of water of at least 1 500 l/min in the fire main, i.e. sufficient to serve lines of hose from two separate landing valves simultaneously. A running pressure of 8 bar³⁾ should be maintained at each landing valve when fully opened.

6.4.1.5 A test facility, including permanently installed devices for measuring pressure and flow, should be provided at the pump delivery branch downstream of each outlet check valve to permit a running pressure test of each pump at full load condition.

6.4.2 Electrical supplies

6.4.2.1 The electrical power supply to wet fire main pumps should be separate from all other circuits in the building so that the failure of other equipment does not render the installation inoperative.

6.4.2.2 Each connection to the power supply should be via an isolating protective device reserved solely for the pumps and independent of any other main or sub-main circuit. Such isolating protective devices (with high-rupturing safety devices) should be clearly labelled and identified as to their purpose. They should be secured against unauthorized operation and should, except for maintenance, be kept locked-on.

6.4.2.3 The supply to these isolating protective devices should be independent of the main switch for the building and be appropriately labelled.

6.4.2.4 Wiring systems for the power supplies to the wet fire mains pumps should conform to the following specific recommendations.

- a) The wiring systems should either:
 - 1) consist of:
 - mineral-insulated, copper-sheathed cables conforming to BS EN 60702-1; or
 - cables conforming to the requirements for classification as CWZ in accordance with BS 6387:1994; or
 - cables conforming to BS 7346-6 or BS 7846; or
 - if used in conjunction with the test method in BS 8434-2, cables conforming to BS 7629-1; or
 - 2) be protected against exposure to the fire by separation from any significant fire risk by a wall, partition or floor with a fire resistance of not less than that required for the building.
- b) The wiring systems should be separate from any circuit provided for any other purpose.

6.4.2.5 Where both pumps are electrically powered, a secondary electrical power supply independent of the primary supply to the building, e.g. an automatically started generator or a supply from another substation, should be provided which, independently of the primary supply, will be of sufficient capacity to maintain the pumps for wet fire mains in operation for at least 3 h. The power supplies should conform to the following specific recommendations.

³⁾ 1 bar = 10⁵ N/m² = 100 kPa.

- a) The secondary power supply should be capable of providing the power supply within 15 s of the failure of the primary electrical supply. Where the alternative power supply source is a generator, it should be capable of providing the power necessary for at least 3 h without replenishment of fuel.
- b) Where the secondary electricity supply is taken from a separate substation to that supplying the primary electrical supply, the following criteria should be met:
 - 1) The electrical supplies to the two independent substations should be taken from two separate high-voltage supplies, and not originate from the same substation.
 - 2) The failure of one substation should not lead to the failure of the other.
 - 3) The two independent substations should be adequately separated. Where the substations are located within the building they serve, the following criteria should be met:
 - i) each substation should be enclosed within a fire-resisting structure having a minimum of 2 h fire resistance;
 - ii) the two substations should be located in separate parts of the building.
 - 4) Supply cables from the high-voltage substations should enter directly the high-voltage/low-voltage switch rooms and not pass through the building.
 - 5) The two sets of supply cables should be adequately separated from each other to avoid a single fault affecting both supplies.
- c) Whichever secondary power source is provided, the distribution should be organized such that the secondary supply remains live when the remainder of the supplies in the building are isolated in an emergency.
- d) The primary and secondary power supply cables should be terminated in change-over devices located in the room housing the wet mains pumps. The change-over devices should automatically effect the transition from the primary to the secondary power supply if the primary supply to the pumps fails.
- e) Any electrical substation or enclosures containing any distribution board, generator and any other equipment associated with the wet fire mains pumps, should be separated from the building by construction having a standard of fire resistance of not less than 2 h.

6.5 Additional precautions for wet fire mains

6.5.1 Arrangements for draining a wet fire main should be incorporated to enable any necessary repairs to be carried out.

6.5.2 To reduce the risk of hose bursting, arrangements should be made in accordance with BS 5041-1 so that when the water is shut off at the nozzle the static pressure in any line of hose connected to a landing valve does not exceed 10 bar.⁴⁾

⁴⁾ 1 bar = 10^5 N/m² = 100 kPa.

6.5.3 Pressure-reducing valves should be provided to regulate the flows and pressures to those required. Arrangements for the disposal of water following flow tests and during commission and maintenance should be made via a return facility to the tank(s) or to drain. These arrangements should be on all floors.

NOTE Male flange adaptors to suite are available with locking blank caps to prevent backpressure onto other valves.

6.5.4 Where a fire main is supplied direct from a town's main supply and a shut-off valve is incorporated in the fire main, the valve should be kept secured in the open position by a chain and padlock.

6.5.5 Where a fire main is bifurcated, valves should be provided to enable either branch to be isolated for repair without adversely affecting the other one.

6.6 Emergency arrangements for filling suction tanks

Arrangements should be provided for the remote filling of suction tanks. Where the tanks are no higher than 60 m above ground level, pipes of not less than 100 mm nominal size should be installed. Each pipe should have an open end at a convenient distance above the maximum level of the water in the tank(s) and its other end should be connected to an appropriately sized inlet breeching provided in an inlet box at a convenient position on the face of the building. In selecting positions for the inlets, regard should be paid to the effect that falling debris and other possible occurrences during a fire might have on the continuing viability of the location. The fire authority and water undertaker should be consulted in this connection.

Arrangements should also be made to monitor and indicate/warn the fire and rescue service of the need to supplement the water supply. Provision should also be made for an alarm to indicate at the inlet breeching when the tank has been sufficiently replenished.

6.7 Ring main supply

Where a number of fire hydrants or wet fire mains are required because of the area of the premises to be covered, the mains supplying these systems should be in the form of a ring main to form a complete circuit of the site. It is advisable for water to be supplied to the ring at more than one position, preferably from supplies obtained from different sources. Isolating valves should be incorporated in the system so that sections of the ring main can be isolated to enable repairs to be carried out. Branches to town's mains should also have an isolating valve and a non-return valve to suit the water undertaker's requirement.

7 Installation, commissioning and maintenance

7.1 Work on site

7.1.1 Adequate provision should be made by the responsible contractor to protect materials and components on site from deterioration or damage.

7.1.2 Unloading, stacking and storage should be carried out with care to prevent damage to pipes and pipe threads, hydrants, fittings, couplings and other components used in the system.

7.1.3 Pipes should be securely anchored before any pressure or flow tests are carried out.

7.2 Protection of buildings under construction

7.2.1 In order that a fire occurring during the construction of a building can be dealt with effectively, especially in high or extensive buildings where large quantities of combustible materials might be stored, mains should be in an operational condition as soon as any floor of the building reaches 11 m above fire service access level. These mains should be extended and commissioned progressively as work on the building proceeds to provide fire-fighting facilities at all stages of construction.

7.2.2 Where wet mains are provided, installation initially can be as a dry main. When construction reaches 50 m, the system should be commissioned as a wet main.

NOTE This height is based upon using 51 mm hose and a fire-fighting branch having hydraulic characteristics of K-value = 230.

7.2.3 From the time that the wet fire main is first commissioned, the running pressure at each outlet should conform to the recommendations given in **6.4.1.4**.

7.3 Initial inspections and acceptance tests

7.3.1 Tests on fire mains

7.3.1.1 General

Fire mains should be tested at appropriate stages during installation, as work progresses, and upon final completion. Records should be kept of the tests and their results.

7.3.1.2 Pre-test procedures

Prior to conducting tests, water should be allowed to flow through the fire main and be discharged via the topmost outlet to flush out any debris that might be present. This procedure is of particular importance at acceptance test as there is a possibility of quantities of foreign matter being lodged in the pipework. Facilities should be provided for flushing out at the base of the main debris which is too large to be flushed to the top of the building.

7.3.1.3 Static pressure test

The system should be completely charged with water to a pressure equal to its design operating pressure (see **4.1.3.1** and **4.1.4.1**) 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.

For dry fire mains, upon completion of the static pressure test, when the pressure has been released at the pumping appliance the coupling to the fire main inlet should be disconnected and the action of the non-return valves checked. The system should then be drained and left ready for use.

7.3.1.4 Flow and pressure test for wet mains

After the static pressure test (see **7.3.1.3**) is completed successfully, a flow and pressure test should be carried out.

For this test, water should be passed through the system under pressure and readings taken of flows and pressures. The flow and pressure test should be carried out at each landing valve, using the built-in pumps. Built-in test facilities should be provided for each wet fire main, owing to the difficulties that might otherwise be experienced in disposing of water and the risk of burst hose and consequent water damage.

Inability to achieve the performance criteria recommended in **6.4.1.4** is deemed a failure of the test. Appropriate remedial action should be taken and the system should be retested.

7.3.1.5 Tests on pumps

Pumps, including any standby pumps, should be tested individually to determine whether each one will operate satisfactorily and meet the appropriate performance criteria. Any standby pump should be tested to determine whether it will operate satisfactorily in the event of failure of the duty pump.

7.3.2 Tests on private fire hydrants

7.3.2.1 Inspection of and, where practicable, a wet test of private underground fire hydrants should be made in conjunction with the fire authority and the owner or occupier of the premises or their representative.

Where such hydrants are supplied from mains, arrangements should also be made with the water undertaking before tests are carried out.

7.3.2.2 During these inspections and tests the condition of the following should be checked and noted for remedial action if necessary:

- a) pits;
- b) frames;
- c) covers;
- d) surface paving round edges of frames;

- e) depth of outlet below the frame, which should be no more than 300 mm below ground level;
- f) method of indication by means of hydrant indicator plate or sticker.

7.3.2.3 The test should include flushing out the outlet and checking the outlet connection. The flow and pressure at the outlet should also be measured and noted.

7.3.2.4 On completion of the test, the operation of the frost valve (where fitted) should be checked, and the pit should be left empty and clean.

7.3.3 Indemnities

Before testing any system a signed indemnity should be sought from the person at that time responsible for the work site or premises.

NOTE This might be required by the appropriate authority in respect of liability for damage caused to persons or property arising out of, or in connection with, any test.

7.3.4 Test records

A permanent record of all initial inspections and acceptance tests should be kept by the responsible person.

This should record:

- a) date and time for inspection or test;
- b) person carrying out the test;
- c) test results noted;
- d) any external factors significantly affecting the results (e.g. weather conditions);
- e) follow-up action required;
- f) work carried out as a result of (e) with date, time and result of retest.

7.4 Maintenance of systems and rectification of defects

7.4.1 General

Maintenance frequency and procedures should be in accordance with BS 5588-12.

7.4.2 Competence of maintenance personnel

The services of a competent person should be obtained to carry out maintenance and repairs.

7.4.3 Fire mains

7.4.3.1 Dry fire mains

Inlets, landing valves, drain valves, door hinges and locking arrangements to the inlet and landing valve boxes should be inspected every six months. Special attention should be given to all valves, spindles, glands and washers to ensure that they are in satisfactory condition, so that all equipment is ready for immediate use.

In addition, it is recommended that wet tests be carried out annually when the main can be checked for leaks.

7.4.3.2 Wet fire mains

Maintenance of wet fire mains involves additional checks to those recommended in **7.4.3.1**.

These additional checks are:

- a) check on the internal cleanliness of storage tanks;
- b) thorough check of the booster pumps and their associated mechanical and electrical equipment.

7.4.4 Fire hydrants

7.4.4.1 Arrangements should be made by the owners or the occupiers to ensure that, at least once a year, maintenance is carried out on all private fire hydrants by a competent person. In most cases these arrangements, subject to suitable financial provisions, can be made with the local water undertaking or the fire authority. The former might also be prepared to carry out any necessary repair work.

7.4.4.2 Periodical inspections of the vicinity of all hydrants should also be made to ensure that there are no obstructions impeding accessibility and that hydrant indicator plates are in position.

7.4.4.3 Periodical inspection should be made to ensure that all isolating valves for systems are kept locked in an open position. Also flow and pressure should be checked to ensure that supplies have not deteriorated.

7.4.5 Procedures for defective non automatic fire-fighting systems

Where systems are found to be defective the faulty component should be replaced immediately if possible. Where a replacement is not immediately available or possible an "Out of order" notice should be attached to the faulty component. The premises' responsible person should be informed and arrangements made as soon as possible to reinstate operation of the fire main. The responsible person should also inform the fire and rescue service immediately in order that alternative arrangements can be made to cover this deficiency if the need arises. Where the entire fire main is defective a notice should be placed in the appropriate inlet box. When the installation is reinstated, the fire and rescue service should again be informed so that any alternative arrangements can be cancelled.

8 Signage

8.1 Identification of equipment

8.1.1 Fire mains and associated equipment should be identified in accordance with BS 1710 and should meet the recommendations given in **8.1.2**.

8.1.2 The following notices should be rectangular with white wording on a red background. Letter height should be not less than 25 mm and should be lower case except for the principal initial letters, which should be upper case and in accordance with BS 5499-1 and BS 5499-5.

- a) A notice reading either “Dry fire main” or “Wet fire main” as appropriate should be displayed either on the door of the box or recess in which the landing valve is mounted or in an adjacent prominent position if a door is not provided.
- b) A notice reading “Dry riser – drain valve” should be displayed in a prominent position adjacent to the valve. A notice approximately 100 mm × 75 mm should also be displayed in the inlet box reading “Low level drain valve in (here state location)”.
- c) A notice reading “Fire main pump motor supply – not to be switched off in the event of fire” should be displayed adjacent to all switches in the electrical power supply to pumps.
- d) Where any isolating valves are installed a notice reading “Fire main control valve” should be displayed adjacent to the valve.

8.1.3 The position of any inlets should be clearly indicated using the appropriate notice in accordance with BS 5499-1 and BS 5499-5 and using a letter height of 50 mm.

8.2 System information

8.2.1 Information should be provided, in a position available to the fire and rescue service, to indicate the type of system (i.e. wet or dry fire main) and the parts of the building served by fire main outlets. For dry fire mains, information should also be provided indicating the maximum elevation and/or fall in relation to the riser inlet, and each floor level should have an indication of its elevation in respect to the fire main inlet.

8.2.2 Where reliance is being placed on the operation of fire-fighting systems or appliances during the construction period, temporary notices (to the satisfaction of the fire and rescue service) giving essential information for their protection from damage and for their efficient operation should be set up and remain until the installation becomes fully operative.

8.2.3 All system information signage should be designed in accordance with BS 5499-1 and BS 5499-5.

Annex A (normative)

Protecting installed equipment from theft and vandalism

A.1 General

Equipment stolen or damaged can be expensive to replace, but it is even more important to recognize that the effect of the lack of even a small part of any fire-fighting installation can seriously delay the attack on a fire and in consequence cause unnecessary loss of life and damage to property. In any situation where installed equipment is at risk from thieves and vandals, special measures to protect all parts of the installation are essential, provided that these measures do not inhibit the primary purpose for which the equipment is installed. Precautions of any kind in these circumstances are however of little use unless the installation is kept under adequate surveillance.

Measures designed to discourage persons from removing or damaging equipment are given in A.2 to A.4.

A.2 Reduced attractiveness

Materials which have a high scrap value can be attractive targets for thieves. Components from materials of lower value can be considered when their use is permitted by a British Standard, but in those cases in which there is no standard the local fire and rescue service should be consulted.

Until the outcome of field trials for plastics hydrant outlets are known and sufficient experience has been gained from their use, plastics for these components should not be specified.

A.3 Making theft more difficult

A.3.1 If practicable all exposed screw threads or heads of nuts should be spot welded.

A.3.2 Where it is permitted to choose between providing a panel in the door of a box and providing a panel of breakable material, the latter design, being somewhat less obviously vulnerable, may be adopted.

NOTE Some fire and rescue services permit the use of solid fronted boxes secured by hasp, staple and padlock. These can make it more difficult to tamper with the contents of the box but they have not been accepted as conforming to the requirements of British Standards.

A.4 Action on discovering theft or damage

As soon as loss or damage is noticed the fire and rescue service, the owners and the police should be informed and the advice in 7.4.5 followed.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5306-1, *Code of practice for fire extinguishing installations and equipment on premises – Part 1: Hose reels and foam inlets*

BS 5306-3, *Fire extinguishing installations and equipment on premises – Part 3: Code of practice for the inspection and maintenance of portable fire extinguishers*

BS 5306-8, *Fire extinguishing installations and equipment on premises – Part 8: Selection and installation of portable fire extinguishers – Code of practice*

BS EN 3-7, *Portable fire extinguishers – Part 7: Characteristics, performance requirements and test methods*

BS EN 671-1, *Fixed fire fighting systems – Hose systems – Part 1: Hose reels with semi-rigid hose*

BS EN 806-2, *Specifications for installations inside buildings conveying water for human consumption – Part 2: Design*

Other publications

- [1] HUNT, S. and ROBERTS, G. *Effect of reduced pressures on performance of firefighting branches in tall buildings – Aspects of high-rise firefighting*. London: Fire Statistics and Research Division, Office of the Deputy Prime Minister, 2004. ISBN 1 85112 762 3.
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